85 Martin Road, Badgerys Creek

SSDA Noise and Vibration Impact Assessment (SSD-74191717)

ESR Developments (Australia) Pty Ltd

Prepared by:

SLR Consulting Australia

SLR Project No.: 610.032060.00002

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Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
1.0	3 April 2025	Brandon Nguyen Khuong	Mark Irish	Mark Irish
1.1	30 March 2026	Antony Williams	Aaron McKenzie	Aaron McKenzie
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1.3	22 May 2026	Antony Williams	Aaron McKenzie	Aaron McKenzie

Basis of Report

This report has been prepared by SLR Consulting Australia (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with ESR Developments (Australia) Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

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1.0 Introduction

This Noise and Vibration Impact Assessment (NVIA) supports a State Significant Development Application (SSDA) (SSD-74191717) submitted to the Department of Planning, Housing and Industry (DPHI) on behalf of ESR Developments (Australia) Pty Ltd (ESR). ESR is seeking to secure consent for the construction and operation of a warehouse and distribution estate, referred to as 'Badgerys Creek Industry Park', comprising of four warehouses, supported by ancillary offices, communal areas and associated landscaping. The project provides critical employment floorspace to generate economic activity to support the growth of the Aerotropolis and is designed in accordance with the Western Sydney Aerotropolis Precinct Plan.

SLR is suitably qualified and endorsed by the Planning Secretary to produce this noise impact assessment. SLR staff are members of the Australian Acoustical Society (AAS) and SLR is a member firm of the Association of Australasian Acoustical Consultants (AAAC).

This report summarises the assessment of the potential construction and operational noise impacts associated with the proposal.

The following report uses specialist acoustic terminology. An explanation of common terms is provided in **Appendix A**.

1.1 Proposal Description

The Badgerys Creek Industry Park project seeks to deliver a warehouse and distribution estate at 85 Martin Road, Badgerys Creek, situated within the Western Sydney Aerotropolis. The project seeks detailed staged approval for the construction of 88,800m^2 of employment GFA across four warehouse and distribution buildings and supporting ancillary office GFA. The project provides critical employment floorspace to generate economic activity to support the growth of the Aerotropolis.

The project encompasses the demolition and site preparation works and the construction of infrastructure including an internal private road and temporary stormwater basins. The project is supported by landscaping in the form of perimeter planting surrounding the estate, vegetated communal areas and streetscape planting.

The project involves the staged delivery of the estate across two stages to enable the provision of temporary stormwater basins prior to the delivery of ultimate stormwater infrastructure by Sydney Water. The staged delivery of the estate comprises three warehouses in Stage 1 and one warehouse in Stage 3.

1.2 Site Description

The site is located within Badgerys Creek, 12.5 km south-east of the Penrith Central Business District (CBD), 27 km west of Parramatta, and 47 km from the Sydney CBD. In its current setting, the site is bounded by agricultural uses in all directions with rural residential land uses along Lawson Road (west) and Martin Road (east). Western Sydney International Airport is currently under construction to the west and the recently opened M12 Motorway is to the north and east of the site.

The project is seeking consent for a staged development which includes:

- Stage 1 – three warehouses (1 – 3) and an ancillary private road for vehicle access. Remaining northern area will be retained as a green area.
- Stage 3 – one warehouse (4) development. Green area will be removed to accommodate the development.

Layouts of Stage 1 and 3 are shown in **Figure 1** and **Figure 2**, respectively. The site layout is shown in **Figure 3**.

Figure 1 Stage 1 Development Proposal

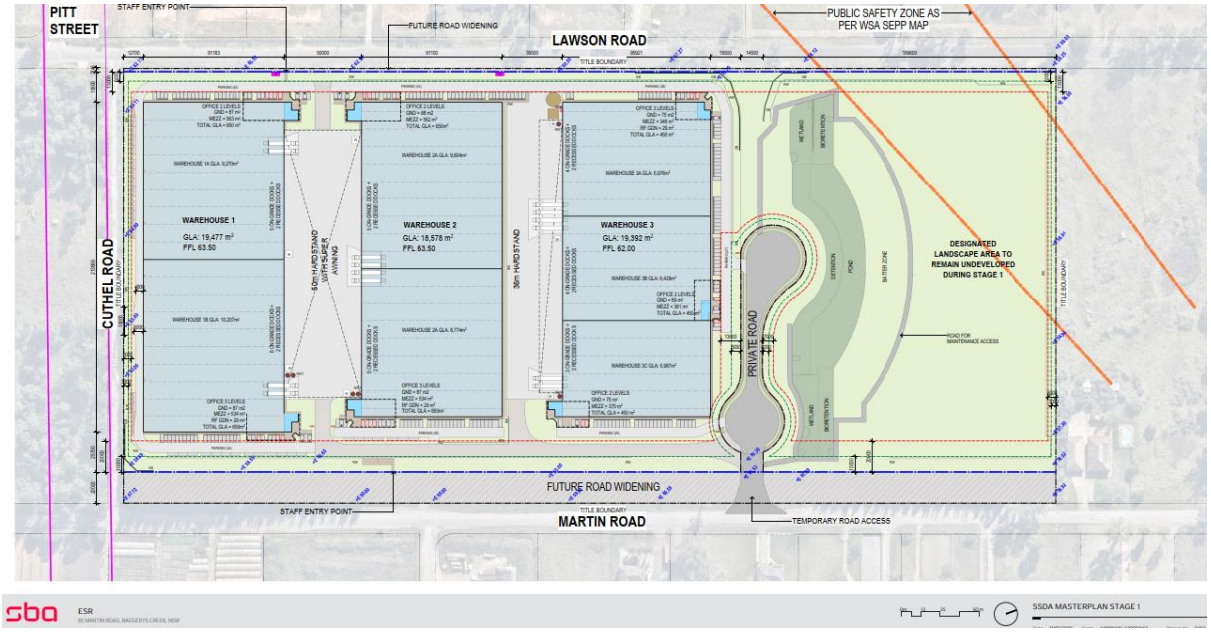
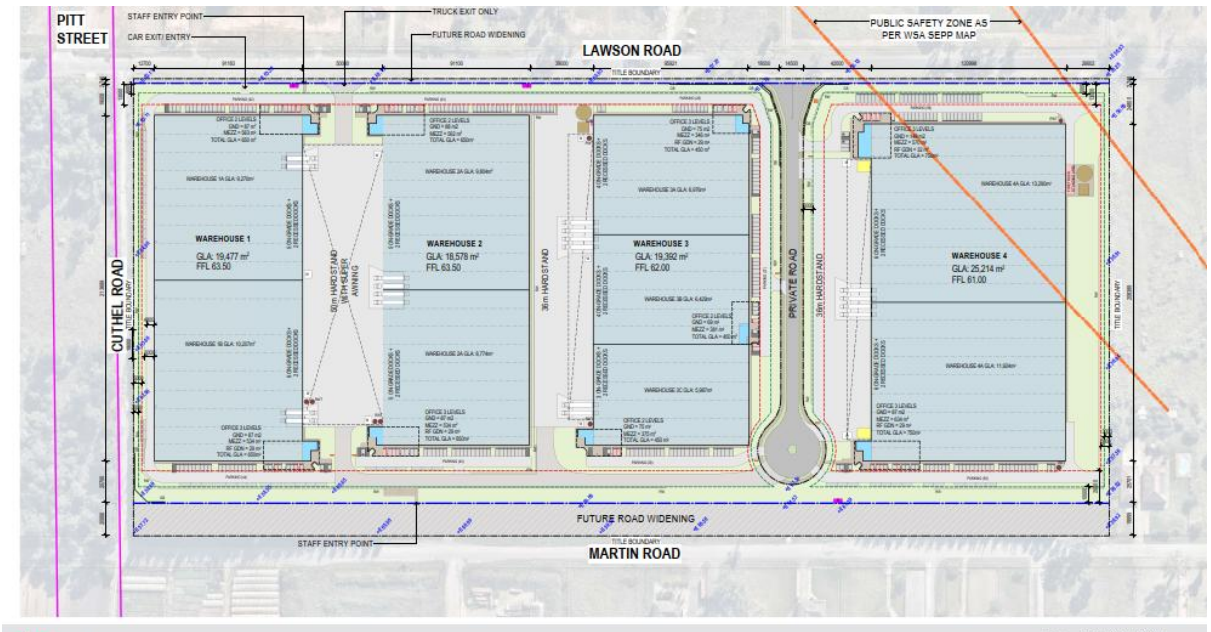
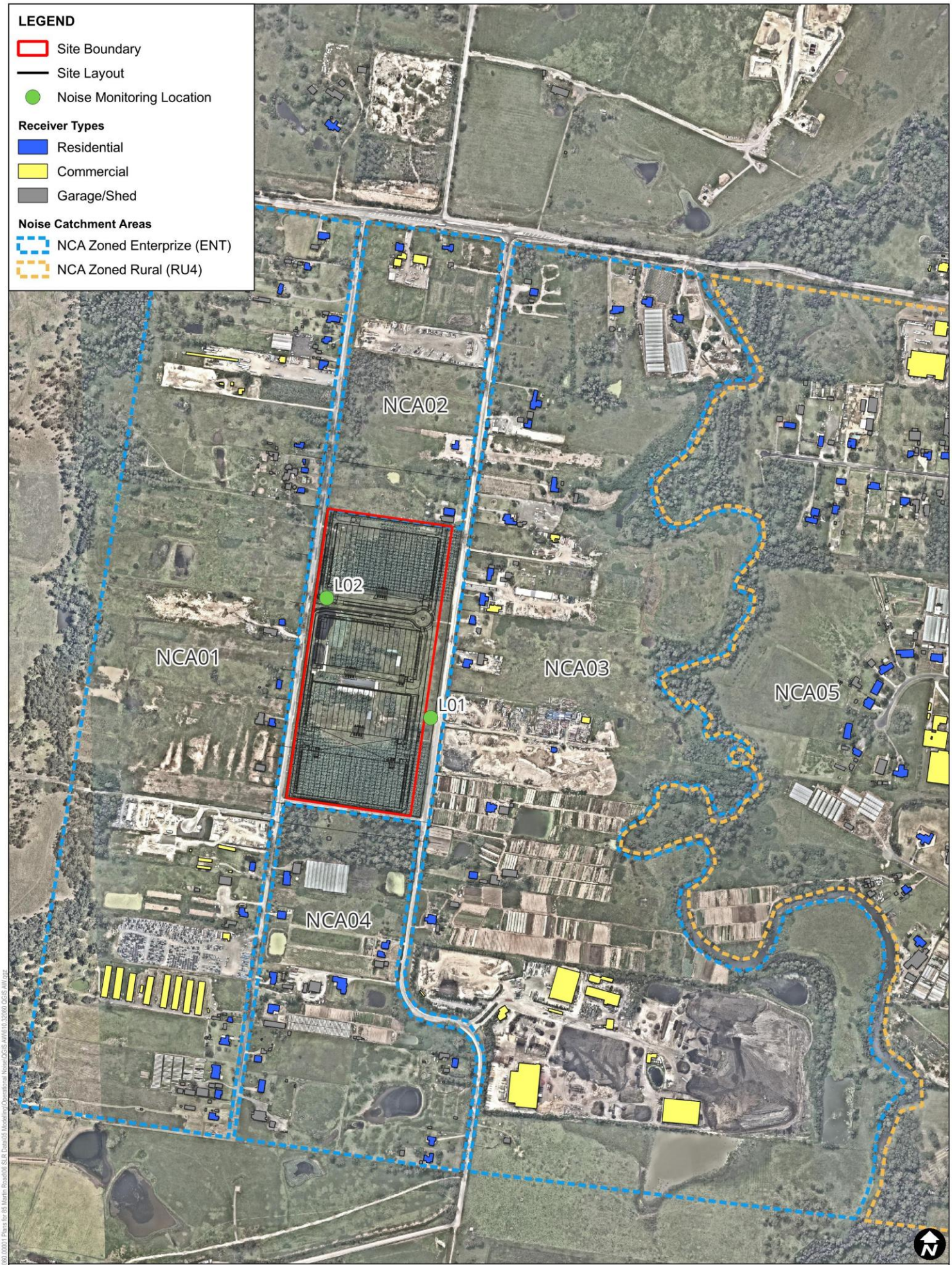


Figure 2 Stage 3 Development Proposal





Scale: 1:10,000 at A4
Coordinate System: GDA2020 / MGA zone 56

Drawn Date: 24-Mar-2026
Project Number: 610.32060

SLR

Data Source:
Nearmap Imagery

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

Site Plan

FIGURE 3

1.2.1 Nearest Receivers

The nearest sensitive receivers are rural residential properties surrounding the site. Additional receivers are further east of the site, within Kemps Creek.

The nearest residential receivers are on land zoned as Enterprise (ENT), within the Badgerys Creek Precinct. These receivers are in NCA01 to NCA04. The residential receivers further to the east, in NCA05, are on land zoned as Rural (RU4). These receivers are over 700 m from the site.

It is understood that all existing receivers zoned as ENT will be redeveloped and replaced with future industrial and business enterprises as part of the Badgerys Creek Precinct.

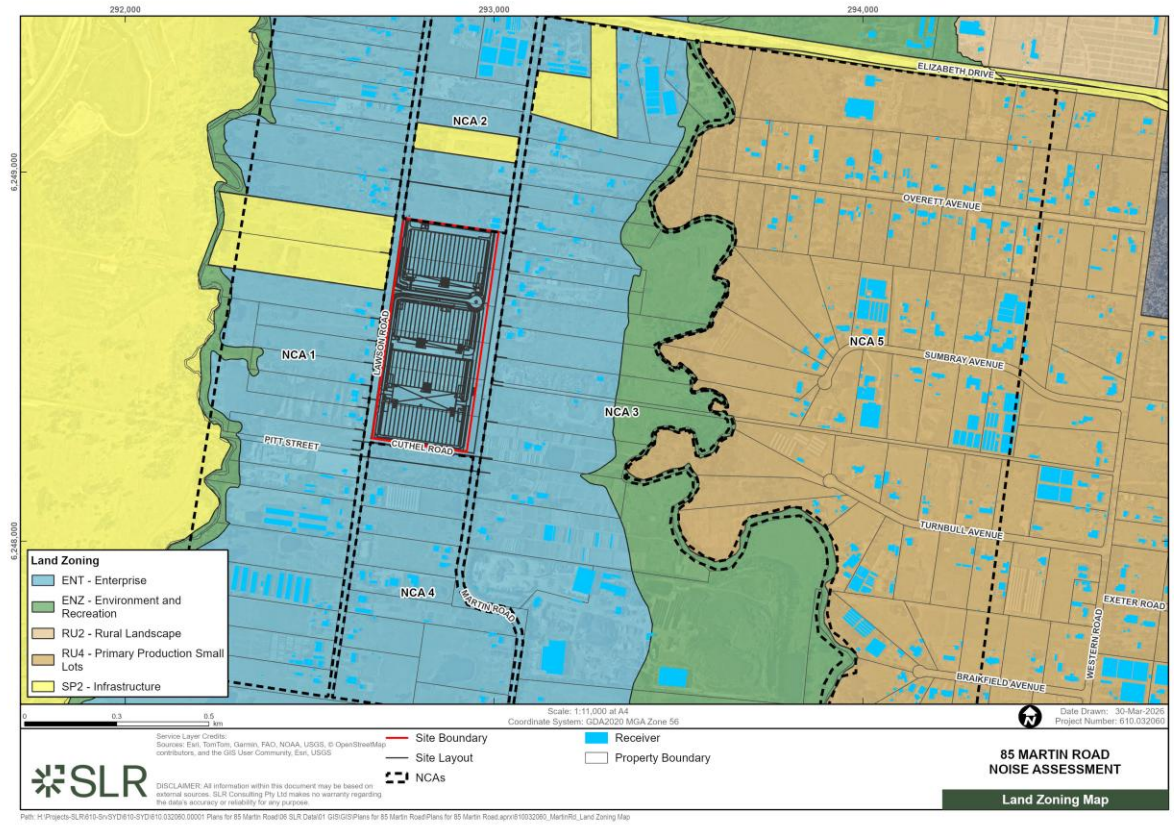
Various commercial receivers are located in the surrounding NCAs, however, most are over 100 m from the site.

The surrounding areas have been separated into Noise Catchment Areas (NCAs). These are shown in **Figure 3** and described in **Table 1**. The land use zoning of the surrounding areas is shown in **Figure 4**.

Table 1 NCAs and Sensitive Receivers

NCA	Direction	Receiver Type	Land Use Zoning	Approx. Closest Distance (m)
Receivers inside the Badgerys Creek Precinct				
NCA01	West	Residential and commercial	ENT	40
NCA02	North	Residential and commercial	ENT	10
NCA03	East	Residential and commercial	ENT	60
NCA04	South	Residential	ENT	130
Receivers outside the Badgerys Creek Precinct				
NCA05	East	Residential and commercial	RU4	700

Figure 4 Land Use Zoning



1.3 Secretary's Environmental Assessment Requirements

The Secretary's Environmental Assessment Requirements (SEARs) were issued by the Department of Planning, Housing and Infrastructure (DPHI) on 27 August 2024 in SSD-74191717. The requirements relevant to noise and vibration are shown in **Table 2**.

Table 2 Secretary's Environmental Assessment Requirements

Noise and Vibration	Where Addressed
Noise and Vibration – a quantitative noise and vibration impact assessment undertaken by a suitably qualified acoustic consultant in accordance with the relevant Environment Protection Authority guidelines and Australian Standards which includes:	This report
- The identification of impacts associated with construction, site emission and traffic generation at noise affected sensitive receivers, including the provision of operational noise contours and a detailed sleep disturbance assessment.	**Section 3.0** **Section 5.0**
- Details of noise monitoring survey, background noise levels, noise source inventory and 'worst case' noise emission scenarios.	**Section 2.0** **Appendix B** **Section 3.0** **Section 4.0**
- Consideration of annoying characteristics of noise and prevailing meteorological conditions in the study area	**Section 4.2.1**

Noise and Vibration	Where Addressed
- A cumulative impact assessment inclusive of impacts from other developments	**Section 3.3.2** **Section 6.0**
- 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 following application of mitigation these measures and details of any proposed compliance monitoring programs.	**Section 7.0**

1.4 Response to Submissions

The noise and vibration related submissions and how they have been addressed in this updated NVIA are shown in **Table 3**.

Table 3 Response to Submissions

Comment	Response	Section
Noise Methodology		
The Department notes the following with the NVIA: - background noise monitoring has been carried out at two locations on the site. Background noise monitoring must be undertaken at the potentially most-affected residences in accordance with Fact Sheet A of the Noise Policy for Industry (NPFI)	The two noise monitoring locations are within around 100 m of the nearest residential receivers and were positioned to be at comparable offset distances from Lawson/Martin Road as the most affected residences. The locations are therefore considered representative of the background noise environment of the adjacent residential receivers. Additionally, the existing background noise levels at both locations during the most sensitive night-time period were measured to be below the 30 dBA minimum level set by the *Noise Policy for Industry*, meaning the 30 dBA minimum gets applied irrespective of the measured existing noise level. As such, monitoring in a slightly different location at the most-affected residences is not expected to alter the assessment. The site is also close to Western Sydney International Airport which is scheduled to open mid-2026 and will likely result in background noise levels in area increasing. The use of 2024 noise monitoring data in this assessment is therefore conservative.	**Section 2.0**
- details of any other noise sensitive receivers (other than residential), and an assessment of noise impacts at these receivers has not been provided	Assessment updated to include all nearby receiver types, which includes both residential and commercial receivers.	**Section 1.2.1** **Figure 3**

Comment	Response	Section
- on-site traffic data has not referenced the Transport Assessment (TA) prepared by Ason Group for the proposal. All traffic assumptions in the NVIA must rely on the traffic predictions in the TA to ensure both assessments use the same inputs and assumptions	Assessment updated to include the most recent traffic forecast for the development, as provided by Ason Group.	**Section 4.2.1.1**
- details of the testing schedule, and any associated noise impacts from the smoke exhaust fans has not been provided	Noise from roof fans is included in the updated NVIA noise model.	**Section 4.2.1.4**
- a quantitative road traffic noise assessment has not been carried out for increased traffic noise on Elizabeth Drive	Quantitative road noise assessment included.	**Section 5.3.3**
- the construction noise assessment does not explain how impacts at highly noise affected receivers will be managed	Additional mitigation provided for construction impacts, including a CNVMP for the proposal.	**Section 7.1** CNVMP
- further consideration of how vibration impacts will be managed/mitigated is required in accordance with Assessing Vibration: a technical guide	Vibration impacts would be managed in accordance with the procedures detailed in the provided CNVMP.	**Section 7.1** CNVMP
- addresses of all the receivers at which exceedances are predicted for sleep disturbance and the most affected receiver in NCA05 must be provided	Addresses provided for all receivers with exceedances of sleep disturbance screening level. **Figure 9** shows location of all receivers with operational exceedances.	**Table 31** **Figure 9**
- the conclusion in section 5.3.1.2 states the exceedance at night-time at NCA05 will be 1dB, however, Tables 31 and 32 state the exceedance will be up to 3dB, this needs to be corrected, and appropriate management/mitigation proposed for this receiver.	Assessment and report have been updated based on altered traffic volumes and slightly revised site layout.	**Section 5.3.1**
Recommendation: An updated NVIA is required that addresses all matters identified above and is consistent with the requirements of the NPfI, the EPA's Approved Methods for the measurement and analysis of environmental noise in NSW and Assessing Vibration: a technical guideline (and other relevant British Standards for vibration).	This NVIA has been updated and addresses all matters identified.	This NVIA

Comment	Response	Section
It is the Applicant's responsibility to demonstrate that the selected mitigation measures are appropriate and to justify any mitigation measures proposed as part of the acoustic assessment. According to the NSW EPA's Noise Policy for Industry (2017), residual noise impacts are identified after all feasible and reasonable source and pathway noise mitigation measures have been considered.	Additional information regarding the considered and recommended feasible and reasonable noise mitigation measures has been added.	**Section 7.0**
Further details of reasonable and feasible noise mitigation measures to be implemented by the Applicant during construction and operation of the development is required. A draft Construction Noise and Vibration Management Plan is required.	Additional information regarding the considered and recommended feasible and reasonable noise mitigation measures has been added, including a CNVMP.	**Section 7.0**
Aircraft Noise		
The site is located within ANEC/ANEF 30 to 35+ for the future second runway and must comply with Australian Standard 2021: 2015 to achieve specified indoor sound levels. The Australian Standard 2021 that 'other industrial' activities are acceptable within all ANEF zones and the applicant considers the proposed warehouses are considered to 'other industrial' uses. The applicant should be aware aircraft overflight will occur in the site's vicinity any time of the day or night and the buildings should be treated with the appropriate acoustic attenuation.	The aircraft noise assessment includes consideration of the future second runway. Additional information has been provided in the assessment regarding indicative facade and glazing requirements likely needed to meet appropriate internal noise levels.	**Section 4.3**
Additional DPHI Noise Comments – May 2026		
Section 2.4.2 of the Noise Policy for Industry states that the approach of deriving the project amenity noise level resulting from a new development on the basis of the recommended amenity noise level minus 5 dB is based on a receiver not being impacted by more than three to four individual industrial noise sources. However, as the site is located within an area in which there are now multiple proposed industrial noise sources (Goodman Project Maverick, Cross Link, Heidelberg Concrete Batching Plant, EMKC's Industrial Devt), with others in the pipeline in the rezoned land surrounding the development, a different approach to the assessment of cumulative impacts should be applied.	Operational noise criteria updated to use the DPHI provided formula to determine applicable amenity criteria.	**Section 3.3.1**

Comment	Response	Section
As the Badgerys Ck Precinct forms part of a large area of rezoned land for industrial development, the amenity goals for individual industrial developments should be determined based upon the approach included in NPfI Section 2.4.2, but instead of being based on the number of developments, the Department advises that the total area of the Badgery Ck Precinct should be used. The reference area to derive the amenity noise goals is bounded by the following: - North - Elizabeth Drive - South – Southern boundary of the Badgerys Creek Precinct and the Aerotropolis Precinct - West - Western Sydney International Airport - East - Eastern boundary of Badgerys Creek precinct. The attached figure defines the WSA Badgerys Creek Precinct noise criteria boundary that is to be used to derive the project amenity noise goals. This is consistent with how other applicants will be required to address noise impacts in this precinct noting the increasingly large number of applications we have in the Precinct.	Operational noise criteria updated to use the DPHI provided formula to determine applicable amenity criteria.	**Section 3.3.1**

2.0 Existing Noise Environment

Unattended noise monitoring was completed at the site during September 2024. The measured noise levels have been used to determine the existing noise environment and to set the criteria used to assess the potential impacts from the proposal.

The monitoring equipment was positioned to measure existing noise levels that are representative of receivers potentially most affected by the proposal, within constraints such as accessibility, security and landowner permission. Two monitoring locations were chosen to represent the different acoustic environment along Martin Road and Lawson Road.

The noise monitoring equipment continuously measured existing noise levels in 15-minute periods during the daytime, evening and night-time. All equipment carried current National Association of Testing Authorities (NATA) or manufacturer calibration certificates and equipment calibration was confirmed before and after each measurement.

The measured data has been processed to exclude noise from extraneous events and periods affected by adverse weather conditions, such as strong wind or rain (measured at Badgerys Creek Bureau of Meteorology Station), to establish representative existing noise levels in each Noise Catchment Area.

The noise monitoring locations are shown in **Figure 3** and the results are summarised in **Table 4**. Details of each monitoring location together with graphs of the measured daily noise levels are provided in **Appendix B**.

Table 4 Summary of Unattended Noise Monitoring Results

ID	Address/Description	Measured Noise Levels (dBA)					
		Background Noise (RBL)			Average Noise (L_{Aeq})		
		Day	Evening	Night	Day	Evening	Night
L01	South-eastern end of site along Martin Road	36	29 (30) [2]	26 (30) [2]	53	51	47
L02	North-western end of site along Lawson Road	37	34	29 (30) [2]	52	56	55

Note 1: The assessment periods are the daytime which is 7 am to 6 pm Monday to Saturday and 8 am to 6 pm on Sundays and public holidays, the evening which is 6 pm to 10 pm, and the night-time which is 10 pm to 7 am on Monday to Saturday and 10 pm to 8 am on Sunday and public holidays. See the NSW EPA *Noise Policy for Industry*.

Note 2: Actual RBLs are below policy minimums, therefore the minimum values in the *Noise Policy for Industry* have been used.

3.0 Assessment Criteria

3.1 Construction Noise Criteria

The NSW *Interim Construction Noise Guideline* (ICNG) is used to assess and manage impacts from construction noise on residences and other sensitive land uses in NSW.

The ICNG contains procedures for determining project specific Noise Management Levels (NMLs) for sensitive receivers based on the existing background noise in the area. The 'worst-case' noise levels from construction of a proposal are predicted and then compared to the NMLs in a 15-minute assessment period to determine the likely impact of the proposal.

The NMLs are not mandatory limits, however, where construction noise levels are predicted or measured to be above the NMLs, feasible and reasonable work practices to minimise noise emissions are to be investigated.

3.1.1 Residential Receivers

The ICNG approach for determining NMLs at residential receivers is shown in **Table 5**.

Table 5 ICNG NMLs for Residential Receivers

Time of Day	NML $L_{Aeq(15minute)}$	How to Apply
Standard Construction Hours Monday to Friday 7:00 am to 6:00 pm Saturday 8:00 am to 1:00 pm No work on Sundays or public holidays	Noise affected RBL[1] + 10 dB	• The noise affected level represents the point above which there may be some community reaction to noise • Where the predicted or measured $L_{Aeq(15minute)}$ 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 dBA	• The Highly Noise Affected (HNA) 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 restructuring 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 works near schools or mid-morning or mid-afternoon for works near residences ○ If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside Standard Construction Hours	Noise affected 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 practises have been applied and noise is more than 5 dB above the noise affected level, the proponent should negotiate with the community.

Note 1: The RBL is the Rating Background Level and the ICNG refers to the calculation procedures in the NSW *Industrial Noise Policy* (INP). The INP has been superseded by the NSW EPA *Noise Policy for Industry* (NPfI).

3.1.2 NML Summary

The construction NMLs for the proposal have been determined using the results from the unattended noise monitoring and are shown in **Table 6**.

Table 6 Project Specific Noise Management Levels

NCA	Receiver Type	Location	Measured RBL[1] (dBA)			NML ($L_{Aeq(15minute)}$ dBA)				Sleep Disturbance Screening Level[2] (L_{Amax} dBA)
						Standard Construction Hours (RBL+10dB)	Out of Hours (RBL+5dB)			
			Day	Eve.	Night	Day	Day	Eve.	Night	Night
NCA01	Residential	L02	37	34	30[3]	47	42	39	35	52
NCA02	Residential	L02	37	34	30[3]	47	42	39	35	52
NCA03	Residential	L01	36	30[3]	30[3]	46	41	35	35	52
NCA04	Residential	L01	36	30[3]	30[3]	46	41	35	35	52
NCA05	Residential	L01	36	30[3]	30[3]	46	41	35	35	52
-	Commercial	-	-	-	-	70	70	70	70	-

Note 1: RBL = Rating Background Level.

Note 2: Sleep disturbance screening level is RBL+15 dB or 52 dBA, whichever is higher.

Note 3: The NPfI minimum RBL value has been used due to the measured RBL being below the NPfI minimum value.

3.2 Construction Vibration Criteria

3.2.1 Minimum Working Distances for Vibration Intensive Works

Minimum working distances for typical vibration intensive construction equipment are provided in the Roads and Maritime *Construction Noise and Vibration Guideline* (CNVG) and are shown in **Table 7**.

The minimum working distances are for both cosmetic damage (from BS 7385 and DIN 4150) and human comfort (from the NSW EPA Vibration Guideline). They are based on empirical data which suggests that where works are further from receivers than the quoted minimum distances then impacts are not considered likely.

The minimum working distances for human comfort relate to continuous vibration. For most construction activities, vibration emissions are intermittent and for this reason, higher vibration levels occurring over shorter periods are allowed.

Table 7 Recommended Minimum Working Distances from Vibration Intensive Equipment

Plant Item	Rating/Description	Minimum Distance		
		Cosmetic Damage		Human Response (NSW EPA Guideline)
		Residential and Light Commercial (BS 7385)	Heritage Items (DIN 4150, Group 3)[1]	
Vibratory Roller	<50 kN (1–2 tonne)	5 m	11 m	15 m to 20 m
	<100 kN (2–4 tonne)	6 m	13 m	20 m
	<200 kN (4–6 tonne)	12 m	15 m	40 m
	<300 kN (7–13 tonne)	15 m	31 m	100 m
	>300 kN (13–18 tonne)	20 m	40 m	100 m
	>300 kN (>18 tonne)	25 m	50 m	100 m
Small Hydraulic Hammer	300 kg (5 to 12 t excavator)	2 m	5 m	7 m
Medium Hydraulic Hammer	900 kg (12 to 18 t excavator)	7 m	15 m	23 m
Large Hydraulic Hammer	1,600 kg (18 to 34 t excavator)	22 m	44 m	73 m
Vibratory Pile Driver	Sheet piles	2 m to 20 m	5 m to 40 m	20 m
Piling Rig – Bored	≤ 800 mm	2 m (nominal)	5 m	4 m
Jackhammer	Hand held	1 m (nominal)	3 m	2 m

Note 1: Minimum working distances for heritage items that have been identified as structurally unsound or otherwise particularly sensitive to vibration. These distances have been calculated based on the 2.5 mm/s PPV criterion from DIN 4150 and the cosmetic damage minimum working distances presented in the CNVG with reference to BS 7385. It is recommended that the 2.5 mm/s PPV criterion is considered at the foundation (rather than the highest floor as suggested in DIN 4150).

The minimum working distances are indicative and will vary depending on the particular item of equipment and local geotechnical conditions. The distances apply to cosmetic damage of typical buildings under typical geotechnical conditions.

3.3 Operational Noise Criteria

The *NSW Noise Policy for Industry* (NPfI) was released in 2017 and sets out the requirements for the assessment and management of operational noise from industry in NSW.

The NPfI defines how to determine 'trigger levels' for noise emissions from industrial developments. Where a development is likely to exceed the trigger levels at existing noise sensitive receivers, feasible and reasonable noise management measures are required to be considered to reduce the impacts.

There are two types of trigger levels – 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 representative 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 NPfI for that particular land use.

Intrusive and amenity noise levels are not used directly as regulatory limits. They are used to assess the potential impact of noise, assess feasible and reasonable mitigation options and subsequently determine achievable noise requirements.

The NPfI provides guidance on assigning residential receiver amenity noise categories based on the site-specific features shown in **Table 8**.

Table 8 Residential Receiver Amenity

Receiver Category	Typical Planning Land Use Zoning	Typical Existing Background Noise Levels (RBL)	Description
Rural	RU1 – primary production RU2 – rural landscape RU4 – primary production small lots R5 – large lot residential E4 – environmental living	Daytime <40 dBA Evening <35 dBA Night <30 dBA	Rural – an area with an acoustical environment that is dominated by natural sounds, having little or no road traffic noise and generally characterised by low background noise levels. Settlement patterns would be typically sparse. Note: where background noise levels are higher than those presented due to existing industry or intensive agricultural activities, the selection of a higher noise amenity area should be considered.

Receiver Category	Typical Planning Land Use Zoning	Typical Existing Background Noise Levels (RBL)	Description
Suburban residential	RU5 – village RU6 – transition R2 – low density residential R3 – medium density residential E2 – environmental conservation E3 – environmental management	Daytime <45 dBA Evening <40 dBA Night <35dBA	Suburban – an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This area often has the following characteristic: evening ambient noise levels defined by the natural environment and human activity.
Urban residential	R1 – general residential R4 – high density residential B1 – neighbourhood centre (boarding houses and shop-top housing) B2 – local centre (boarding houses) B4 – mixed use	Daytime >45 dBA Evening >40 dBA Night >35 dBA	Urban – an area with an acoustical environment that: • Is dominated by 'urban hum' or industrial source noise, where urban hum means the aggregate sound of many unidentifiable, mostly traffic and/or industrial related sound sources • Has through-traffic with characteristically heavy and continuous traffic flows during peak periods • Is near commercial districts or industrial districts • Has any combination of the above.

Amenity noise categories for the surrounding receivers have been determined with reference to the NPfI. The assessment is shown in **Table 9**.

Table 9 Residential Receiver Amenity Category Assessment

NCA	Land Use Zoning	Existing Background Noise Levels RBL (dBA)			Amenity Classification	Discussion
		Day	Eve	Night		
NCA01, NCA02, NCA03 and NCA04	Enterprise (ENT)	36 – 37	30 – 34	30	Rural	The surrounding area is zoned as ENT. ENT zoning is not identified in **Table 8**. The area currently has an acoustical environment that is influenced by natural sounds and generally characterised by low background noise levels. Background noise levels will, however, significantly increase over time as the area is developed. Western Sydney International Airport is currently under construction to the west of the site and the M12 Motorway is to the north. It is understood that all land zoned ENT would be developed and ultimately replaced with a variety of future industrial and business enterprises as part of the Badgerys Creek Precinct.
NCA05	Rural (RU4)	36	30	30	Rural	The surrounding area is zoned as RU4. RU4 zoning is considered rural as per the NPfI and is identified in **Table 8**. The area currently has an acoustical environment that is influenced by natural sounds and generally characterised by low background noise levels. Background noise levels are likely to increase over time as the adjacent areas west of the site are developed. Additionally, Western Sydney International Airport is currently under construction to the west of the site and the M12 Motorway is to the north.

3.3.1 Project Noise Trigger Levels

The trigger levels for industrial noise from the project are summarised in **Table 10**. The Project Noise Trigger Levels (PNTL) are the most stringent of the intrusiveness and amenity trigger level for each period and are highlighted below.

DPHI instructed that project amenity noise levels are required to be determined using the following formula, which is a modified version of the approach in Section 2.4.2 of the NPfI. This formula reduces the recommended amenity noise level for each NCA based on the area of project site relative to the overall Badgerys Creek Precinct.

$$Project\ ANL = Recommended\ ANL + 10 \times \log_{10}\left(\frac{Project\ Site\ Area}{Noise\ Precinct\ Area}\right)$$

The project site and Badgerys Creek noise precinct areas are shown in **Figure 5**.

Table 10 Project Noise Trigger Levels

NCA	Receiver Type	Period	Recommended Amenity Noise Level $L_{Aeq(period)}$	Measured Noise Level (dBA)		Project Noise Trigger Levels $L_{Aeq(15minute)}$ (dBA)	
				RBL[1]	L_{Aeq} (period)	Intrusive-ness	Amenity[2,3]
NCA01 (L02)	Residential	Daytime	50	37	52	42	**39**
		Evening	45	34	56	39	**34**
		Night-time	40	30[4]	55	35	**29**
NCA02 (L02)	Residential	Daytime	50	37	52	42	**39**
		Evening	45	34	56	39	**34**
		Night-time	40	30[4]	55	35	**29**
NCA03 (L01)	Residential	Daytime	50	36	53	41	**39**
		Evening	45	30[4]	51	35	**34**
		Night-time	40	30[4]	47	35	**29**
NCA04 (L01)	Residential	Daytime	50	36	53	41	**39**
		Evening	45	30[4]	51	35	**34**
		Night-time	40	30[4]	47	35	**29**
NCA05 (L01)	Residential	Daytime	50	36	53	41	**39**
		Evening	45	30[4]	51	35	**34**
		Night-time	40	30[4]	47	35	**29**
-	Commercial	When in use	65	-	-	-	**54**

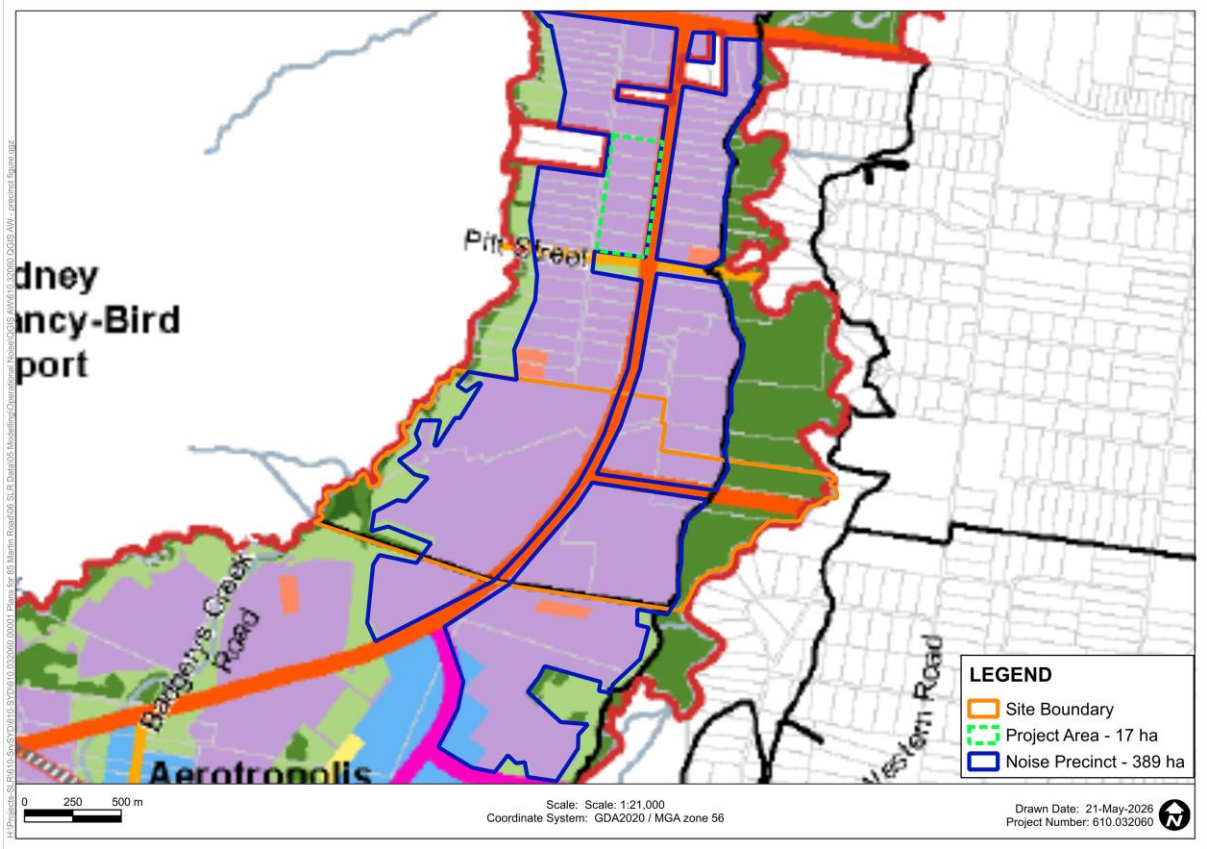
Note 1: RBL = Rating Background Level

Note 2: The recommended amenity noise levels have been reduced by 14 dB to give the project amenity noise levels (calculated using the formula provided by DPHI). This addresses the potential cumulative impacts from the development and any existing/future projects.

Note 3: The project amenity noise levels have been converted to a 15-minute level by adding 3 dB, as outlined in the NPfI.

Note 4: The NPfI minimum RBL value has been used due to the measured RBL being below the NPfI minimum value.

Figure 5 Noise Precinct Map



Note: The noise precinct area is the 'Badgerys Creek Precinct Noise Boundary', as provided by DPHI.

3.3.2 Cumulative Noise Impacts

The NSW Government *Cumulative Impact Assessment Guidelines for State Significant Projects* requires that the potential combined effect of cumulative impacts on all nearby industrial developments to be considered when assessing potential noise impacts from state significant projects. The guideline references the NPfI when determining the approach to assessing the cumulative industrial noise impacts.

The NPfI states that it aims to limit continuing increases in cumulative industrial noise through the application of amenity noise levels, which are applicable to all industrial noise sources in an area.

The NPfI requires that the amenity noise levels which are applied to an individual project be reduced by 5 dB to allow for the potential cumulative impact from multiple sources of industrial noise in an area (including existing and new).

By doing this, the policy accounts for potential cumulative impacts by lowering the criteria for each individual development to ensure that the ambient noise level within an area from all industrial noise sources combined remains below the recommended amenity noise levels, where feasible and reasonable. The NPfI states that *"where the project amenity noise level applies and it can be met, no additional consideration of cumulative industrial noise is required"*.

The potential cumulative impacts from the development and other sources of industrial noise in the area are therefore accounted for in the proposal-specific PNTLs (see **Section 3.3.1**).

3.3.3 Sleep Disturbance

The potential for sleep disturbance from maximum noise level events during the night-time period from the development is required to be considered. This is applicable only to residential receivers.

The NPfI defines the sleep disturbance screening level as 52 dBA L_{AFmax} or the prevailing background level plus 15 dB, whichever is greater.

The sleep disturbance screening levels for the development are shown in **Table 11**.

Table 11 Sleep Disturbance Screening Levels

Location	Noise Level (dBA)	
	Measured Prevailing Night-time Background Level	Sleep Disturbance Screening Level[1]
NCA01	30	52
NCA02	30	52
NCA03	30	52
NCA04	30	52
NCA05	30	52

Note 1: The sleep disturbance screening level as 52 dBA L_{AFmax} or the prevailing background level plus 15 dB, whichever is greater

A detailed maximum noise level event assessment should be completed where the sleep disturbance screening level is exceeded. The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the RBL, and the number of times this happens during the night-time period.

The NPfI refers to the *Road Noise Policy* (RNP) for additional information regarding sleep disturbance. enHealth Council studies are referenced which indicate that for short-term or transient noise events, for good sleep over eight hours the indoor LAFmax sound pressure level should ideally not exceed around 45 dBA more than 10 or 15 times per night.

The RNP goes on to conclude that from the research on sleep disturbance to date:

- Maximum internal noise levels below 50 dBA to 55 dBA are unlikely to awaken people from sleep
- One or two events per night with maximum internal noise levels of 65-70 dBA are not likely to affect health and wellbeing significantly.

3.3.4 Corrections for Annoying Noise Characteristics

Sources of industrial noise can cause greater annoyance where they contain certain characteristics, such as tonality, intermittency or dominant low-frequency content. The NPfI specifies the following modifying factor corrections, shown in **Table 12**, which are to be applied where annoying characteristics are present.

Table 12 NPfI Modifying Factor Corrections

Factor	Assessment / Measurement	When to Apply	Correction[1]
Tonal noise	One-third octave or narrow band analysis	Level of one-third octave band exceeds the level of the adjacent bands on both sides by the levels defined in the NPfI.	5 dB[2]
Low-frequency noise	Measurement of source contribution C-weighted and A-weighted level and one-third octave measurements	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 the level to which the thresholds defined in the NPfI are exceeded.	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. The NPfI further defines intermittent noise as noise where the level suddenly drops/increases several times during the assessment period, with a noticeable change in source noise level of at least 5 dB, for example, equipment cycling on and off. The EPA has confirmed[4] that the intermittent correction does not apply to short-term events that emerge above the general industrial noise level and is therefore not applicable to industrial or commercial sites that have vehicle or plant movements at night, including audible reversing alarms. The intermittency correction is not intended to be applied to changes in noise level due to meteorology	5 dB[3]
Maximum adjustment	Refer to individual modifying factors	Where two or more modifying factors are indicated.	Maximum correction of 10 dB[2] (excluding duration correction)

Note 1: Corrections to be added to the measured or predicted levels.

Note 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.

Note 3: Adjustment to be applied to night-time only.

Note 4: *How to Apply the Noise Policy for Industry Intermittent Modifying Factor Corrections*, NSW Environment Protection Authority, Acoustics Australia Vol. 50, No. 3, September 2022.

Details of the modifying factor corrections applied in the assessment are provided in **Section 4.2**.

3.3.5 Residual Impacts

The NPfI defines residual noise impacts as exceedances of the Project Noise Trigger Levels which remain after all feasible and reasonable source and pathway mitigation measures have been considered.

The significance of residual noise impacts, as defined in the NPfI, is shown in **Table 13.** Examples of receiver-based treatments that can be used to mitigate residual impacts are shown in **Table 14**.

Table 13 NPfI Significance of Residual Noise Impacts

If the Predicted Noise Level minus the Project Noise Trigger Level is:	And the Total Cumulative Industrial Noise Levels is:	Then the Significance of the Residual Noise Level is:
≤ 2 dBA	Not applicable	Negligible
≥ 3 but ≤ 5 dBA	< recommended amenity noise level or > recommended amenity noise level, but the increase in total cumulative industrial noise level resulting from the development is less than or equal to 1dB	Marginal
≥ 3 but ≤ 5 dBA	> recommended amenity noise level and the increase in total cumulative industrial noise level resulting from the development is more than 1 dB	Moderate
> 5 dBA	≤ recommended amenity noise level	Moderate
	> recommended amenity noise level	Significant

Table 14 NPfI Examples of Receiver-based Treatments to Mitigate Residual Noise Impacts

Significance of Residual Noise Impact	Example of Potential Treatment
Negligible	The exceedances would not be discernible by the average listener and therefore would not warrant receiver-based treatments or controls.
Marginal	Provide mechanical ventilation/comfort condition systems to enable windows to be closed without compromising internal air quality/amenity.
Moderate	As for ‘marginal’, but also upgraded facade elements, such as windows, doors or roof insulation, to further increase the ability of the building facade to reduce noise levels.
Significant	May include suitable commercial agreements where considered feasible and reasonable.

3.3.6 Traffic on Surrounding Roads

The potential impacts from project related traffic on the surrounding public roads are assessed using the NSW EPA *Road Noise Policy* (RNP).

An initial screening test is first applied to evaluate if existing road traffic noise levels are expected to increase by more than 2.0 dB. Where this is considered likely, further assessment is required using the RNP criteria shown in **Table 15**.

Table 15 RNP Criteria for Assessing Traffic on Public Roads

Road Category	Type of Project/Land Use	Assessment Criteria (dBA)	
		Daytime (7 am – 10 pm)	Night-time (10 pm – 7 am)
Freeway / arterial / sub-arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq(15hour)}$ 60 (external)	$L_{Aeq(9hour)}$ 55 (external)
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq(1hour)}$ 55 (external)	$L_{Aeq(1hour)}$ 50 (external)

3.4 Aircraft Noise

The potential aircraft noise impacts on the development site from Western Sydney International Airport are assessed using *Australian Standard AS2021:2015 – Acoustics Aircraft Noise Intrusion – Building Siting and Construction*. The standard provides 'building site acceptability' guidance based on the Australian Noise Exposure Forecast (ANEF) zone of the site. The building site acceptability recommendations are shown in **Table 16**.

Table 16 Building Site Acceptability Based on ANEF Zones

Building Type	ANEF Zone of Site		
	Acceptable	Conditionally Acceptable	Unacceptable
Light industrial	Less than 30 ANEF	30 to 40 ANEF	Greater than 40 ANEF

AS2021 provides indoor design sound levels for light industry buildings as shown in **Table** 17.

Table 17 Indoor Design Sound Level for Determination of Aircraft Noise Reduction

Building Type and Activity	Indoor Design Sound Level[1], dB(A)
Industrial	
Inspection, analysis, precision work	75
Light machinery, assembly, bench work	80

Note 1: These indoor design sound levels are not intended to be used for measurement of adequacy of construction.

4.0 Methodology

4.1 Construction Noise and Vibration Assessment

A noise model of the study area has been used to predict noise levels from the proposed construction work to all surrounding receivers. The model uses ISO 9613 algorithms in SoundPLAN software. Local terrain, receiver buildings and structures were digitised in the noise model to develop a three-dimensional representation of the construction sites and surrounding areas.

Construction noise levels have been predicted for Stage 1 and Stage 3 separately, as per **Figure 1** and **Figure 2**.

4.1.1 Construction Activities

Representative scenarios have been developed to assess the likely impacts from the various construction phases of the proposal. These scenarios are shown in **Table 18** together with a high-level description of each works activity.

The assessment uses 'realistic worst-case' scenarios to determine the impacts from the noisiest 15-minute period that are likely to occur for each work scenario, as required by the ICNG. The impacts represent construction noise levels without mitigation applied.

Details of the items of plant that would be used during each scenario, together with corresponding sound power levels, are in **Appendix C**.

Table 18 Construction Scenario Descriptions

Ref.	Stage	Description
W1	Site Establishment	Site establishment
W2	Stage 1	Underground services installation and connections
W3	Stage 2	Detailed excavation for pad levels and footings
W4	Stage 3	Substructure (foundations and retaining walls)
W5	Stage 4	Superstructure (warehouse and office buildings)
W6	Stage 5	External works (landscaping, fencing, etc)
W7	Stage 6	Fit-out, testing and commissioning

4.1.2 Hours of Construction

Construction activities for the proposal would only be undertaken during the following hours:

- 7:00 am to 6:00 pm, Mondays to Fridays
- 8:00 am to 1:00 pm on Saturdays
- At no time on Sundays or Public Holidays.

4.2 Operational Noise Assessment

The potential operational noise levels from the proposal have been predicted to the surrounding receivers using the ISO 9613-2 algorithm in SoundPLAN, implemented in accordance with ISO 17534.

The ISO 9613-2 algorithm predicts continuous A-weighted sound pressure levels under noise-enhancing meteorological conditions favourable to downwind propagation, or equivalently, propagation under a well-developed, moderate, ground-based temperature inversion, such as commonly occurs on clear calm nights.

ISO 9613-2 has been used extensively on industrial projects in Australia over several decades and has been accepted previously by NSW DPE (now DPHI) in numerous environmental noise assessments.

The noise model includes ground topography, ground type (ground absorption modelled at 0.75 in the surrounding residential areas and 0.0 within the development site), buildings and representative worst-case noise sources from the proposal.

The potential noise impacts from the development have been determined by comparing the predicted noise levels to the noise limits in 15-minute assessment periods which are representative of the worst-case expected activity from the development.

The worst-case 15-minute periods have been determined as those with the highest expected volumes of on-site traffic and corresponding activity for the daytime, evening and night-time periods.

4.2.1 Operational Noise Sources

The development comprises of various lots with associated ancillary offices, a private estate road, heavy vehicle access, hardstands, light vehicle access and carparking. Vehicles would access the site from Lawson Road or Martin Road. Heavy vehicles would park in the hard stand loading areas while they are loaded/unloaded, before exiting the site. Light vehicle carparking is provided at each warehouse and would generally be used by staff.

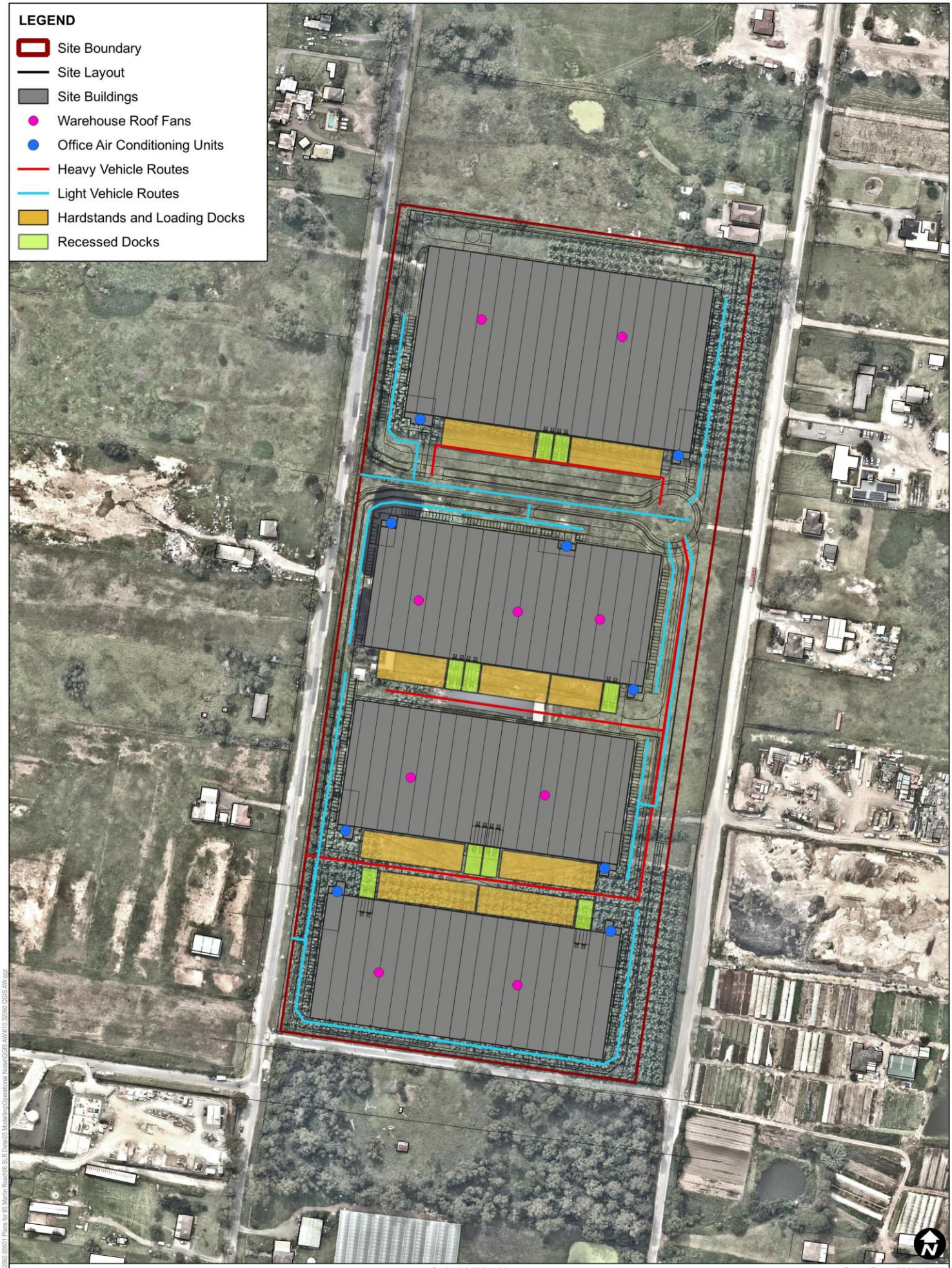
Internal noise sources would generally be minimal and associated with typical logistical, distribution, warehousing and office space activities. There would be no use of manufacturing equipment within any warehouses.

Roof mounted mechanical plant would be provided for each office and the warehouse. The development would operate 24 hours a day.

The main sources of operational noise at the development are expected to include:

- On-site light, medium and heavy vehicle movements
- Loading dock activities in hardstands
- Mechanical plant
- Off-site vehicle movements.

A summary of the expected noise sources and worst-case assessment scenarios associated with the operation of the development is provided below. The locations of all modelled noise sources are shown in **Figure 6**. The figure shows the Stage 3 noise sources. Stage 1 sources relate to the operation of Warehouse 1 – 3.



Scale: 1:3,500 at A4
Coordinate System: GDA2020 / MGA zone 56

Drawn Date: 25-Mar-2026
Project Number: 610.31010

Data Source:
Nearmap Imagery

Operational Sources

FIGURE 5

4.2.1.1 On-Site Traffic

On-site vehicles have been modelled using the data in **Table 19** and **Table 20**. The volumes are representative of the expected worst-case 15-minute period for the daytime, evening and night-time. The volumes conservatively assume that light and heavy vehicles concurrently access the various warehouse tenancies during the worst-case 15-minute assessment period. In reality, vehicle access to each warehouse would be unlikely to occur concurrently, particularly during the night-time.

Heavy vehicle deliveries to the warehouses would be via a range of freight vehicles including medium trucks (ie rigid trucks or similar) and heavy trucks (ie semi-trailers or similar). The modelled vehicle routes are shown in **Figure 6**.

Table 19 Vehicle Traffic Data – Worst-case 15-Minute Period

Lot	Vehicle Type	Number of Vehicles in Worst-case 15-minute Period[1]		
		Daytime (7am to 6pm)	Evening (6pm to 10pm)	Night-time (10pm to 7am)
WH1	Heavy trucks	1	1	1
	Medium trucks	2	1	2
	Light vehicles	8	3	8
WH2	Heavy trucks	1	1	1
	Medium trucks	2	1	2
	Light vehicles	8	3	7
WH3	Heavy trucks	1	1	1
	Medium trucks	2	1	2
	Light vehicles	8	3	8
WH4	Heavy trucks	2	1	1
	Medium trucks	3	1	2
	Light vehicles	11	4	10

Note 1: Total vehicles, includes both inbound and outbound vehicles. Volumes are rounded up to whole numbers for display purposes.

Table 20 Vehicle Sound Power Levels

Vehicle	Movement	Sound Power Level (dBA)	Vehicle Speed (km/h)
Heavy trucks	Access routes	108[1]	25
	On-lot routes and hardstands		10
Medium trucks	Access routes	97[2]	25
	On-lot routes and hardstands		10
Light vehicles	Car park	90[3]	20

Note 1: Sound power level for 'heavy vehicles' based on 106 dBA for trucks at slow speed for 80% of the time and 111 dBA for trucks accelerating for 20% of the time. Sound power levels taken from the Federal Highway Administration's Traffic Noise Model and is representative of trucks with three or more axles.

Note 2: Sound power level for 'medium vehicles' based on 95 dBA for trucks at slow speed for 80% of the time and 100 dBA for trucks accelerating for 20% of the time. Sound power level for 'medium vehicles' is based on measurement data.

Note 3: Sound power level for light vehicles based on SLR measurement data.

The sound power level for medium vehicles is based on SLR measurement data taken over multiple years at multiple locations and includes various medium truck types and models in the approximate 5 to 15 tonne range. Sound power level data is based on pass-by measurement at a known distance with the passby L_{Amax} measurement used to develop the source sound power level. The measured sound power levels ranged from 91-100 dBA for low-speed (5-20km/h) manoeuvring including acceleration. A sound power level of 97 dBA has been used for this assessment.

The sound power level for light vehicles is based on measurement data from SLR's noise measurement database taken over multiple years at multiple locations and includes various light vehicle types and models. Measurements of the L_{Amax} sound power level were made of light vehicle passbys at speeds of up to around 40 km/h, including accelerating conditions. SLR's database for light vehicles indicates a SWL range of 73-90 dBA. A sound power level of 90 dBA has been used for this assessment.

The modelling conservatively assumes that all light, medium and heavy vehicles concurrently access all warehouses during the realistic worst-case 15-minute assessment periods. In reality, vehicle access across the lots would be spread over a longer period, particularly during the night-time.

4.2.1.2 Hardstands and Loading Docks

Details of the hardstand and loading dock noise sources are shown in **Table 21**. The various sources have been modelled in the hardstand areas (see **Figure 6**) based on the corresponding number of heavy vehicle movements in the worst-case 15-minute periods (see **Table 19**).

Table 21 Typical Hardstand and Loading Dock Noise Sources

Noise Source	Sound Power Level (dBA)[1]	Typical Duration of Use in Worst-case 15-minute Period
Truck reversing alarm	107[2,3]	30 seconds
Forklift reversing alarm	102[2,3]	90 seconds
Air brakes	118	1 second
Roller door	94	15 seconds
Electric forklift	84	900 seconds

Note 1: SWLs based on measurement data, where appropriate.

Note 2: SWL based on recommendation to use broadband reversing alarms, see **Section 7.2**.

Note 3: SWL includes a -3 dB reduction due to alarms being discrete events.

4.2.1.3 Internal Activities

The future tenants of the warehouses would likely be associated with typical warehousing and distribution uses. Internal noise-generating activities at all warehouses are expected to generally be minimal. A sound power level of 75 dBA has been applied at openings in the facades of each warehouse to cover potential break-out noise from general internal activities, based on observations of loading activities at similar warehouse facilities. Warehouse roller shutter doors are assumed to be open during loading dock activities.

The facade and roof construction of the warehouses would be metal sheeting (Colorbond or similar). The proposed warehouse construction is expected to be sufficient to minimise noise breakout through the facade and roof to a level that results in negligible to external noise emissions.

4.2.1.4 Mechanical Plant

At this early stage of the development, specific mechanical plant requirements for each building have not been determined. External mechanical plant noise emissions would be reassessed during the detailed design stage of the project, when more definitive information is available.

Indicative external mechanical plant types, sound power levels and number of units have been assumed based on information from the client and requirements of similar warehouse developments.

The assumed sound power levels and hours of operation for fixed external mechanical plant are detailed in **Table 22**. The locations of the sources are shown in **Figure 6**.

Table 22 Mechanical Plant

Noise Source	Sound Power Level (dBA)	Indicative Locations
Office condensers	78 per unit	One unit on the roof of each office – conservatively assumed to operate 24 hours a day.
Roof fans	90 per unit	Two to three units on the roof of each warehouse (depending on number of tenancies) – conservatively assumed to operate 24 hours a day.

4.2.1.5 Noise Sources with Potential for Sleep Disturbance

As the development is proposed to operate 24-hours a day, noise emissions during the night-time require assessment for potential sleep disturbance at the nearest residential receivers. The details of typical activities with the potential to cause sleep disturbance are shown in **Table 23**.

Table 23 Sleep Disturbance Noise Events – L_{Amax} Sound Power Levels

Noise Source	Sound Power Level L_{Amax} (dBA)
Heavy truck movement	111
Heavy truck airbrake	118
Truck reversing alarm	110
Forklift reversing alarm	105
Roller door	94

4.2.1.6 Noise Source Inventory

A noise source inventory which includes the details of the various operational noise sources at the development is shown in **Table 24**.

Table 24 Noise Source Inventory

Category	Noise Source	Usage	Reference for Noise Data
On-site traffic	Light vehicles	Light vehicles would access the development and park in the various car parks. Modelled in all locations shown in **Figure 6** using vehicle volumes in **Table 19**.	Sound power level taken from measurement data of various light vehicle types and models at speeds of up to around 40 km/h, including vehicle acceleration.
	Medium vehicles	Deliveries to the development would be via medium and heavy vehicles. Medium and heavy vehicles would access the development and travel to the various hardstands/loading docks. Modelled on all medium/heavy vehicle routes shown in **Figure 6** using vehicle volumes in **Table 19**.	Sound power level taken from historical measurement data of various medium rigid truck types and models in approximate 5 to 15 tonne range.
	Heavy vehicles		Sound power level taken from Federal Highway Administration's Traffic Noise Model. Assumes slow speed for 80% of the time and truck acceleration for 20% of the time.
Hardstand and loading docks	Forklifts, reversing alarms, air brakes, roller doors	Heavy vehicle deliveries would be unloaded by forklifts in the various hardstands/loading docks. Modelled in all hardstands/loading docks shown in **Figure 6** using vehicle volumes in **Table 19**.	Sound power level taken from historical measurement data of typical loading dock activities at similar warehousing and distribution facilities.
Internal activities	Typical warehousing and distribution activities	Internal noise-generating activities at all warehouses would be associated with typical warehousing and distribution activities. Noise from these activities is expected to be minimal.	Sound power level based on observations of typical internal activities at similar warehousing and distribution facilities.
Mechanical plant	Roof fans	Roof fans would be used to cycle air in the warehouses. At this early stage of the development, specific mechanical plant requirements for each building have not been determined.	Sound power level taken from measurement data and manufacturers specifications for typical roof fans at similar warehousing and distribution facilities.
	Office air-conditioning units	Air-conditioning units would be used for all office buildings. At this early stage of the development, specific mechanical plant requirements for each building have not been determined.	Sound power level taken from measurement data and manufacturers specification data for typical air-conditioning units.

4.2.1.7 Corrections for Annoying Noise Characteristics

The potential annoying noise characteristics and modifying factor corrections relevant to the proposal are:

- **Tonality** – the only source identified with potential tonal characteristics is reversing alarms. However, when considering broadband reversing alarms have been recommended as a noise mitigation measure (see **Section 7.2**), it is unlikely that this noise source would result in tonal noise impacts and no corrections have been applied.
- **Low frequency noise** – previous measurements of sources similar to those operating at the development indicate that no sources are expected to result in low frequency noise impacts.
- **Intermittent noise** – the NPfI defines intermittent noise as noise heard at the receiver where the level suddenly drops or increases several times during the assessment period, with a noticeable change of at least 5 dB, such as where equipment cycles on and off. The intermittent correction does not apply to short-term events that emerge above the general industrial noise level and is therefore not applicable to industrial or commercial sites that have vehicle or plant movements at night, including audible reversing alarms. No sources have been identified with potential intermittent characteristics.

4.2.2 Off-site Road Traffic

Traffic associated with the development would enter and exit the development from the west via Lawson Road or Martin Road, and then travel directly to/from Elizabeth Drive.

The availability of existing traffic data for the surrounding local roads is limited. The only available traffic data for Elizabeth Drive is from 2023.

Table 25 summarises the existing daytime traffic compared to development related traffic.

Table 25 Traffic Volumes – Existing and Development-related

Road	Traffic Volumes (24 hour)			
	2023 Existing		Development-related	
	Light	Heavy	Light	Heavy
Elizabeth Drive	8407	3299	1587	584

4.2.3 Weather Conditions

Fact Sheet D of the NPfI requires noise assessments to consider the potential effects of noise-enhancing weather conditions, such as wind from the source to the receiver and/or temperature inversions.

The nearest sensitive receivers within the Badgerys Creek Precinct are less than 100m from the proposal site and the effects of weather on noise levels are expected to be minimal. Receivers outside the Badgerys Creek Precinct are over 700m from the proposal site and may be subjected to the effects of noise-enhancing weather.

Notwithstanding, the noise prediction modelling uses ISO 9613-2 algorithms which include noise-enhancing weather conditions including downwind propagation, or equivalently, propagation under a well-developed moderate ground-based temperature inversion.

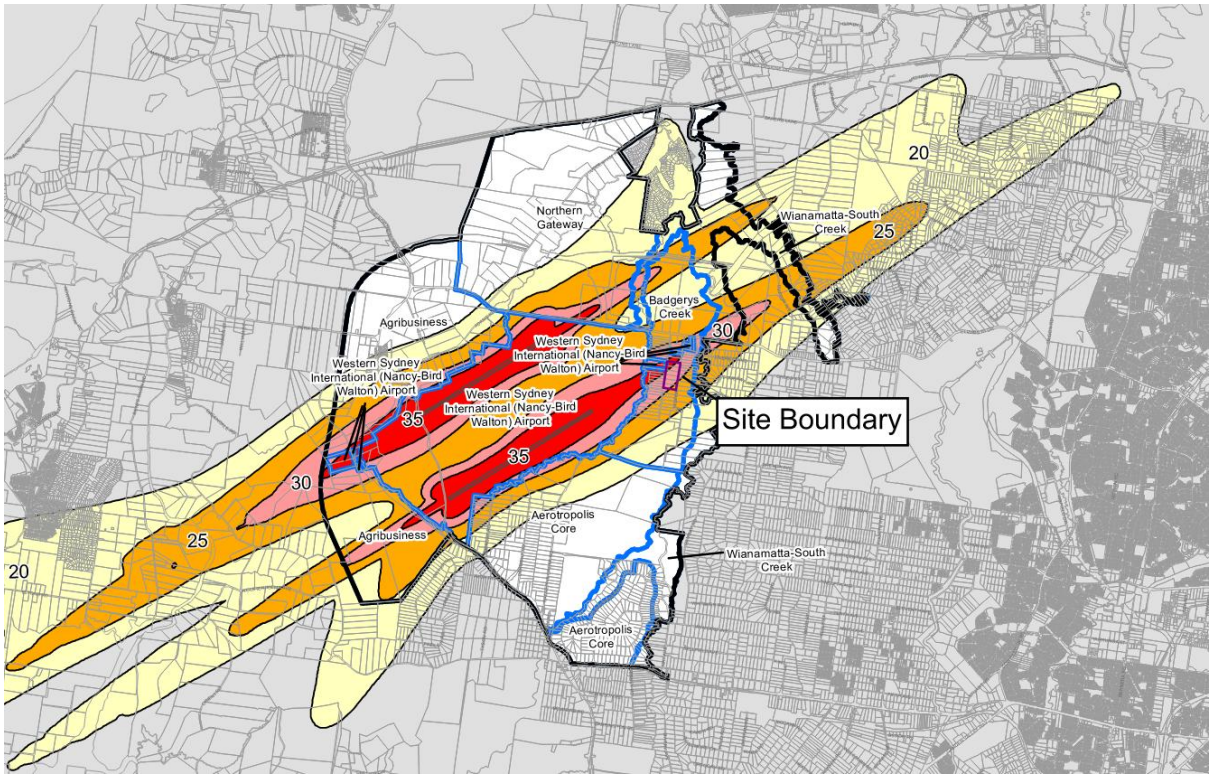
As such, the assessment has conservatively applied noise-enhancing weather conditions for all periods as per Option 1 of Fact Sheet D of the NPfI.

4.3 Aircraft Noise Assessment

The potential aircraft noise impacts on the development site from Western Sydney International Airport have been assessed using the Australian Noise Exposure Concept (ANEC) contours for the area surrounding the airport.

The site's location in relation to the ANEC contours are shown in **Figure 7**. The requirements for the site are determined from the 'building site acceptability' categories for 'light industrial' uses in *Australian Standard AS2021:2015 – Acoustics Aircraft Noise Intrusion*.

Figure 7 Site Location and Western Sydney International Airport ANEC



5.0 Assessment of Impacts

5.1 Construction Noise

The predicted construction noise impacts from Stage 1 and Stage 3 of the development have been assessed separately at the most-affected sensitive receivers surrounding the site and are shown in **Table 27**.

The predictions are representative of the highest noise levels that could potentially be experienced at the surrounding receivers when the works are at the closest point. For most construction activities, it is expected that the construction noise levels would frequently be lower than those predicted, as the noise levels presented are based on all items of equipment in each scenario being used concurrently and occurring at the nearest point of the site to each receiver.

The assessment shows the predicted impacts based on the exceedance of the NMLs, as per the categories in **Table 26**.

The assessment uses ‘realistic worst-case’ scenarios to determine the impacts from the noisiest 15-minute period that are likely to occur for each work scenario, as required by the ICNG. The impacts represent construction noise levels without mitigation applied.

Table 26 Exceedance Bands and Impact Colouring

Exceedance of NML	Subjective Classification	Impact Colouring
No exceedance	Negligible	
1 to 10 dB	Low impact	
11 dB to 20 dB	Moderate impact	
21 dB to 30 dB	High impact	
Highly Noise Affected[1]	Highly Noise Affected	

Note 1: Greater than 75 dBA at residential receivers.

Table 27 Predicted Construction Noise Levels at Nearest Receivers

Receiver	Receiver Type	NML (dBA)	Predicted $L_{Aeq(15minute)}$ Construction Noise Impact (dBA)						
			W1	W2	W3	W4	W5	W6	W7
			Site Establishment	Stage 1 Services	Stage 2 Excavation	Stage 3 Substructure	Stage 4 Superstructure	Stage 5 External Works	Stage 6 Fit out
Stage 1									
NCA01	Residential	47	68	64	69	65	67	60	56
NCA02 (near)		47	53	49	54	50	52	45	41
NCA02 (mid)		47	46	42	47	43	46	39	35
NCA02 (far)		47	38	34	39	35	38	31	27
NCA03		46	64	60	65	61	62	55	51
NCA04		46	55	51	56	52	55	48	44
NCA05		46	40	36	41	37	40	33	29
NCA01	Commercial	70	53	49	54	50	53	46	42
NCA02		70	42	38	43	39	41	34	30
NCA03		70	58	54	59	55	56	49	45
NCA05		70	37	33	38	34	37	30	26
Stage 3									
NCA01	Residential	47	64	60	65	61	62	55	51
NCA02 (near)		47	77	73	78	74	71	64	60
NCA02 (mid)		47	54	50	55	51	53	46	42
NCA02 (far)		47	41	37	42	38	41	34	30
NCA03		46	64	60	65	61	62	55	51
NCA04		46	43	39	44	40	43	36	32
NCA05		46	41	37	42	38	41	34	30
NCA01	Commercial	70	49	45	50	46	49	42	38
NCA02		70	45	41	46	42	44	37	33
NCA03		70	59	55	60	56	58	51	47
NCA05		70	38	34	39	35	38	31	27

Note 1: There are only four receivers in NCA02. Noise levels are presented for the receiver that is immediately adjacent the site boundary (ie NCA02 (near)) and also for the three receivers which are set back further (ie NCA02 (mid) and NCA02 (far)).

The assessment of the worst-case construction noise levels during Stage 1 shows:

- Noise levels at residential receivers are expected to comply with the NMLs in NCA05 for all scenarios.
- Noise levels in NCA01, NCA03 and NCA04 are generally expected to result in 'low' to 'moderate' impacts for most work scenarios. 'High' impacts are predicted in NCA01 during Site Establishment (W1) and Excavation (W3). This is due to receivers in these catchments being relatively close to the site, with the nearest receivers being around 40 m away in NCA01.
- There are only four residential receivers in NCA02. Noise levels in NCA02 are expected to result in:
    - Compliance with the NMLs at the three receivers that are set-back from the site.
    - 'Low' noise impacts during the noisier scenarios for the receiver that is immediately adjacent the northern boundary of the site.
- The highest impacts are during the early phases of the works, during scenarios such as Site Establishment (W1) and Excavation (W3). Construction and Fit Out of the warehouses is expected to result in significantly lower noise levels and impacts.
- No receivers are predicted to be Highly Noise Affected (ie >75 dBA $L_{Aeq(15minute)}$).
- No commercial receivers are predicted to be impacted.

The assessment of the worst-case construction noise levels during Stage 3 shows:

- Noise levels at residential receivers are expected to comply with the NMLs in NCA04 and NCA05 for all scenarios.
- Noise levels in NCA01 and NCA03 are expected to result in 'low' to 'moderate' impacts. This is due to receivers in these catchments being relatively close to the site.
- There are only four residential receivers in NCA02. Noise levels in NCA02 are expected to result in:
    - Compliance with the NMLs at the two receivers furthest from the site.
    - 'Low' noise impacts during the noisier scenarios for the receiver that is around 150 m north of the site.
    - 'Moderate' to 'high' noise impacts for the receiver that is immediately adjacent the northern boundary of the site. This receiver is also predicted to be Highly Noise Affected (ie >75 dBA $L_{Aeq(15minute)}$) during Site Establishment (W1) and Excavation works (W3).
- The highest impacts are during the early phases of the works, during scenarios such as Site Establishment (W1) and Excavation (W3). Construction and Fit out of the warehouses is expected to result in significantly lower noise levels and impacts.
- No commercial receivers are predicted to be impacted.

The presented worst-case impacts would only be expected to occur when noisy work is being completed close to the site boundaries, relative to each receiver. When work is in central areas of the site, or when less noise intensive equipment is being used, the noise levels would reduce.

Feasible and reasonable construction noise mitigation measures should be applied where exceedances of the NMLs are predicted. Construction noise mitigation and management measures are discussed in **Section 7.1**.

5.2 Construction Vibration

The major potential sources of vibration from the proposed construction activities would likely be during Site Establishment when vibratory rollers are being used.

Vibration offset distances have been determined from the CNVG minimum working distances for cosmetic damage and human comfort (see **Table 7**) and the assessment is summarised in **Figure 8** for Stage 1 and Stage 3. Buildings within the minimum working distances for human comfort and cosmetic damage have been highlighted.

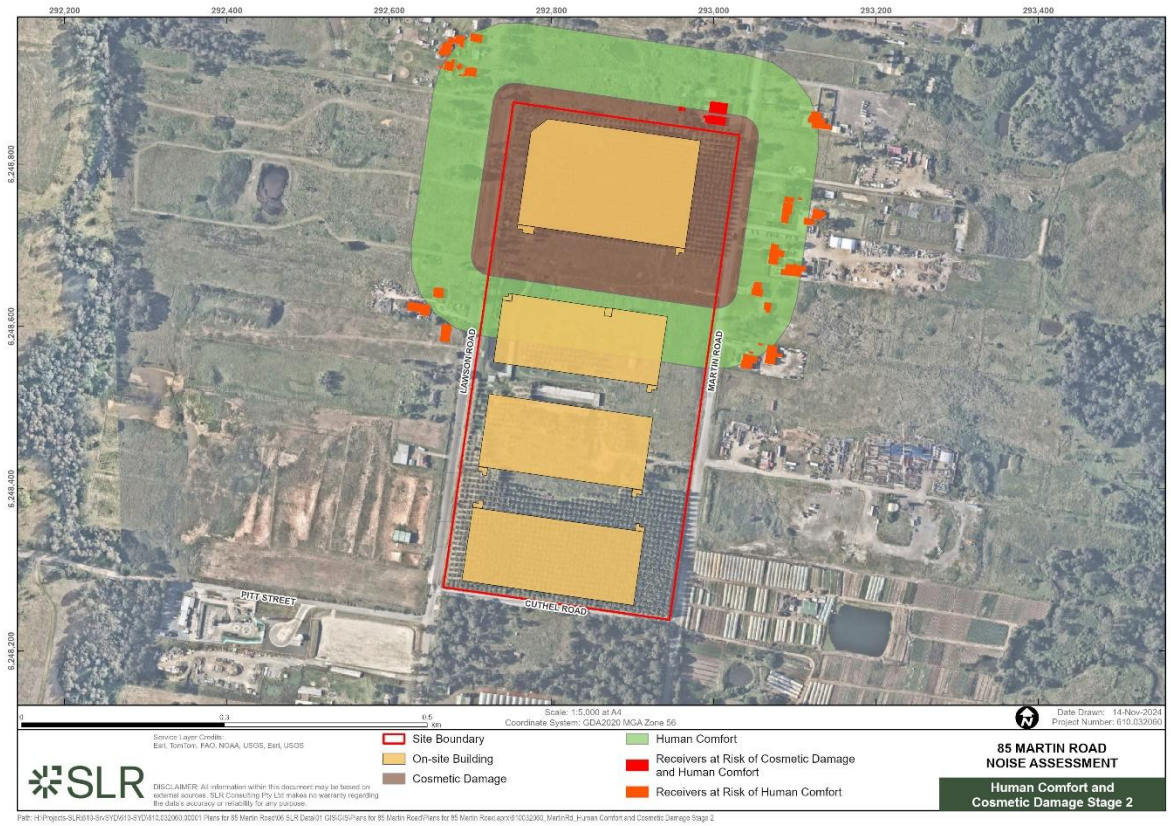
Cosmetic Damage and Human Comfort Assessment

The assessment of potential vibration impacts in relation to the use of vibration intensive equipment as part of the works is summarised below.

- Stage 1:
  - Cosmetic damage is unlikely as the distance between the construction work and the nearest sensitive receivers is sufficient for all receiver buildings to be outside of the cosmetic damage minimum working distance.
  - Nearby buildings are within the recommended human comfort minimum working distance and occupants of these buildings may be able to perceive vibration at times when vibration intensive equipment is in use nearby. Where impacts are perceptible, they would likely only be apparent for relatively short durations when the vibration intensive equipment is in use.
- Stage 3:
  - Most buildings are outside of the cosmetic damage minimum working distance, however the receiver directly adjacent to the site's northern boundary is within it. Mitigation measures should therefore be applied when vibration intensive works are near to this receiver.
  - Nearby buildings are within the recommended human comfort minimum working distance and occupants of these building may be able to perceive vibration at times when vibration intensive equipment is in use nearby. Where impacts are perceptible, they would likely only be apparent for relatively short durations when the vibration intensive equipment is in use.

Feasible and reasonable construction vibration mitigation measures should be applied where vibration intensive works are required within the minimum working distances. Construction mitigation and management measures are discussed further in **Section 7.1**.

Figure 8 Construction Vibration – Large Vibratory Roller



5.3 Operational Noise

Operational noise levels have been assessed for the Stage 1 and Stage 3 development.

5.3.1 Predicted Operational Noise Levels

The predicted worst-case levels are compared to the PNTLs to determine the potential impact from the proposal. Noise contours of the predicted worst-case operational noise impacts for Stage 1 and Stage 3 are included in **Appendix D**.

A detailed assessment of all potential feasible and reasonable mitigation measures that could be applied to the development to minimise the impacts has been completed and is summarised in **Section 7.2**. The following predictions include the recommended mitigation measures, where appropriate.

5.3.1.1 Stage 1

A summary of the worst-case operational noise assessment at the receivers surrounding the proposal for Stage 1 is shown in **Table 28**.

Table 28 Stage 1 Operational Noise Assessment

NCA	Receiver Type	Period	$L_{Aeq(15\ minutes)}$ Noise Level (dBA)			Compliance
			Noise Criteria	Predicted	Exceedance	
Receivers inside the Badgerys Creek Precinct (zoned Enterprise)						
NCA01	Rural Residential	Daytime	39	52	13	**No**
		Evening	34	51	17	**No**
		Night-time	29	52	23	**No**
NCA02	Rural Residential	Daytime	39	35	-	Yes
		Evening	34	34	-	Yes
		Night-time	29	35	6	**No**
NCA03	Rural Residential	Daytime	39	50	11	**No**
		Evening	34	49	15	**No**
		Night-time	29	50	21	**No**
NCA04	Rural Residential	Daytime	39	34	-	Yes
		Evening	34	33	-	Yes
		Night-time	29	34	5	**No**
All	Commercial	When in use	54	39	-	Yes
Receivers outside the Badgerys Creek Precinct (zoned Rural)						
NCA05	Rural Residential	Daytime	39	30	-	Yes
		Evening	34	29	-	Yes
		Night-time	29	30	1	**No**
All	Commercial	When in use	54	29	-	Yes

The assessment of the worst-case impacts during Stage 1 indicates the following:

Permanent Receivers Outside Badgerys Creek Precinct (NCA05, Zoned Rural)

- Noise from the proposal is predicted to comply with the PNTLs at the majority of receivers outside of the Badgerys Creek Precinct (in NCA05), however a 1 dB exceedance is predicted at one receiver during the night-time period only.
- This exceedance is a result of the low night-time PNTL of 29 dBA. The PNTLs have been determined using the formula provided by DPHI (see **Section 3.3.1**) that reduces the amenity noise level for each NCA based on the area of project site relative to the overall Badgerys Creek Precinct. As the project site is small relative to the Badgerys Creek Precinct, this results in a large reduction in amenity noise level and particularly stringent PNTLs.

Temporary Receivers Inside Badgerys Creek Precinct (NCA01 – 04, Zoned Enterprise)

- All receivers inside the Badgerys Creek Precinct are on land zoned Enterprise. It is understood that all receivers in this precinct will be redeveloped and replaced with future industrial and business enterprises as the Badgerys Creek Precinct progresses.
- Noise from the proposal is predicted to comply with the PNTLs at all residential receivers in NCA02 and NCA04 during the daytime and evening periods. Noise levels are also predicted to comply with the PNTLs at all commercial receivers.
- Noise levels are, however, predicted to exceed the PNTLs at residential receivers in NCA01 and NCA03 during all periods, and in NCA02 and NCA04 during the night-time only.
- These exceedances are a result of the low PNTLs that have been applied to the development based on the area of the proposal site relative to the overall Badgerys Creek Precinct (see **Section 3.3.1**). The outcome of this approach to determining amenity noise criteria is that all receivers within around 300 m of the development exceed the PNTLs.
- The highest noise impacts are generally controlled by heavy vehicle movements around the site, along with noise from loading activities.
- Receivers in NCA01 – NCA04 are zoned Enterprise and will be redeveloped as part of the Badgerys Creek Precinct. The predicted exceedances are therefore considered temporary during the transition period before redevelopment occurs.

Where operational noise impacts from a site are predicted to exceed the relevant noise criteria, the NPfI requires all feasible and reasonable operational noise mitigation and management measures to be considered. This exercise is summarised in **Section 7.2**.

5.3.1.2 Stage 3

A summary of the worst-case operational noise assessment at the receivers surrounding the proposal for Stage 3 is shown in **Table 29**.

Table 29 Stage 3 Operational Noise Assessment

NCA	Receiver Type	Period	$L_{Aeq(15\ minutes)}$ Noise Level (dBA)			Compliance
			Noise Criteria	Predicted	Exceedance	
Receivers inside the Badgerys Creek Precinct (zoned Enterprise)						
NCA01	Rural Residential	Daytime	39	52	13	**No**
		Evening	34	51	17	**No**
		Night-time	29	52	23	**No**
NCA02	Rural Residential	Daytime	39	38	-	Yes
		Evening	34	36	2	**No**
		Night-time	29	37	8	**No**
NCA03	Rural Residential	Daytime	39	52	13	**No**
		Evening	34	50	16	**No**
		Night-time	29	51	22	**No**
NCA04	Rural Residential	Daytime	39	34	-	Yes
		Evening	34	34	-	Yes
		Night-time	29	34	5	**No**
All	Commercial	When in use	54	45	-	Yes
Receivers outside the Badgerys Creek Precinct (zoned Rural)						
NCA05	Rural Residential	Daytime	39	31	-	Yes
		Evening	34	30	-	Yes
		Night-time	29	30	1	**No**
All	Commercial	When in use	54	30	-	Yes

The assessment of the worst-case impacts during Stage 3 indicates the following:

Permanent Receivers Outside Badgerys Creek Precinct (NCA05, Zoned Rural)

- Noise from the proposal is predicted to comply with the PNTLs at the majority of receivers outside of the Badgerys Creek Precinct (in NCA05), however a 1 dB exceedance is predicted at four receivers during the night-time period only.
- These exceedances are a result of the low night-time PNTL of 29 dBA. The PNTLs have been determined using the formula provided by DPHI (see **Section 3.3.1**) that reduces the amenity noise level for each NCA based on the area of project site relative to the overall Badgerys Creek Precinct. As the project site is small relative to

the Badgerys Creek Precinct, this results in a large reduction in amenity noise level and particularly stringent PNTLs.

Temporary Receivers Inside Badgerys Creek Precinct (NCA01 – 04, Zoned Enterprise)

- Noise from the proposal is predicted to comply with the PNTLs at all residential receivers in NCA04 during the daytime and evening periods. Noise levels are also predicted to comply with the PNTLs at all commercial receivers.
- Noise levels are, however, predicted to exceed the PNTLs at the nearest residential receivers in NCA01 and NCA03 during all periods, in NCA02 during the evening and night-time, and in NCA04 during the night-time only.
- These exceedances are a result of the low PNTLs that have been applied to the development (see **Section 3.3.1**). The outcome of this approach to determining amenity noise criteria is that all receivers within around 300 m of the development exceed the PNTLs.
- The highest noise impacts are generally controlled by heavy vehicle movements around the site, along with noise from loading activities.
- Receivers in NCA01 – NCA04 are zoned Enterprise and will be redeveloped as part of the Badgerys Creek Precinct. The predicted exceedances are therefore considered temporary during the transition period before redevelopment occurs.

Where operational noise impacts from a site are predicted to exceed the relevant noise criteria, the NPfI requires all feasible and reasonable operational noise mitigation and management measures to be considered. This exercise is summarised in **Section 7.2**.

5.3.2 Sleep Disturbance

The predicted night-time maximum noise levels at the nearest residential receivers are shown in **Table 30**.

Table 30 Sleep Disturbance Assessment

NCA	Source	Sleep Disturbance Screening Level	Predicted L_{Amax} (dBA)	Exceedance	Below Screening Level
Stage 1					
Receivers inside the Badgerys Creek Precinct (zoned Enterprise)					
NCA01	Airbrake	52	69	17	**No**
	Truck reversing alarm		61	9	**No**
	Forklift reversing alarm		56	4	**No**
	Roller door		42	-	Yes
	Trucks		70	18	**No**
	Cars		60	8	**No**
NCA02	All	52	49	-	Yes

NCA	Source	Sleep Disturbance Screening Level	Predicted L_{Amax} (dBA)	Exceedance	Below Screening Level
NCA03	Airbrake	52	63	11	**No**
	Truck reversing alarm		55	3	**No**
	Forklift reversing alarm		46	-	Yes
	Roller door		36	-	Yes
	Trucks		66	14	**No**
	Cars		55	3	**No**
NCA04	All	52	50	-	Yes
Receivers outside the Badgerys Creek Precinct (zoned Rural)					
NCA05	All	52	43	-	Yes
Stage 3					
Receivers inside the Badgerys Creek Precinct (zoned Enterprise)					
NCA01	Airbrake	52	69	17	**No**
	Truck reversing alarm		61	9	**No**
	Forklift reversing alarm		56	4	**No**
	Roller door		42	-	Yes
	Trucks		70	18	**No**
	Cars		60	8	**No**
NCA02	Airbrake	52	41	-	**No**
	Truck reversing alarm		34	-	Yes
	Forklift reversing alarm		30	-	Yes
	Roller door		22	-	Yes
	Trucks		53	1	**No**
	Cars		52	-	Yes
NCA03	Airbrake	52	70	18	**No**
	Truck reversing alarm		62	10	**No**
	Forklift reversing alarm		51	-	Yes
	Roller door		46	-	Yes
	Trucks		62	10	**No**
	Cars		53	1	**No**
NCA04	All	52	50	-	Yes
Receivers outside the Badgerys Creek Precinct (zoned Rural)					
NCA05	All	52	43	-	Yes

The above assessment indicates the following:

Permanent Receivers Outside Badgerys Creek Precinct (NCA05, Zoned Rural)

- Noise from the operation of the development is predicted to comply with the sleep disturbance screening levels during both Stage 1 and Stage 3 operations.

Temporary Receivers Inside Badgerys Creek Precinct (NCA01 – 04, Zoned Enterprise)

- During Stage 1, noise levels are predicted to comply with the sleep disturbance screening levels in NCA02 and NCA04. Exceedances are predicted in NCA01 and NCA03. The nearest receivers are predicted to be subject to exceedances of between 4 and 18 dB in NCA01, and between 3 and 14 dB in NCA03. The sources of these exceedances are truck airbrakes, truck/forklift reversing alarms and truck and light vehicle movements.
- During Stage 3, noise levels and exceedances are generally comparable to Stage 1, with the exception that NCA02 now has a minor 1 dB exceedance from truck movements. This is due to the inclusion of Warehouse 4 in this stage which is immediately adjacent to the nearest receiver to the north of the site in NCA02.
- The potentially impacted receivers are all within the Badgerys Creek Precinct and on land zoned as Enterprise (ENT).
- Addresses of all residential receivers that are predicted to exceed the sleep disturbance screening level are shown in **Table 31**.

The NPfI requires a detailed maximum noise level assessment to be completed where night-time noise levels exceed the sleep disturbance screening level.

Table 31 Receivers with Exceedances of Sleep Disturbance Screening Level

No.	NCA	Address	Stage 1	Stage 3
1	NCA01	115 Lawson Rd, Badgerys Creek	Yes	Yes
2		135 Lawson Rd, Badgerys Creek	Yes	Yes
3		145 Lawson Rd, Badgerys Creek	Yes	Yes
4	NCA02	65 Martin Rd, Badgerys Creek	-	Yes
5	NCA03	70 Martin Rd, Badgerys Creek	Yes	Yes
6		90 Martin Rd, Badgerys Creek	Yes	Yes
7		100 Martin Rd, Badgerys Creek	Yes	Yes
8		110 Martin Rd, Badgerys Creek	Yes	Yes
9		120 Martin Rd, Badgerys Creek	Yes	Yes
10		140 Martin Rd, Badgerys Creek	Yes	Yes
11		150 Martin Rd, Badgerys Creek	Yes	Yes
12		160 Martin Rd, Badgerys Creek	Yes	Yes

5.3.2.1 Detailed Maximum Noise Level Assessment

The detailed maximum noise level assessment is summarised in **Table 32**. Noise from various sources is predicted to exceed the sleep disturbance screening level at receivers in NCA01 to NCA03.

Table 32 Detailed Maximum Noise Level Assessment

NCA	Maximum Noise Level L_{Amax} (dBA)					Comments
	Sleep Disturbance Goals (dBA)		Development Related Maximum Noise Events		Existing Maximum Noise Levels	
	Awakening Response[1]	Good Sleep[2]	Predicted	Frequency of Occurrence		
NCA01	65	Around 55 (10 to 15 times per night)	42 – 70 (Stage 1) 42 – 70 (Stage 3)	>10-15 events	Typical: 60-70 dBA Occasional: >70 dBA	**Awakening Response:** maximum noise levels are predicted to exceed the 'awakening response' level in NCA01 during truck movements and when trucks use airbrakes in the hardstand areas. In NCA03, maximum noise levels are predicted to exceed the 'awakening response' level during truck movements on the eastern internal access road. **Good Sleep:** truck airbrakes on the hardstands, truck movements, truck/forklift reversing alarms and light vehicle movements are predicted to exceed 55 dBA at the nearest residences. Maximum noise events may adversely affect 'good sleep' in NCA01 and NCA03 (ie they could potentially occur more than 10-15 times per night). **Existing maximum noise levels:** the unattended noise monitoring showed that existing maximum noise levels were measured to frequently be in the range 60 to 70 dBA in NCA01 and NCA02, and frequently in the range of 50 to 65 dBA in NCA03. Development related maximum noise levels are likely to generally be comparable in magnitude to existing maximum noise levels.
NCA02			Up to 49 (Stage 1) 22 – 53 (Stage 3)			
NCA03			36 – 66 (Stage 1) 46 – 70 (Stage 3)		Typical: 50-65 dBA Occasional: >65 dBA	

Note 1: Based on RNP guidance that maximum internal noise levels below 50 dBA to 55 dBA are unlikely to awaken people from sleep. This equates to an external noise level of 65 dBA when assuming a 10 dB loss for partially open windows for ventilation.

Note 2: Based on RNP guidance that for a good sleep over eight hours the indoor L_{Amax} sound pressure level should not exceed around 45 dBA more than 10 or 15 times per night. This equates to an external noise level of around 55 dBA when assuming a 10 dB loss for partially open windows for ventilation.

The above indicates that the predicted sleep disturbance screening level exceedances at the nearest residences may result in internal noise levels that have the potential to cause sleep disturbance.

The maximum noise levels from the development are likely to be similar to the existing maximum noise levels in the area, however, as the existing site is mostly dominated by natural ambience, existing maximum noise events are likely related to occasional vehicle pass-by, crickets chirping, trees rustling, etc. Therefore, maximum noise impacts from industrial noise sources at the site are likely to be more intrusive and may result in sleep disturbance for nearby residents.

All potentially affected residences are located within the Badgerys Creek Precinct and are on land zoned as Enterprise. It is understood all potentially impacted receivers will ultimately be removed and redeveloped into future industrial land uses. Feasible and reasonable operational mitigation measures for the development are discussed further in **Section 7.2**.

5.3.3 Off-site Traffic Assessment

Traffic associated with the development would enter and exit from Lawson Road or Martin Road, and travel north to Elizabeth Drive.

There is currently limited traffic information available for Lawson Road and Martin Road, meaning an accurate traffic noise assessment is not able to be completed. However, based on the quiet and rural nature of the area, it is likely that the site generated traffic would result in existing traffic noise increasing by more than 2 dB for receivers on Lawson Road and Martin Road.

However, once vehicles get near to Elizabeth Drive (which is around 600 m north of the site), the influenced of development-related traffic noise would be minor as Elizabeth Drive is a major arterial road.

Indicative predictions indicate an increase in existing traffic noise of around 0.7 dBA due to development related traffic on Elizabeth Drive (based on historic traffic data measured in 2023).

Additionally, it is expected that traffic noise levels in general in the wider Badgerys Creek Precinct and Western Sydney Aerotropolis Precinct would substantially increase over time as the area is progressively developed and traffic volumes unrelated to this proposal increase.

5.4 Aircraft Noise Impacts

The north-west corner of the site is located within ANEC 35, as shown in **Figure 7**. The site is therefore deemed ‘conditionally acceptable’ as per the building site acceptability criteria in **Table 16**.

The required aircraft noise reduction (ANR) has been estimated using the methodology outlined in AS 2021. The maximum external aircraft noise level at the most-affected office buildings for a Boeing 747-400 (long haul) on the future second runway is expected to be around 95 dBA.

Although the site’s purpose and activities are categorised as ‘light industrial’, consideration for dedicated office spaces within the site buildings has also been included for the following spaces:

- Boardrooms
- Open Plan Office Areas.

Based on the assumed external aircraft noise levels, the following indicative acoustic specifications may be required:

- Glazing – single-glazed fixed windows comprising 12.5 mm acoustic laminated panels (minimum Rw 40)
- Roof – steel roof cladding (0.6 mm) with steel C-Joist, 60 mm fibreglass insulation (10 kg/m^3) and a single layer 13 mm standard plasterboard ceiling (8 kg/m^2) (minimum Rw 54).

The above recommended construction is indicative and should be reviewed during detailed design.

6.0 Cumulative Impacts

The NSW Government *Cumulative Impact Assessment Guidelines for State Significant Projects* requires that the potential combined effect of cumulative impacts on all nearby industrial developments to be considered when assessing potential noise impacts from state significant projects. Cumulative impacts can be caused by the compounding effects of multiple projects in an area, and by the accumulation of effects from past, current and future activities as they arise.

6.1 Construction Noise

Cumulative construction noise impacts can occur where multiple work activities are being completed near to a particular receiver at the same time.

The construction work has the possibility of interacting with the construction activities of other nearby projects within the Badgerys Creek Precinct, if they are constructed at the same time.

Since construction scenarios and equipment for the various projects would generally require similar items of equipment to the proposal, concurrent construction work could theoretically increase the worst-case noise levels from the proposal by around 3 dB (ie the logarithmic addition of two sources of noise at the same level). The likelihood of worst-case noise levels being generated by works on different projects at the same time is, however, considered low.

As such, cumulative construction impacts are not considered likely to significantly alter the predictions from the proposal and no specific mitigation to address cumulative impacts is expected to be required. The potential cumulative impacts from the proposal and other projects would continue to be considered as the project progresses when detailed construction planning is developed as part of preparation of the site's Construction Environmental Management Plans (CEMPs).

6.2 Operational Noise

The *Noise Policy for Industry* states that it aims to limit continuing increases in cumulative industrial noise through the application of amenity noise levels, which are applicable to all industrial noise sources in an area.

The policy accounts for potential cumulative impacts by lowering the criteria for each individual development to ensure that the ambient noise level within an area from all industrial noise sources combined remains below the recommended amenity noise levels, where feasible and reasonable.

As such (as discussed in **Section 3.3.2**), the potential cumulative operational impacts from the proposal and other potential sources of industrial noise in the area are accounted for in the proposal-specific PNTLs and, therefore, do not require further consideration.

7.0 Mitigation and Management Measures

7.1 Construction Impacts

The impacts during construction of the project are predicted to be typical of major construction works near to sensitive receivers. The worst-case impacts are expected to exceed the Highly Noise Affected level, however, this is limited to one residential receiver to the immediate north of the site. No works outside of standard construction hours are currently proposed.

The use of standard mitigation measures to minimise the impacts is considered sufficient to control the majority of the impacts. Examples of measures which could be applied to the work are provided in the ICNG and the Transport for NSW *Construction Noise and Vibration Guideline* (see **Appendix E**).

Recommended work practices and standard mitigation measures for the proposal construction include:

- Regular toolbox notification and training of workers and contractors to be aware of nearby noise sensitive receivers and use equipment in ways to minimise noise.
- Use the minimum sized equipment necessary to complete the work and where possible, use alternative, low-impact construction techniques
- Long term stationary noise sources should be enclosed or shielded from nearby sensitive receivers where possible
- Where complaints are received, work practices should be reviewed and feasible and reasonable practices implemented to minimise any further impacts.

AS 2436 provides further guidance on the control of construction noise and vibration and includes the nominal noise reduction possible from various mitigation strategies summarised in **Table 33**.

Table 33 Nominal Construction Noise Reductions

Control	Example	Nominal Noise Reduction (AS 2436)
Distance	Maximising the offset distance between noisy plant and adjacent sensitive receivers.	6 dB per doubling of distance
Screening	Use of structures (ie site shed, earth bund, temporary hoarding) to shield adjacent sensitive receivers from noisy plant and activities.	5-10 dB
Enclosure	Construct a solid enclosure around generators, compressors, pumps or similar long-term plant.	15-25 dB
Silencing	Fit muffler, silenced or dampened bit to relevant noise intensive equipment.	5-10 dB

Construction impacts are expected during certain work activities at the nearest sensitive receivers even with the implementation of all feasible and reasonable mitigation measures.

The impacts would be managed using the Construction Noise and Vibration Management Plan (CNVMP) for the project (see SLR Report 610.032060.00004-R01-v1.0, dated April 2026). The CNVMP identifies all potentially impacted receivers, assesses the potential

noise and vibration impacts from the project and provides details regarding how the impacts would be minimised through the use of all feasible and reasonable mitigation measures.

7.2 Operational Noise Impacts

Where operational noise impacts from the site are predicted to exceed the relevant noise criteria, feasible and reasonable operational noise mitigation and management measures should be considered, with the aim of reducing noise emissions to the relevant criteria.

The typical hierarchy for mitigation and management of industrial noise sources is as follows:

- Reducing noise emissions at the source (ie noise source control)
- Reducing noise in transmission to the receiver (ie noise path control)
- Reducing noise at the receiver (ie at-receiver control).

A detailed assessment of all potential feasible and reasonable mitigation measures that could be applied to the development to minimise the impacts has been completed and is summarised in **Table 34**.

The measures should be regarded as indicative and would be further refined during detailed design when more details regarding specific tenants are known.

Table 34 Operational Noise Mitigation Options

Ref.	Mitigation Option	Noise Impact/Benefit	Feasible and Reasonable to Apply
Source Control			
S1	Optimised site layout to minimise noise emissions from the site	Where possible, the site layout has been designed so that the warehouse buildings screen the noisier areas of the development (ie hardstands and truck routes) from the nearest receivers.	**Yes** – applied during design of the concept masterplan. Hardstands both facing inwards and away streets and receivers, where possible.
S2	Limit vehicle movements	A reduction in concurrent vehicle movements across the site by staggering delivery/pickup times and/or employee shift change times could reduce noise emissions. In practice, this would occur naturally across the estate due to operational requirements of the different tenants.	No – vehicle volumes used in this assessment are likely needed to meet tenant's requirements. Placing restrictions on allowable vehicle movements across the different tenancies is unlikely to be feasible and reasonable. Notwithstanding, potential source control measures have been investigated and are discussed further in **Section 7.2.1**.
S3	Hardstand/external equipment use	Minimising the concurrent use of forklifts or other mobile plant outside the warehouses and/or limiting their use to the less sensitive day and evening periods. In practice, this would occur naturally across the estate due to operational requirements of the different tenants.	No – placing restrictions on allowable external use of forklifts and equipment across the different tenancies is unlikely to be feasible and reasonable.

Ref.	Mitigation Option	Noise Impact/Benefit	Feasible and Reasonable to Apply
S4	Quieter mobile plant and equipment	Use of quieter mobile plant and equipment options, such as electric forklifts instead of gas forklifts.	**Yes** – the development proposes to use quieter equipment such as electric forklifts instead of gas forklifts.
S5	Use broadband and/or ambient sensing alarms on trucks and forklifts where they are required to reverse during the night-time.	Reduce potential for annoying noise emissions during the night-time from forklifts and trucks.	**Yes** – use broadband and/or ambient sensing alarms on forklifts and trucks where they are required to reverse during the night-time.
S6	Appropriate specification and location of mechanical plant during detailed design.	If noise impacts from mechanical plant are identified during detailed design, quieter plant could be selected, or the plant could be relocated to a location screened from view of the nearest receivers, where appropriate.	No – specific impacts from mechanical plant were not identified during this assessment. Noise impacts from mechanical plant would be investigated further during detailed design or construction certificate stages when specific plant requirements are identified.
S7	Appropriate design of warehouses during detailed design.	Appropriate warehouse materials to minimise noise break-out from internal activities would be selected during detailed design. Where it is identified that noisier equipment is required to be used within the warehouse buildings than currently assumed (eg manufacturing equipment instead of standard warehousing and distribution equipment), facade and roof construction can use materials that provide a greater acoustic benefit.	Potentially – noise impacts from internal equipment would be investigated further during construction certificate stages if tenants require manufacturing plant or other noisy equipment.
S8	Roller doors kept closed when loading/unloading is not occurring to minimise noise breakout.	Use of roller doors to minimise internal noise breakout.	**Yes** – roller doors should be kept closed when not in use for loading/unloading trucks.
S9	Appropriate design of site layout to minimise the need for trucks to stop or brake outside of loading docks with line of sight to residential receivers.	Minimise noise emissions, particularly from truck airbrakes.	**Yes** – applied during design of the concept masterplan, where possible.

Ref.	Mitigation Option	Noise Impact/Benefit	Feasible and Reasonable to Apply
S10	Production of an Operational Noise Management Plan.	This would detail the measures that could be used by the various tenants to minimise general noise emissions from the site. Reference can be made to the Best Management Practice (BMP) and Best Available Technology Economically Available (BATEA) measures listed in the NPfI (see **Appendix F**).	**Yes** – would be completed during later stages of the project, where necessary.
Path Control			
P1	Noise barriers	Construction of noise barriers along boundary fence locations or other strategic locations could be used to reduce noise levels where plant or equipment are in line of sight of the nearest receivers.	Unlikely – the potential noise impacts are mostly limited to receivers within the Badgerys Creek Precinct which are on land zoned as Enterprise. These receivers are expected to be developed into future industrial land uses as the precinct progresses, meaning the use of permanent noise barriers to mitigate these temporarily impacted receivers is unlikely to be considered reasonable. Notwithstanding, potential noise barriers have been investigated and are discussed further in **Section 7.2.2**.
P2	Aircraft noise impacts	Minimise aircraft noise impacts on internal noise sensitive areas of proposal.	The assessment indicates that the site is impacted by aircraft noise and is 'conditionally acceptable' for light industry use. Upgraded facade construction and glazing may be required to achieve suitable internal noise levels. Indicative specifications have been recommended. These would be reviewed and confirmed during detailed design.

Ref.	Mitigation Option	Noise Impact/Benefit	Feasible and Reasonable to Apply
Receiver Control			
R1	At-property treatments	The NPfI notes that noise mitigation at a residence may be required to be considered where the residual impact exceeds the PNTLs by ≥3 dB. At-property treatments typically include mechanical ventilation to allow windows to be closed as a noise mitigation measure, together with upgraded facade elements such as windows, doors and acoustic seals. Where impacts are 'significant', receiver-based treatments may include commercial agreements.	Potentially – noise levels are generally predicted to comply with the noise goals at receivers outside the Badgerys Creek Precinct. While exceedances are predicted at the nearest receivers within the Badgerys Creek Precinct, these receivers are considered temporary as they are all on land zoned as Enterprise and will be redeveloped into future industrial land uses over time. At-property treatment and/or offers of commercial agreements may not be considered reasonable given the temporary nature of the impacted receivers. Residual noise impacts are discussed further in **Section 7.2.3**.
Verification Monitoring			
V1	Noise monitoring	Verify post-construction operational noise levels are in-line with predictions and the mitigation is working as intended.	**Yes** – would be completed as part of post-construction verification, where necessary.

7.2.1 Source Control Analysis

Source control mitigation has been investigated for the development with the aim of reducing noise impacts.

An additional noise modelling scenario was investigated which removed all heavy vehicles and external loading activities from the site during all periods. Only light vehicle movements and roof mounted mechanical plant were included.

A comparison of the additional 'Source Control Scenario' with the Stage 3 noise modelling scenario which includes all noise sources (ie taken from **Table 29**) is provided in **Table 35**.

Table 35 Source Control Scenario vs Original Stage 3 Scenario

NCA	Period	$L_{Aeq(15\ minutes)}$ Noise Level (dBA)				
		Noise Criteria	Stage 3 Scenario with all Noise Sources		Stage 3 Source Control Scenario with only Light Vehicles and Mechanical Plant	
			Predicted	Exceedance	Predicted	Exceedance
NCA01	Daytime	39	52	13	42	3
	Evening	34	51	17	40	6
	Night-time	29	52	23	42	13
NCA02	Daytime	39	38	-	32	-
	Evening	34	36	2	30	-
	Night-time	29	37	8	31	2
NCA03	Daytime	39	52	13	40	1
	Evening	34	50	16	37	3
	Night-time	29	51	22	39	10
NCA04	Daytime	39	34	-	32	-
	Evening	34	34	-	31	-
	Night-time	29	34	5	32	3

The above shows that:

- Even if all heavy vehicles and loading dock activities were entirely removed from the site, so that the only remaining noise sources were light vehicles and mechanical plant, relatively large worst-case exceedances of the PNTLs would remain.
- Mitigation aimed at reducing source noise levels would adversely affect the operational capabilities of the site, whilst not removing the predicted noise exceedances.

7.2.2 Noise Barrier Analysis

Noise barriers could potentially be used on the site boundary to reduce noise levels where there is line-of-sight from the nearest receivers to on-site noise sources.

Indicative noise barriers have been modelled at heights of 2 m and 4 m, as shown in the locations in **Figure 9**, to determine the potential benefit they would provide at exceeding receiver locations. The assessment is summarised in **Table 36**.

Figure 9 Indicative Noise Barriers

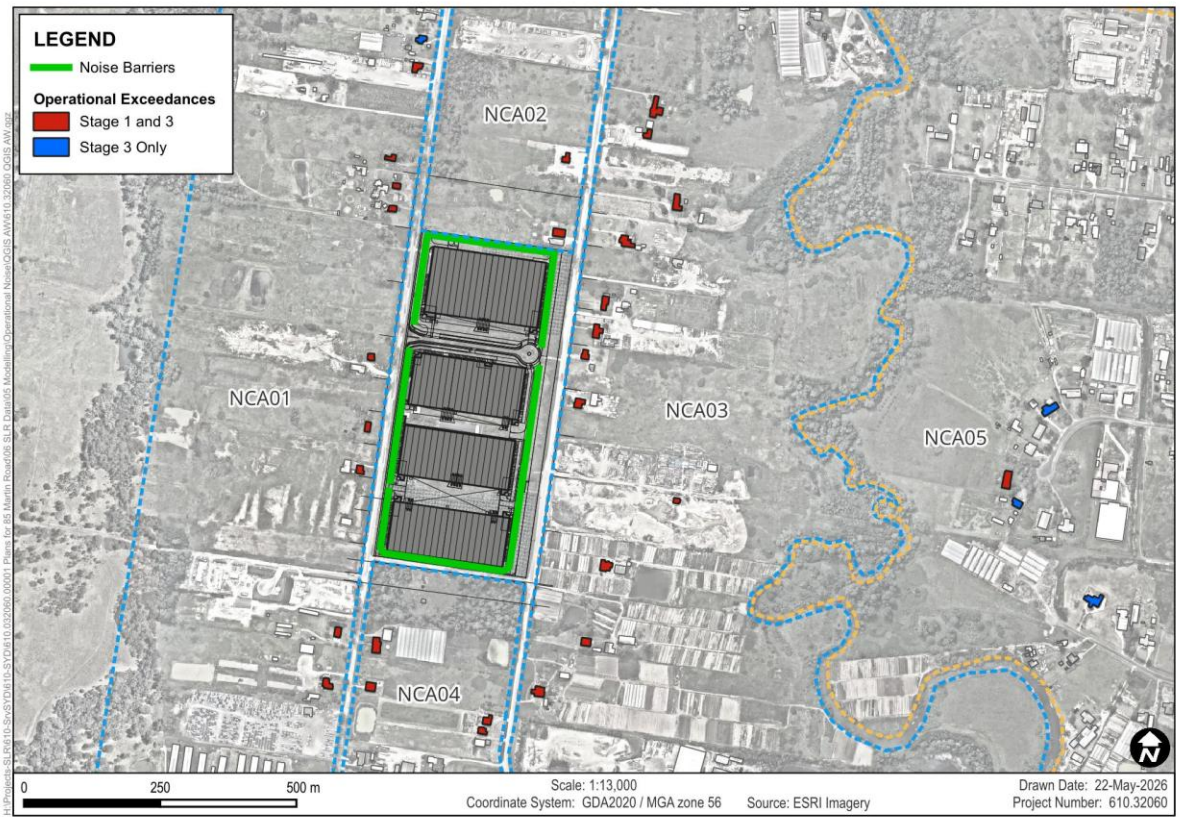


Table 36 Indicative Noise Barrier Reductions

NCA	Land Use Zoning	Indicative Noise Reduction	
		2m Barriers	4m Barriers
Receivers inside the Badgerys Creek Precinct			
NCA01	ENT	Up to 3 dB	Up to 6 dB
NCA02	ENT	Up to 1 dB	Up to 1 dB
NCA03	ENT	Up to 5 dB	Up to 6 dB
NCA04	ENT	Up to 1 dB	Up to 2 dB
Receivers outside the Badgerys Creek Precinct			
NCA05	RU4	Up to 1 dB	Up to 1 dB

The above shows that:

- Noise barriers provide between 1 dB and 6 dB benefit to the most impacted receivers that are inside the Badgerys Creek Precinct and zoned Enterprise (ie in NCA01 to NCA04). As previously discussed, these receivers are expected to be developed into future industrial land uses.
- Noise barriers provide up to 1 dB benefit to the most impacted receivers that are outside the Badgerys Creek Precinct (ie in NCA05).

- The noise barriers provide the most benefit to a limited number of receivers which are close to the site, with receivers that are more distant having limited benefit due to increased line-of-sight over the top of the barriers.
- The majority of receivers remain above the operational noise criteria with either the 2 m or 4 m noise barrier option.

Based on the above discussion, noise barriers are unlikely to be an appropriate noise mitigation option, primarily because:

- The majority of the residential receivers which are predicted to exceed the operational noise criteria are within the Badgerys Creek Precinct on land zoned as Enterprise. These receivers are expected to be developed into future industrial land uses, meaning the use of permanent noise barriers to mitigate these temporary receivers is unlikely to be considered reasonable.
- Noise barriers provide a negligible 1 dB of benefit to receivers outside the Badgerys Creek Precinct. Noise barriers are generally expected to provide a minimum benefit of 5 dB to be considered reasonable.
- The majority of receivers remain above the PNTLs even with the use of 4 m noise barriers.

7.2.3 Residual Impacts

The NPfI defines residual noise impacts as exceedances of the Project Noise Trigger Levels which remain after all source and pathway feasible and reasonable mitigation measures have been considered. Residual noise impacts that exceed the Project Noise Trigger Levels by ≤2 dB are considered negligible and would not be discernible by most people. Exceedances of ≥3 dB are considered potentially significant and may require further consideration.

The predicted potentially significant residual impacts from either Stage 1 or 3 of the development include a total of 23 receivers. All potentially impacted receivers are located within the Badgerys Creek Precinct and on land zoned as Enterprise. These receivers are shown in **Figure 10**. Addresses of eligible receivers are provided in **Table 37**.

It is understood that the receivers identified with potential residual impacts would ultimately be developed into future industrial land uses. As such, while the residual impacts from the proposal are potentially considered ‘significant’ at some receivers (ie they are > 5dB, see **Table 13**), they are temporary and would only occur until the point at which the surrounding area is developed.

The NPfI states that where residual impacts are identified, it may be appropriate to provide at-property treatment and/or offer to enter into commercial agreements (based on the level of exceedance), where feasible and reasonable (see **Table 14**).

Figure 10 Potentially Significant Residual Exceedances of PNTLs

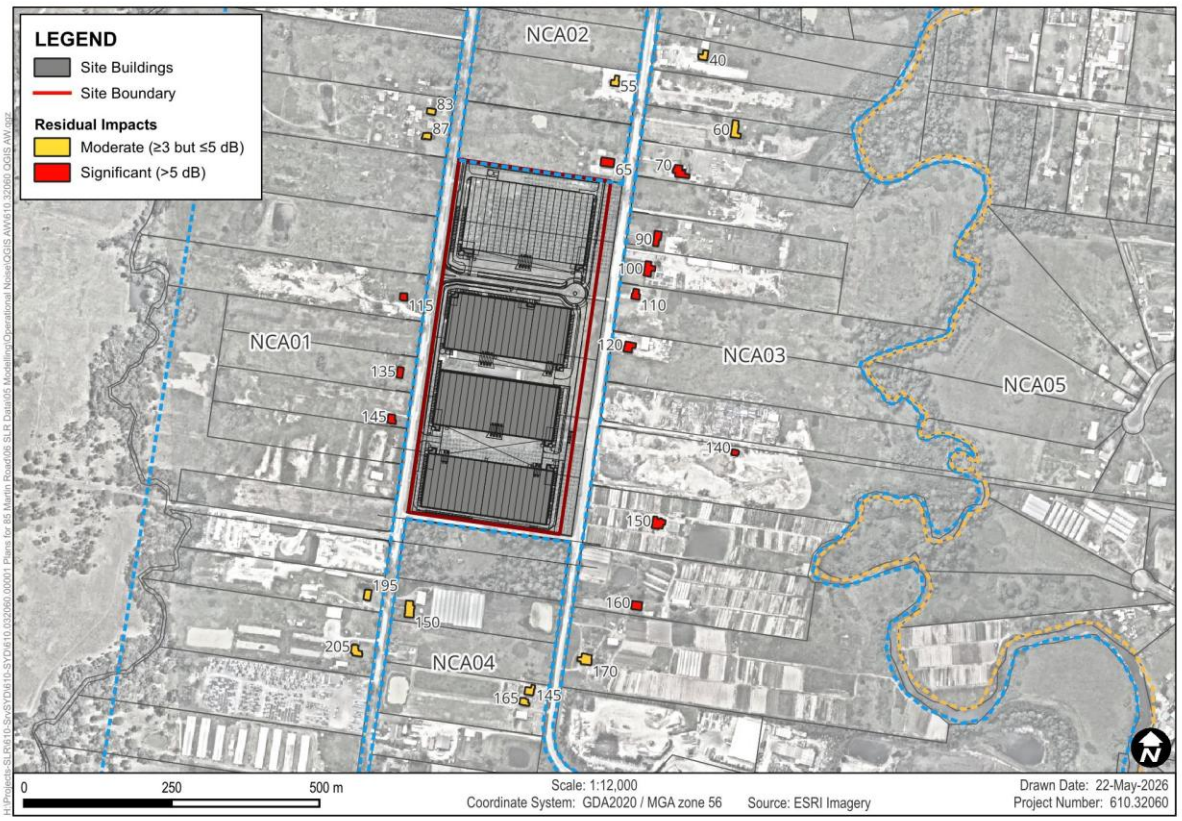


Table 37 Receivers with Potentially Significant Residual Exceedances of PNTLs

No.	NCA	Address	Significance of Residual Noise Impact[1]
1	NCA01	83 Lawson Road, Badgerys Creek	Moderate
2		87 Lawson Road, Badgerys Creek	Moderate
3		115 Lawson Road, Badgerys Creek	Significant
4		135 Lawson Road, Badgerys Creek	Significant
5		145 Lawson Road, Badgerys Creek	Significant
6		195 Lawson Road, Badgerys Creek	Moderate
7		205 Lawson Road, Badgerys Creek	Moderate
8	NCA02	55 Martin Road, Badgerys Creek	Moderate
9		65 Martin Road, Badgerys Creek	Significant
10	NCA03	40 Martin Road, Badgerys Creek	Moderate
11		60 Martin Road, Badgerys Creek	Moderate
12		70 Martin Road, Badgerys Creek	Significant
13		90 Martin Road, Badgerys Creek	Significant
14		100 Martin Road, Badgerys Creek	Significant
15		110 Martin Road, Badgerys Creek	Significant

No.	NCA	Address	Significance of Residual Noise Impact[1]
16		120 Martin Road, Badgerys Creek	Significant
17		140 Martin Road, Badgerys Creek	Significant
18		150 Martin Road, Badgerys Creek	Significant
19		160 Martin Road, Badgerys Creek	Significant
20		170 Martin Road, Badgerys Creek	Moderate
21	NCA04	145 Martin Road, Badgerys Creek	Moderate
22		165 Martin Road, Badgerys Creek	Moderate
23		150 Lawson Road, Badgerys Creek	Moderate

Note 1: Refer to **Table 14** for examples of receiver-based treatments to mitigate residual noise impacts.

It is noted that several assumptions have been made regarding the likely future sources of noise. The noise predictions and recommendation in this report should be regarded as indicative for planning purposes and are required to be confirmed at a later stage when detailed information is available.

7.2.4 Regulatory Interpretation of Noise Criteria

The PNTLs adopted in this assessment have been determined in accordance with the methodology prescribed by DPHI, which applies a modified version of the approach in Section 2.4.2 of the NPfI. This approach allocates the overall amenity noise allowance for the Badgerys Creek Precinct across all existing and future industrial development within the noise precinct boundary.

As the proposal site represents a relatively small proportion of the total precinct area, the application of this methodology results in comparatively low PNTLs, particularly during the night-time period. In this context, the predicted exceedances at nearby receivers are primarily a function of the stringent allocation of allowable noise under a cumulative assessment framework, rather than an indication of substantial noise emissions from the proposal.

Consistent with the intent of the NPfI, the assessment has therefore focused on identifying and implementing all feasible and reasonable noise mitigation measures. Residual impacts have been considered in accordance with the NPfI significance criteria, see **Section 7.2.3**, where exceedances of up to 2 dB are generally considered to be negligible and not expected to result in adverse noise impacts on the amenity of surrounding receivers.

8.0 Conclusion

SLR has been engaged to assess the potential construction and operational noise emissions from the proposed distribution warehouse development located at 85 Martin Road, Badgerys Creek.

The impacts during construction of the project are predicted to be typical of major construction works near to sensitive receivers. Construction noise levels are predicted to exceed the Noise Management Levels during certain stages, however, this is only expected to occur when noisy work is being completed close to the site boundary nearest to these receivers. Construction mitigation has been recommended and impacts would be managed using a Construction Noise and Vibration Management Plan.

Operational noise levels are predicted to generally comply with the relevant noise goals at all receivers outside the Badgerys Creek Precinct. Minor exceedances of up to 1 dB are predicted at a small number of residential receivers during the night-time period only. These exceedances result from the stringent night-time noise goal derived for the project (ie 29 dBA) and are considered negligible in practical terms.

Noise levels are predicted to exceed the noise goals at the nearest receivers within the Badgerys Creek Precinct, however, all potentially impacted receivers are on land zoned as Enterprise. These receivers are expected to be developed into future industrial land uses as development of the precinct occurs, meaning these impacts are temporary and would only occur until the point at which the surrounding area is developed.

The noise goals for the project have been derived using the methodology provided by DPHI, which allocates the overall amenity noise allowance across the broader Badgerys Creek Precinct. As the proposal site represents a relatively small proportion of the overall precinct, this results in comparatively low noise goals and widespread exceedance of the criteria at nearby receivers. In this context, these exceedances reflect the conservative allocation of allowable noise under a cumulative assessment framework, rather than substantial noise emissions from the proposal.

Notwithstanding, a range of feasible and reasonable mitigation measures have been incorporated into the design and assessment of the development. Additional operational management measures have also been identified to minimise noise emissions in accordance with the *Noise Policy for Industry*.

For receivers where residual exceedances remain following the application of all feasible and reasonable mitigation measures, at-property treatments and/or offers to enter into commercial agreements may be considered, where feasible and reasonable. This is consistent with the approach used on several other nearby SSDA industrial developments, including Westlink in Mamre Road Precinct.

Where commercial agreements are in place with a particular receiver, that receiver may no longer be considered noise-sensitive and the exceedance at that location would not require further mitigation.

Based on the predicted levels and indicative mitigation measures, the proposal is considered appropriate from an acoustic perspective.

Appendix A Acoustic Terminology

85 Martin Road, Badgerys Creek

SSDA Noise and Vibration Impact Assessment (SSD-74191717)

ESR Developments (Australia) Pty Ltd

SLR Project No.: 610.032060.00002

22 May 2026

1. Sound Level or Noise Level

The terms 'sound' and 'noise' are almost interchangeable, except that 'noise' often refers to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure. The human ear responds to changes in sound pressure over a very wide range with the loudest sound pressure to which the human ear can respond being ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or LP are commonly used to represent Sound Pressure Level. The symbol LA represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2×10^{-5} Pa.

2. 'A' Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an 'A-weighting' filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4,000 Hz), and less sensitive at lower and higher frequencies. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dB or 2 dB in the level of a sound is difficult for most people to detect, whilst a 3 dB to 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels.

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120	Heavy rock concert	Extremely noisy
110	Grinding on steel	
100	Loud car horn at 3 m	Very noisy
90	Construction site with pneumatic hammering	
80	Kerbside of busy street	Loud
70	Loud radio or television	
60	Department store	Moderate to quiet
50	General Office	
40	Inside private office	Quiet to very quiet
30	Inside bedroom	
20	Recording studio	Almost silent

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as 'linear', and the units are expressed as dB(lin) or dB.

3. Sound Power Level

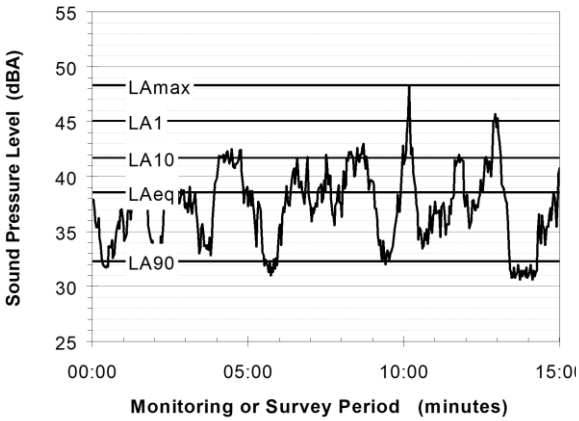
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or L_W, or by the reference unit 10^{-12} W.

The relationship between Sound Power and Sound Pressure is similar to the effect of an electric radiator, which is characterised by a power rating but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

4. Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels L_{AN}, where L_{AN} is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the L_{A1} is the noise level exceeded for 1% of the time, L_{A10} the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.



Of particular relevance, are:

L_{A1} The noise level exceeded for 1% of the 15 minute interval.

L_{A10} The noise level exceeded for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

L_{A90} The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

L_{Aeq} The A-weighted equivalent noise level (basically, the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

L_{Amax} The A-weighted maximum sound pressure level of an event measured with a sound level meter.

5. Frequency Analysis

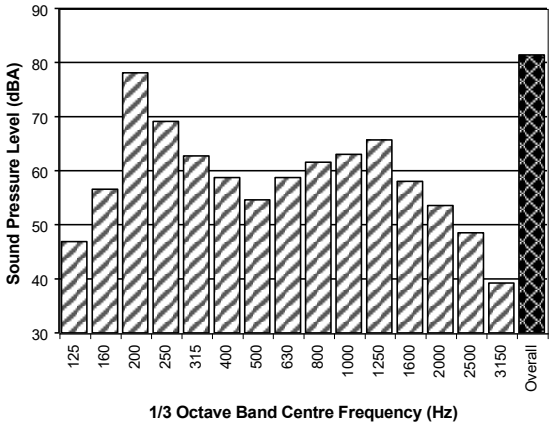
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal.

The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (three bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.



6. Annoying Noise (Special Audible Characteristics)

A louder noise will generally be more annoying to nearby receivers than a quieter one. However, noise is often also found to be more annoying and result in larger impacts where the following characteristics are apparent:

- **Tonality** - tonal noise contains one or more prominent tones (ie differences in distinct frequency components between adjoining octave or 1/3 octave bands), and is normally regarded as more annoying than 'broad band' noise.
- **Impulsiveness** - an impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.
- **Intermittency** - intermittent noise varies in level with the change in level being clearly audible. An example would include mechanical plant cycling on and off.
- **Low Frequency Noise** - low frequency noise contains significant energy in the lower frequency bands, which are typically taken to be in the 10 to 160 Hz region.

7. Vibration

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity. These may be expressed in terms of 'peak' velocity or 'rms' velocity.

The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as 'peak particle velocity', or PPV. The latter incorporates 'root mean squared' averaging over some defined time period.

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements (ie vertical, longitudinal and transverse).

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V, expressed in mm/s can be converted to decibels by the formula 20 log (V/Vo), where Vo is the reference level (10^{-9} m/s). Care is required in this regard, as other reference levels may be used.

8. Human Perception of Vibration

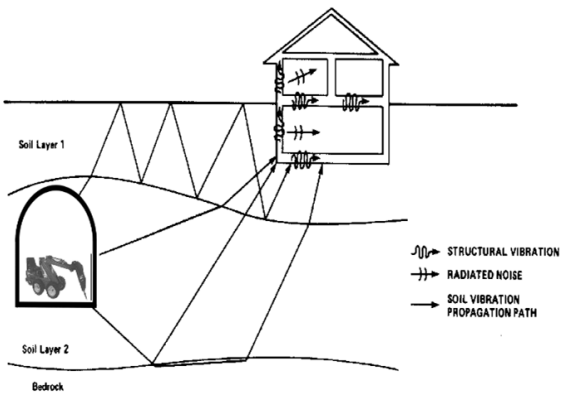
People are able to 'feel' vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as 'normal' in a car, bus or train is considerably higher than what is perceived as 'normal' in a shop, office or dwelling.

9. Ground-borne Noise, Structure-borne Noise and Regenerated Noise

Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed 'structure-borne noise', 'ground-borne noise' or 'regenerated noise'. This noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air.

Typical sources of ground-borne or structure-borne noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

The following figure presents an example of the various paths by which vibration and ground-borne noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.



The term 'regenerated noise' is also used in other instances where energy is converted to noise away from the primary source. One example would be a fan blowing air through a discharge grill. The fan is the energy source and primary noise source. Additional noise may be created by the aerodynamic effect of the discharge grill in the airstream. This secondary noise is referred to as regenerated noise.

Appendix B Noise Monitoring Data

85 Martin Road, Badgerys Creek

SSDA Noise and Vibration Impact Assessment (SSD-74191717)

ESR Developments (Australia) Pty Ltd

SLR Project No.: 610.032060.00002

22 May 2026

ESR Developments (Australia) Pty Ltd
85 Martin Road, Badgerys Creek

22 May 2026
SLR Project No.: 610.032060.00002
SLR Ref No.: 610.032060.00002-R01-v1.3 20260522.docx

Noise Monitoring Location	L01
Noise Monitoring Address	**85 Martin Road, Badgerys Creek**

Logger Device Type: Svantek 977, Logger Serial No: 98465
Sound Level Meter: Brüel and Kjær 2250, Sound Level Meter Serial No: 3004636

Ambient noise monitor located in the south-eastern boundary of the site, along Martin Road.

Attended noise measurements indicate the ambient noise environment at this location is dominated by natural ambience including birds, insects and trees rustling from light breeze.

Measured Attended Noise Levels (LAmax):
Birds – 45-47 dB(A)
Vehicle pass by – 67 – 72 dB(A)
Distant construction – 46 – 49 dB(A)

Map of Noise Monitoring Location

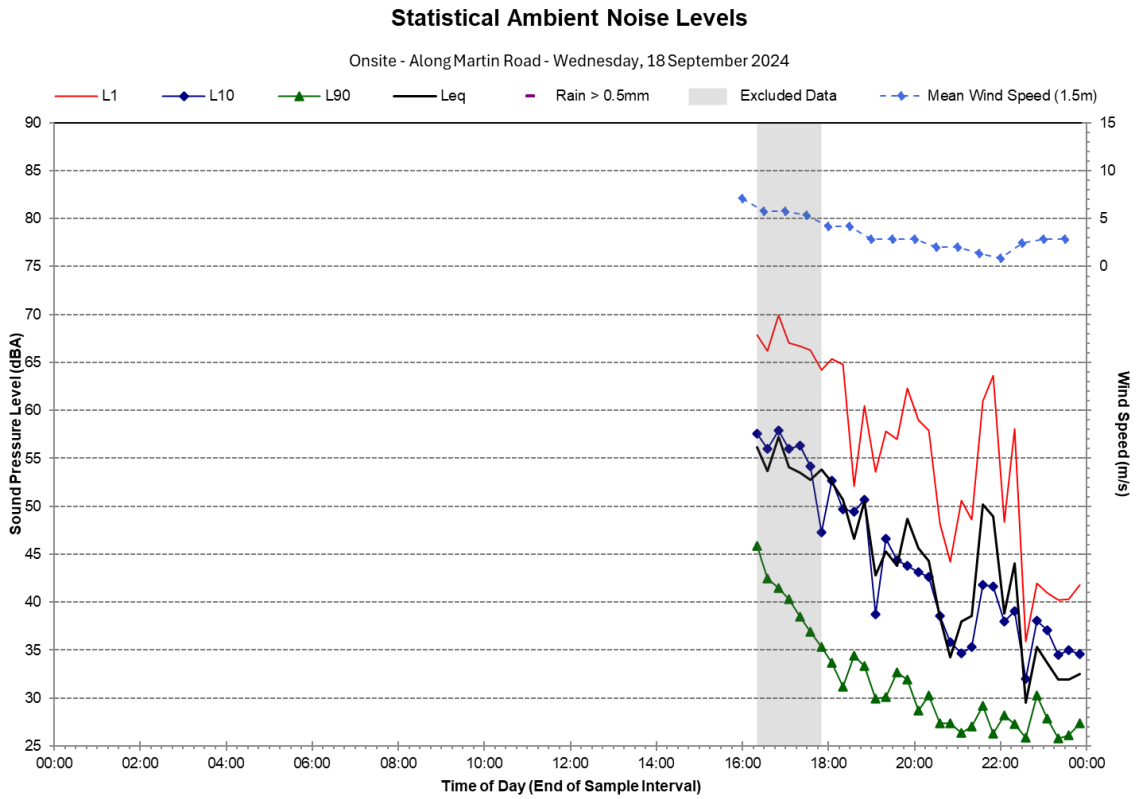
Ambient Noise Logging Results – ICNG/NPfI Defined Time Periods

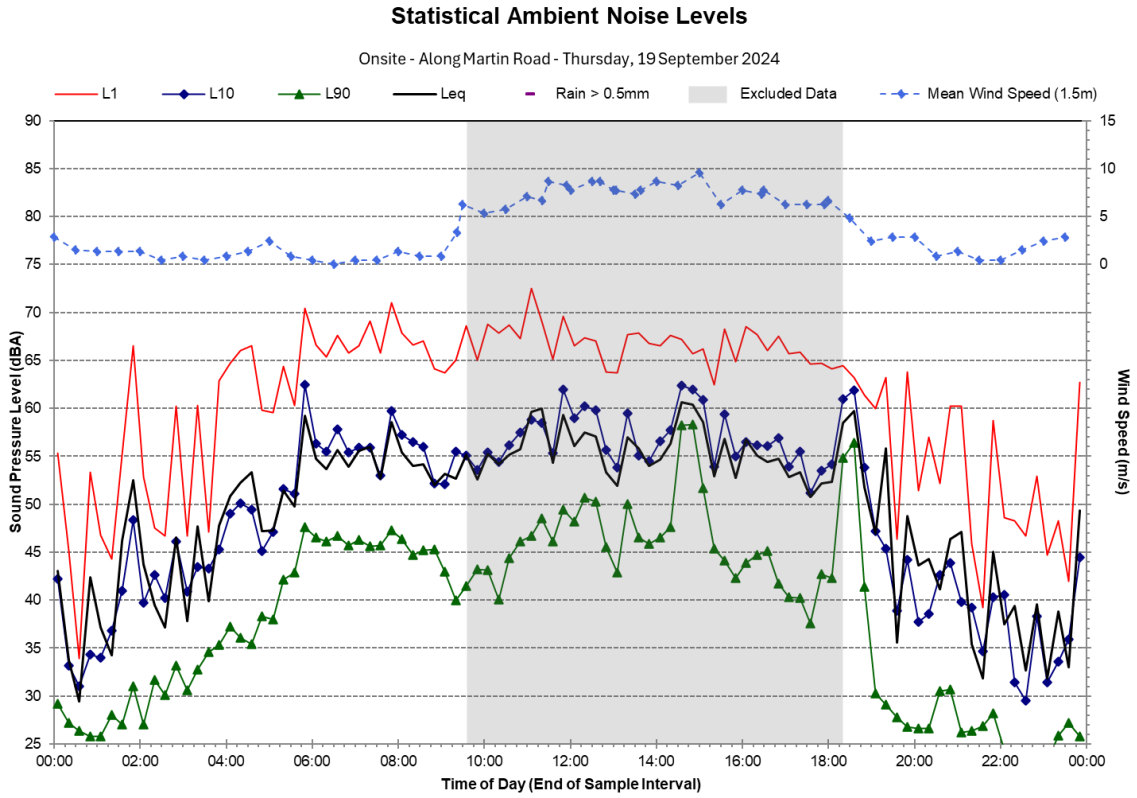
Monitoring Period	Noise Level (dBA)			
	RBL	L_{Aeq}	L_{10}	L_1
Daytime	36	53	53	66
Evening	29	51	41	53
Night-time	26	47	38	49

Attended Noise Measurement Results

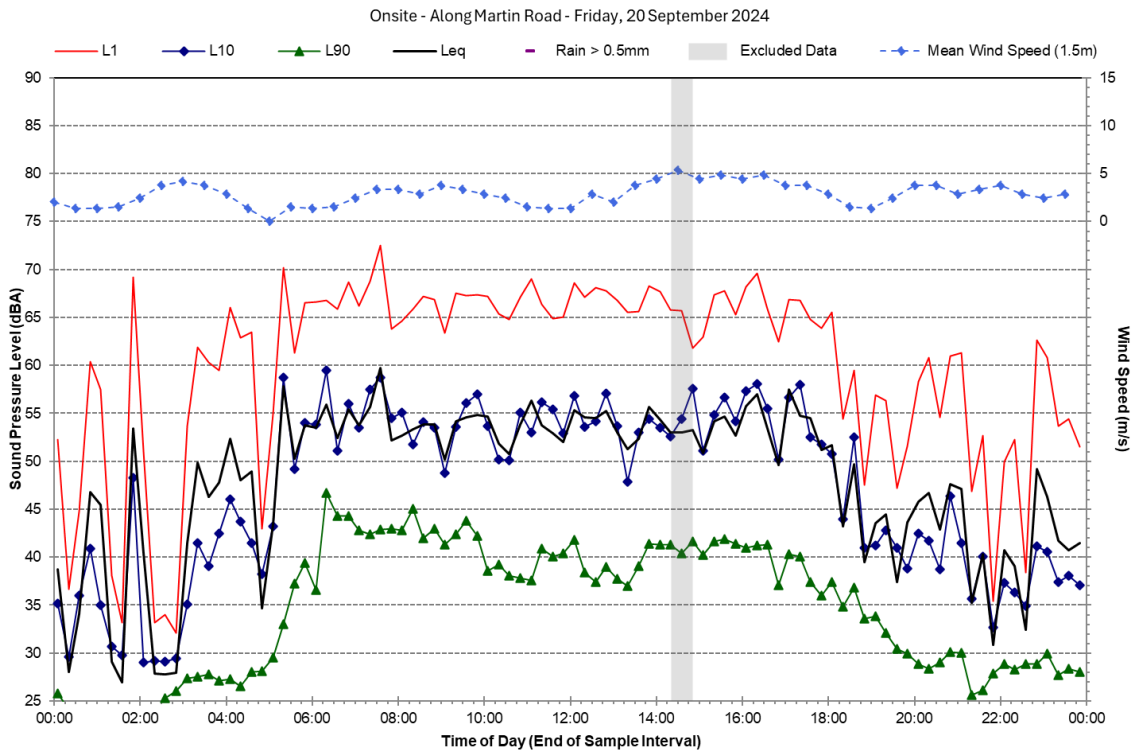
Date	Start Time	Measured Noise Level (dBA)		
		L_{A90}	L_{Aeq}	L_{Amax}
1/10/2024	17:17	43	52	72

Photo of Noise Monitoring Location

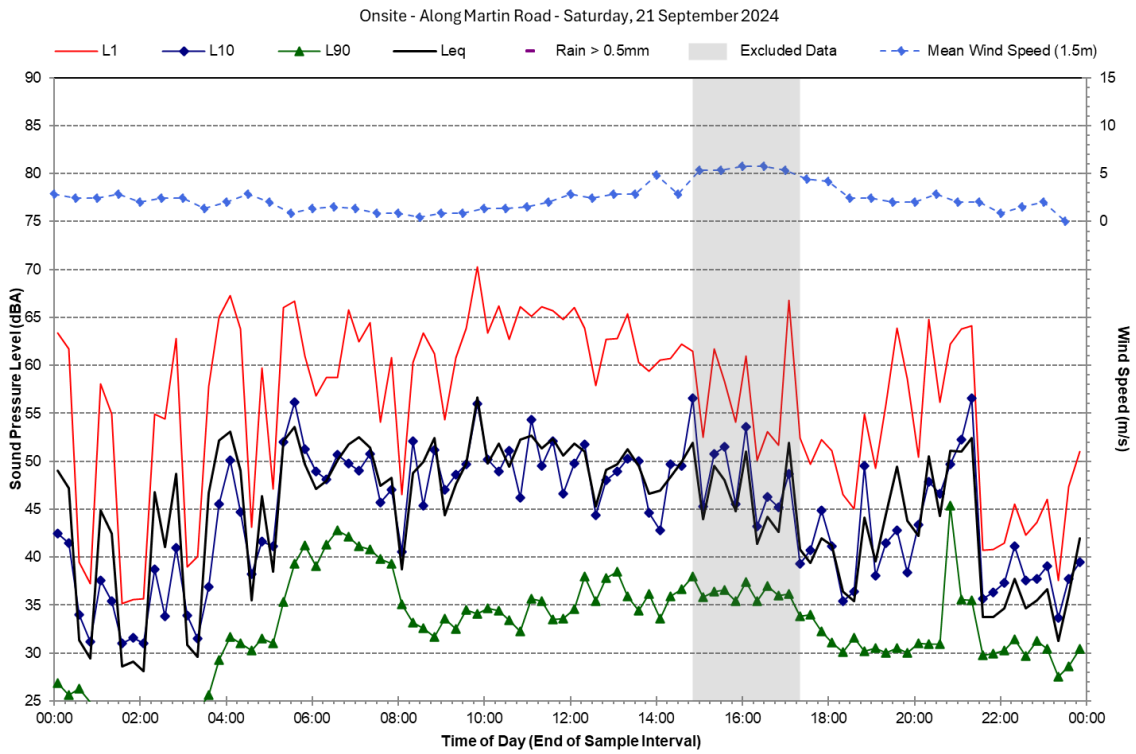

Statistical Ambient Noise Levels
Onsite - Along Martin Road - Wednesday, 18 September 2024
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Onsite - Along Martin Road - Thursday, 19 September 2024
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

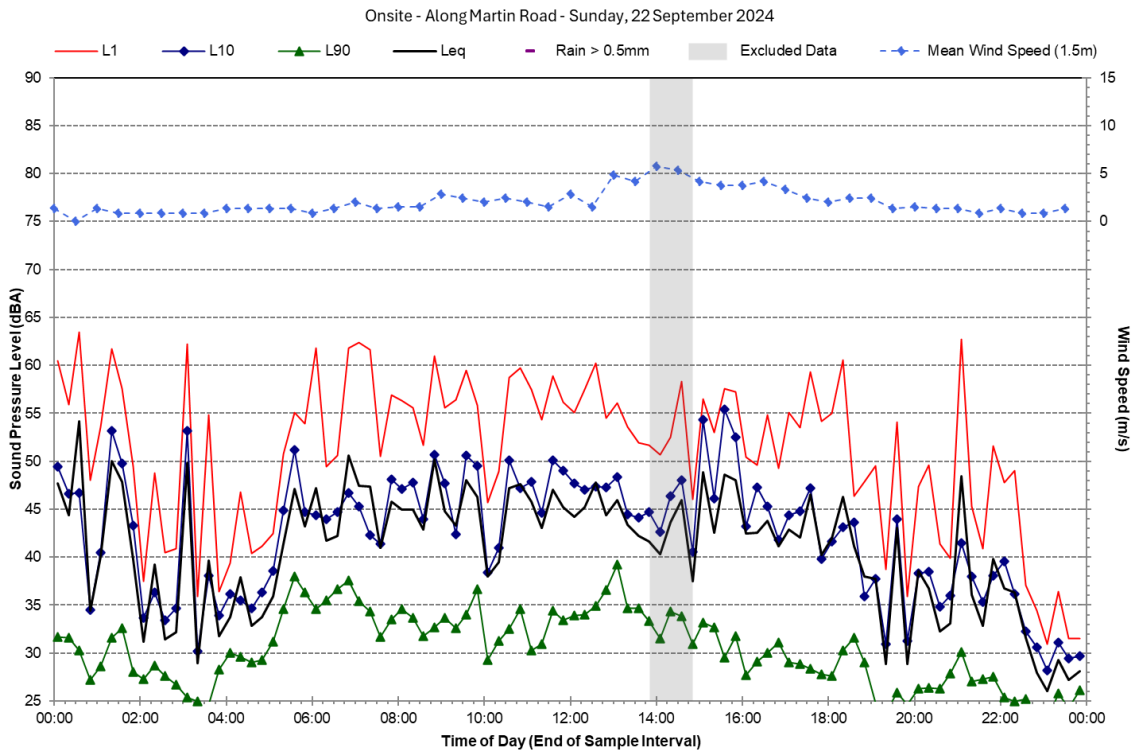
Statistical Ambient Noise Levels



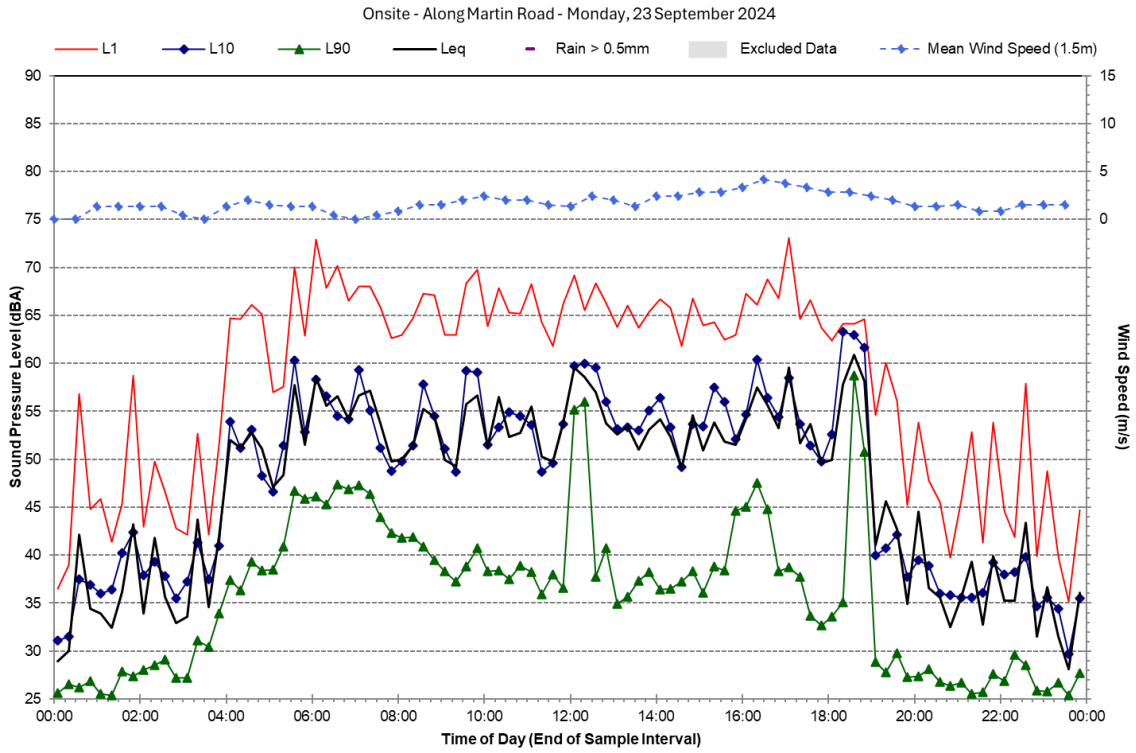
Statistical Ambient Noise Levels

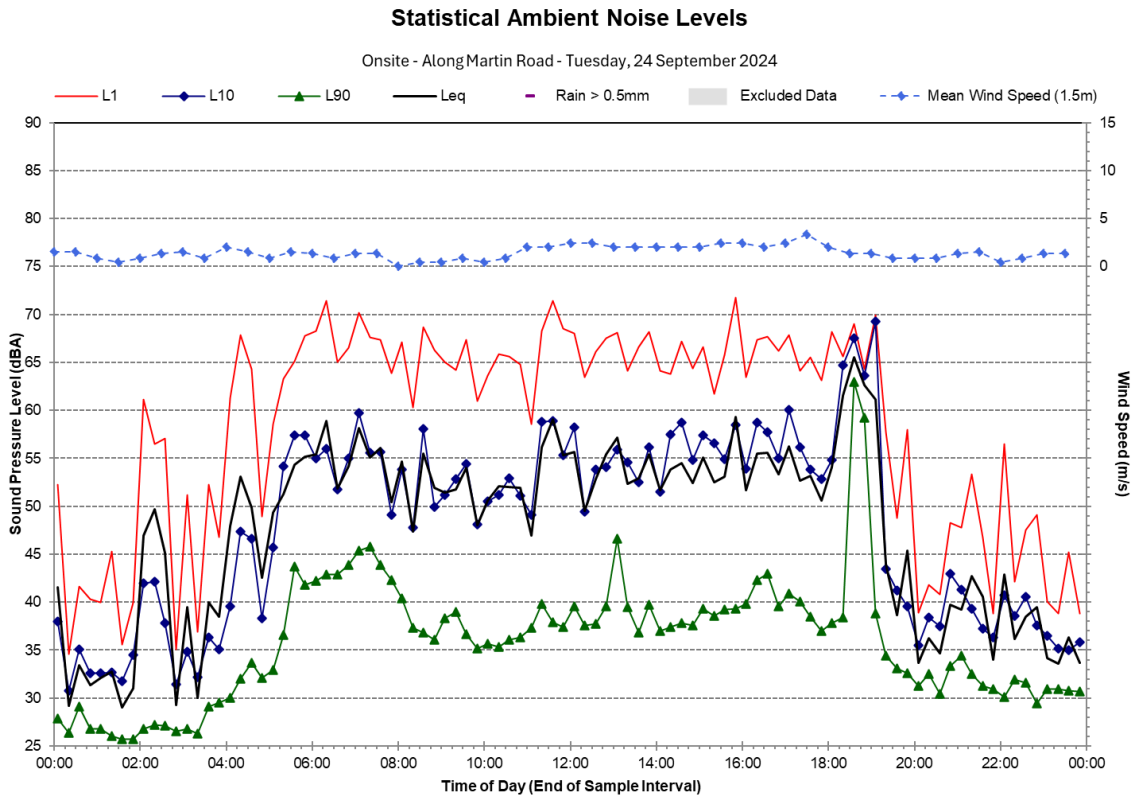


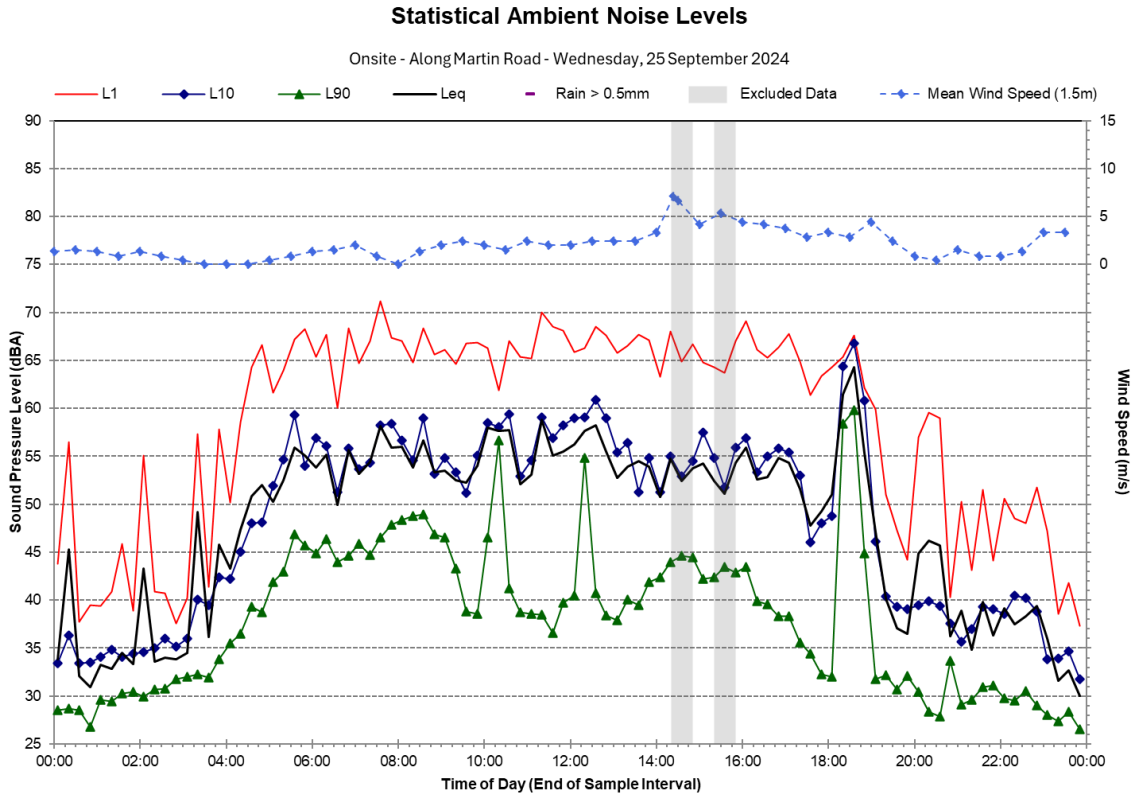
Statistical Ambient Noise Levels

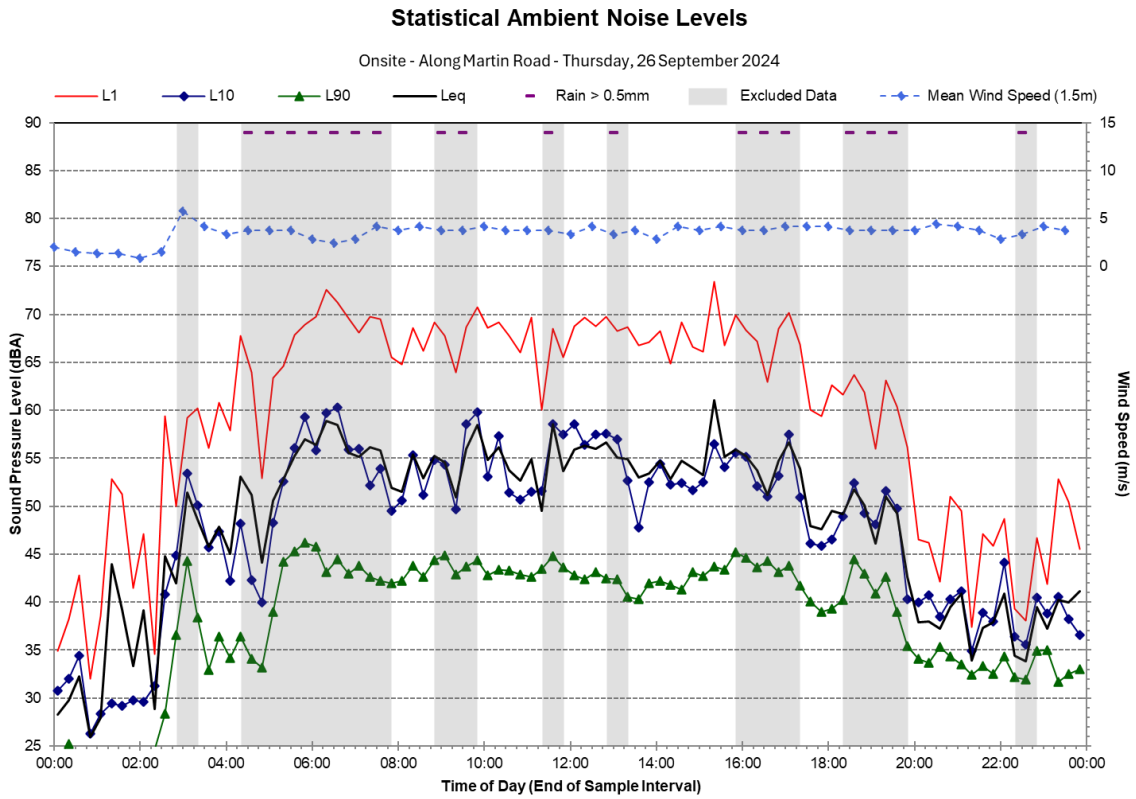


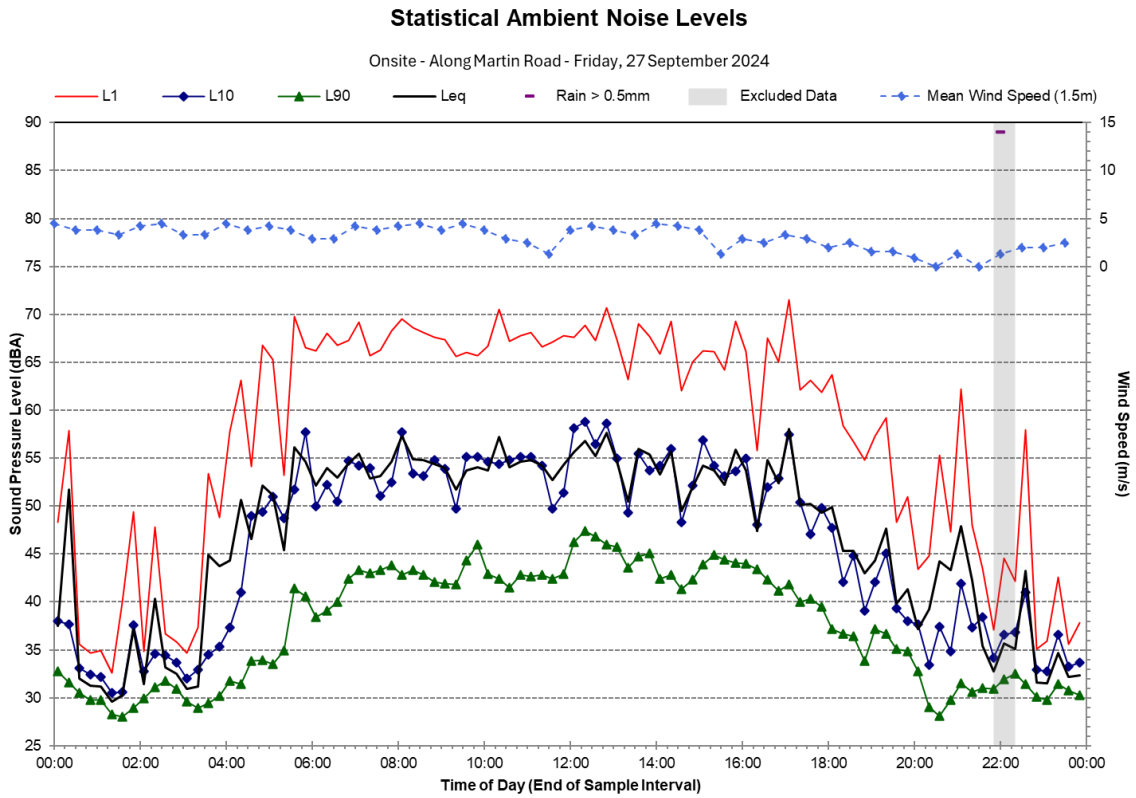
Statistical Ambient Noise Levels

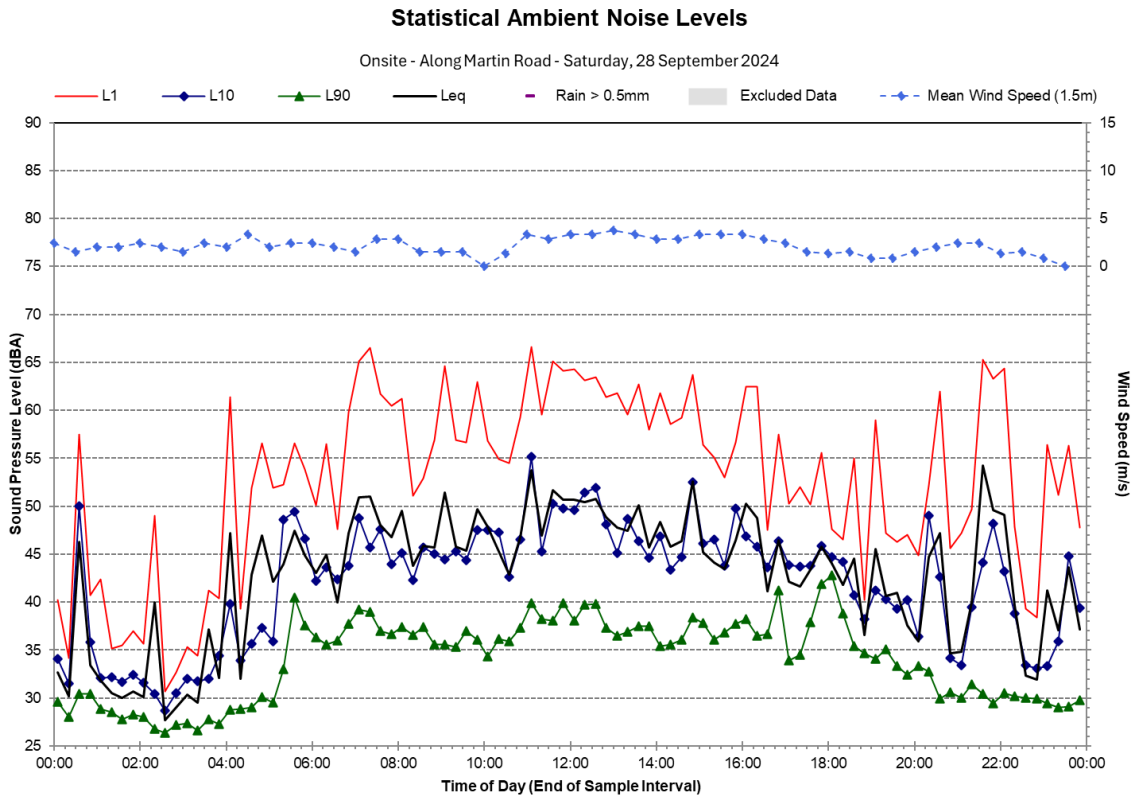


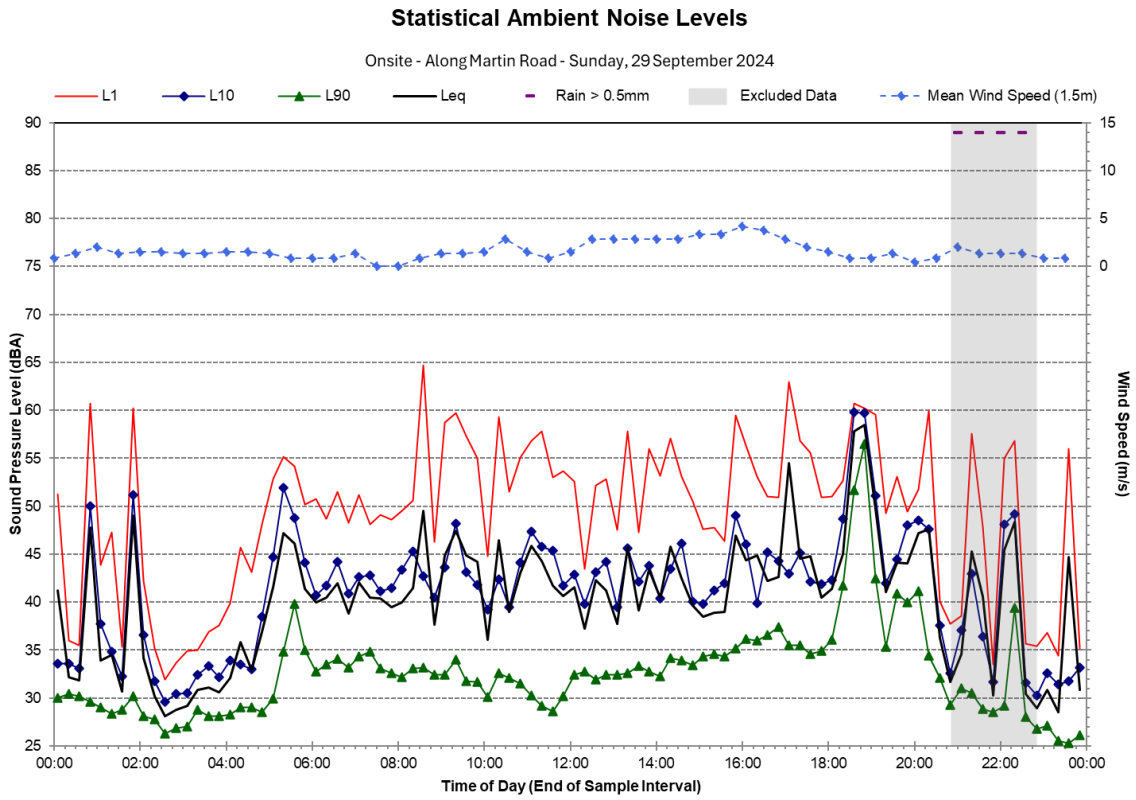

Statistical Ambient Noise Levels
Onsite - Along Martin Road - Tuesday, 24 September 2024
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Onsite - Along Martin Road - Wednesday, 25 September 2024
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Onsite - Along Martin Road - Thursday, 26 September 2024
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Onsite - Along Martin Road - Friday, 27 September 2024
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Onsite - Along Martin Road - Saturday, 28 September 2024
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Onsite - Along Martin Road - Sunday, 29 September 2024
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

Noise Monitoring Location	L02
Noise Monitoring Address	**85 Martin Road, Badgerys Creek**

Logger Device Type: Svantek 957, Logger Serial No: 27578
Sound Level Meter: Brüel and Kjær 2250, Sound Level Meter Serial No: 3004636

Ambient noise monitor located in the north-western boundary of the site, along Martin Road.

Attended noise measurements indicate the ambient noise environment at this location is dominated by natural ambience including birds, insects and trees rustling from light breeze.

Measured Attended Noise Levels (LAmax):
Birds – 57 – 58 dB(A)
Vehicle pass by – 61 dB(A)
Distant construction – 47 – 48 dB(A)

Map of Noise Monitoring Location

Ambient Noise Logging Results – ICNG/NPfI Defined Time Periods

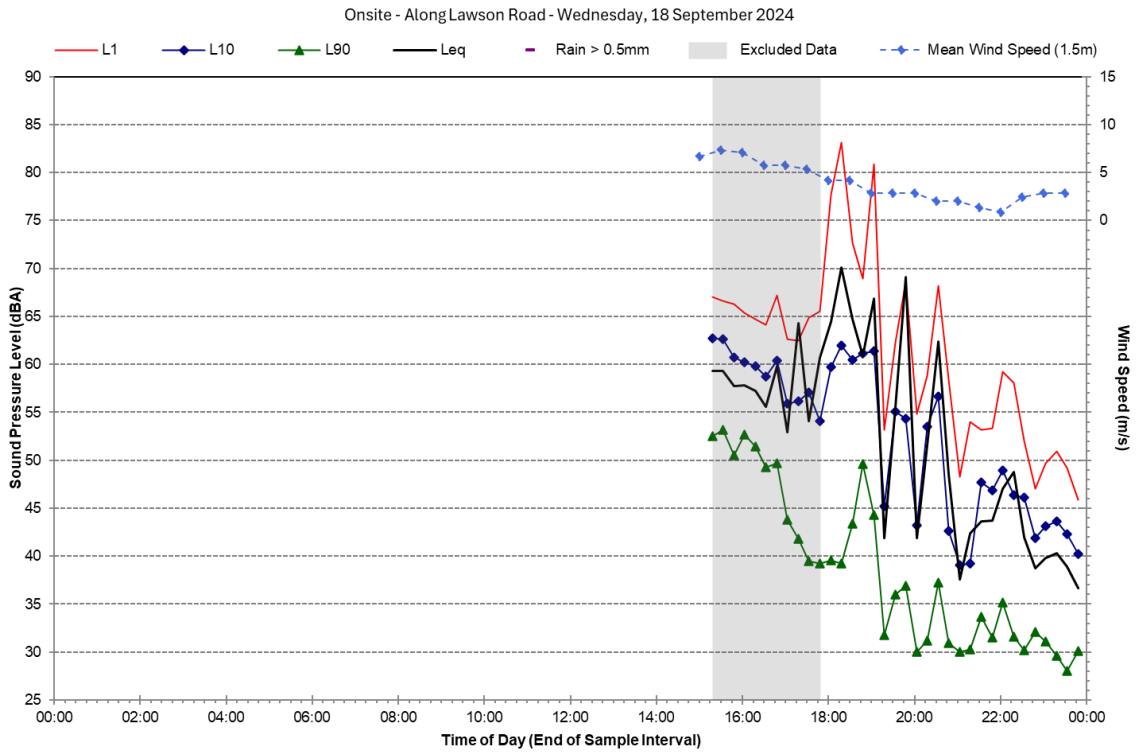
Monitoring Period	Noise Level (dBA)			
	RBL	L_{Aeq}	L_{10}	L_1
Daytime	37	52	51	58
Evening	34	56	49	53
Night-time	29	55	44	51

Attended Noise Measurement Results

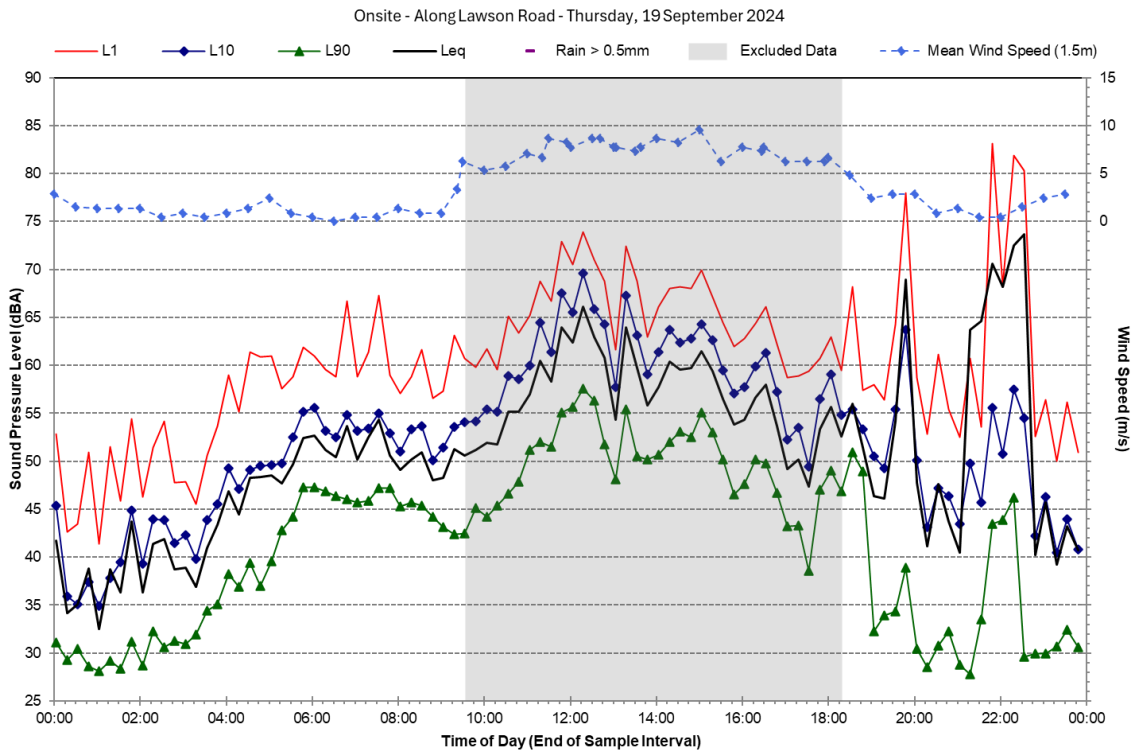
Date	Start Time	Measured Noise Level (dBA)		
		L_{A90}	L_{Aeq}	L_{Amax}
1/10/2024	16:25	46	51	62

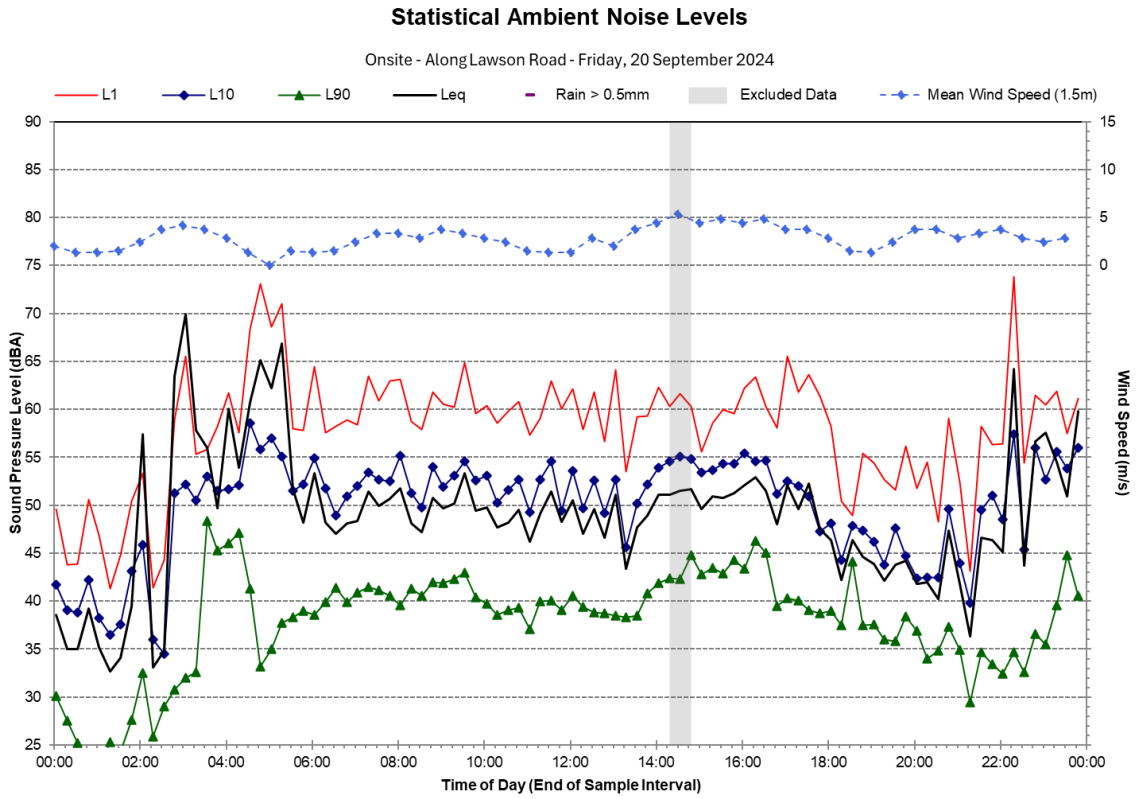
Photo of Noise Monitoring Location

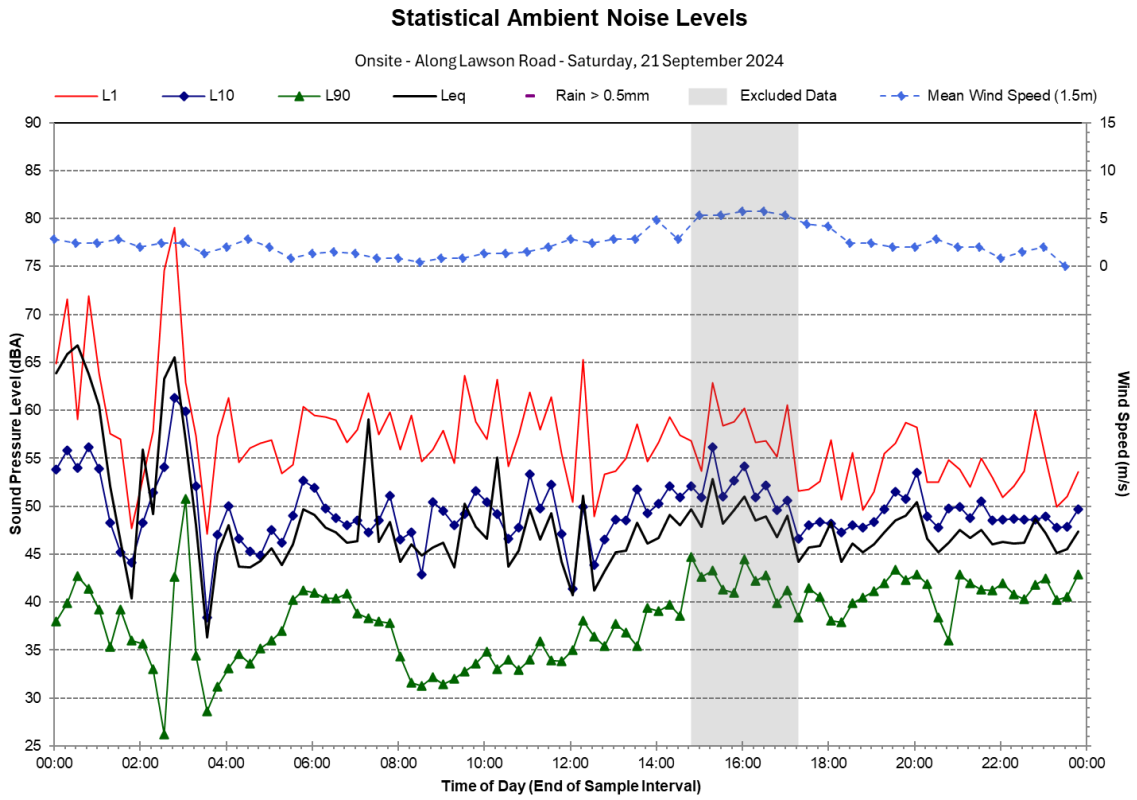
Statistical Ambient Noise Levels



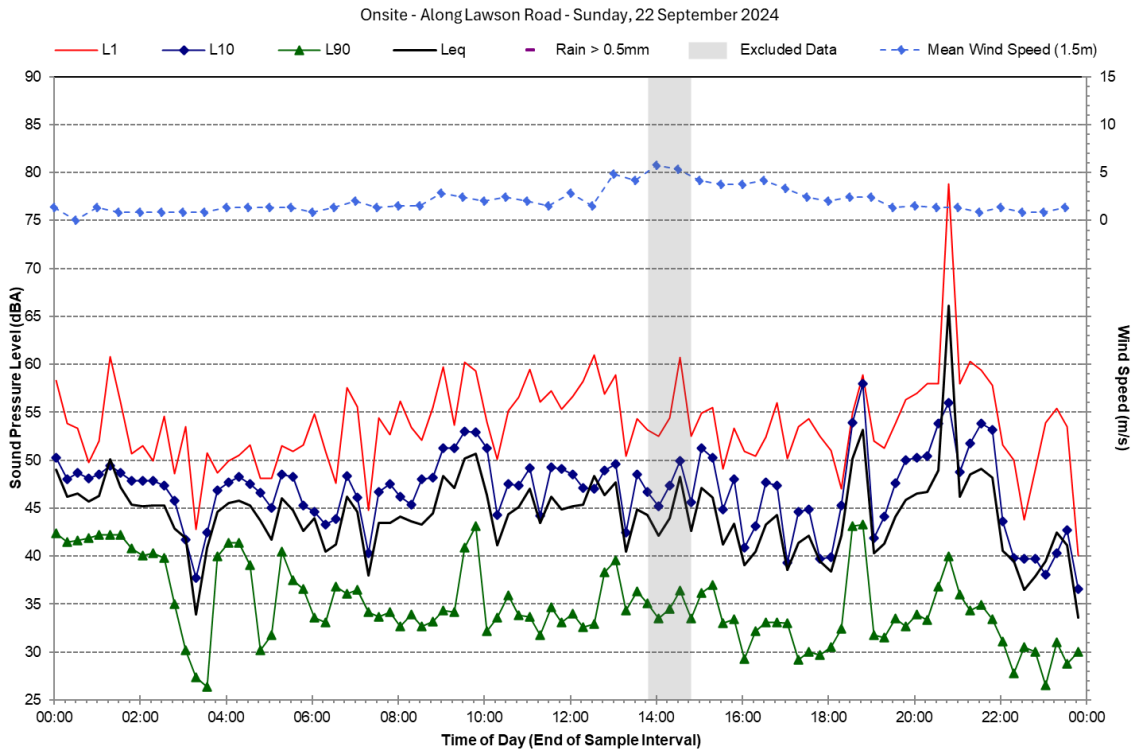
Statistical Ambient Noise Levels




Statistical Ambient Noise Levels
Onsite - Along Lawson Road - Friday, 20 September 2024
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Onsite - Along Lawson Road - Saturday, 21 September 2024
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

Statistical Ambient Noise Levels



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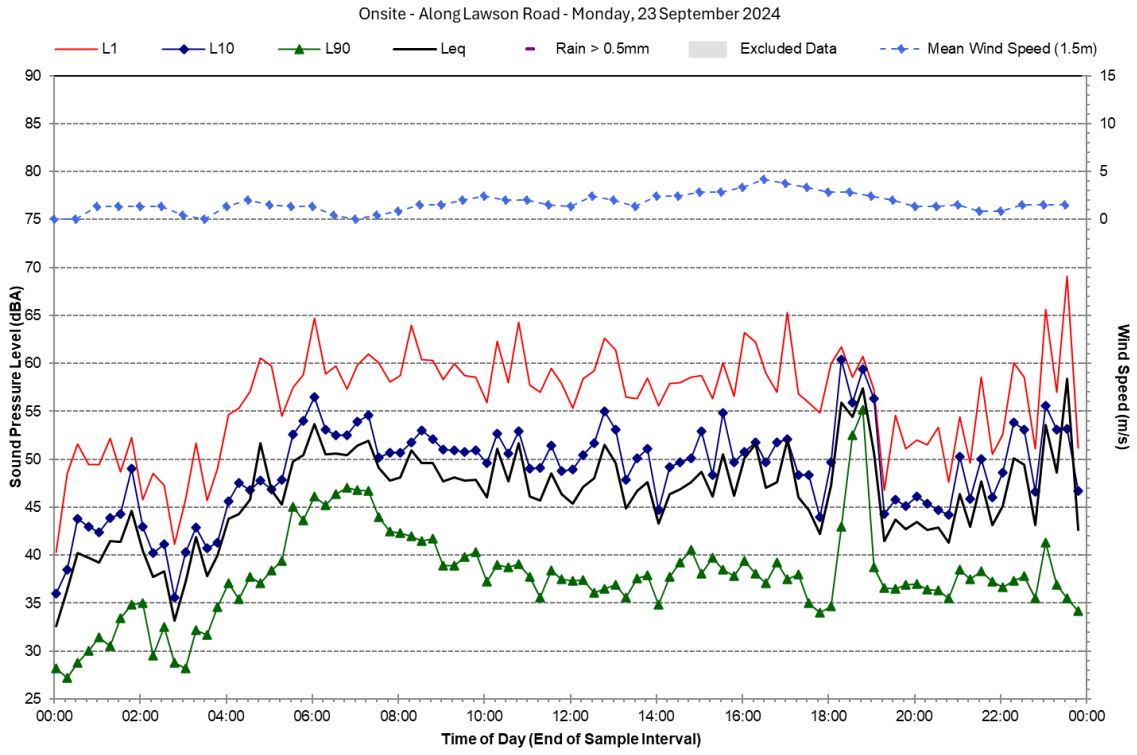
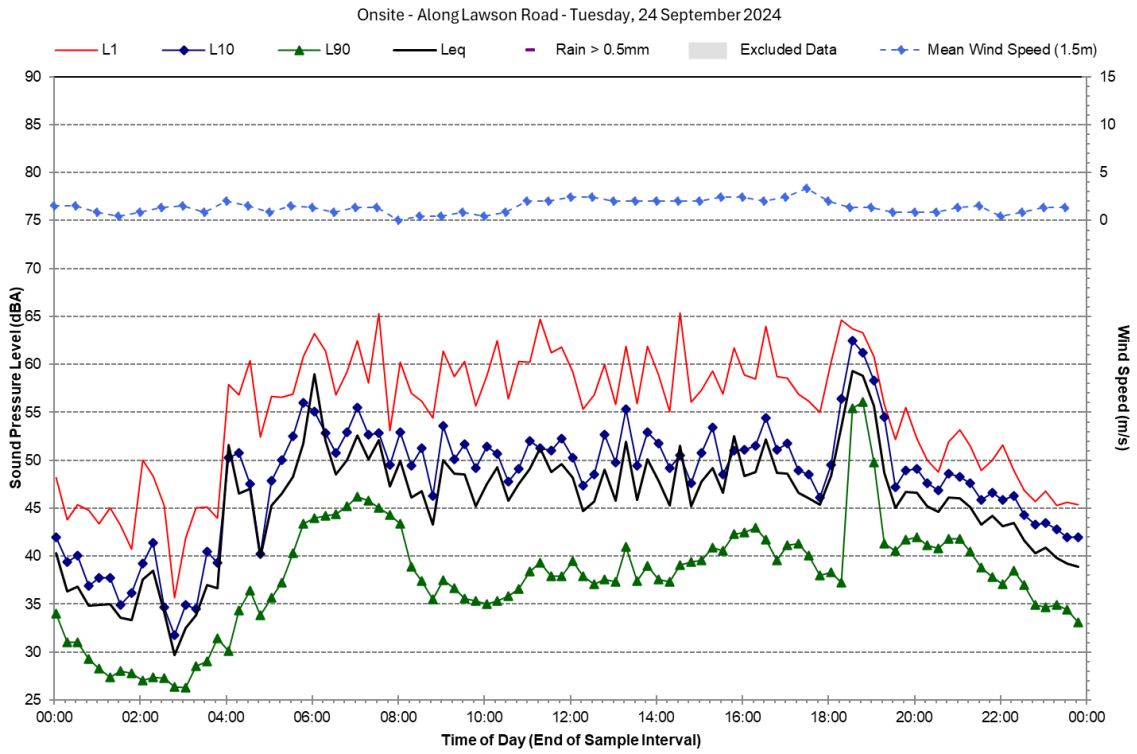


Statistical Ambient Noise Levels



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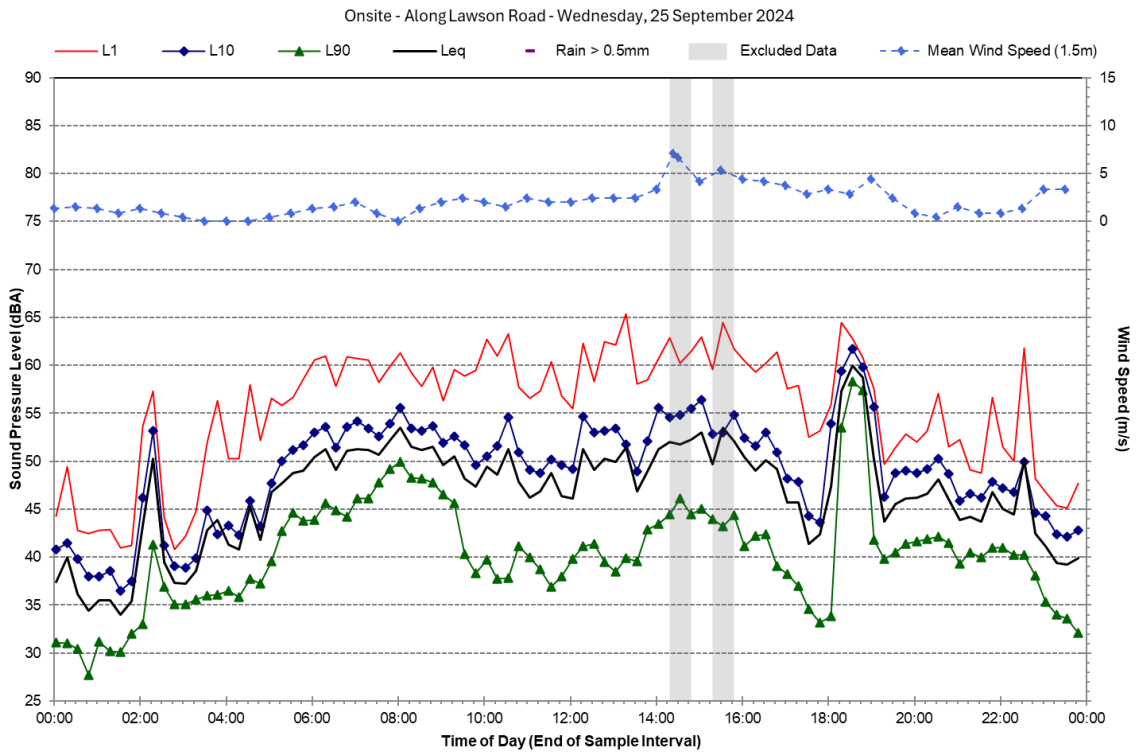
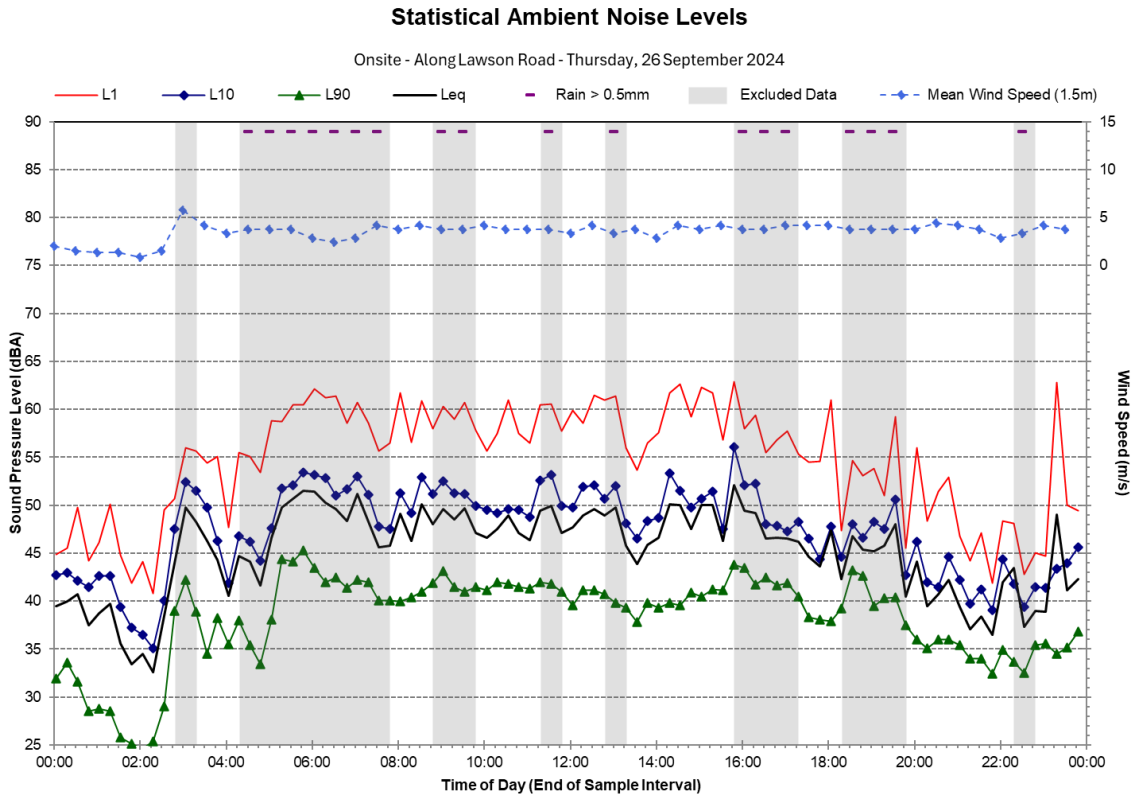
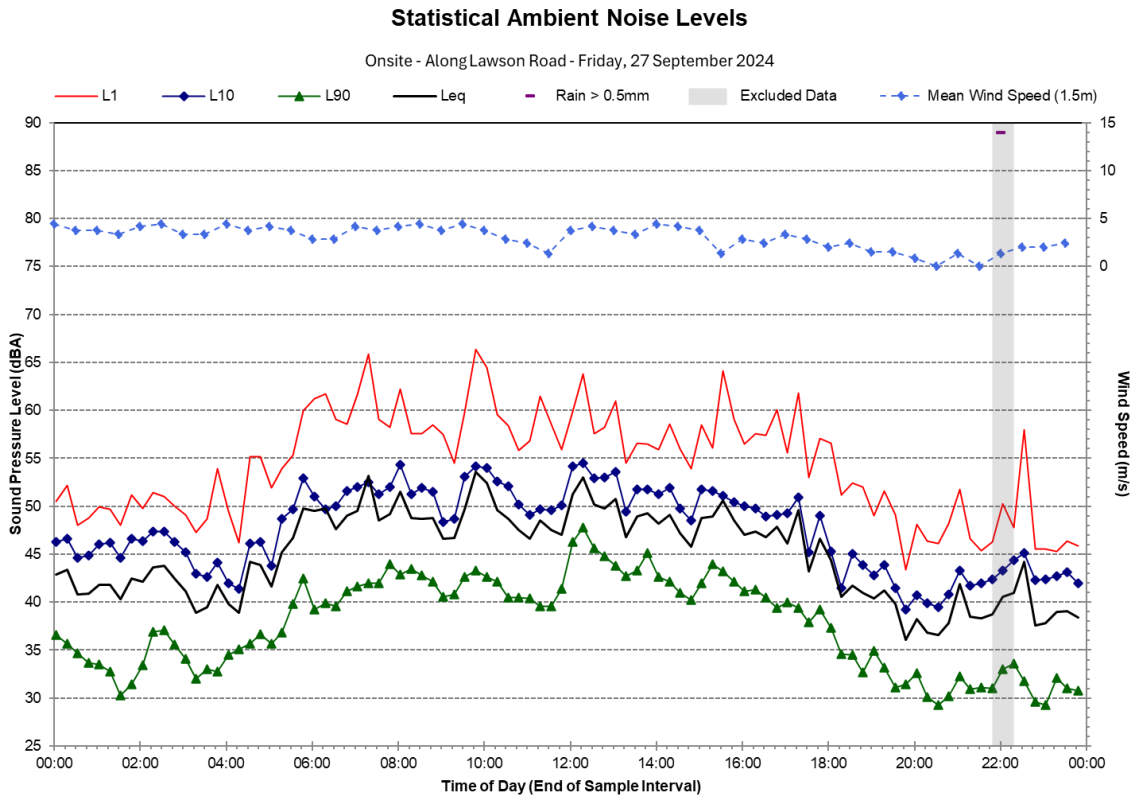
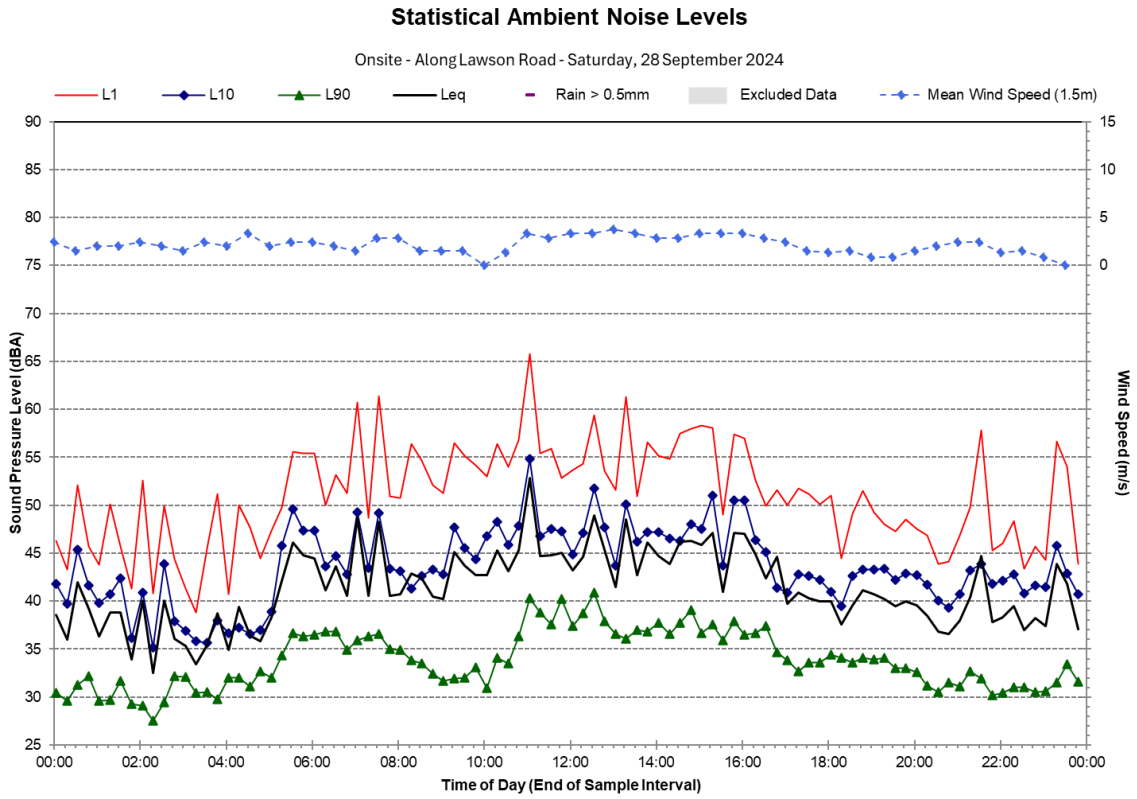
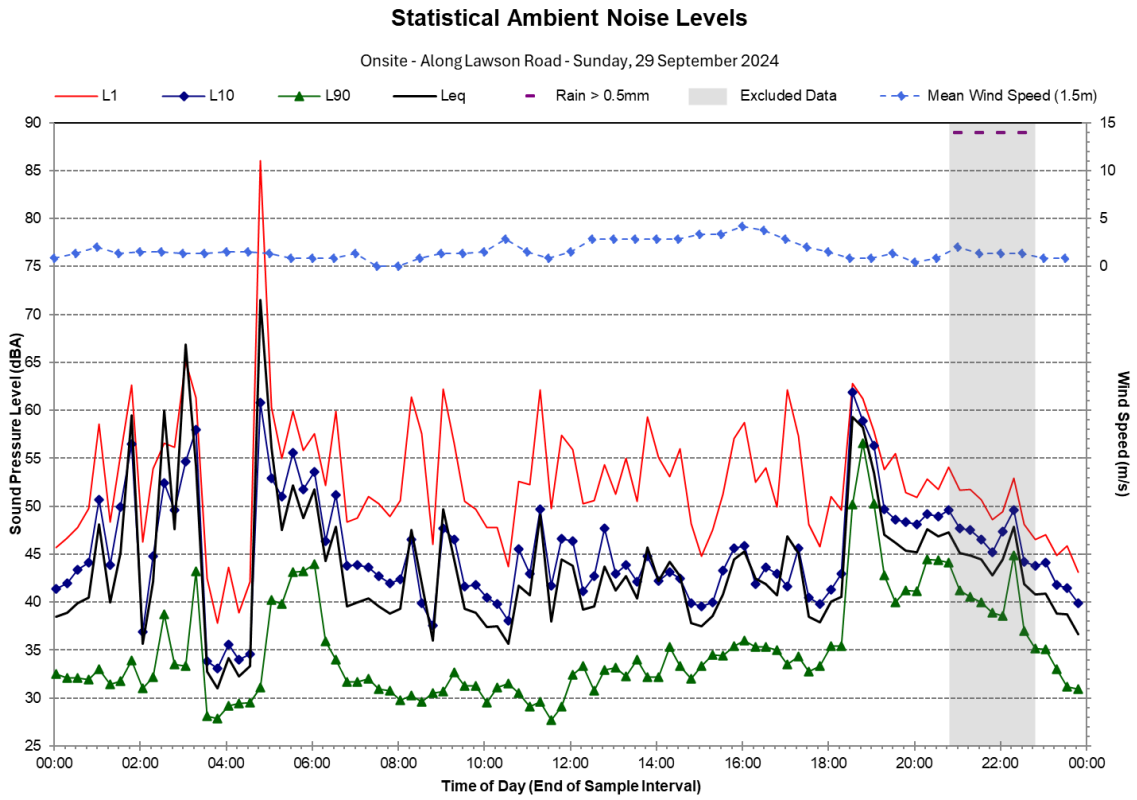



Statistical Ambient Noise Levels
Onsite - Along Lawson Road - Thursday, 26 September 2024
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Onsite - Along Lawson Road - Friday, 27 September 2024
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Onsite - Along Lawson Road - Saturday, 28 September 2024
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Onsite - Along Lawson Road - Sunday, 29 September 2024
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

Appendix C Construction Noise Sources

85 Martin Road, Badgerys Creek

SSDA Noise and Vibration Impact Assessment (SSD-74191717)

ESR Developments (Australia) Pty Ltd

SLR Project No.: 610.032060.00002

22 May 2026

Construction Scenario Descriptions

Equipment	Back Hoe (7.5 tonne JCB)	Circular Saw[1]	Concrete Mixer Truck	Concrete Pump	Elevated Working Platform	Excavator (22 tonne)	Hand Tools	Mobile Crane - Franna	Pneumatic hammer[1]	Roller - Vibratory (12 tonne)[1]	Semi Trailer	Suction Truck	Truck	Ute	Total Sound Power Level (dBA)
Sound Power Level (dBA)	102	106	103	106	97	99	94	98	114	109	106	100	107	98	
Assumed on-time in any 15 minutes	15	15	7.5	7.5	15	7.5	15	7.5	5	15	5	15	5	15	
Site Establishment	X					X				X					110
Stage 1 - Services	X					X	X						X		106
Stage 2 - Excavation	X					X	X		X			X	X		111
Stage 3 - Substructure			X	X		X							X		107
Stage 4 - Superstructure		X	X	X	X		X	X			X		X		110
Stage 5 - External works			X				X							X	103
Stage 6 - Fit out							X							X	99

Note 1: Equipment classed as 'annoying' in the ICNG and requires a 5 dB correction.

Note 2: Sound power level data is taken from the TfNSW *Construction Noise and Vibration Strategy* (CNVG-R and CNVG-PTI), AS2436-2010 and DEFRA Noise Database.

Appendix D Operational Noise Contours

85 Martin Road, Badgerys Creek

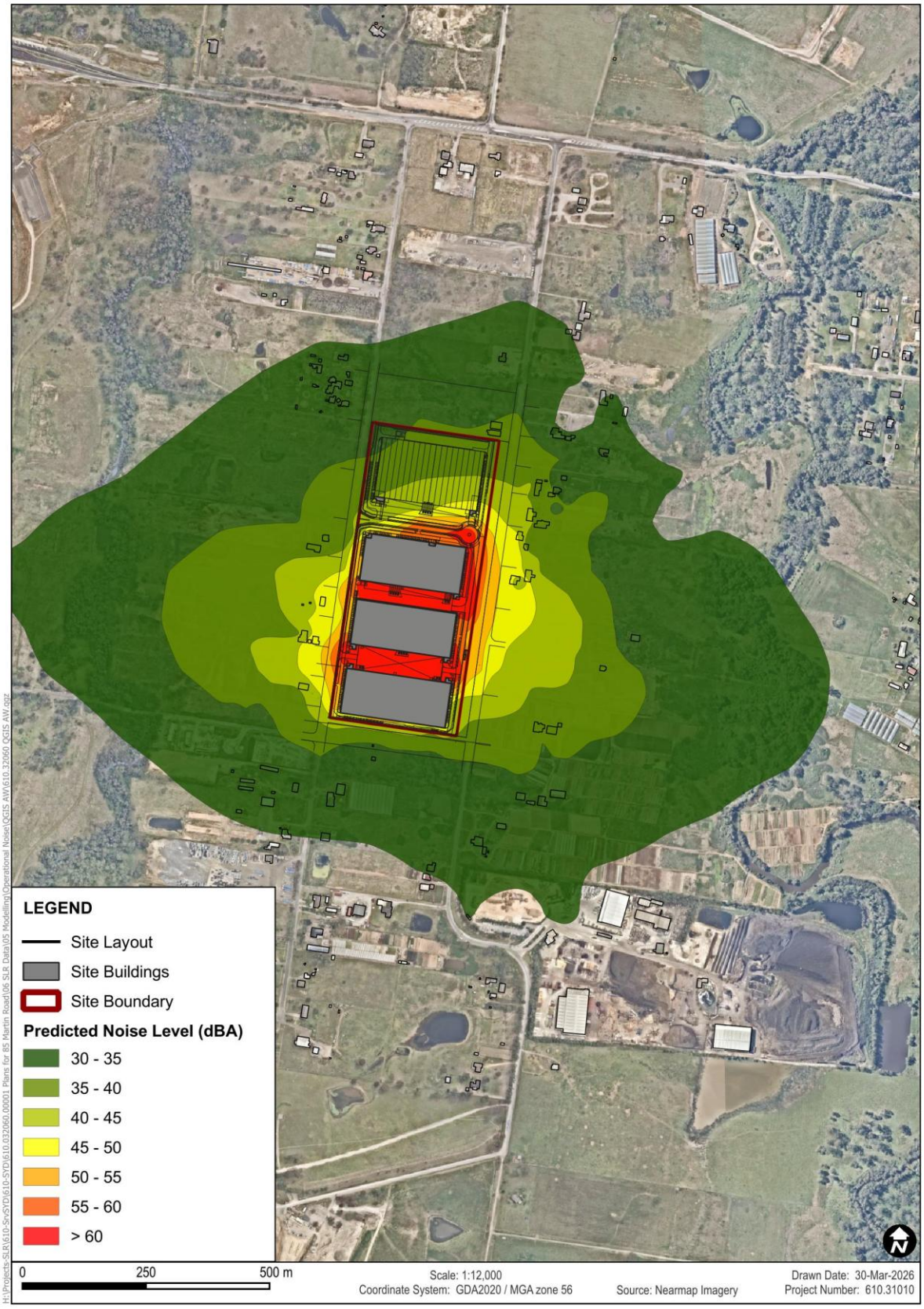
SSDA Noise and Vibration Impact Assessment (SSD-74191717)

ESR Developments (Australia) Pty Ltd

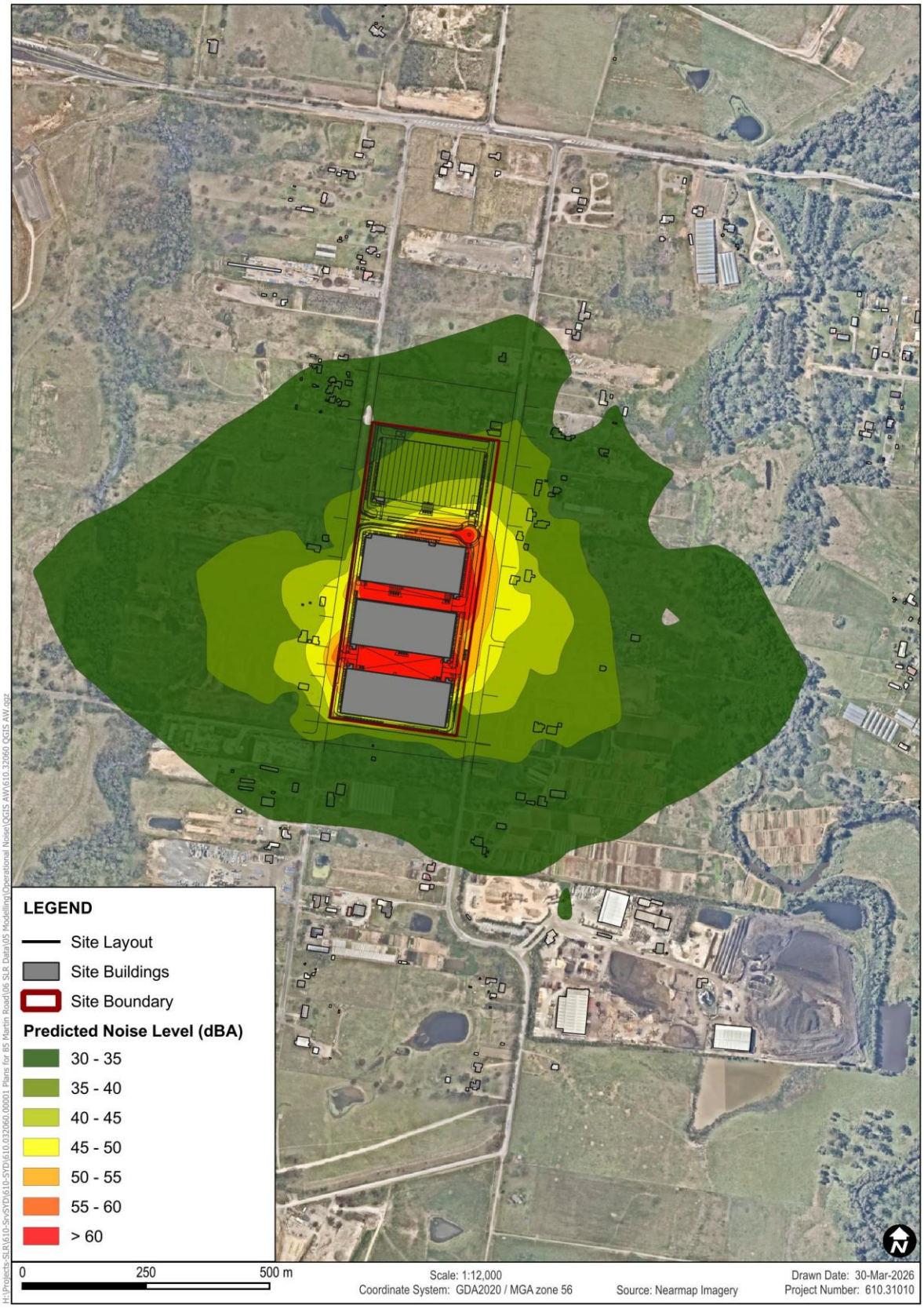
SLR Project No.: 610.032060.00002

22 May 2026

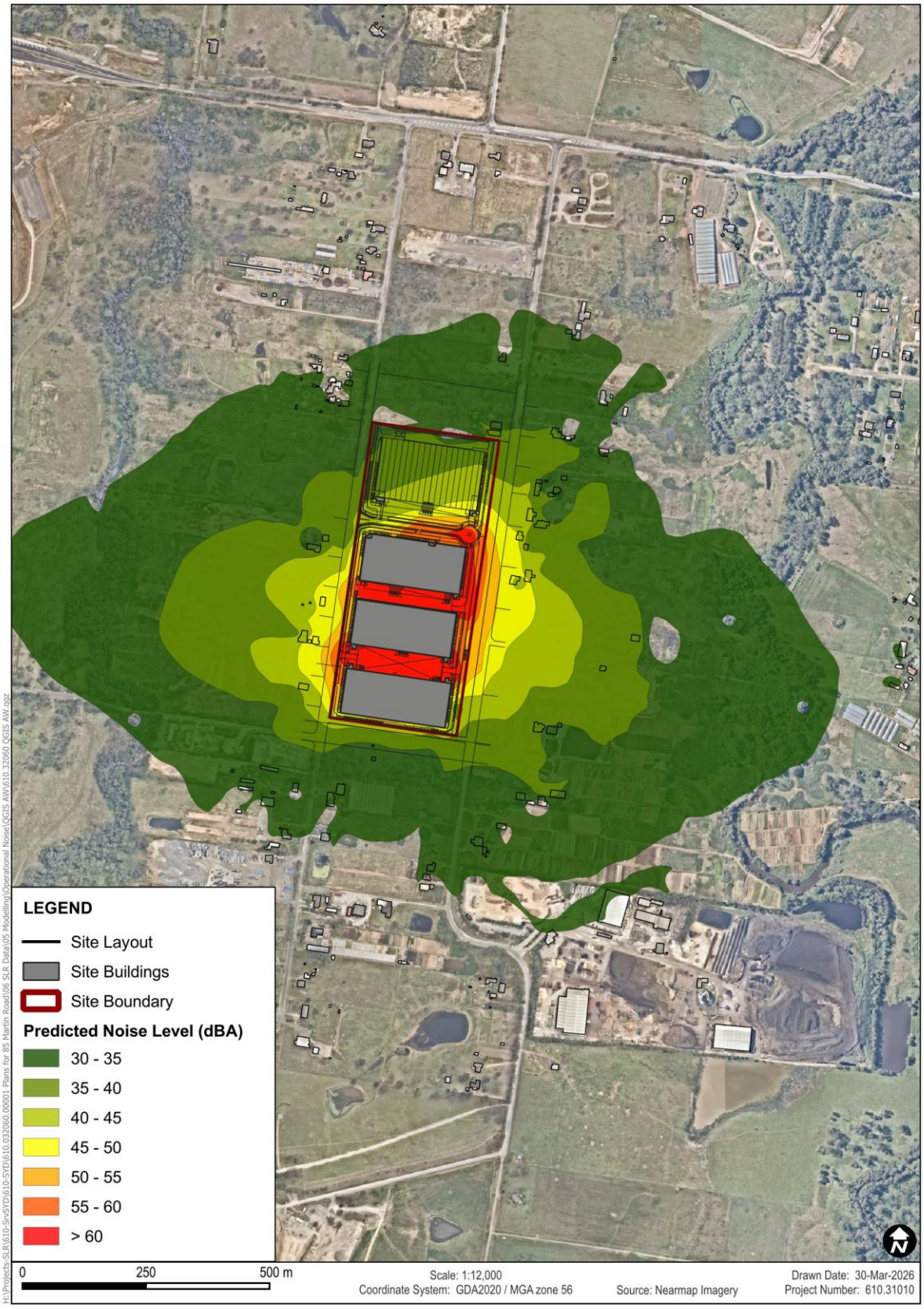
Stage 1 – Daytime Operational Noise Contour Maps



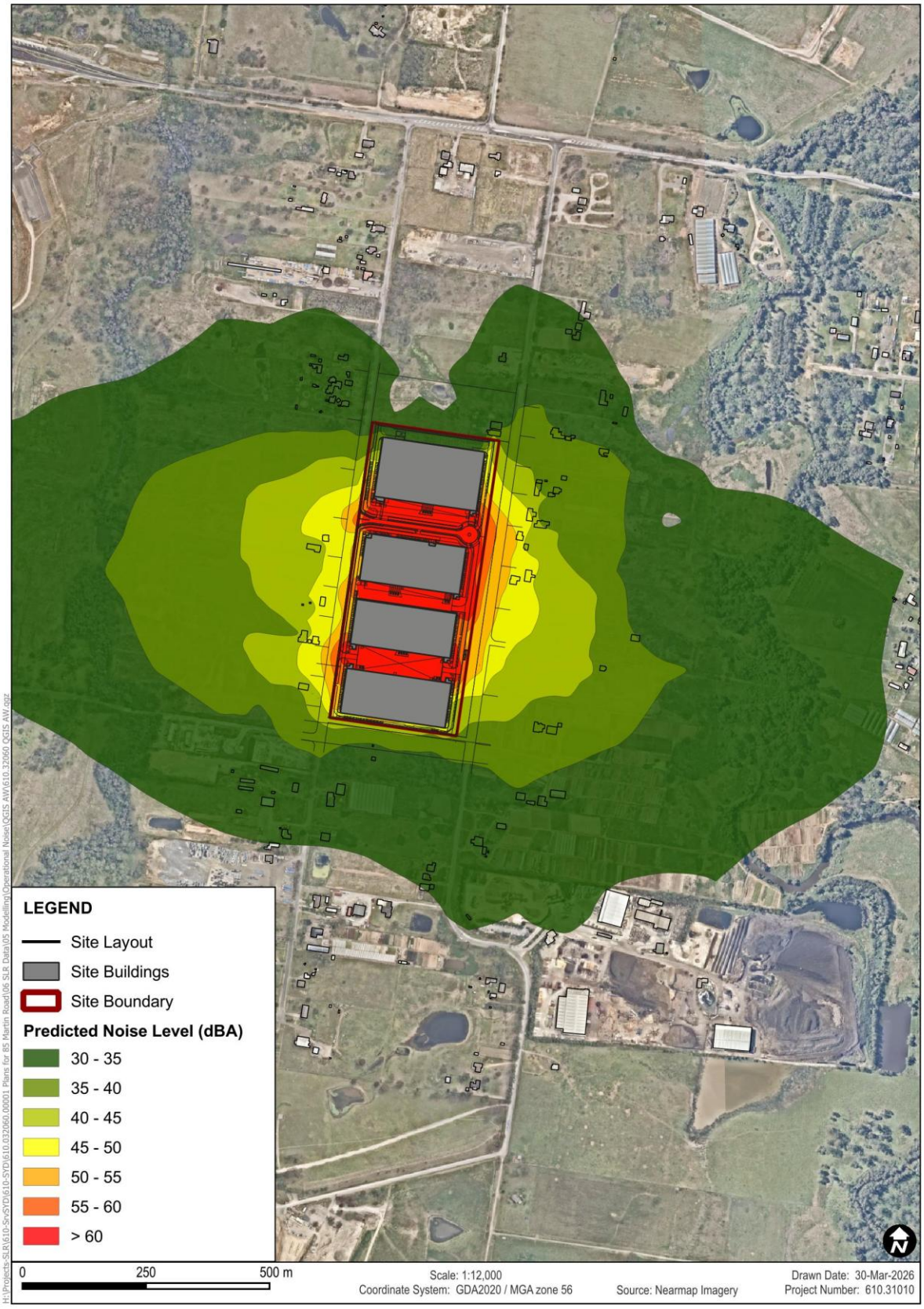
Stage 1 – Evening Operational Noise Contour Maps



Stage 1 – Night-time Operational Noise Contour Maps

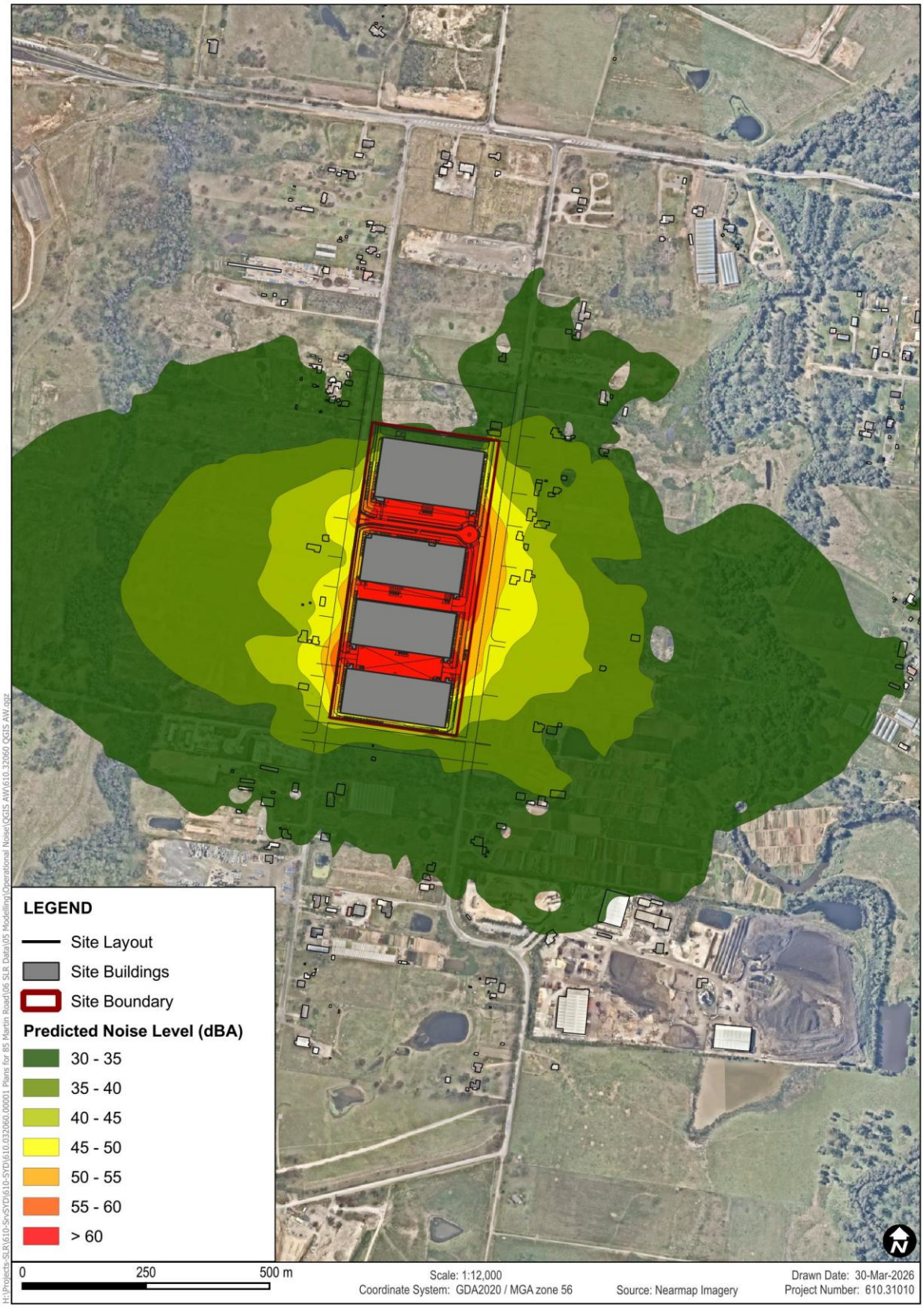


Stage 3 – Daytime Operational Noise Contour Maps



Stage 3 – Evening Operational Noise Contour Maps

Stage 3 – Night-time Operational Noise Contour Maps



Appendix E CNVG Mitigation Measures

85 Martin Road, Badgerys Creek

SSDA Noise and Vibration Impact Assessment (SSD-74191717)

ESR Developments (Australia) Pty Ltd

SLR Project No.: 610.032060.00002

22 May 2026

CNVG Standard Mitigation and Management Measures

Action Required	Applies To	Details
Management measures		
Implementation of any project specific mitigation measures required.	Airborne noise	Implementation of any project specific mitigation measures required.
Implement community consultation or notification measures.	Airborne noise Ground-borne noise & vibration	Notification detailing work activities, dates and hours, impacts and mitigation measures, indication of work schedule over the night-time period, any operational noise benefits from the works (where applicable) and contact telephone number. Notification should be a minimum of 7 calendar days prior to the start of works. For projects other than maintenance works more advanced consultation or notification may be required. Please contact Roads and Maritime Communication and Stakeholder Engagement for guidance. Website (If required) Contact telephone number for community Email distribution list (if required) Community drop-in session (if required by approval conditions).
Site inductions	Airborne noise Ground-borne noise & vibration	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: • all project specific and relevant standard noise and vibration mitigation measures • relevant licence and approval conditions • permissible hours of work • any limitations on high noise generating activities • location of nearest sensitive receivers • construction employee parking areas • designated loading/unloading areas and procedures • site opening/closing times (including deliveries) • environmental incident procedures.
Behavioural practices	Airborne noise	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.
Verification	Airborne noise Ground-borne noise & vibration	Where specified under Appendix C of the CNVG a noise verification program is to be carried out for the duration of the works in accordance with the Construction Noise and Vibration Management Plan and any approval and licence conditions.
Attended vibration measurements	Ground-borne vibration	Where required attended vibration measurements should be undertaken at the commencement of vibration generating activities to confirm that vibration levels are within the acceptable range to prevent cosmetic building damage.
Update Construction Environmental Management Plans	Airborne noise Ground-borne noise & vibration	The CEMP must be regularly updated to account for changes in noise and vibration management issues and strategies.

Action Required	Applies To	Details
Building condition surveys	Vibration Blasting	Undertake building dilapidation surveys on all buildings located within the buffer zone prior to commencement of activities with the potential to cause property damage
Source controls		
Construction hours and scheduling	Airborne noise Ground-borne noise & vibration	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels should be scheduled during less sensitive time periods.
Construction respite period during normal hours and out-of-hours work	Ground-borne noise & vibration Airborne noise	See Appendix C of the CNVG for more details on the following respite measures: • Respite Offers (RO) • Respite Period 1 (R1) • Respite Period 2 (R2) • Duration Respite (DR)
Equipment selection.	Airborne noise Ground-borne noise & vibration	Use quieter and less vibration emitting construction methods where feasible and reasonable. For example, when piling is required, bored piles rather than impact-driven piles will minimise noise and vibration impacts. Similarly, diaphragm wall construction techniques, in lieu of sheet piling, will have significant noise and vibration benefits. Ensure plant including the silencer is well maintained.
Plant noise levels.	Airborne-noise	The noise levels of plant and equipment must have operating Sound Power or Sound Pressure Levels compliant with the criteria in Appendix H of the CNVG. Implement a noise monitoring audit program to ensure equipment remains within the more stringent of the manufacturers specifications or Appendix H of the CNVG.
Rental plant and equipment.	Airborne-noise	The noise levels of plant and equipment items are to be considered in rental decisions and in any case cannot be used on site unless compliant with the criteria in Table 2 of the CNVG.
Use and siting of plant.	Airborne-noise	The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Noise-emitting plant to be directed away from sensitive receivers. Only have necessary equipment on site.
Plan worksites and activities to minimise noise and vibration.	Airborne noise Ground-borne vibration	Locate compounds away from sensitive receivers and discourage access from local roads. Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site. Where additional activities or plant may only result in a marginal noise increase and speed up works, consider limiting duration of impact by concentrating noisy activities at one location and move to another as quickly as possible. Very noise activities should be scheduled for normal working hours. If the work can not be undertaken during the day, it should be completed before 11:00pm. Where practicable, work should be scheduled to avoid major student examination periods when students are studying for examinations such as before or during Higher School Certificate and at the end of higher education semesters.

Action Required	Applies To	Details
		If programmed night work is postponed the work should be re-programmed and the approaches in this guideline apply again.
Reduced equipment power	Airborne noise Ground-borne vibration	Use only the necessary size and power.
Non-tonal and ambient sensitive reversing alarms	Airborne noise	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work. Consider the use of ambient sensitive alarms that adjust output relative to the ambient noise level.
Minimise disturbance arising from delivery of goods to construction sites.	Airborne noise	Loading and unloading of materials/deliveries is to occur as far as possible from sensitive receivers. Select site access points and roads as far as possible away from sensitive receivers. Dedicated loading/unloading areas to be shielded if close to sensitive receivers. Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible. Avoid or minimise these out of hours movements where possible.
Engine compression brakes	Construction vehicles	Limit the use of engine compression brakes at night and in residential areas. Ensure vehicles are fitted with a maintained Original Equipment Manufacturer exhaust silencer or a silencer that complies with the National Transport Commission's 'In-service test procedure' and standard.
Path controls		
Shield stationary noise sources such as pumps, compressors, fans etc.	Airborne noise	Stationary noise sources should be enclosed or shielded where feasible and reasonable whilst ensuring that the occupational health and safety of workers is maintained. Appendix D of AS 2436:2010 lists materials suitable for shielding.
Shield sensitive receivers from noisy activities.	Airborne noise	Use structures to shield residential receivers from noise such as site shed placement; earth bunds; fencing; erection of operational stage noise barriers (where practicable) and consideration of site topography when situating plant.
Receptor control		
Structural surveys and vibration monitoring	Ground-borne vibration	Pre-construction surveys of the structural integrity of vibration sensitive buildings may be warranted. At locations where there are high-risk receptors, vibration monitoring should be conducted during the activities causing vibration.
See Appendix C of the CNVG for additional measures	Airborne noise Ground-borne vibration	In some instances, additional mitigation measures may be required.

Appendix F NPfI Mitigation Measures

85 Martin Road, Badgerys Creek

SSDA Noise and Vibration Impact Assessment (SSD-74191717)

ESR Developments (Australia) Pty Ltd

SLR Project No.: 610.032060.00002

22 May 2026

Best Management Practice (BMP)

Best management practice (BMP) is the application of particular operational procedures that minimise noise while retaining productive efficiency.

Where applied, these measures and practices are often documented in a noise management plan so that operational practices and undertakings are clearly understood and applied at all levels of an industrial operation. Application of BMP can include the following types of practice:

- Using the quietest plant that can do the job
    - Scheduling the use of noisy equipment at the least-sensitive time of day
- Not operating, or reducing operations at night
    - Siting noisy equipment behind structures that act as barriers, or at the greatest distance from the noise-sensitive area or orienting the equipment so that noise emissions are directed away from any sensitive areas, to achieve the maximum attenuation of noise
- Where there are several noisy pieces of equipment, scheduling operations so they are used separately rather than concurrently
    - Keeping equipment well-maintained and operating it in a proper and efficient manner
- Using ‘quiet’ practices when operating equipment, for example, positioning idling trucks in appropriate areas
    - Running staff-education programs and regular tool box talks on the effects of noise and the use of quiet work practices.

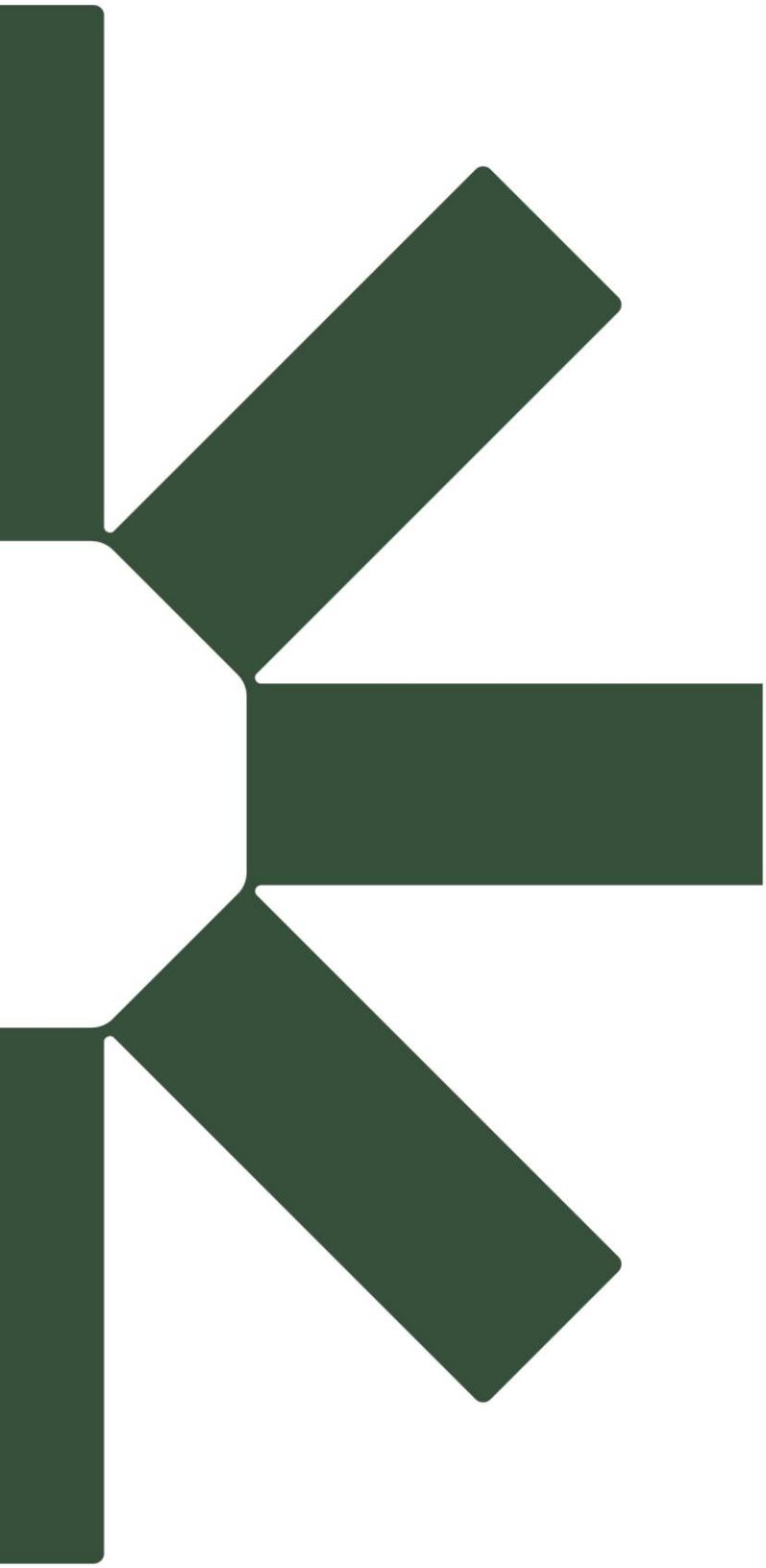
Best Available Technology Economically Achievable (BATEA)

With ‘Best available technology economically achievable’ (BATEA), equipment, plant and machinery that produce noise incorporate the most advanced and affordable technology to minimise noise output. Affordability is not necessarily determined by the price of the technology alone. Increased productivity may also result from using more advanced equipment, offsetting the initial outlay, for example, using ‘quieter’ equipment that can be operated over extended hours. Old or badly-designed equipment can often be a major source of noise.

Where BMP fails to achieve the required noise reduction by itself, the BATEA approach should then be considered. Examples of uses of BATEA include:

- Considering alternatives to tonal reversing alarms (where work health and safety is appropriately considered)
    - Using equipment with efficient muffler design
- Using quieter engines, such as electric instead of internal combustion
    - Fitting and maintaining noise reduction packages on plant and equipment
- Using efficient enclosures for noise sources
    - Damping or lining metal trays or bins
- Active noise control.

For many industries there are a wide range of factors that can restrict the feasibility and reasonableness of applying BMP or BATEA measures on a particular site. Work health and safety considerations must also be taken into account as well as any other regulatory and process requirements.



Making Sustainability Happen