Acoustics
Vibration
Structural Dynamics

MAMRE ROAD DATA CENTRE CAMPUS, KEMPS CREEK

Noise and Vibration Impact Assessment

12 December 2025

Plan Project Management

TP886-01F05 Mamre Road Data Centre Campus SSDA NVIA (r6).docx

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1 Introduction

1.1 Overview and purpose of report

Renzo Tonin & Associates (RTA) has been engaged by Plan Project Management (PPM) to undertake an operational and construction noise and vibration impact assessment (NVIA) to accompany the State Significant Development Application (SSD) 92743706 for the proposed Mamre Road Data Centre at 706–752 Mamre Road, Kemps Creek, NSW (the Proposal). The Proposal site is located within the Mamre Road Precinct (MRP). The MRP is located within the Western Sydney Employment Area.

This report assesses noise and vibration impacts during the construction and operational phases of the Proposal. It proposes mitigation and management measures to reduce impacts during the construction and operational phases of the Proposal. The report has been prepared to address the requirements of the Secretary of the Department of Planning, Housing and Infrastructure (DPHI) ('the Secretary's environmental assessment requirements') (SEARs).

The noise and vibration assessment has been carried out in accordance with the policies, guidelines and standards presented in Section 1.5 of this report addressing construction noise and vibration and operational noise, respectively.

This report has been prepared by suitably qualified and experienced acoustic engineers. Engineers involved in the preparation of the report are of member grade of the Australian Acoustical Society (AAS), are appropriately experienced acoustic engineers employed by a firm being a member of the Association of Australasian Acoustic Consultants (AAAC) and have extensive experience in environmental acoustics.

1.2 Secretary’s environmental assessment requirements

The Department of Planning, Housing and Infrastructure (DPHI) issued Secretary’s environmental assessment requirements for the Proposal dated 30 September 2025. These requirements are addressed in this report, as outlined in Table 1-1.

Table 1-1: Secretary’s environmental assessment requirements – Noise and vibration

Secretary’s environmental assessment requirements	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 noise and vibration impact assessment report
• details of noise monitoring survey, background noise levels, noise source inventory and ‘worst case’ noise emission scenarios	Section 3 – Noise monitoring Section 8.1 – Noise generating operations Section 8.2 - Noise source inventory and operational noise source details Section 8.4.4 - ‘Worst case’ noise emission scenarios (including testing of any back-up power system)
• establishment of suitable project noise trigger levels at all nearby sensitive receivers, including consideration of clustering of noise-generating industry within the Mamre Road Precinct, appropriate amenity noise levels, and any applicable external façade to internal space corrections for educational and childcare facilities (supported by robust evidence, preferably using noise measurements)	**Project noise trigger levels and nearby sensitive receivers** Section 2 - Receivers - Nearby noise and vibration sensitive receivers Section 5.2.4 – Project noise trigger levels **Cumulative / clustering of noise-generating industry noise assessment** Section 5.2.1 – Cumulative / clustering of noise-generating industry noise overview and context Section 5.2.3.2 – Cumulative criteria Section 8.5 – Operational noise predictions, against cumulative criteria. **Amenity noise levels and adopted internal to external corrections** Section 5.2.3 - Amenity noise levels and adopted internal to external corrections Section 5.2.4 – Project noise trigger levels
• identification of realistic assessment scenarios for both construction and operation of the development (including potential impacts associated with traffic generation	Section 8.4.4 - Operational noise emission modelled assessment scenarios (including testing of any back-up power system)
• details of manufacturer specifications for plant and equipment and an associated noise source inventory for each scenario (demonstrating worst-case modelling of plant and equipment)	APPENDIX D - Manufacturer data for noise inventory plant and equipment
• an assessment of all ‘worst case’ noise emission scenarios (including testing of any back-up power system and a critical power failure scenario), supported by:	Section 8.2 - Noise source inventory and operational noise source details Section 8.4.4 - ‘Worst case’ noise emission scenarios (including testing of any back-up power system)
o noise contour maps and a detailed sleep disturbance assessment.	APPENDIX F – Noise contours Section 8.5.4 - Sleep disturbance assessment

Secretary's environmental assessment requirements	Where addressed
o a cumulative impact assessment inclusive of impacts from other proposed and approved developments in the Mamre Road Precinct and adjoining areas (including, but not limited to, other data centre developments in the vicinity of the site)	Section 5.2.1 – Cumulative industrial noise overview and context Section 5.2.3.2 – Cumulative criteria Section 8.5 – Assessment of operational predictions, against cumulative criteria Section 7.3.3 - Cumulative construction noise
o if operation of the development is staged, an assessment of each stage in isolation to accurately represent the predicted noise impacts of each stage.	Section 7.3.1 – Construction noise predictions, including predictions from all construction stages Section 8.1.2 – Development staging details APPENDIX B - Development staging diagrams Section 8.5 – Operational predictions, including predictions from all progressive stages
• consideration of annoying characteristics of noise (including, but not limited to, low frequency noise) and prevailing meteorological conditions in the study area	Section 8.4.3 - Meteorological factors Section 8.5.2 - Annoying characteristics
• details and analysis of the effectiveness of proposed 'feasible and reasonable' management and mitigation measures to adequately manage identified impacts, including a clear identification of residual noise and vibration impacts following application of these mitigation measures and details of any proposed compliance monitoring programs.	Section 8.3 - Initial assessment outcomes and Proposal acoustic mitigation and management measures review Section 8.5 – Operational noise predictions, inclusive of 'feasible and reasonable' management and mitigation measures Section 8.6 – Review of residual impacts Section 8.7 - Operational noise management

1.3 Proposal overview

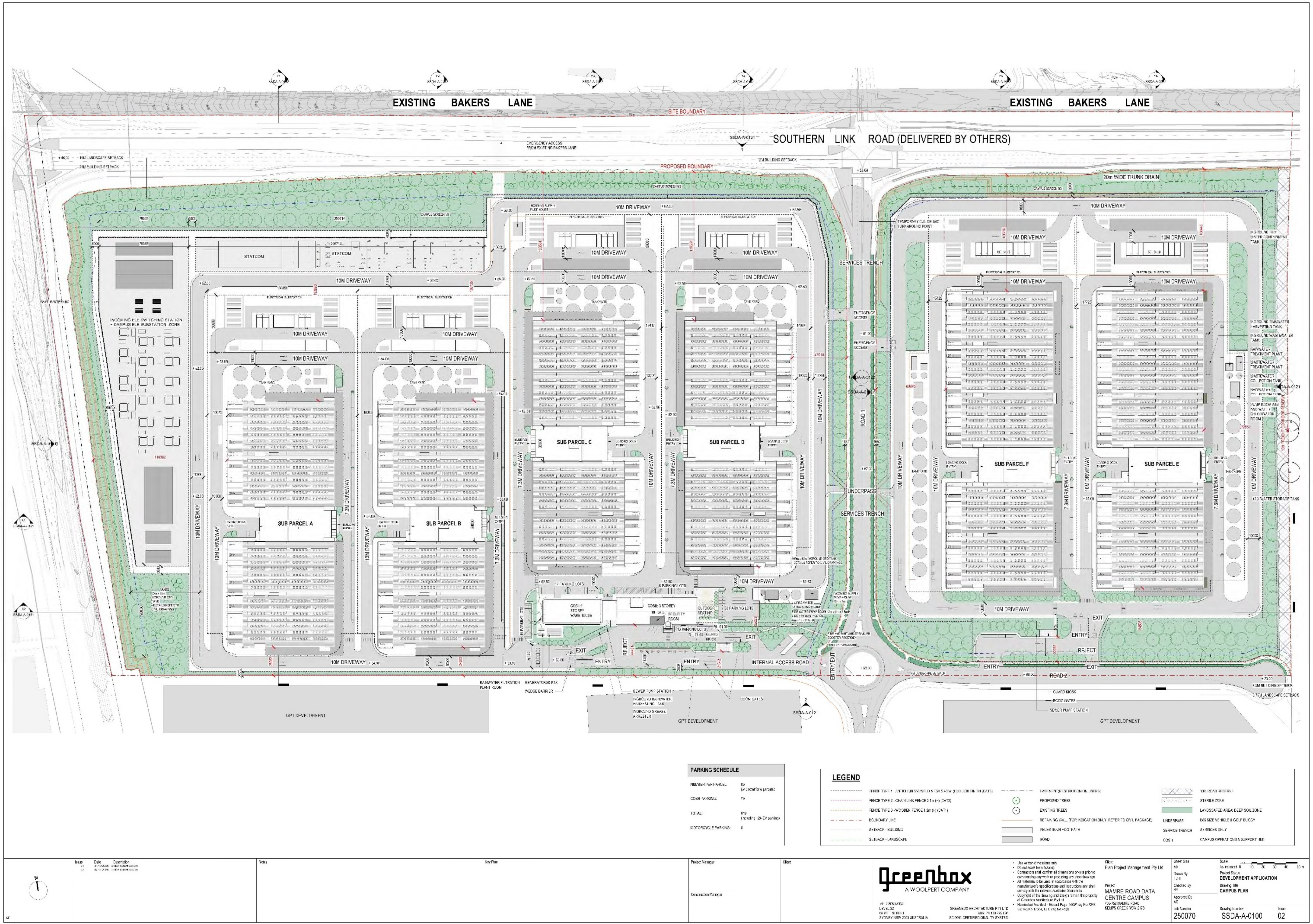
1.3.1 Proposal description

The Proposal is proposed for development under a State Significant Development Application (SSDA) as a data centre campus comprising:

- Approximately 26 shells across four-storey data centre buildings (4x four shells and 2x five shells), including six technical office buildings, plus a campus office.
- Incoming and internal electrical substations and associated infrastructure.
- Site preparation, including earthworks, stormwater, sewer, roads, and associated infrastructure.

The overall Proposal plan is presented in Figure 1-1.

Figure 1-1: Proposal overall campus plan



]

1.3.2 Proposal hours

The Proposal hours of operation are to be 24 hours, 7 days per week.

1.3.3 Proposal location

The project area for the Proposal, 706-752 Mamre Road, Kemps Creek (Lot 10 DP 1280592), constitutes the main development site with areas across the shared boundaries to the east and south (described below) utilised to facilitate roadworks and bulk earthworks:

- Gibb Group site to the East known as 1-22 Bakers Lane, Kemps Creek (Lot 40 in DP 709347).
- GPT Group site to the South known as 754 Mamre Road, Kemps Creek (Lot 180 in DP 1290397).

Additionally, power supply lead-in from Sydney-West Substation is proposed as part of the development, which traverses through multiple landholdings.

The site is shown in identified in Figure 1-2.

Figure 1-2:Proposal location

1.4 Proposal site context - Mamre Road Precinct (MRP)

The Proposal is located within the Mamre Road Precinct (MRP). The MRP is within the Western Sydney Employment Area and was rezoned in June 2020. The MRP provides about 850 hectares of industrial land. The rezoning of the precinct preserves around 95 hectares of land for environmental conservation and open space and protects a site for a potential Western Sydney freight intermodal terminal (IMT).

The development control plan (MRP DCP) was adopted on 19 November 2021 following a public exhibition.

As detailed in Section 1.6 "*Precinct Vision*" of the MRP DCP states:

"*The Mamre Road Precinct will be a world-class industrial area, primarily catering for warehousing and logistics on larger consolidated land parcels close to the Western Sydney Airport. The Precinct will accommodate an intermodal terminal serviced by the planned Western Sydney Freight Line and a dedicated freight road network, and has convenient and quick access to the M12 and Elizabeth Drive. Connectivity to the broader Western Sydney Employment Area will be improved.*

Flexible zoning and land use controls will also promote other smaller industrial, manufacturing, commercial and clean industrial uses that provide for a range of employment opportunities. Low impact urban services will be encouraged in transition areas adjoining rural-residential properties in Mount Vernon, where views, the natural landscape, noise and amenity will be carefully managed.

Sympathetic site planning, earthworks and building design will be required at the interface with sensitive land uses as well as Wianamatta-South Creek, Kemps Creek and Ropes Creek, bushland and open space, to ensure public spaces and environmental lands are protected, attractive and activated…."

Presented in Figure 1-3 is the structure plan for the MRP as part of the rezoning presented in the MRP DCP, while presented in Figure 1-4 are the recent proposed, in-progress and approved developments within the MRP, with the applicable SSD or Development Application (DA) reference.

Figure 1-3:Mamre Road Precinct – Structure Plan (MRP DCP)

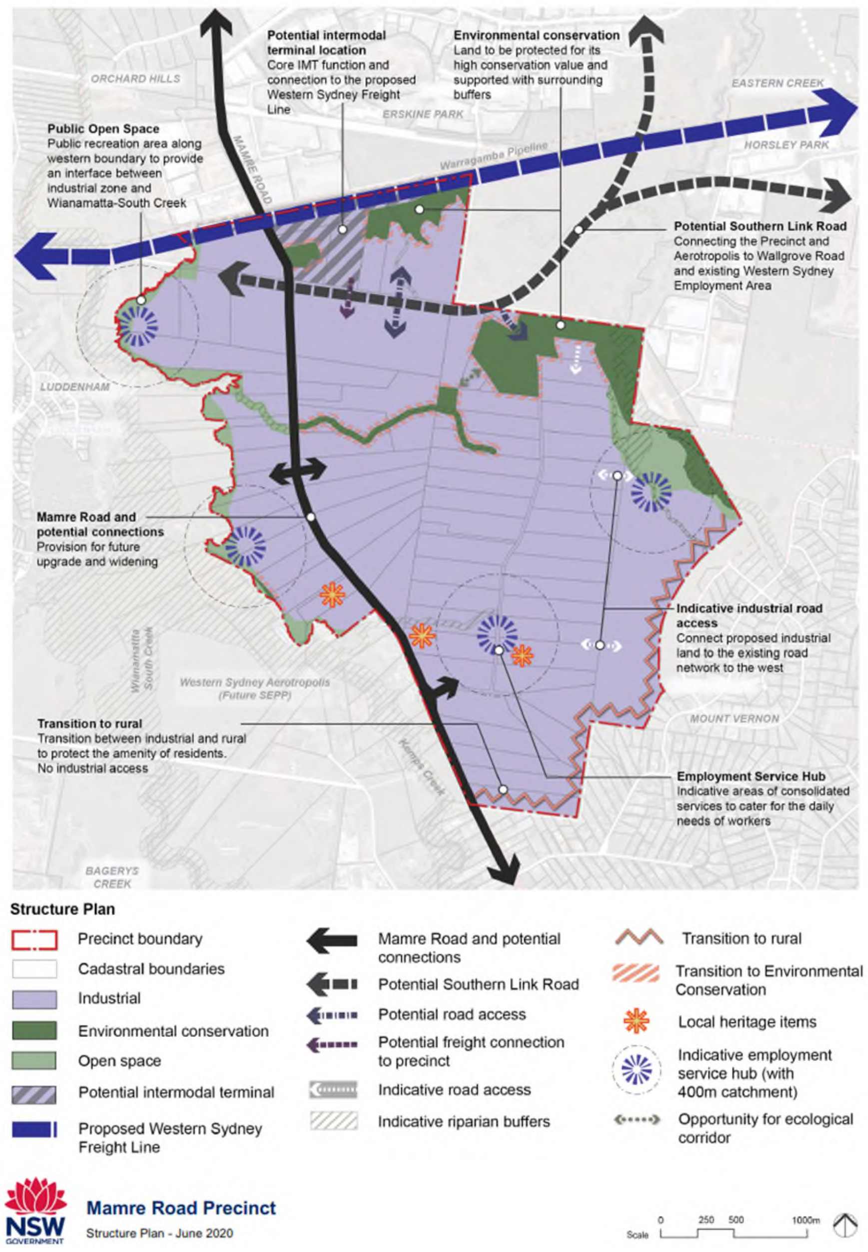
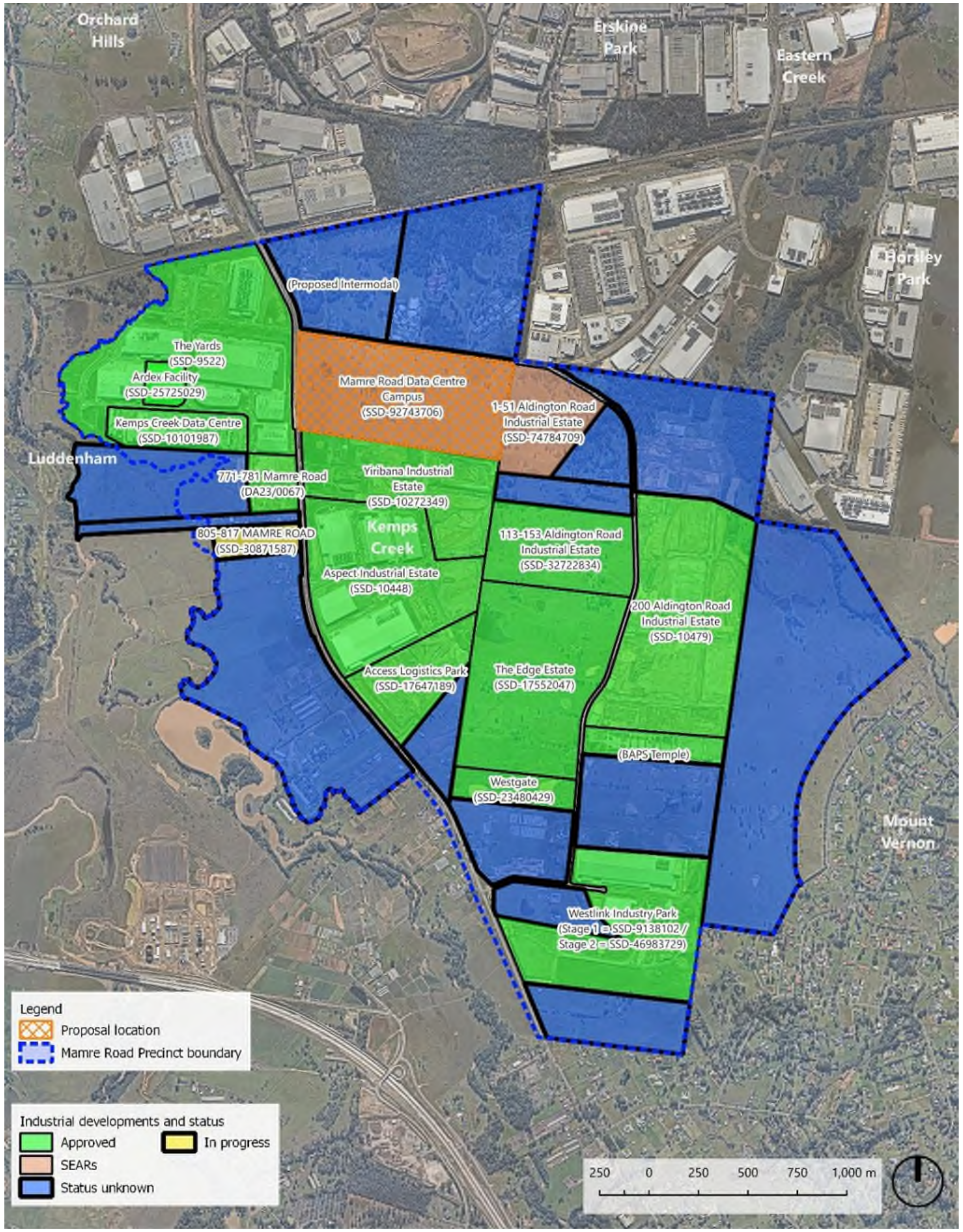


Figure 1-4:Proposed surrounding developments within the MRP (as of October 2025)



1.5 Assessment objectives

The assessment objectives are to determine the potential levels of noise and vibration at sensitive receivers located near the Proposal and determine the levels of mitigation that would be required to enable compliance with the current NSW requirements.

As part of preparing this assessment, the following policies, guidelines, and standards have been considered:

- NSW *Noise Policy for Industry* (NPfI) (EPA 2017)
- NSW *Road Noise Policy* (RNP) (DECCW 2011)
- NSW *Interim Construction Noise Guideline* (ICNG) (DECC 2009)
- NSW *Assessing Vibration – A Technical Guideline* (AVTG) (DEC 2006)
- NSW *Environmental Criteria for Road Traffic Noise* (ECRTN) (EPA 1999)
- NSW *Approved methods for measurement and analysis of environmental noise in NSW* (NSW Approved Methods) (EPA, 2022)

1.6 Acoustic terms & quality

This report is technical in nature and uses acoustic terminology throughout. A summary and explanation of the common acoustic terms that have been used in this report is presented in APPENDIX A Section A.1. Some of the key acoustic concepts used in this report are outlined in APPENDIX A Section A.3.

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001.

2 Nearby noise and vibration sensitive receivers

2.1 Site and surrounding land use

The Proposal site is located within the MRP. The land surrounding the Proposal area currently comprises a predominantly rural typology, with a variety of rural dwellings, rural land, farm dams and scattered vegetation. As per Section 1.4, this land rezoned for the MRP from RU2 Rural Landscape zone to IN1 General Industrial zoning under the State Environmental Planning Policy (Western Sydney Employment Area) 2009 (WSEA SEPP). Subsequent to the approval of the MRP rezoning, large areas of this land have been purchased for industrial development, and construction has commenced on a number of approved developments.

The nearby sensitive receivers have been categorised as to whether they are located within or outside of the MRP rezoned area. Noting the current rate of change and development across the MRP, the majority of the existing non-industrial noise sensitive receivers located within the MRP are only likely to be located there short-term. However, there are a number of receivers that may be there for the long term, and they have been addressed separately in the assessment. Figure 2-1 shows the location of the Proposal, the nearby noise sensitive receivers and the land uses near the Proposal.

2.2 Noise catchment areas

As the existing acoustic environment varies at the nearby residential receivers, these residential receivers have been grouped into Noise Catchment Areas (NCAs) based upon areas with similar acoustic environments, and similar grouping of receivers considering when impacts may occur.

This has been done to logically group the receivers to assist with the assessment and allocate the appropriate project noise trigger levels or management levels to each receiver. The locations of these noise catchment area boundaries are also shown in Figure 2-1 and Figure 2-2.

2.3 Noise sensitive receiver groups

To address the MRP DCP and SEARs requirements the receivers surrounding the development need to be grouped into three categories for the nearby noise sensitive receivers.

2.3.1 Receivers outside the MRP

The first group are receivers outside the MRP, which include the permanent existing residences outside the MRP. The nearest long-term residential receivers are located in Luddenham (near Twin Creeks Golf & Country Club) to the west, along Medinah Avenue, Luddenham.

The noise sensitive receivers surrounding the Proposal area and the MRP are presented in Figure 2-1 and described below:

- Luddenham (NCA06) (near Twin Creeks Golf & Country Club) – with the closest residences approximately 1,400 metres west from the Proposal,
- Orchard Hills (NCA05) – with the closest residences approximately 1,500 metres north west from the Proposal
- Mount Vernon and Horsley Park (NCA08) – with the closest residences approximately 2 kilometres east and south-east from the Proposal
- Kemps Creek (NCA07) – with the closest residences approximately 1,600 metres south from the Proposal

2.3.2 Receivers inside the MRP (long-term receivers)

There are a number of existing noise sensitive receivers within the MRP area in the vicinity of the Proposal site. Although these receivers are within the rezoned MRP area, it is unknown whether they are likely to relocate in the medium or long term, or if it is expected that they may be there for the long-term. At this point in time, in both cases, the following receivers are expected to remain in place as receivers for some time:

- Catholic Healthcare Emmaus Retirement Village (NCA02)
- Trinity Catholic Primary School (NCA02)
- Emmaus Catholic College (NCA02)
- BAPS Shri Swaminarayan Hindu Mandir and Cultural Precinct (BAPS Temple) (NCA03-PW)

2.3.3 Receivers inside the MRP (short-term receivers)

There are also a number of existing noise sensitive receivers within the MRP area in the vicinity of the Proposal site, which are expected to only be there for the short-term. These receivers are in NCA01, NCA03 and NCA04 and any noise impacts could only be expected while the receiver buildings remain and they remain occupied as residences or schools. These include:

- Existing residences (NCA01, NCA03 and NCA04)
- Mamre Anglican School (relocating in 2029 to Sydney Science Park, Luddenham[1])

Figure 2-1 presents the Proposal location, the MRP boundary, and the nearby receivers and groups, along with the noise catchment areas.

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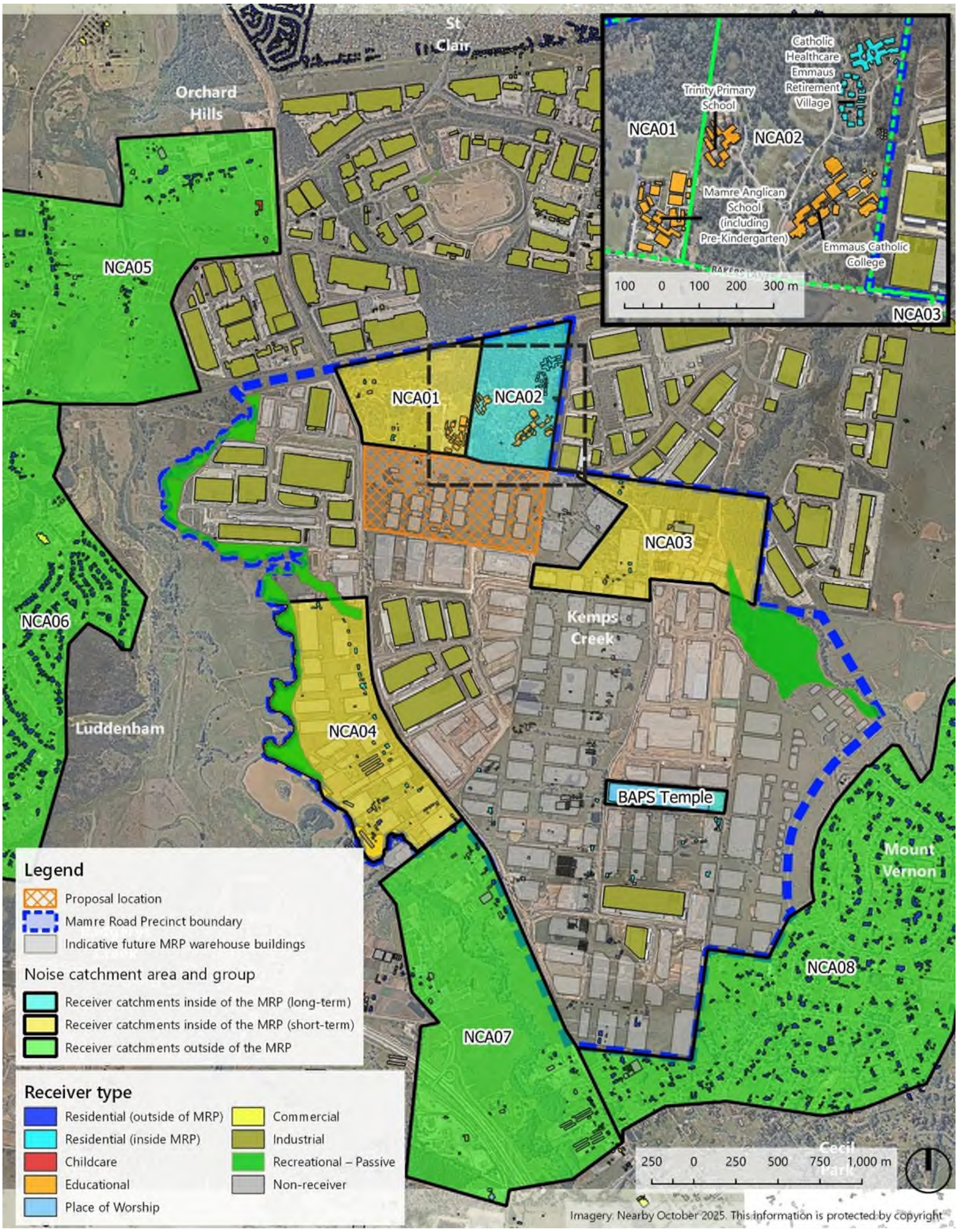
[1] [1]*"Mamre is on the move...2029 Relocation Information"* https://mamre.nsw.edu.au/relocation/

Figure 2-1:Site location, nearby noise sensitive receivers, land uses and NCAs



2.4 Assessment receivers

To assess to the potentially most affected locations surrounding the Proposal, noise levels have been modelled to a large range of nearby and potentially impacted noise sensitive receivers as shown in Figure 2-2. However, to simplify the reporting of results, only the results from critical locations are included based upon the noise levels at receivers with the highest predicted noise levels. For many receiver locations (eg. schools) there are multiple buildings or assessment points considered, and the assessment is based upon the highest predicted noise levels.

As per Section 2.2, groups of residential receivers have been grouped into NCAs based on their acoustic environment. NCAs are presented in Table 2-1 and Figure 2-2.

Existing noise and vibration sensitive receivers have been identified in Table 2-1 and Figure 2-2. Additionally, future adjacent industrial receivers have been included as assessment locations.

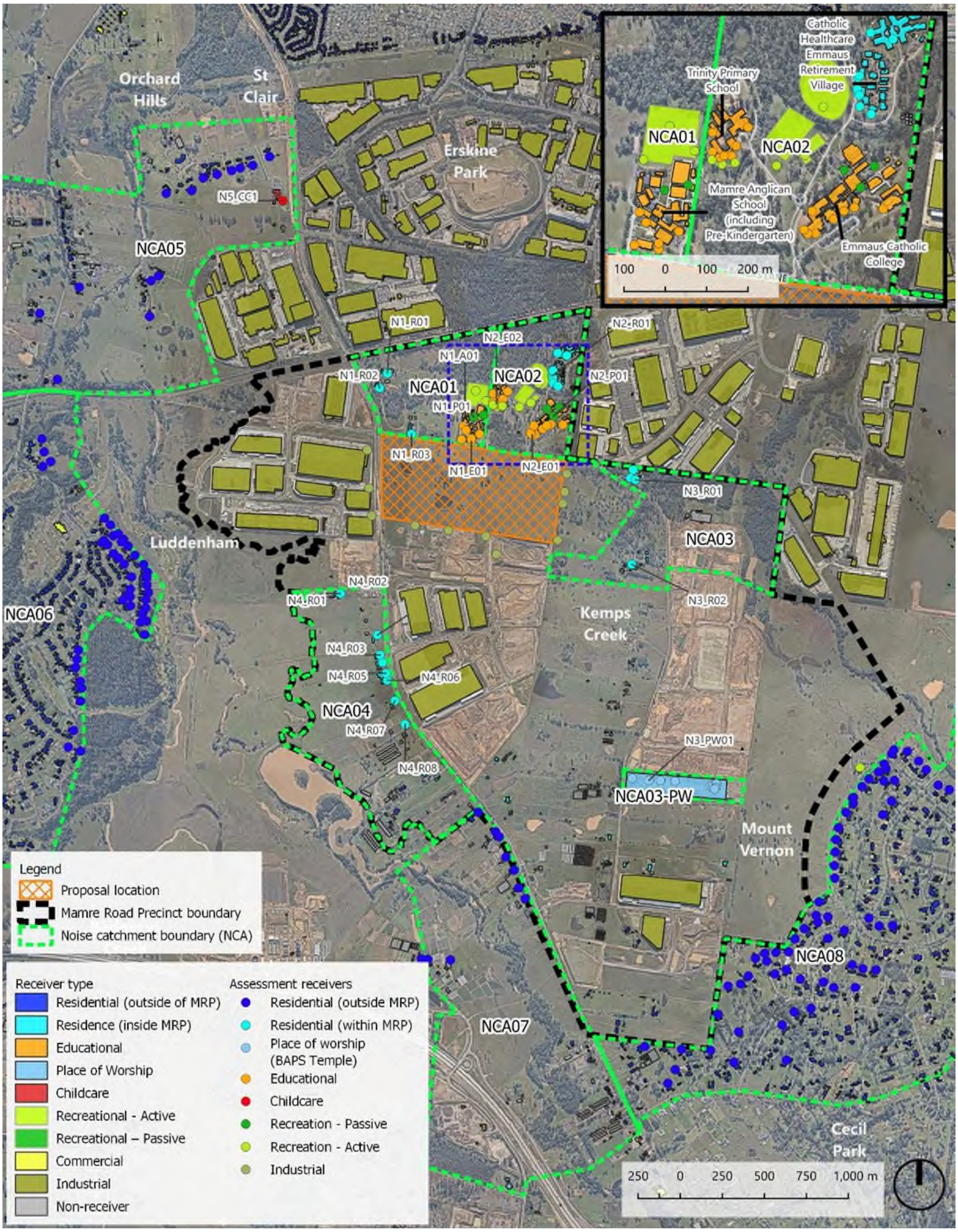
Table 2-1: Assessment receiver locations

Residential noise catchment area (NCA)	Receiver reference	Address	Receiver type	Approximate distance to the Proposal, metres[4]
NCA01	N1_R01	654-674 Mamre Road, Kemps Creek	Residential	360
NCA01	N1_R02	676-702 Mamre Road, Kemps Creek	Residential	270
NCA01	N1_R03	1 Bakers Lane, Kemps Creek	Residential	30
NCA01	N1_E01	Mamre Anglican School[3]	Educational[1]	60
NCA01	N1_P01		Passive Rec (School)	
NCA01	N1_A01		Active Rec (School)	
NCA02	N2_R01	Emmaus Retirement Village	Residential	480
NCA02	N2_E01	Emmaus Catholic College	Educational	170
NCA02	N2_P01		Passive Rec (School)	
NCA02	N2_A01		Active Rec (School)	
NCA02	N2_E02	Trinity Primary School	Educational	320
NCA02	N2_P02		Passive Rec (School)	
NCA02	N2_A02		Active Rec (School)	
NCA03-PW	N3_PW01	BAPS Temple and Cultural Precinct	Place of worship	1,520
NCA03	N3_R01	20 Aldington Road, Kemps Creek	Residential	430
NCA03	N3_R02	53 Aldington Road, Kemps Creek	Residential	490
NCA04	N4_R01	799-803 Mamre Road, Kemps Creek	Residential	520
NCA04	N4_R02	819 Mamre Road, Kemps Creek	Residential	700
NCA04	N4_R03	833A Mamre Road, Kemps Creek	Residential	810
NCA04	N4_R04	833B Mamre Road, Kemps Creek	Residential	850
NCA04	N4_R05	845A Mamre Road, Kemps Creek	Residential	920
NCA04	N4_R06	845-857 Mamre Road, Kemps Creek	Residential	950
NCA04	N4_R07	859-869 Mamre Road, Kemps Creek	Residential	1,070
NCA04	N4_R08	885-899 Mamre Road, Kemps Creek	Residential	1,200
NCA05	All[1]	Orchard Hills	Residential	1,500
NCA05	N5_CC1	Old MacDonald's Child Care	Childcare	1,510
NCA06	All[1]	Luddenham	Residential	1,400
NCA07	All[1]	Kemps Creek	Residential	1,600
NCA08	All[1]	Mount Vernon	Residential	2,200
IND	I01	East	Industrial	Adjacent
	I02	South	Industrial	Adjacent
	I03	West	Industrial	Adjacent

Notes:

1. Multiple receiver locations within the noise catchment have been assessed as identified in Figure 3-1 as Proposal noise levels at receivers may vary across the catchment and change across project phases.
2. Little Smarties Child Care which was previously on site of the Mamre Anglican School is now closed. Mamre Anglican runs a Pre-Kindergarten in the same space, which has been assessed as a classroom space.
3. Relocating in 2029 to a new campus at the Sydney Science Park in Luddenham [1] *"Mamre is on the move...2029 Relocation Information"* https://mamre.nsw.edu.au/relocation/
4. Approximate distance from Proposal Boundary to closest receiver assessment location/building, as per Figure 1-1. It should be noted that a calibrated 3D noise model has been prepared for the Proposal to determine predicted noise levels. The distances in the table are provided for summary information only and have not been relied upon for the noise assessment.

Figure 2-2: Site location, assessment noise sensitive receivers, land uses and NCAs



Legend
▨ Proposal location
▭ Mamre Road Precinct boundary
▭ Noise catchment boundary (NCA)

Receiver type	Assessment receivers
🟦 Residential (outside of MRP)	● Residential (outside MRP)
🟦 Residence (inside MRP)	● Residential (within MRP)
🟧 Educational	● Place of worship (BAPS Temple)
🟦 Place of Worship	● Educational
🟥 Childcare	● Childcare
🟩 Recreational - Active	● Recreation - Passive
🟩 Recreational – Passive	● Recreation - Active
🟨 Commercial	● Industrial
🟩 Industrial	
⬜ Non-receiver	

3 Existing noise environment and noise monitoring

Criteria for the assessment of operational and construction noise are usually derived from the existing noise environment of an area, excluding noise from the subject development.

As the noise environment of an area almost always varies over time, background and ambient noise levels need to be determined for the operational times of the proposed development. Background noise varies over the course of any 24-hour period, typically from a minimum at 3:00am in the morning to a maximum during morning and afternoon traffic peak hours. Therefore, the NSW Environment Protection Authority (EPA) Noise Policy for Industry (NPfI) (EPA 2017) requires that the level of background and ambient noise be assessed separately for the daytime, evening and night-time periods. Fact Sheet B of the NPfI outlines the methods for determining the background noise level of an area.

The typical time periods in accordance with the NPfI are as follows:

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

Noise measurements are ideally carried out at the nearest or most potentially affected locations surrounding a development in absence of noise from the subject site. Furthermore, representative locations may be established in the case of multiple receivers as it is usually impractical to carry out. As such, noise catchment areas have been established to group assessment receivers based on areas with similar acoustic characteristics.

This assessment has reviewed recently approved State Significant Developments (SSD) and State Significant Infrastructure (SSI) in the area to determine suitable noise monitoring survey results that would be applicable to the project and representative of nearby residential receivers and existing background noise levels. This was done for consistency with previous SSDA and State Significant Infrastructure (SSI) assessments.

Table 3-1 provides details of the adopted noise monitoring data, with locations shown in Figure 3-1 and the summary background noise data from these surveys presented in Table 3-2.

Table 3-1: Reference noise monitoring locations and data adopted for the assessment

NCA	Reference location (Figure 3-1)	Address	Monitoring period	Description (as per relevant reporting)
NCA01	L01	676-702 Mamre Road, Kemps Creek	11/04/2018 – 19/04/2018	Monitoring undertaken by Acoustic Works as part of the SSD 9522 SSDA. (Noise Monitor B). Noise levels were generally influenced my road traffic on Mamre Road. The noise monitoring location is considered representative of receiver locations within NCA 3.
NCA02	L02	The 'Village', 85 Bakers Lane, Kemps Creek	1 May 2021 and 29 June 2021	Monitoring undertaken as part of the Oakdale West noise assessment (RWDI, Oakdale West Industrial Estate Buildings 4a and 4b, RWDI#2102730.07, 5 December 2022) These are generally consistent with the values presented in SSD-30628110, which was based upon 2015 monitoring data, but from more recent monitoring data. RWDI, Oakdale West Industrial Estate Buildings 4a And 4b, report reference RWDI#2102730.07, 5 December 2022
NCA03	L03	Eastern boundary of Aspect Industrial Estate	November 2019	Monitoring undertaken as part of the SSD-10448 noise assessment (SLR Consulting report 610.19127-R02-v1.3, dated October 2020). Monitoring location L03.
NCA04	L04	833-843 Mamre Rd, Kemps Creek	November 2024	*Mamre Road upgrade Stage 2 Noise and vibration assessment report – Review of environmental factors*, August 2025, Report reference: EMF-NV-PR-0083 Prepared by SLR Consulting for Transport for NSW Monitoring location L02
NCA05	L05	25-31 Mandalong Cl, Orchard Hills	October 2020	Monitoring undertaken as part of the Mamre Road Upgrade Stage 1 noise assessment (SLR report 610.30064-R02-v1.0-20210719, dated July 2021). Monitoring location L07.
NCA06	L06	1 Medinah Av, Luddenham	25/11/2020 – 07/12/2020	ARUP report SYD05-06-07_Y-R-0000 Revision 3 – Kemps Creek Data Centre. Monitoring location L1
NCA07	L07	981 Mamre Rd, Kemps Creek	June 2022	Monitoring was undertaken as part of the SSD-46983729 Westlink Stage 2 noise assessment (SLR Consulting report 610.30893.00100-R02-v5.0-20250401, dated April 2025). Monitoring location L05.
NCA08	L08	62 Mount Vernon Road, Mount Vernon	June 2022	Monitoring was undertaken as part of the SSD-46983729 Westlink Stage 2 noise assessment (SLR Consulting report 610.30893.00100-R02-v5.0-20250401, dated April 2025). Monitoring location L03.

The measured background noise levels at the monitoring locations are presented in Table 3-2 below and the noise monitoring locations are shown in Figure 3-1.

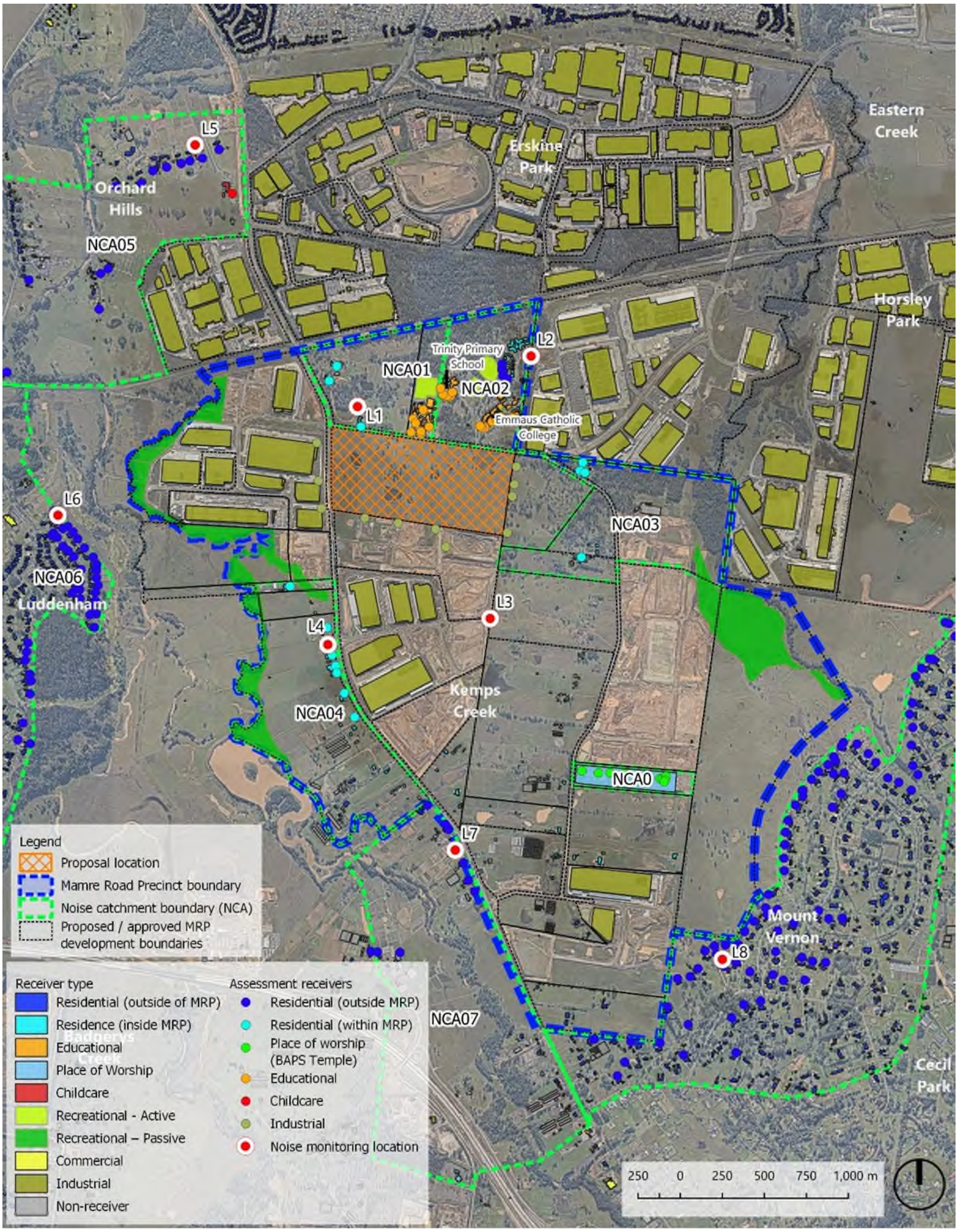
Table 3-2: Measured rating background noise levels (RBL), dB(A)

Ref.	Location description	Rating background noise levels (RBL), $L_{A90,\ 15\ minute}$		
		Day[1]	Evening[2]	Night[3]
L1	676-702 Mamre Road, Kemps Creek	44	43	37
L2	The 'Village', 85 Bakers Lane, Kemps Creek	39	38	37
L3	Eastern boundary of Aspect Industrial Estate	35[4] (34)	33	30[4] (29)
L4	833-843 Mamre Rd, Kemps Creek	47	41	34
L5	25-31 Mandalong Cl, Orchard Hills	41	41[5] (42)	35
L6	1 Medinah Av, Luddenham	37	36	33
L7	981 Mamre Rd, Kemps Creek	48	46	34
L8	62 Mount Vernon Rd, Mount Vernon	36	36	33

Notes:

1. Day: 7.00am to 6.00pm Monday to Saturday and 8.00am to 6.00pm Sundays & Public Holidays
2. Evening: 6.00pm to 10.00pm Monday to Sunday & Public Holidays
3. Night: 10.00pm to 7.00am Monday to Sunday & Public Holidays
4. As per NPfI Section 2.3, the minimum assumed RBL for the night period is 30 dB(A) and for the day 35 dB(A). Where background noise levels have been measured below this NPfI minimum levels, the minimum is to be adopted. Number in brackets represents the measured (actual) RBL value.
5. Number in brackets represents the measured (actual) Evening RBL value, which is greater than the measured Day RBL. As per the NPfI Section 2.3, if Evening RBL > Day RBL, then Day RBL has been used for assessment purposes

Figure 3-1: Site location, nearby noise sensitive receivers, noise monitoring, land uses and NCAs (surrounding the MRP)



4 Construction noise and vibration objectives

4.1 Construction noise objectives

4.1.1 Construction hours

4.1.1.1 Standard construction hours

The NSW *Interim Construction Noise Guideline* (DECCW, 2009) (ICNG) establishes standard construction hours, which are:

- 7:00am to 6:00pm Monday to Friday
- 8:00am to 1:00pm on Saturday
- No work performed on Sunday and Public Holidays.

Whilst the standard construction hours are not mandatory, limiting construction works to within standard construction hours as much as practicable assists in managing noise or vibration impact by limiting potentially noisy and vibration causing activities to the daytime, when background noise levels are higher, and by providing respite from construction noise and vibration during the evening, overnight, and on weekends.

4.1.1.2 Works outside of standard construction hours

Where construction works cannot be undertaken during the ICNG standard construction hours, they would be subject to a separate approval process or approval pathway. The ICNG identifies that there are five categories of work that typically may be required to be carried out outside of the standard construction hours:

1. The **delivery of oversized plant or structures** that police or other authorities determine require special arrangements to transport along public roads
2. **Emergency work** to avoid imminent injury or the loss of life or damage to property, or to prevent environmental harm
3. **Maintenance and repair of public infrastructure** where disruption to essential services and/or considerations of worker safety do not allow work within standard construction hours
4. **Public infrastructure works** that shorten the length of the project and are supported by the affected community
5. Works where a proponent demonstrates and justifies **a need to operate outside the recommended standard construction hours**.

In the last two categories, the proponent should provide the relevant authority with clear justification for reasons other than convenience, such as to sustain operational integrity of road, rail and utility networks.

This report proposes some construction activities outside of standard construction hours (OOH) where they have been identified as required at this early planning stage. As such, this report addressees in Section 7.2.2.2 the reasons as to why these works are required to take place outside of outside of standard construction hours for the Proposal, along with the reasons as to why these works are required OOH, and the feasible and reasonable mitigation and management measures that would be considered during future planning stages, and implemented during construction where feasible and reasonable.

Where OOH works (OOHW) are proposed to take place, the proposed construction works may require an assessment of potential noise and/or vibration impacts, and the identification of feasible and reasonable mitigation and management measures that would be implemented as part of the construction works to manage potential noise and vibration impacts on nearby sensitive receivers. If this is the case, the ICNG noise management levels that should be adopted for that assessment for the Proposal are presented in Section 4.1.5.

4.1.2 Noise management levels (NMLs)

The NSW *Interim Construction Noise Guideline* (ICNG, 2009) provides guidelines for assessing noise generated during the construction phase of developments.

The key components of the guideline that are incorporated into this assessment include:

- Use of L_{Aeq} as the descriptor for measuring and assessing construction noise.
- Application of reasonable and feasible noise mitigation measures.
- As stated in the ICNG, a noise mitigation measure is feasible if it is capable of being put into practice and is practical to build given the project constraints.
- Selecting reasonable mitigation measures from those that are feasible involves making a judgement to determine whether the overall noise benefit outweighs the overall social, economic and environmental effects.

The ICNG provides two methods described for the assessment of construction noise, being either a quantitative or a qualitative assessment. A quantitative assessment is recommended for major construction projects of significant duration and involves the measurement and prediction of noise levels and assessment against set criteria. A qualitative assessment is recommended for small projects with duration of less than three weeks and focuses on minimising noise disturbance through the implementation of reasonable and feasible work practices, and community notification. Given the scale and duration of the construction works proposed, a quantitative assessment is carried out herein, consistent with the ICNG requirements.

Table 4-1 reproduced from the ICNG, sets out the airborne noise management levels and how they are to be applied for residential receivers.

Table 4-1: Noise management levels at residential receivers

Time of day	Management level $L_{Aeq\ (15\ min)}$ *	How to apply
Recommended standard hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured LAeq (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: times identified by the community when they are less sensitive to noise (such as before/ 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 recommended standard 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 practices have been applied and noise is more than 5dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see *ICNG* section 7.2.2.

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

4.1.3 Sleep disturbance

The ICNG recommends that where construction works are planned to extend over more than two consecutive nights, maximum noise levels and the extent and frequency of maximum noise level events exceeding the RBL should be considered.

In line with the ICNG, further guidance is taken from the NSW *Road Noise Policy (Department of Climate Change and Water, 2011) (RNP),* as this document has superseded the NSW Environmental Criteria for Road Traffic Noise (ECRTN) (Environment Protection Authority 1999). The potential for both sleep disturbance and awakenings should be considered in the assessment.

To assess the likelihood of sleep disturbance, an initial screening level of $L_{Amax} < L_{A90(15min)}$ + 15 dB(A) is used. This is an external noise level, while receivers will be located inside when there is potential for sleep disturbance impacts.

When considering awakening reactions, the RNP includes a review of internal sleep arousal research and concluded that:

- L_{Amax} (the maximum A-weighted noise level) internal noise levels below 50–55 dB(A) are unlikely to awaken people from sleep (corresponding to approximately 60-65 dB(A) external noise level with an open window)
- One or two noise events per night, with maximum internal noise levels of 65–70 dB(A) (corresponding to approximately 75–80 dB(A) external noise level assuming an open window), are not likely to affect health and wellbeing substantially.

Typically, when considering internal noise impacts using a conservative 10 dB(A) reduction from external noise levels to internal noise levels is assumed considering an open window in line with the ICNG, which is not always the case and could be greater especially in the case that the receivers have a closed windows/facade. Sealed facades or facades with windows closed can provide external to internal noise reductions much greater than 10 dB(A). Noise reductions greater than 20–25 dB(A) is achievable where facades consist of standard to thick glazing and heavy facade construction (eg. brick construction).

Where noise events are found to exceed the initial screening level, further analysis is then made to identify:

- The likely number, nature, distribution and frequency of events above the screening level that might occur during the night assessment period.
- Whether events exceed an 'awakening reaction' level of 55 dB(A) L_{Amax} (internal) (that equates to an external NML of L_{Amax} 75 dB(A), assuming closed windows).

4.1.4 Non-residential receiver construction noise management levels

Table 4-2 sets out the ICNG noise management levels for other noise sensitive receiver locations.

Table 4-2: Noise management levels at other noise sensitive land uses

Land use	Time of day	Where objective applies	Management level $L_{Aeq\ (15\ min)}$
Classrooms at schools and other educational institutions	When in use	Indoor noise level Outdoor noise level$_1$	45 dB(A) 55 dB(A)
Hospital wards and operating theatres	When in use	Indoor noise level Outdoor noise level$_1$	45 dB(A) 55 dB(A)
Places of worship	When in use	Indoor noise level Outdoor noise level$_1$	45 dB(A) 55 dB(A)
Active recreation areas	When in use	Outdoor noise level	65 dB(A)
Passive recreation areas	When in use	Outdoor noise level	60 dB(A)
Commercial premises	When in use	Outdoor noise level	70 dB(A)
Industrial premises	When in use	Outdoor noise level	75 dB(A)

Notes: 1. Outdoor noise level based on internal noise level in ICNG and assumes 10 dB loss through an open window

4.1.5 Summary of construction noise management levels

Table 4-3 presents the construction noise management levels established for the nearest noise sensitive residential receivers based upon the noise monitoring outlined in Section 3. The assessment locations and nearby sensitive receivers for the construction assessment are identified in Figure 2-2.

Table 4-3: Construction noise management levels

NCA	Receiver type	Noise management level $L_{Aeq(15min)}$[1]				Sleep disturbance screening level (Night), L_{Amax}[4,5,7]
		Standard construction hours	Outside standard construction hours			
			Day (OOHW)	Evening (OOHW)	Night (OOHW)	
NCA01	Residential	54	49	48	42	52
NCA02	Residential	49	44	43	42	52
NCA03	Residential	45	40	38	35	52
NCA04	Residential	57	52	46	39	52
NCA05	Residential	51	46	46	40	52
NCA06	Residential	47	42	41	38	52
NCA07	Residential	58	53	51	39	52
NCA08	Residential	46	41	41	38	52
All	Education – classroom (external)[3]	55[2]				n/a
NCA05	Childcare	55[2,6]				n/a
All	Place of worship	55[2]				n/a
All	Industrial	75[2]				n/a

Notes:

1. Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5m above ground level. If the property boundary is more than 30m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30m of the residence. Noise levels may be higher at upper floors of the noise affected residence.
2. Noise management levels apply when receiver is in use.
3. External noise management level. A conversion from internal to external assumes 10dB(A) loss from outside to inside through open window.
4. Noise management level applies at the facade of the dwelling
5. Sleep disturbance screening level is RBL plus 15 dB or L_{AFmax} 52 dB(A), whichever is the greater consistent with the NPfI Section 2.5 guidance for maximum noise levels assessments.
6. External noise management level. An external screening level of 55 dB(A) is adopted for assessing childcare centres, based upon the recommended external and internal noise levels in the Association of Australian Acoustical Consultants (AAAC) Guideline for Child Care Centre Acoustics Assessment (2020), and assuming an equivalent external noise goals based upon a 20 dB loss from outside to inside with doors and/or windows closed. This considers the centre has sleeping areas.
7. Awakening reaction noise levels as per the NSW RNP oof 65dB(A) LAmax is then assessed if noise events are above the screening level as per Section 4.1.3.

4.2 Construction vibration objectives

Construction vibration is associated with three main types of impact:

- disturbance to building occupants
- potential damage to buildings, and

- potential damage to sensitive equipment in a building.

Generally, if disturbance to building occupants is controlled, there is limited potential for structural damage to buildings.

Vibration amplitude may be measured as displacement, velocity, or acceleration.

- Displacement (x) measurement is the distance or amplitude displaced from a resting position. The International System of Units (SI unit) for distance is the metre (m), although common industrial standards include mm.

- Velocity ($v=\Delta x/\Delta t$) is the rate of change of displacement with respect to change in time. The SI unit for velocity is metres per second (m/s), although common industrial standards include mm/s. The Peak Particle Velocity (PPV) is the greatest instantaneous particle velocity during a given time interval. If measurements are made in 3-axis (x, y, and z) then the resultant PPV is the vector sum (i.e. the square root of the summed squares of the maximum velocities) regardless of when in the time history those occur.

- Acceleration ($a=\Delta v/\Delta t$) is the rate of change of velocity with respect to change in time. The SI unit for acceleration is metres per second squared (m/s2). Construction vibration goals are summarised below.

The vibration objectives identified in this report are identified to appropriately minimise potential construction vibration impacts to nearby receivers and receiver structures. The vibration objectives are not set to prevent or mitigate impacts from other ground and/or structural aspects which are outside the discipline and responsibility of the acoustic consultant (ie. ground movement, settling, subsidence, etc).

Construction vibration goals are summarised below.

4.2.1 Disturbance to buildings occupants

The acceptable vibration values to assess the potential for human annoyance from vibration are set out in the NSW '*Environmental Noise Management Assessing Vibration: A Technical Guideline*' (AVTG).

To assess the potential for vibration impact on human comfort, an initial screening test will be done based on peak velocity units, as this metric is also used for the cosmetic damage vibration assessment. The screening test is based on the continuous vibration velocity (i.e. vibration that continues uninterrupted for a defined period). If the predicted vibration exceeds the initial screening test, the total estimated Vibration Dose Value (i.e. eVDV) will be determined based on the level and duration of the vibration event causing exceedance. The initial screening test values and VDVs recommended in BS 6472-1992 for which various levels of adverse comment from occupants may be expected, are presented in Table 4-4. The 'Low probability of adverse comment eVDV' represent the preferred and maximum value presented in the AVTG.

Table 4-4: Vibration management levels for disturbance to building occupants

Place and Time	Initial screening test Velocity, PEAK, mm/s (>8Hz)	Low probability of adverse comment eVDV $m/s^{1.75}$	Adverse comment possible eVDV $m/s^{1.75}$	Adverse comment probable eVDV $m/s^{1.75}$
Critical areas (day or night)1	0.28	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8
Residential buildings 16 hr day2	0.56	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8 hr night2	0.40	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8
Offices, schools, educational institutions and places of worship (day or night)	1.10	0.4 to 0.8	0.8 to 1.6	1.6 to 2.4
Workshops (day or night)	2.20	0.8 to 1.6	1.6 to 3.2	3.2 to 6.4

Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria specify above

Daytime is 7am to 10pm and night-time is 10pm to 7am

4.2.2 Cosmetic damage to building structures

Potential structural damage of buildings as a result vibration is typically managed by ensuring vibration induced into the structure does not exceed certain limits and standards, such as British Standard BS 7385 Part 2 and German Standard DIN 4150 Part 3. Currently there is no existing Australian Standard for assessment of structural building damage caused by vibration energy.

It is noted that vibration levels required to cause minor cosmetic damage are typically 10 times higher than levels that will cause disturbance to building occupants. Many building occupants assume that building damage is occurring when they feel vibration or observe rattling of loose objects, however the level of vibration at which people perceive vibration or at which loose objects may rattle is far lower than vibration levels that can cause damage to structures.

BS 7385-2 sets guide values for building vibration based on the lowest vibration levels above which damage has been credibly demonstrated. These levels are judged to give a minimum risk of vibration induced damage, where minimal risk for a named effect is usually taken as a 95% probability of no effect.

The recommended limits (guide values) from BS 7385-2 for transient vibration to ensure minimal risk of cosmetic damage to residential and industrial buildings are presented numerically in Table 4-5.

Table 4-5: BS 7385 structural damage criteria

Group	Type of structure	Damage level	Peak component particle velocity, mm/s		
			4Hz to 15Hz	15Hz to 40Hz	40Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	Cosmetic	50		
2	Un-reinforced or light framed structures Residential or light commercial type buildings	Cosmetic	15 to 20	20 to 50	50

Notes:
1. Peak Component Particle Velocity is the maximum Peak particle velocity in any one direction (x, y, z) as measured by a tri-axial vibration transducer.
2. PPV values increase between specified frequencies as detailed in BS7385-2
3. Values referred to are at the base of the building, as per Section 6.3 of BS7385-2

BS 7385-2 states that the guide values in Table 4-5 relate predominantly to transient vibration which does not give rise to resonant responses in structures, and to low-rise buildings. Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values in Table 4-5 may need to be reduced by up to 50%.

BS 7385-2 goes on to state that minor damage is possible at vibration magnitudes which are greater than twice those given in Table 4-5 and major damage to a building structure may occur at values greater than four (4) times the tabulated values.

4.2.2.1 Heritage structures and items

Heritage items are considered on a case by case basis, and care should be taken as these structures can be difficult to repair in the case of damage. It should be noted that British Standard BS 5228-2:2009 states that *'a building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive'* (p.39) when compared to other structures.

Where a structure is found to have defects, or is structurally unsound following an inspection, maximum vibration criteria are to be established for that specific structure for works to not further damage the structure. As stated previously, German Standard DIN 4150 - Part 3 (2016) '*Vibration in buildings - Effects on Structures*' (DIN 4150-3:2016) provides guidance for structures that are sensitive to vibration (eg. structurally unsound).

A conservative vibration damage screening level of 2.5 mm/s has been adopted as a screening level for heritage structures. This does not necessarily reflect that there would be a vibration impact on the structure if this level is exceeded, instead it is a suitable vibration level that is used as part of the construction vibration management process to trigger further investigation.

Any heritage structure predicted to exceed the screening level would be further investigated during detailed design, and appropriate vibration criteria for the structure adopted.

The general approach to manage potential vibration impacts on heritage items would be to:

1. Identify heritage items where the 2.5 mm/s peak component particle velocity objective may be exceeded during specific construction activities
2. Carry out a structural engineering report on identified heritage items, to confirm structural integrity of the building and confirm if item is 'structurally sound'
3. **Where the item is confirmed as 'structurally sound',** adopt the recommended screening vibration level from the structural engineer, which may be adopting the appropriate level from BS7385 Part 2 with additional consideration for frequency or other recommended vibration management limit, or
4. **Where the item is confirmed as 'structurally unsound',** adopt the vibration limits presented in DIN 4150-3: (2016) Table 1 Line 3 with additional consideration for frequency.

4.2.2.2 Vibration damage to buildings screening criteria

In accordance with BS 7385-2 and DIN 4150-3, a conservative vibration damage screening level (peak component particle velocity) per receiver type is outlined below:

The limits presented in Table 4-5 above relate predominantly to transient vibration which does not give rise to resonant responses in structures, and to low-rise buildings. Conservatively it is assumed that dynamic magnification due to resonance could occur, and so the guide values in Table 4-5 have been reduced by up to 50 percent to establish the below vibration screening criteria.

On this basis, consistent a conservative vibration screening criteria per receiver type is given below:

Reinforced or framed structures:	25.0 mm/s
Unreinforced or light framed structures:	7.5 mm/s
Heritage structures (if structurally unsound):	2.5 mm/s.

These levels do not necessarily reflect that there would be a vibration impact on the structure if this level is exceeded but are established as suitable vibration levels to be used as part of the construction vibration management process to trigger further investigation.

At locations where the predicted and/or measured vibration levels are greater than shown above (peak component particle velocity), a more detailed analysis of the building structure, vibration source, dominant frequencies and dynamic characteristics of the structure would be required to determine the applicable vibration limit to manage the vibration intensive works.

4.2.3 Damage to vibration sensitive equipment

Some high technology manufacturing facilities, hospitals and laboratories utilise equipment that is highly sensitive and susceptible to vibration, for example scanning electron microscopes and micro-electronic manufacturing facilities. In addition, buildings housing sensitive computer or telecommunications equipment may require assessment against stricter criteria than those nominated for building damage.

This is also important to consider for this project, noting that that construction will take place adjacent to operational data centre buildings which will include vibration sensitive equipment. As such, potential impacts should be considered.

There is no explicit guidance on acceptable vibration levels for such equipment, so recommended vibration levels should be obtained from instrument manufacturers. In the absence of equipment specific data provided by manufacturers, there are generic vibration criteria that can be used to assess the impact of vibration generating activities on buildings housing vibration sensitive equipment. For example, the Vibration Criteria (VC) curves are often referred to as they are generic and apply to all tools/ equipment types within each category. The VC curves are defined over the frequency range 8 to 100 Hz.

Table 4-6 below summarises a range of suitable and conservatively stringent vibration limits that are applicable to buildings housing vibration sensitive equipment which may potentially be affected by construction vibration.

Table 4-6: Acceptable vibration limits for vibration measured on building structure housing sensitive equipment

Equipment Requirements	Vibration Limit[1] mm/s,		Description of Use[3]
	RMS[4]	Peak [5]	
Computer Areas[2]	0.7	1.0	Barely perceptible vibration. Adequate for computer equipment accommodation environments.
Medical[2, 3]	0.1	0.14	Vibration not perceptible. Suitable in most instances for microscopes to 100X and for other equipment of low sensitivity.
VC-A[3]	0.05	0.07	Vibration not perceptible. Adequate in most instances for optical microscopes to 400X, microbalances, optical balances, proximity and projection aligners, etc

Notes: 1. As measured in one-third octave bands of frequency over the frequency range 8 to 100 Hz. Vibration measured on the building structure near vibrating equipment or in areas containing sensitive equipment.

2. Based on AS 2834 Computer Accommodation

3. Gordon CG Generic Vibration Criteria for Vibration Sensitive Equipment

4. Root Mean Square value representing the average value of a signal

5. In the absence of Peak limits, RMS limits are converted to Peak by conservatively assuming the vibration signal is sinusoidal and random with a nominal crest factor of 1.414

4.2.4 Damage to buried services

Section 5.3 of DIN 4150-3:2016 also sets out guideline values for vibration velocity to be used when evaluating the effects of vibration on buried pipework. These values, which apply at the wall of the pipe, are reproduced and presented in Table 4-7 below.

Table 4-7: DIN 4150-3:2016 Guideline values for vibration velocity to be used when evaluating the effects of short-term vibration on buried pipework

Line	Pipe Material	Guideline values for vibration velocity measured on the pipe, mm/s
1	Steel (including welded pipes)	100
2	Vitrified clay, concrete, reinforced concrete, prestressed concrete, metal (with or without flange)	80
3	Masonry, plastics	50

For long-term vibration the guideline levels presented in Table 4-7 should be halved.

Recommended vibration goals for electrical cables and telecommunication services such as fibre optic cables range from between 50 mm/s and 100 mm/s. It is noted however that although the cables may sustain these vibration levels, the services they are connected to, such as transformers and switch blocks, may not.

5 Operational noise objectives

5.1 Secretary's environmental assessment requirements (SEARs)

The SEARs for SSD-92743706 require:

> *establishment of suitable project noise trigger levels at all nearby sensitive receivers, including consideration of clustering of noise-generating industry within the Mamre Road Precinct, appropriate amenity noise levels, and any applicable external façade to internal space corrections for educational and childcare facilities (supported by robust evidence, preferably using noise measurements)*

While the SEARs also identifies that the application should be consistent with the Mamre Road Precinct (MRP) Development Control Plan (DCP).

Mamre Road Precinct (MRP) Development Control Plan (DCP) Section 4.3.1 requires that:

> *5) Acoustic Reports for individual developments must assess cumulative noise impacts, including likely future noise emissions from the development and operation of the Precinct. The consultant should liaise with the relevant consent authority to determine acceptable amenity goals for individual industrial developments and background noise levels.*

The Proposal project team presented to DPHI and EPA on 18 November 2025 the approach to address the cumulative industrial noise requirements of the DCP considering the MRP industrial cluster and surrounds. The approach proposed in that presentation is the basis of this assessment.

5.2 NSW EPA *Noise Policy for Industry*

This assessment aims to quantify the potential operational noise emissions from the Proposal in accordance with the NPfI. The assessment procedure has two components:

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

In accordance with the NPfI, noise impact should be assessed against the project noise trigger level which is the lower value of the project intrusiveness noise levels and project amenity noise levels.

5.2.1 Cumulative industrial noise

The above SEARs and DCP require that cumulative industrial noise is addressed by establishment of suitable project noise trigger levels at all nearby sensitive receivers, including consideration of clustering of noise-generating industry within the Mamre Road Precinct.

As cumulative industrial noise management is a complex issue, and requires consideration of many site specific factors, it is important to provide context about how cumulative industrial noise is addressed in accordance with NSW guidelines.

5.2.1.1 Cumulative industrial noise management in accordance with the NPfI

The management of cumulative operational noise is required by both the SEARs (Section 1.2) and the NPfI. By addressing cumulative noise impacts consistent with the NPfI, this will also sufficiently address cumulative impacts in accordance with the DPHI guideline "*Cumulative Impact Assessment Guidelines for State Significant Projects*" (DPHI, 2022).

As stated in Section 2.1 of the NPfI "*The project intrusiveness noise level aims to protect against significant changes in noise levels, whilst the project amenity noise level seeks to protect against cumulative noise impacts from industry and maintain amenity for particular land uses.*". The NPfI amenity noise criteria aims to ensure that the total industrial noise level (existing plus new) remain within the recommended amenity noise levels for an area.

The standard approach adopted in the NPfI (NPfI Section 2.4) to address the potential for cumulative industrial noise is to subtract 5 dB from the recommended amenity noise level, which is derived on the basis that a receiver may be impacted by three to four individual industrial operations concurrently. However, one of the exceptions to following this approach is where the proposed development is located in a major industrial cluster, which is the case for the Proposal.

There are two aspects of cumulative noise that are applicable for large industrial developments/clusters, the first being the total cumulative noise from the multiple operations within a proposed development (ie. a warehouse estate with multiple warehouse operations), while the second is the cumulative build-up of noise from other nearby developments outside of the proposed development combined with the Proposal impacting the same receiver location. As the Proposal is a single operation, the first aspect is not applicable for this Proposal.

Beyond the standard approach in NPfI Section 2.4, the NPfI provides a number of approaches for addressing the contribution from multiple developments, including NPfI Section 2.4.2 (*Amenity noise levels in areas near an existing or proposed cluster of Industry*) and NPfI Section 2.8 (*Noise management precincts*). These approaches represent the two extremes of addressing cumulative operational noise, where the approach in NPfI Section 2.8 of establishing a noise management precinct applies where a single entity has control over all or the majority of industrial operations - this is not applicable for the Proposal and the MRP. At the other extreme, the approach detailed in NPfI Section 2.4.2, sets out a simplistic method of allocation of noise criteria where a development is proposed adjacent to a cluster of industrial operations. The method equally proportions the allowable noise levels, independent of a large range of considerations such as size, intensity, distance to receiver and potential for the development to impact receivers.

In previous discussions with the NSW Environment Protection Authority (EPA), it was noted that the NPfI does not cover, and does not aim to address, a process where there has been a large rezoning of landuse to industrial, which is the situation for the Proposal and the MRP. The NPfI provides guidance generally about the concepts that should be considered when determining appropriate criteria, but a specific process is not provided. The method for managing rezoning and changes of landuse are to be addressed in the specific planning instruments for the rezoned area as there may be site specific issues and considerations that are relevant. These instruments should consider what protections they put in place to address landuse conflict issues and address existing landuse rights of nearby receivers, while also being consistent with the proposed future planning outcomes for the rezoned area.

However, considering a range of factors such as size, type of operations and number of operations across the MRP, the specific approaches detailed in the NPfI are not appropriate for directly deriving the applicable criteria for developments within the MRP.

It is understood that over the period since the rezoning, DPHI have developed an approach for managing the cumulative noise build up from the MRP, in consultation with the EPA and consistent with the approaches in the NPfI. It is also understood that the approach is conservative in order to allow for progressive but managed increase in cumulative industrial noise. This is further discussed in Section 5.2.1.3.

5.2.1.2 Changing noise environment

As a result of the MRP rezoning, approved June 2020, industrial developments were envisaged as detailed in the MRP Finalisation Report, which is the driver of change to the existing noise environment through the addition of industrial noise to receivers within the MRP and will likely increase noise levels in the surrounding environment.

As detailed in the MRP Finalisation Report (June 2020), "*The rezoning of the Mamre Road Precinct (the precinct) responds to the demand for industrial land in Western Sydney. The rezoning of the precinct facilitates the NSW Government's vision for the Western Parkland City. The Western City District Plan recognises the opportunity to deliver a 30 minute city. This means people can reach their nearest metropolitan and strategic centres within 30 minutes, seven days a week by public transport, which includes expansive industrial and urban services land. The development of land within the precinct will provide for Greater Sydney's long term freight and logistics and industrial needs and is an opportunity to deliver liveability and sustainability outcomes including the protection of Wianamatta-South Creek and its tributaries. The precinct will provide for jobs closer to people's homes and contribute to the NSW economy.*"

Additionally, "*The new planning controls for the precinct provide for around 850 hectares of industrial land with an approximate capacity of 17,000 jobs depending on the nature of development proposals. The rezoning also sees the creation of new environmental conservation areas and public open space. The rezoning will:*

- *Permit a range of industrial uses, supporting the establishment of freight and logistics uses.*

- *Establish controls for appropriate industrial development, including design and environmental considerations.*
- *Support the delivery of a potential future intermodal terminal (IMT) to service the existing WSEA and the development of the Western Sydney Aerotropolis.*
- *Identify and plan for delivery of infrastructure that is required to support development.*
- *Protect significant vegetation and support the protection of Wianamatta - South Creek, the green spine of the Western Parkland City."*

Additionally, there a range of projects and infrastructure underway or in planning phase in the surrounding area to achieve the proposed future planning outcomes envisaged by the state planning instruments for the area which are expected to change the ambient noise environment:

- Western Sydney Employment Area (Mamre Road Precinct)
- Mamre Road Upgrade Stage 2 (MRUS2)
- Sydney Metro (Western Sydney Airport) (to open in 2027)
- Western Sydney International Airport (WSI) (to open in 2026)
- Western Sydney Aerotropolis (in particular Northern Gateway and Badgerys Creek precincts)
- M12 Motorway (to open in 2026)

5.2.1.3 Cumulative considerations and issues for the MRP

There are many potential new industrial developments within the MRP, as shown in Figure 1-4, with other areas not already covered by proposed developments within the MRP, also with the potential of becoming industrial developments. Noting the above, DPHI has developed, over the period since the rezoning, an approach for managing the cumulative noise build up from the MRP, consistent with the approaches in the NPfI. This has been done using a conservative approach, and in a progressive and managed way, considering unknowns across the MRP at the early development stages.

There are a range of considerations in relation to potential cumulative industrial noise impacts that should be considered in relation to the MRP:

- The MRP covers a large area, with substantial distances between some areas and sensitive receivers. The MRP is approximately 4.5km north to south, and 4km east to west. Resulting in receivers ranging from approximately 150 metres to 4 kilometres from proposed industrial developments.
- The larger the development cluster and number of developments, the more unlikely it is that all developments would be operating with realistic worst case operations concurrently and contributing these worst case noise levels at the same time to nearby receivers. As such, for large

development clusters proportioning criteria without factoring or considering this would not be a reasonable approach.

- The greater the distance between the industrial cluster, the greater the number of potential operations that could contribute noise. However these would likely do so at lower noise levels and in some cases there would also be intervening structures providing acoustic shielding.

As the MRP now consists of around 50% approved developments, their expected noise levels presented in their noise assessments, along with issued consent noise limits, identify that a review of the approach would be appropriate to efficiently use the industrial land. The Proposal assessment herein therefore includes a number of aspects to address cumulative noise which refine the current approach.

5.2.1.4 Consideration of timing of potential impacts (short-term and long-term)

Given the extended timeframe over which the Proposal will be developed and the long period over which the MRP is likely to be fully developed (15-20 years considering current rates) it would not be reasonable or appropriate to assess the fully developed Proposal based on the noise environment that existed prior to the commencement of the MRP's development.

The reason it is proposed to consider the timing of potential impacts (short-term partially developed or long-term fully developed) in the MRP, is because the cumulative noise is being managed precinct wide for the newly rezoned area, and the fully developed state (long-term) forms the basis for the precinct-wide cumulative noise management.

The cumulative noise management approach adopted to date by DPHI uses the amenity criteria consistent with NPfI Section 2.4.2. It aims to manage noise across the MRP considering the progressive build up of noise over the entire MRP for the fully developed state. Therefore it is appropriate to use the same long-term timeframe when determining suitable project noise trigger levels.

In the short term, the MRP will not be fully developed, meaning that industrial noise contributions assumed in DPHI's cumulative approach will not yet be fully realized during this period of time. While over the long-term, these industrial noise levels may be realised, and so consideration of cumulative management for the fully developed precinct would be appropriate at that future point in time. Similar concepts to address a changing noise environment over a long period are considered in NPfI through Section 2.4.3 and NPfI Fact Sheet A1.

The timeframes for short-term and future fully developed (long-term) are not fixed, but are subject to the rate of development across the MRP, which is dependent on a range of external factors. As the MRP development progresses to its fully developed state, the associated industrial noise levels will increase correspondingly. Accordingly, for the consideration of project noise trigger levels for receivers within the MRP, these varying timeframes would then change how the receivers are considered to be affected by industrial noise.

This is of particular importance for NCA02. The method used to determine project noise trigger levels for these receivers is included in APPENDIX C.

5.2.2 Intrusive noise levels

According to the NPfI, the intrusiveness of a noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the $L_{Aeq,15min}$ descriptor) does not exceed the background noise level measured in the absence of the source by more than 5 dB(A).

The aim is so that there is not a noticeable difference as a result of a new development. However, due to the situation with the MRP where there are a large number of future developments, this is not necessarily, considering the intended planning outcomes from the MRP.

The project intrusiveness noise level, which is only applicable to residential receivers, is determined as follows:

$L_{Aeq,15minute}$ Intrusiveness noise level = Rating Background Level ('RBL') plus 5 dB(A)

However, when evaluating the noise impacts for a proposed site it is important to consider the likely future state and any changing character of the surrounding landuse and noise environment. NPfI Section 2.4.3 "*Effects of changing land use*" is relevant in the context of the Proposal for deriving project trigger noise levels for the Proposal. NPfI Section 2.4.3 states;

> *When land uses in an area are undergoing significant change, for example, residential subdivisions with associated development of local and regional roads, the background noise levels would be expected to change, sometimes significantly. The impact of noise from an existing industry on a proposed new residential area should be made using the recommended amenity noise level for the residential land use, not the project intrusiveness noise level.*

Consistent with the precinct vision for the MRP detailed Section 1.4, and considering the following **proposed future planning outcomes** for the surrounding area envisaged by the state planning instruments, it is likely that existing night time background noise levels will increase from existing levels due to the range of projects and infrastructure underway or in planning in the surrounding area as detailed in Section 5.2.1.2/

As such, consistent with NPfI Section 2.4.3, it is not recommended that project intrusive noise levels are used to determine the applicable project noise trigger levels for addressing long-term impacts due the area undergoing significant change and the existing noise environment likely changing.

Project intrusive noise levels are derived in Table 5-1 for managing short-term impacts.

Table 5-1: Intrusiveness noise levels

Receiver	Intrusiveness noise level, $L_{Aeq,15min}$		
	Day	Evening	Night
NCA01	44 + 5 = 49	43 + 5 = 48	37 + 5 = 42
NCA02	39 + 5 = 44	38 + 5 = 43	37 + 5 = 42
NCA03	35 + 5 = 40	33 + 5 = 38	30 + 5 = 35
NCA04	47 + 5 = 52	41 + 5 = 46	34 + 5 = 39
NCA05	41 + 5 = 46	41 + 5 = 46	35 + 5 = 40
NCA06	37 + 5 = 42	36 + 5 = 41	33 + 5 = 38
NCA07	48 + 5 = 53	46 + 5 = 51	34 + 5 = 39
NCA08	35 + 5 = 40	33 + 5 = 38	30 + 5 = 35

Notes: 1. Day: 7:00am to 6:00pm Monday to Saturday and 8:00am to 6:00pm Sundays & Public Holidays

2. Evening: 6:00pm to 10:00pm Monday to Sunday & Public Holidays

3. Night: 10:00pm to 7:00am Monday to Saturday and 10:00pm to 8:00am Sundays & Public Holidays

4. Consistent with Section 2.3 of the NPfI, the project intrusiveness noise level for the shoulder is set no greater than for Daytime.

5.2.3 Amenity noise levels

The project amenity noise levels for different time periods of day are determined in accordance with Section 2.4 of the NPfI. The NPfI recommends amenity noise levels ($L_{Aeq,period}$) for various receivers including residential, commercial, industrial receivers and sensitive receivers such as schools, hotels, hospitals, churches and parks. These “recommended amenity noise levels” represent the objective for total industrial noise experienced at a receiver location. However, when assessing a single industrial development and its impact on an area then “project amenity noise levels” apply.

The recommended amenity noise levels applicable for the subject receiver areas are reproduced from the NPfI Table 2.2 in Table 5-2 below.

Table 5-2: Recommended amenity noise levels

Type of receiver	Noise amenity area	Time of day	Recommended amenity noise level, $L_{Aeq,}$ dB(A)
Residential	Rural	Day	50
		Evening	45
		Night	40
	Suburban	Day	55
		Evening	45
		Night	40
	Urban	Day	60
		Evening	50
		Night	45
Hotels, motels, caretakers’ quarters, holiday accommodation, permanent resident caravan parks	See column 4	See column 4	5 dB(A) above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day

Type of receiver	Noise amenity area	Time of day	Recommended amenity noise level, $L_{Aeq,}$ dB(A)
School classroom (internal)	All	Noisiest 1-hour period when in use	35[5]
Hospital ward	All		
- Internal		Noisiest 1-hour	35
- External		Noisiest 1-hour	50
Place of worship (internal)	All	When in use	40
Passive recreation (e.g. national park)	All	When in use	50
Active recreation (e.g. school playground,	All	When in use	55
Commercial premises	All	When in use	65
Industrial premises	All	When in use	70
Industrial interface (applicable only to residential noise amenity areas)	All	When in use	Add 5 dB(A) to recommended noise amenity area

Notes:
1. Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 7.00 am.
2. On Sundays and Public Holidays, Daytime 8.00 am - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 8.00 am.
3. The L_{Aeq} index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.
4. The recommended amenity noise levels refer only to noise from industrial sources. However, they refer to noise from all such sources at the receiver location, and not only noise due to a specific project under consideration. The levels represent outdoor levels except where otherwise stated
5. In the case where existing schools are affected by noise from existing industrial noise sources, the acceptable LAeq noise level may be increased to 40 dB LAeq(1hr)

As per NPfI Section 2.6, where internal amenity noise levels are specified, such as for school classrooms, they refer to the noise level at the centre of the habitable room that is most exposed to the noise and apply with windows opened sufficiently to provide adequate ventilation, except where alternative means of ventilation complying with the Building Code of Australia are provided.

Consistent with NPfI Section 2.6, for school classroom and places of worship the assessment has adopted a 10 dB(A) loss from outside to inside to convert internal project noise trigger levels to external noise levels.

5.2.3.1 Residential amenity categories

NPfI Table 2.2 (presented in Table 5-2) identifies the three primary categories of residential receivers which can be assigned, they are: urban, suburban and rural.

Table 2.3 "*Determining which of the residential receiver categories applies*" of the NPfI provides guidance on assigning residential receiver noise categories. Guidance from NSW EPA in the journal *Acoustics Australia (Volume 50, No. 3, September 2022)* (EPA updated amenity guidance) provided clarification on how to use the table to determine the noise amenity category for residential receivers.

It presents the following methodology for determining which of the residential receiver noise categories apply:

1. Determine the planning land use zoning for residential receivers.
2. Adopt the residential receiver category that aligns with the typical planning zoning (column 2 of NPfI Table 2.3).
3. Adopt the ANL that corresponds to the residential receiver category.
4. Variations to the ANL should only be varied with strong justification and having regard to the 'Typical existing background noise levels' (column 3 of NPfI Table 2.3) and 'Description' of the acoustic environment of the receiver' (column 4 of NPfI Table 2.3).
5. Report the derived ANL from land use planning and if applicable the amenity level varied on the basis of Columns 3 and 4 of NPfI Table 2.3.

5.2.3.1.1 Receivers outside the MRP - Residence located in Mount Vernon, Horsley Park, Kemps Creek, Luddenham and Orchard Hills

The nearest residential receivers outside of the MRP are located in Mount Vernon, Horsley Park, Kemps Creek, Luddenham (near Twin Creeks Golf & Country Club) and Orchard Hills. The residences in these areas are located in areas zoned E2 Environmental Living, RU2 Rural Landscape and RU4 Primary Production Small Lots with falls under the Rural residential category in column 2 of NPfI Table 2.3, as shown in Table 5-3.

Table 5-3: Zoning of residential receivers

Location / Suburb	Zoning of residence	Column 2 of NPfI Table 2.3 classification
Mount Vernon	E4 Environmental Living	Rural residential
Kemps Creek	RU2 Rural Landscape, RU4 Primary Production Small Lots	Rural residential
Luddenham	E4 Environmental Living	Rural residential
Orchard Hills	RU2 Rural Landscape	Rural residential

As such and in-line with undertaking a conservative assessment these receivers have been categorised as 'rural', independent of future changes in the noise environment.

5.2.3.1.2 Receivers inside the MRP (long-term receivers)

The Catholic Healthcare Emmaus Retirement Village (NCA02) is a group of residential receivers within NCA02 that are existing and likely to remain in place for some time and so will be a receiver for the long-term.

Based on a review of historical zoning information, the land where the Catholic Healthcare Emmaus Retirement Village is located was previously zoned RU2 Rural Landscape. Based on EPA guidance, residential RU2 would be considered '**rural residential' in the existing and short term.**

However, as detailed in Section 5.2.1.4, the timing of this transition is not fixed, but is subject to the rate of development across the MRP which is dependent on a range of external factors. **As such, in the long term, it would be expected that this receiver would transition to an urban environment.** This approach is summarised in Table 5-4, and is considered an appropriate approach to address the issues around cumulative noise and the progression of the MRP consistent with procedures in the NPfI.

Table 5-4: Considerations for residential amenity category (NCA02) short term and long term

Item	Short-term	Future fully developed
Surrounding noise environment	Low-existing industrial noise level Few MRP developments operating (including adjacent proposed intermodal) Existing industrial sources with some MRP contribution Area surrounding transitioning from rural residential, with many major infrastructure projects in construction or commencing operations.	Increased industrial noise levels All MRP developments operating Fully surrounding as located within the MRP rezoned area Major infrastructure projects operating, including: Southern Link Road (TfNSW planned project) and Mamre Road Upgrade Stage 2 operational Western Sydney International Airport
Appropriate residential receiver category	**Rural residential**	**Urban residential**

5.2.3.1.3 Receivers inside the MRP (short-term receivers)

The existing residences in NCA01, NCA03, NCA04 include existing residences that are likely to be receivers only for the short-term.

Based on a review of historical zoning information, the residences within the MRP were previously zoned RU2 Rural Landscape, RU4 Primary Production Small Lots. Based on EPA guidance, residential RU4 and RU2 would be considered **'rural residential' in the existing and short term.**

In the notes of Table 2.3 of the NPfI, it states that "... *for isolated residences within an industrial zone the industrial zone amenity level would usually apply*". As a result of the rezoning of the area to be IN1 Industrial, as part of the Mamre Road Precinct (see Section 1.4). However, DPHI and EPA have previously requested that *"...residences within MRP DCP as being categorised as 'residential'."* considering the receivers existing amenity. As such and in-line with undertaking a conservative assessment these receivers have been categorised as 'rural', considering the previous zoning.

It is noted that given these receivers would likely be in place for only a short time, it would not be reasonable to provide mitigation or management measures in order to achieve the same acoustic amenity as for long-term receivers, and subsequently any consideration of mitigation or management measures should take this into account.

5.2.3.2 Project amenity noise levels

To ensure that the total industrial noise level (existing plus new) remains within the recommended amenity noise levels for an area, the project amenity noise level should apply for each new industrial noise source coming into the area.

The recommended amenity noise level from Table 2.2 of the NPfI represents the total industrial noise level from all sources that is sought to be achieved using feasible and reasonable controls. However, where a greenfield or redevelopment of an existing cluster of industry consisting of multiple new noise-generating premises is proposed, the approach for determining the project amenity noise level in Section 2.4 is not applicable, this is further detailed in Section 5.2.1.1.

To determine the appropriate amenity noise levels as required by the MRP DCP and SEARs, as the three groups of receivers identified in Section 2.2 will be impacted differently by the MRP they should be addressed separately. For the Proposal, different adjustments are identified across the three receiver groups due the nature and potential timing of noise impacts. These are detailed in the following sections:

- Receivers outside the MRP (Section 5.2.3.1.1)
- Receivers inside the MRP (long-term receivers) (Section 5.2.3.1.2)
- Receivers inside the MRP (short-term receivers) (Section 5.2.3.1.3)

5.2.3.2.1 NPfI standard approach for amenity noise goals

To ensure that the total industrial noise level (existing plus new) remains within the recommended amenity noise levels for an area, the standard approach included in the NPfI is that the project amenity noise level should apply for each new industrial noise source and is determined as follows:

$$L_{Aeq,period} \textbf{ Project amenity noise level (ANL)} = L_{Aeq,period} \textbf{ Recommended amenity noise level – 5 dB(A)}$$

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, assumes a receiver is not being impacted by more than three to four surrounding individual industrial noise developments.

Furthermore, given that the intrusiveness noise level is based on a 15 minute assessment period and the project amenity noise level is based on day, evening and night assessment periods, the NPfI provides the following guidance on adjusting the $L_{Aeq,period}$ level to a representative $L_{Aeq,15minute}$ level in order to standardise the time periods.

$$L_{Aeq,15minute} = L_{Aeq,period} + 3dB(A)$$

5.2.3.2.2 Receivers outside the MRP - Residence located in Mount Vernon, Horsley Park, Kemps Creek, Luddenham and Orchard Hills

Part A – Current area based approach

It is understood that DPHI's current approach for determining acceptable amenity goals for individual industrial developments within the MRP considers an area based approach consistent with Chapter 2 of the *Noise Policy for Industry* (NPfI), similar to that shown in NPfI Section 2.4.2 but instead based upon the area of a development.

Based upon the Proposal area, and the MRP areas presented in *Table 1. Summary of Mamre Road Precinct development outcomes* of the MRP Finalisation Report (June 2020) Table 5-5 presents the area based amenity noise goal adjustment that is calculated for the Proposal.

Table 5-5: MRP area based precinct noise goal adjustment

Mamre Road Precinct area	Proposal area	Cumulative adjustment to amenity goal based upon Proposal area, dB(A)
999 hectares	52 hectares	-13
972 hectares (SP2 zoning removed)		-13
848 hectares (IN1 zone only)		-12

Part B – Large industrial cluster and mature MRP factor considerations

Although area based methods proportion the noise criteria in a simple and pragmatic way, the method does not efficiently allocate the criteria across the industrial land because this type of allocation is a more complex problem.

The area based method simplification assumes that an equal acoustic energy is generated from every square metre of the subject site and the entire industrial precinct or cluster. It also assumes that distant sites can contribute the same amount of noise as close sites. In practice not all industrial developments will contribute equally to any individual receiver or be able to take up 100% of their allocated noise criteria. This is because of limitations in distance between the facilities and receivers or by other receivers located closer to them. Furthermore, this does not consider other factors such as the concurrency of all operations, prevailing meteorological conditions and if sites can utilise their allotted noise criteria.

Previous SEARs issued for MRP SSD projects, have identified using NPfI Section 2.4.2 of the Noise Policy for Industry to derive project amenity noise levels. Some Proposals, such as SSD-30628110, aimed to identify the likely contributing developments, to directly apply the approach presented in NPfI Section 2.4.2 to aid with addressing the issues with the area based approach.

Based upon a review of other SSD predicted noise levels at nearby developments, many developments at further distances from receivers are not expected to achieve their allotted noise criteria through the current allocation method.

Furthermore, the MRP now consists of around 50% approved developments, and expected noise levels presented in noise assessments for MRP developments, along with issued consent noise limits identify that a review of the approach would be appropriate to efficiently use the industrial land. The approach used in this assessment includes a number of aspects to address cumulative noise which refine the current approach by considering the more mature state of the MRP.

For the Proposal, Table 5-6 presents the factors that are relevant when considering cumulative industrial noise from a large industrial cluster. These have been accounted for when determining a reasonable approach for the amenity noise goal adjustment for the Proposal.

The Proposal approach aims to be consistent with DPHI's current aims for cumulative noise management across the MRP using the following:

- Adopts an area-based approach
- Overall noise from the MRP is divided equitably between developments
- Allows for progressive and appropriate cumulative noise creep
- Consistent with Chapter 2 of the Noise Policy for Industry (NPfI)

However, the following more refined approach considers further factors while remaining consistent with the intent of the current DPHI approach but adopting a more refined method to more efficiently use the rezoned industrial land of the MRP given its more mature state.

Table 5-6: Large industrial cluster factor considerations – Proposal specific adjustments

Large industrial cluster factor	Approach and adjustment
Separation factor / Noise generating capacity factor	The MRP covers a large area (~ 972 hectares). The MRP is approx. 4.5km north to south, and 4km east to west. Receiver distances to industrial sites range from approx. 150 m to 4 km. Eastern sites are generally 2.5km from Luddenham. An analysis of spatial factor analysis found that that many industrial noise generating developments on the far side of the MRP compared to the receiver area will not be able to contribute up to the allocated noise levels at each receiver location, because they are either controlled by different and potentially closer receiver or do not have the noise generating capacity. This spatial separation from the east and west sides of the MRP (ie. Luddenham is controlled by western sites, and Mount Vernon is controlled by eastern sites) mean that respective 'far' opposite side only increasing the cumulative predicted noise levels by 1 dB(A) (based upon SSDA NVIA noise contours, predictions and limits for other MRP SSDAs). A review of noise assessments and approved noise limits for developments within the MRP was undertaken and the outcomes are presented in Appendix C.1. For many SSD NVIAs the predictions are lower than the approved noise limits for varying catchments resulting in unused capacity of criteria allocation (eg. SSD-10479 200 Aldington Road Industrial Estate, located in MRP east, Luddenham approved noise limit is 30 dB(A) while predicted noise level < 20 dB(A)). The outcome determine that the contribution of the opposite side worst case noise levels has a very minor affected (combined increase of only 1 dB(A)). **This analysis determined that to take into account the spatial separation between the industrial operations, a conservative adjustment to the criteria could be 1-2 dB(A).**

Large industrial cluster factor	Approach and adjustment
Concurrency factor	The developments across the MRP involve a range of industries with varying operational hours that could operate in the precinct. This is consistent with the MRP aims of being a world-class industrial area, primarily catering for warehousing and logistics, being realised as the majority of MRP developments are warehousing that have varying operation times/intensities and not all will operate worst-case concurrently. The larger the development cluster and number of sites, the more unlikely it is that all sites would be operating with worst-case operations concurrently and unlikely to be able to contribute worst-case noise levels to both near and distant receivers. Across the variety of industrial operators, and in RTA's experience, it is unlikely that all industrial lots would be operating with "*reasonable worst case*" noise emissions concurrently across the entire precinct. Steady state noise sources (ie. mechanical plant) can operate continuously. However, these noise sources are often contributing substantially lower noise levels compared with the transient sources (ie. trucks and loading dock activities) or can be more easily mitigated to achieve these lower contributions. **Noting this, a conservative approach is to assume that up to 50% instead of 100% of the industries could be operating with "reasonable worst case" operations all in a single 15-minute period – this is equivalent to a 3 dB(A) adjustment to the criteria.**
Outcome and Proposal approach	**Considering the above factors, this assessment conservatively adopts a Proposal adjustment of 3 dB(A) for all receivers outside of the MRP, even though the above would support adjustments greater than this.**

Based upon Part A and Part B Table 5-7 presents the Proposal cumulative correction for residences outside of the MRP.

Table 5-7: Proposal cumulative adjustment for residences outside of the MRP, $L_{Aeq\ 15minute}$

Adjustment factor considered	Cumulative adjustment to amenity goal based upon Proposal area, dB(A)	Source
Part A – Area based approach	-13	Table 5-5
Part B - Large industrial cluster factors	+3	Table 5-6
Overall correction to amenity goal based	**-10**	-

5.2.3.2.3 Receivers inside the MRP (long-term receivers)

The following noise sensitive receivers are located within the MRP, and may be receivers for the long-term if they remain in place for some time, and as such will potentially experience impacts over both the short and long term (see Section 5.2.1.4):

- Catholic Healthcare Emmaus Retirement Village (NCA02)
- Trinity Catholic Primary School (NCA02)
- Emmaus Catholic College (NCA02)
- BAPS Shri Swaminarayan Hindu Mandir and Cultural Precinct (BAPS Temple)

For these receivers the methodology for determining the Proposal cumulative correction for these receivers is detailed in Appendix C.2. The outcome of this approach is detailed in Table 5-8.

Table 5-8: Considerations for cumulative correction for short term and long term impacts for NCA02

Item	Short-term	Future fully developed
Noise Policy for Industry Section 2.4 amenity correction	Considering that few MRP developments are operating (including adjacent proposed intermodal): **5 dB(A) cumulative adjustment** NPfI approach of 5 dB(A) reduction to consider 3 to 4 sites contributing noise concurrently to these receivers is appropriate for the short-term.	Considering that all MRP developments are operating: **10 dB(A) cumulative adjustment** Detailed review of contributing developments required, as per NPfI Section 2.4.2. 10 dB(A) cumulative correction based on 6 directly impacting developments, and 10 indirectly impacting developments, is appropriate for the long-term.

5.2.3.2.4 Receivers inside the MRP (short-term receivers)

NCA01, NCA03 and NCA04 include existing residences that are likely to be receivers only for the short-term, as these receivers are within the re-zoned MRP area and in close proximity of the increasing developments within the MRP, so will experience noise that will be dominated by nearby operations with shielding from operations at further distances.

As such, the NPfI Section 2.4 standard approach (as per Section 5.2.3.2.1) of 5 dB(A) reduction to consider 3 to 4 developments contributing noise concurrently at each receiver is appropriate for these receivers.

5.2.4 Project noise trigger levels (PNTL)

A summary of all PNTLs for the Proposal are presented in Table 5-9 and these are applicable for cumulative noise emissions. In accordance with the approaches outlined in the previous sections the project noise trigger levels (PNTL) are presented in Table 5-9.

Noting the conversions between short term and future fully developed situations as per Section 5.2.3.1.2, the PNTLs for the short term and future fully developed situations generally end up having the same noise levels for the Proposal to achieve.

For receivers with two amenity criteria (i.e. residences and schools in NCA02 for short term and future fully developed situations), the lower criteria have been adopted for the design.

Table 5-9: Project noise trigger levels

Receiver group (see Figure 2-1)	NCA (see Figure 2-1	Period of noise impacts	Residential amenity category	Time of day	RBL	Project intrusive noise level, $L_{Aeq,15min}$	Recommended amenity noise level, $L_{Aeq,Period}$, dB(A)	Project amenity noise level, $L_{Aeq,Period}$, dB(A)	Project amenity noise level, $L_{Aeq,15min}$, dB(A)	Project noise trigger level, $L_{Aeq,15min}$, dB(A)
Short-term receivers within the MRP	NCA01	Short-term	Rural residence	Day	44	49	50	50 – 5[10] = 45	45 + 3 = 48	**48**
				Evening	43	48	45	45 – 5[10] = 40	40 + 3 = 43	**43**
				Night	37	42	40	40 – 5[10] = 35	35 + 3 = 38	**38**
			School classroom	Noisiest 1-hour period when in use	-	-	35 (internal)[6] / 45 (external)[2]	45 – 5[10] = 40	40 +3 = 43	**43**
			Passive recreation	When in use	-	-	50	50 – 5[10] = 45	45 + 3 = 53	**48**
			Active recreation	When in use	-	-	55	55 – 5[10] = 50	50 + 3 = 53	**53**
Long-term receivers within the MRP	NCA02	Short-term	Rural residence	Day	39	44	50	50 – 5[9] = 45	45 + 3 = 48	**44**
				Evening	38	43	45	45 – 5[9] = 40	40 + 3 = 43	**43**
				Night	37	42	40	40 – 5[9] = 35	35 + 3 = 38	**38**
		Future fully developed	Urban residence	Day	-	-[12]	60	60 – 10[9] = 50	50 + 3 = 53	**53**
				Evening	-	-[12]	50	50 – 10[9] = 40	40 + 3 = 43	**43**
				Night	-	-[12]	45	45 – 10[9] = 35	35 + 3 = 38	**38**
		Short-term	School classrooms	Noisiest 1-hour period when in use	n/a	n/a	35 (internal)[6] / 45 (external)[2]	45 – 5[9] = 40	40 +3 = 43	**43**
		Future fully developed	School classrooms	Noisiest 1-hour period when in use	n/a	n/a	40 (internal)[7] / 50 (external)[2]	50 – 10[9] = 40	40 +3 = 43	**43**
		All	Passive recreation	When in use	-	-	50	50 – 10[9] = 40	40 + 3 = 43	**43**
		All	Active recreation	When in use	n/a	n/a	55	55 – 10[9] = 45	45 + 3 = 48	**48**
	BAPS Temple	All	Place of worship	When in use	n/a	n/a	40 (internal) / 50 (external)[2]	50 – 10[9] = 40	40 + 3 = 43	**43**
Short-term receivers within the MRP	NCA03	Short-term	Rural residence	Day	35	40	50	50 – 5[10] = 45	45 + 3 = 48	**40**
				Evening	33	38	45	45 – 5[10] = 40	40 + 3 = 43	**38**
				Night	30	35	40	40 – 5[10] = 35	35 + 3 = 38	**35**
	NCA04	Short-term	Rural residence	Day	47	52	50	50 – 5[10] = 45	45 + 3 = 48	**48**
				Evening	41	46	45	45 – 5[10] = 40	40 + 3 = 43	**43**
				Night	34	39	40	40 – 5[10] = 35	35 + 3 = 38	**38**
Receivers outside of the MRP (Mount Vernon and Luddenham, Orchard Hills and Kemps Creek)	NCA05	All	Rural residence	Day	41	46	50	50 – 10[8] = 40	40 + 3 = 43	**43**
				Evening	41	46	45	45 – 10[8] = 45	45 + 3 = 38	**38**
				Night	35	40	40	40 – 10[8] = 30	30 + 3 = 33	**33**
		All	Childcare	When in use	n/a	n/a	35[11] (internal) / 45 (external)[2]	45 – 10[8] = 35	35 +3 = 38	**38**
	NCA06	All	Rural residence	Day	37	42	50	50 – 10[8] = 40	40 + 3 = 43	**42**
				Evening	36	41	45	45 – 10[8] = 45	45 + 3 = 38	**38**
				Night	33	38	40	40 – 10[8] = 30	30 + 3 = 33	**33**
	NCA07	All	Rural residence	Day	48	51	50	50 – 10[8] = 40	40 + 3 = 43	**43**
				Evening	46	51	45	45 – 10[8] = 45	45 + 3 = 38	**38**
				Night	34	46	40	40 – 10[8] = 30	30 + 3 = 33	**33**
	NCA08	All	Rural residence	Day	36	41	50	50 – 10[8] = 40	40 + 3 = 43	**41**
				Evening	36	38	45	45 – 10[8] = 45	45 + 3 = 38	**38**
				Night	33	38	40	40 – 10[8] = 30	30 + 3 = 33	**33**

Receiver group (see Figure 2-1)	NCA (see Figure 2-1	Period of noise impacts	Residential amenity category	Time of day	RBL	Project intrusive noise level, $L_{Aeq,15min}$	Recommended amenity noise level, $L_{Aeq,Period}$, dB(A)	Project amenity noise level, $L_{Aeq,Period}$, dB(A)	Project amenity noise level, $L_{Aeq,15min}$, dB(A)	Project noise trigger level, $L_{Aeq,15min}$, dB(A)
Other		All	Industrial premises	When in use	n/a	n/a	70	70 – 5 = 65	65 + 3 = **68**	**68**
			Commercial	When in use	n/a	n/a	65	65 – 5 = 60	60 + 3 = **63**	**63**

Notes:

1. Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 7.00 am. On Sundays and Public Holidays, Daytime 8.00 am - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 7.00 am.
2. Conversion of trigger levels from internal to external for school classroom and place of worship assumes 10dB(A) loss from outside to inside through open window, as per NPfI Section 2.6.
3. Project noise trigger level is only applicable when the receiver type is in use.
4. For a residence, the project noise trigger level and maximum noise levels are to be assessed at the reasonably most-affected point on or within the residential property boundary.
5. For commercial or industrial premises the noise level is to be assessed at the reasonably most-affected point on or within the property boundary.
6. In the short term, it is assumed the existing school is not affected by noise from existing industrial noise sources.
7. In the case where existing schools are affected by noise from existing industrial noise sources, the acceptable LAeq noise level may be increased to 40 dB LAeq(1hr). See Section 5.2.1.2 and 5.2.1.4.
8. Refer to Section 5.2.3.2.2 for explanation and justification cumulative correction **for receivers outside of the MRP** to account for cumulative industrial noise contributions,
9. Refer to Section 5.2.3.1.2 for explanation and justification cumulative correction **for long term receivers within the MRP** to account for cumulative industrial noise contributions.
10. Refer to Section 5.2.3.1.3 for explanation and justification cumulative correction **for short term receivers within the MRP** to account for cumulative industrial noise contributions.
11. Based upon the recommended external and internal noise levels in the Association of Australian Acoustical Consultants (AAAC) Guideline for Child Care Centre Acoustics Assessment (2020), and assuming an equivalent external noise goals based upon a 20 dB loss from outside to inside with doors and/or windows closed. This considers the centre has sleeping areas.
12. See Section 5.2.1, regarding consideration of NPfI Section 2.4.3.

5.3 Sleep disturbance noise levels

The potential for sleep disturbance due to maximum noise level events from the Proposal site during the night-time period needs to be considered. In accordance with NPfI, a detailed maximum noise level event assessment should be undertaken where the subject development night-time noise levels at a residential location exceed the following noise trigger levels:

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

Where there are noise events found to exceed the initial screening level, further analysis is undertaken.

The detailed assessment should consider all feasible and reasonable noise mitigation and management measures with a goal of achieving the sleep disturbance noise trigger levels. The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period. Some guidance on possible impact is contained in the review of research results in the NSW *Road Noise Policy* (RNP).

Other factors that may be important in assessing the extent of impacts on sleep include:

- How often high noise events will occur,
- the distribution of likely events across the night-time period and the existing ambient maximum events in the absence of the subject development
- whether there are times of day when there is a clear change in the noise environment (such as during early-morning shoulder periods)
- current scientific literature available at the time of the assessment regarding the impact of maximum noise level events at night.

Maximum noise level event assessments should be based on the L_{AFmax} descriptor on an event basis under 'fast' time response.

In relation to maximum noise level events, the NSW RNP identifies in its summary on sleep disturbance research to date that:

> 1. *Maximum internal noise levels below 50–55 dB(A) are unlikely to awaken people from sleep*
> 2. *One or two noise events per night, with maximum internal noise levels of 65–70 dB(A), are not likely to affect health and wellbeing significantly.*

The above references identify that internal noise levels of 50 to 55 dB(A), are unlikely to cause awakenings. On the assumption that there is a 10 dB(A) outside-to-inside noise loss through an open window (see Section 2.6 of the NPfI, p15), this indicates that external noise levels of L_{Amax} 60 to 65 dB(A) are unlikely to cause awakening reactions. Given the equivalent external noise levels and considering the second point above, an L_{Amax} 65 dB(A) has then been used as the assessment noise level to determine the potential for awakening reactions.

In accordance with the NPfI and current scientific literature, the sleep disturbance project assessment noise levels, are presented in Table 5-10 below.

Table 5-10: Sleep disturbance project assessment noise levels

Noise catchment area	Sleep disturbance project assessment noise levels, dB(A) (Night - 10:00pm to 7:00am)		
	EPA NPfI sleep disturbance assessment levels, L_{Amax}	Awakening reaction[1], L_{Amax}	EPA NPfI sleep disturbance assessment levels, $L_{Aeq,15min}$
NCA01	56	65	42
NCA02	52	65	42
NCA03	52	65	35
NCA04	52	65	39
NCA05	52	65	40
NCA06	52	65	38
NCA07	52	65	39
NCA08	52	65	38

Notes: 1. As per the NSW RNP

By achieving the PNTLs for the Proposal presented earlier in this report, the sleep disturbance $L_{Aeq,15min}$ assessment levels presented in the table above will automatically be met, as the PNTLs are equivalent or more stringent. Therefore, no further assessment of sleep disturbance $L_{Aeq,15min}$ levels is necessary.

5.4 Emergency operations

The Proposal will be served by a new 330 kilovolt (kV) substation, located in the northwest corner of the site (Incoming electrical switching station). This substation will be directly fed from the Sydney West Bulk Supply Point Substation (Sydney West BSP) via three redundant 330 kV feeders in an N-1 configuration, sized so that the full site load can be accommodated on 2 of the 3 feeders, stepping voltages down to 132 kV via three (3) 330/132 kV transformers. The outgoing transformer supplies are connected to 132 kV Gas-insulated switchgear (GIS) in a breaker-and-a-half configuration allowing for dedicated 132 kV supplies reticulating around site with N-1 redundancy across all development stages of the Proposal. This configuration ensures extremely high availability and reliability for distribution of mains power supply for the site, such that the loss of one redundant utility supply to the site does not trigger any requirement for generators to provide emergency power.

Sydney West BSP is operated by Transgrid and is located approximately 4.5 kilometres (km) northeast of the Proposal site. This infrastructure is subject to a Category 2 level of redundancy under NSW Transmission Reliability and Performance Standard (2017) and has a maximum allowable unserved energy (USE) of one (1) minute per year. However, it is highlighted that Sydney West BSP has maintained 100 % uptime since 2005 per panel analysis of Australian Energy Market Operator (AEMO) data outlined in Australian Energy Market Commission (AEMC) Reliability Panel Annual Report (AEMC, 2022).

This Proposal differs from many other data centre developments, in that a significant level of redundancy is built into the design to ensure that the use of diesel generators is minimised. For example, other data centres may be connected to the electricity supply grid by one feeder only, such that any interruption to that supply would require full deployment of back-up power via diesel generators. In this case, three feeders would supply the Proposal site, and generators (likely only a subset) would only be required for a short time, should supply from one or two feeders fail.

In the case that a feeder was to fail, some generators would be required to be operated temporarily (likely 15 to 20 minutes) whilst a medium voltage changeover occurs. Generators would only be used until the electricity supply is reconnected or whilst the changeover occurs. Considering that Sydney West BSP has maintained 100 % uptime since 2005 which demonstrates that N-1 contingencies at the BSP have been successfully managed without customer outages, this is not expected to occur are part of any regular operations.

While Section 5.2.4 presents the PNTLs for typical operations, which includes scheduled maintenance testing of emergency plant and equipment, these PNTLs are not considered reasonable for emergency operating conditions outlined above, i.e. the event of a mains feeder failure or regional network failure, and would be considered unreasonable to implement noise treatment due to the extremely rare occurrence of this scenario. Similarly, noting the reliability of the feeders, it would be considered unreasonable to implement further noise treatments for the situation of an unexpected feeder failure due to this extremely rare occurrence of this scenario and minimal required duration that noise would be generated.

Based on the above, the requirement for a feasible and reasonable approach as required by the NPfI, existing regulations, and in absence of any relevant specific NSW guideline for emergency generators, noise limits for emergency operations are not required and have not been proposed.

Predicted noise levels for emergency operations will be presented for information purposes only.

5.5 Road traffic noise

Noise impacts from the potential increases in traffic on the surrounding road network due to construction and operational activities from the Proposal are assessed in accordance with the RNP. The RNP sets out criteria to be applied to particular types of road and land uses. These noise criteria are to be applied when assessing noise impacts and determining mitigation measures for sensitive receivers that are potentially affected by road traffic noise associated with the construction and operation of the subject site, with the aim of preserving the amenity appropriate to the land use.

The Proposal will be using sub-arterial / arterial roads and not local roads. Therefore, for existing residences affected by additional traffic on existing sub-arterial / arterial roads generated by land use developments, the following RNP road traffic noise criteria would apply.

Table 5-11: RNP Road Traffic Noise Criteria, dB(A)

Road Category	Type of Project/Land Use	Assessment Criteria, dB(A)	
		Day 7am – 10pm	Night 10pm – 7am
Freeway/arterial/sub-arterial roads	3. Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq,(15\ hour)}$ 60 (external)	$L_{Aeq,(9\ hour)}$ 55 (external)

Further to the above, the RNP states the following for land use developments generating additional traffic:

"For existing residences and other sensitive land uses affected by **additional traffic on existing roads generated by land use development**, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'no build option'."

The RNP states that in assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

5.6 Mamre Road Precinct Development Control Plan

The MRP Development Control Plan (DCP) 2021, adopted 19 November 2021, applies to the Mamre Road Precinct within the State Environmental Planning Policy (Western Sydney Employment Area) 2009 (SEPP WSEA). Sections 4.3.1 relates to Noise and Vibration and is presented below.

Table 5-12: MRP Development Control Plan (DCP) 2021, Section 4.3.1 Noise and Vibration

MRP Development Control Plan (DCP) 2021	Where addressed
Section 4.3.1 Noise and vibration	
Objectives a) To ensure noise and vibration do not adversely impact human health and amenity. b) To ensure building design adequately protects workers from noise and vibration.	This SSDA NVIA report
Controls	
1) Any machinery or activity considered to produce noise emissions from a premise shall be adequately sound-proofed so that noise emissions are in accordance with the provisions of the Protection of the Environment Operations Act 1997.	Section 8.3 – Initial assessment Section 8.4.4 – Noise predictions

MRP Development Control Plan (DCP) 2021	Where addressed
2) Noise should be assessed in accordance with Noise Policy for Industry (EPA, 2017) and NSW Road Noise Policy (Department of Environment, Climate Change and Water, 2011).	Section 5 – Operational noise objectives Section 5.2 - Noise Policy for Industry Section 5.5 – Road traffic noise (NSW Road Noise Policy)
3) An Acoustic Report by a qualified acoustical engineer must be submitted where proposed development, including traffic generated by that development, will create noise and/or vibration impacts, either during construction or operation, that impacts on adjoining developments or nearby rural-residential areas. The Acoustic Report should outline the proposed noise amelioration strategies and management methods.	This SSDA NVIA report
4) An Acoustic Report shall be prepared for developments within 500m of rural-residential areas and other sensitive receivers, including educational establishments.	
5) Acoustic Reports for individual developments must assess cumulative noise impacts, including likely future noise emissions from the development and operation of the Precinct. The consultant should liaise with the relevant consent authority to determine acceptable amenity goals for individual industrial developments and background noise levels.	Section 5.2.1 – Cumulative industrial noise
6) The use of mechanical plant and equipment may be restricted in areas close to sensitive receivers, such as adjoining rural-residential development and educational establishments.	Section 8.3 – Initial assessment and design mitigation and management measures Section 8.4.4 – Noise predictions
7) Building design is to incorporate noise amelioration features. Roof elements are to control potential breakout noise, having regard to surrounding topography.	
8) Boundary fences are to incorporate noise amelioration features and control breakout noise having regard to developments adjoining rural-residential areas.	
9) Development shall comply with the relevant Australian Standards for noise and vibration.	Section **4** – Construction noise and vibration objectives Section 5 -- Operational noise objectives
10) A qualified acoustical consultant is to certify any acoustic design measures have been satisfactorily incorporated into the development at construction certificate stage and validate the criteria at occupation certificate stage.	To applicable at environmental assessment stage

Additional sections that relate to noise are as follows:

Section 4.2.3 of the MRP DCP is concerned with Landscaping and is presented below, and is addressed by the assessment of the non-residential sensitive receivers as detailed in Section 2.4 and assessed as per Section 5.2.4.

> ***Controls***
>
> *8) Developments adjoining existing sensitive receivers (e.g. educational establishments) shall be designed to mitigate impacts on sensitive receivers such as through generous buffer zones and landscaping, and locating noise generating activities away from the sensitive interface, as well as traffic management measures to improve safety and minimise conflicts.*

Section 2.11 of the MRP DCP is concerned with Aviation Safeguarding and is presented below and addressed in Section 6:

> ***Objectives***
>
> *a) To safeguard the future operations of the Western Sydney Airport, including 24-hour operations and provide appropriate protections for the surrounding community.*
>
> *b) To ensure compatible development that exhibits design excellence occurs on surrounding land.*
>
> *c) To ensure development does not introduce or intensify noise sensitive uses.*
>
> ***Controls***
>
> ***Noise***
>
> *3) Development is constructed in accordance with Australian Standards AS2021 – Acoustics Noise Intrusion – Building Siting and Construction.*

Appendix B of the MRP DCP provides the high-level requirements for the acoustic assessment that should be addressed in this SSDA NVIA report, including the polices and standards to be considered in the assessment where relevant to this proposal, which are reflected in Section 1.5. These items have been addressed in this SSDA NVIA.

> ***Acoustic Assessment***
>
> *An acoustic assessment prepared by a suitably qualified acoustic consultant must be submitted with any Development Application for the design, construction and operation for:*
>
> - *New or modified industrial development;*
> - *Commercial and mixed used development;*
> - *Subdivision of land where there could be potential for the development of multiple noise sources in each lot;*
> - *Sensitive development adjoining and in the vicinity of rail corridors, high-volume roads and industrial development (Note: sensitive development including places of public worship and child-care facilities are permitted in industrial zones);*
> - *Road traffic generating development; and*
> - *New or modified infrastructure.*
>
> *The acoustic assessment is to be prepared with consideration of the relevant guideline documents, including the:*
>
> - *the **Noise Policy for Industry (2017)**, which sets assessment noise levels, provides methods to measure and reduce noise levels, and is the recommended guideline for assessing noise from new developments and some existing developments*
> - *the **Interim construction noise guideline (DECC, 2009),** which advises on work practices to better manage construction noise, including from industrial developments.*

- *__Assessing vibration a technical guideline (DEC, 2006)__ which presents preferred and maximum vibration values that should not be exceeded, and recommends effective measurement and evaluation techniques, including for industrial premises.*
- *the __NSW Road Noise Policy (DECCW, 2011)__ establishes criteria to help plan and design the operation of roads to assess the impacts of road traffic noise on the community and help reduce road traffic noise levels.*
- *the __Rail Infrastructure Noise Guideline (EPA, 2013)__ provides guidance to ensure noise and vibration impacts associated with particular rail development projects are evaluated in a consistent and transparent manner.*
- *the noise requirements of the __State Environmental Planning Policy (Infrastructure) 2007__ need to be satisfied while the development near rail corridors and busy roads – interim guideline provides information to guide the development in areas that are in or adjacent to rail corridors or high volume roads.*
- *comply with the __Protection of the Environment Operations Act 1997__, including the __Protection of the Environment Operations (Noise Control) Regulation 2017__.*
- *comply with the requirements of relevant Australian Standards and State and Local Government Policies.*

The acoustic assessment should include but not be limited to; the location of all sensitive receptors, an assessment of background noise; noise emission goals (including sleep disturbance); the identification and assessment of all potential noise and vibration sources associated with the development; hours of operation, the potential impact of any road traffic noise and proposed hours of operation. The assessment must also outline the noise and vibration mitigation, monitoring and management measures. This should include but not necessarily be limited to mitigation and management measures, siting, orientation and architectural design of buildings etc and validation processes.

Acoustic Report

An Acoustic Report in accordance with Section 4.3.1 of this DCP must be prepared by a suitably qualified acoustic consultant who possesses the qualifications to render them eligible for membership of the Australian Acoustical Society or employed by an Association of Australasian Acoustical Consultants (AAAC) member firm. The report should refer to the relevant Australian Standards and State Government policies and guidelines relating to noise.

5.7 State Environmental Planning Policy (Western Sydney Employment Area) 2009 (SEPP WSEA)

In the SEPP WSEA (2009) Clause 23 contains items related to noise emissions, and Clause 33D contains items related to aircraft noise.

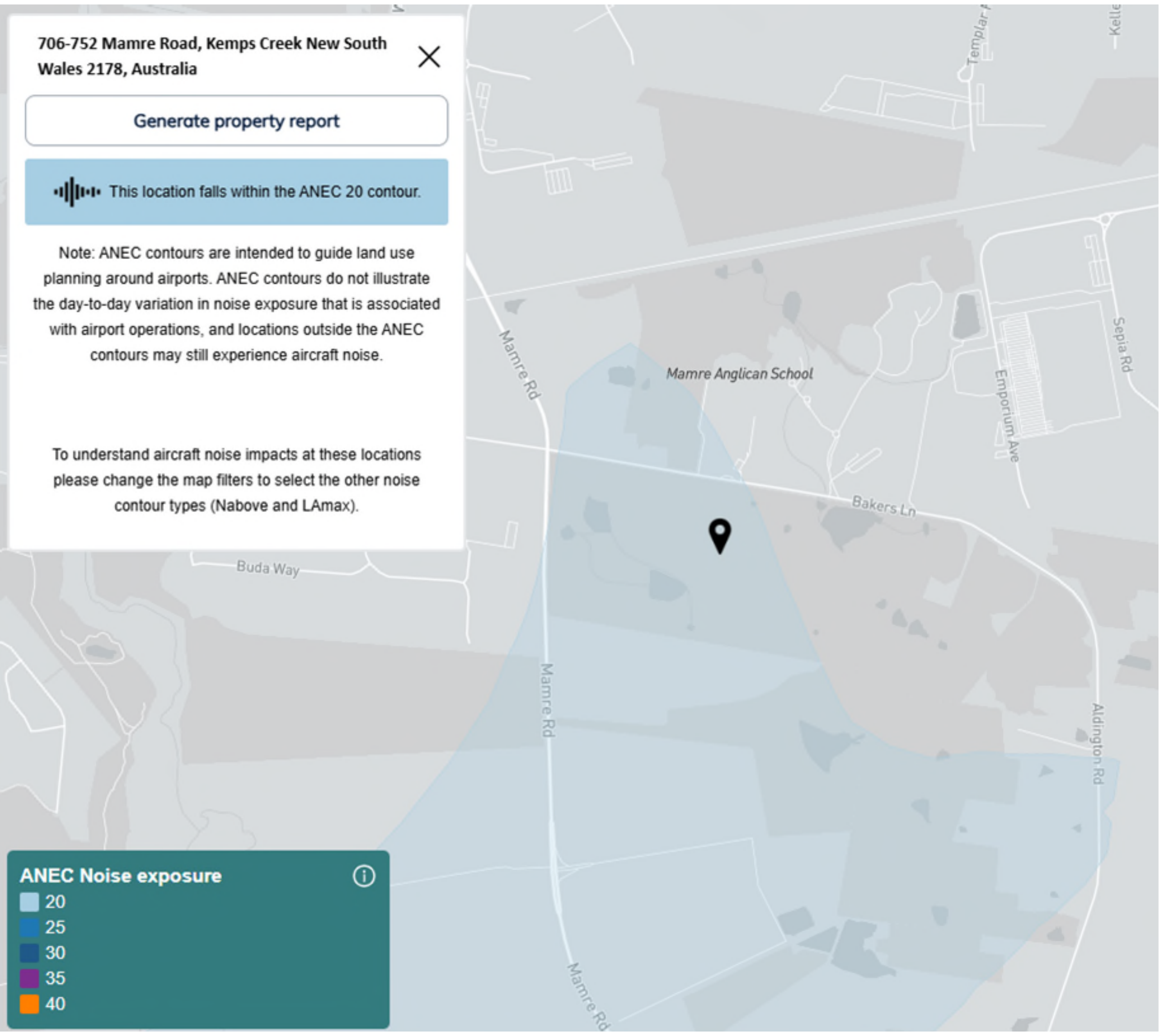
By addressing Section 2.11 of the MRP DCP, this will address the noise requirements detailed in Clause 33D of the SEPP WSEA (2009). By addressing the requirements of the NPfI, this will address the noise requirements detailed in Clause 23 of the SEPP WSEA (2009).

6 Aircraft noise intrusion

As required by the MRP DCP (Section 2.11) and the SEPP WSEA (2009), Proposed developments should be assessed to determine that they can achieve the noise level requirements of *Australian Standards AS2021 – Acoustics Noise Intrusion – Building Siting and Construction*. As part of the final EIS the detailed modelling of the potential noise impacts for WSI's preliminary flight paths are provided in the Aircraft Overflight Noise Tool which is available at https://wsiflightpaths.aerlabs.com/. The tool indicated three Runway preference options, including no preference, a preference for Runway 05, and a preference for Runway 23.

The ANEC contours for the Western Sydney Airport have been reviewed, and the Proposal site is located outside of the ANEC 20 contour, except for the "*Year 2055 Prefer 05*" situation for which the Proposal is located within the ANEC 20 contour as shown in Figure 8. As such, a further review of the of the potential aircraft noise levels has been undertaken in accordance with AS2021:2015.

Figure 8: Western Sydney International (Nancy-Bird Walton) Airport Aircraft Overflight Noise Tool (Year 2055) – Preferred 05 direction)



706-752 Mamre Road, Kemps Creek New South Wales 2178, Australia

This location falls within the ANEC 20 contour.

Note: ANEC contours are intended to guide land use planning around airports. ANEC contours do not illustrate the day-to-day variation in noise exposure that is associated with airport operations, and locations outside the ANEC contours may still experience aircraft noise.

To understand aircraft noise impacts at these locations please change the map filters to select the other noise contour types (Nabove and LAmax).

6.1 AS2021-2015 - aircraft noise intrusion

Aircraft noise intrusion from take-off, landing and circuit training operations at civil aerodromes or military airfields is assessed using Australian Standard A2021-2015 – '*Acoustics – Aircraft Noise Intrusion – Building Siting and Construction*' ('AS2021'). This section of the report outlines the application of AS2021. The scope of AS2021-2015 is stated as:

> *This standard, together with the relevant Australian Noise Exposure Forecast (ANEF) chart provides guidelines for determining-*
>
> *a. whether the extent of aircraft noise intrusion makes building sites 'acceptable', 'unacceptable' or 'conditionally acceptable' for the types of activity to be, or being, undertaken (Clause 2.3);*
>
> *b. for 'conditionally acceptable' sites, the extent of noise reduction required to provide acceptable noise levels indoors for the types of activity to be, or being, undertaken; and*
>
> *c. the type of building construction necessary to provide a given noise reduction, provided that external windows and doors are closed.*

6.2 Building site acceptability

AS2021 contains advice on the acceptability of building sites based on Australian Noise Exposure Forecast (ANEF) zones. The ANEF chart provides a predicted cumulative exposure to aircraft flyover noise in communities near aerodromes. The chart presents zones represented by noise contours overlaid on a locality map specific to an airport. The ANEF system was developed as a land use planning tool aimed at controlling encroachment on airports by noise sensitive buildings.

Table 2.1 of AS2021 sets acceptability zones for different building types and land uses. Table 6-1 reproduces the sections of AS2021 Table 2.1 relevant to the Proposal and given it is situated on the 20 contour is acceptable.

Table 6-1: Building site acceptability based on ANEF zones (Table 2.1 of AS2021)

Building type	ANEF zone of site		
	Acceptable	**Conditional**	**Unacceptable**
Commercial building	Less than ANEF 25	25 to 35 ANEF[2]	Greater than 35 ANEF
Light industrial	Less than ANEF 30[1]	30 to 40 ANEF[2]	Greater than 40 ANEF
Other industrial	Acceptable in all ANEF zones		

Section 2.3 of AS2021 details the actions resulting from the acceptability determination. Table 6-2 presents the outcomes as a result of the Proposal building being classified as acceptable.

Table 6-2: Description of building site acceptability

Zone	Description
Acceptable	If from Table 2.1, the building site is classified as 'acceptable', there is usually no need for the building construction to provide protection specifically against aircraft noise. However, it should not be inferred that aircraft noise will be unnoticeable in areas outside the ANEF 20 contour. (See Notes 1, 2 and 3 of AS2021:2015 Table 2.1.)

As such the Proposal has been assessed as acceptable and it is determined that no further assessment is required to address the requirements of AS2021:2015.

7 Construction noise and vibration assessment

7.1 Background

Construction activities associated with the proposed development will result in increased noise levels during construction hours. The works undertaken in the various stages consist of a mixture of both high and low noise activities. This assessment identifies potentially noisy activities, their impacts on surrounding receivers and outlines management strategies to control the impacts of noise and vibration during the construction stages of the Proposal.

7.2 Construction noise and vibration activities and assumptions

7.2.1 Construction works and activities

An assessment of the potential level of construction noise and vibration impact has been carried out to determine whether mitigation would be required, and to determine appropriate management controls.

Specific construction equipment requirements are not yet known. The type and number of plant and equipment associated with the proposed works was assumed based upon experience with similar noise assessments.

Prior to the commencement of construction, the final construction details should be reviewed against the assumptions in this report to ensure that the mitigation and management measures that will be implemented remain consistent with these assumptions, and appropriate for the Proposal.

The approximate phases and duration of works are presented in Table 7-1 In most cases, multiple construction phases will be occurring concurrently. The key areas of construction are shown in Figure 7-1. A high-level Gantt chart shown in Table 7-2 outlines the indicative construction scheduling and visualises the anticipated concurrent construction activities for the Proposal.

Table 7-1: Approximate construction phases and duration of works

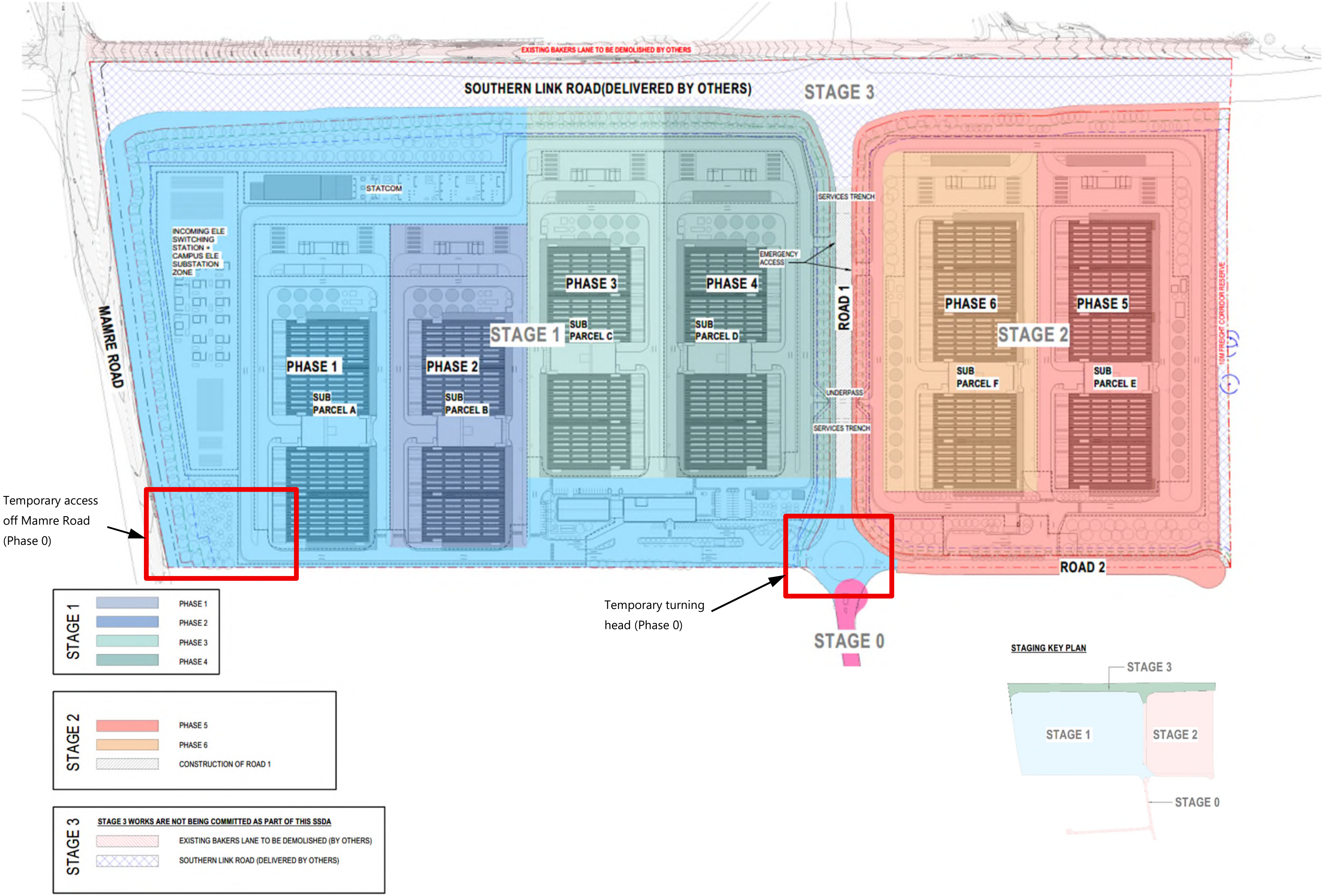
Phase	Construction phase / works	Works area (Figure 7-1)	Modelling scenario reference	Construction activities	Approximate duration (subject to approval)^{1,2}
Phase 0	Site establishment	Entire of Stage 1 - Phase 1/2/3/4 + Substation and Statcom	P0	Site establishment and early works Establishment of construction facilities	Year 0 4 months
	Bulk earthworks, cut/fill and excavation works	Entire of Stage 1 - Phase 1/2/3/4 + Substation and Statcom	P0E	Bulk earthworks and retaining wall works for western portion of Proposal. Utilities related works, including drainage formation, and installation of early service conduits, temporary power and water connections	Year 0-2 2-3 years
	Road works	Temporary access & temporary turning head	P0R	Construction of temporary access to the site off Mamre Road. Construction of temporary turning head off the North-South Collector Road within Yiribana Logistics Estate.	
Phase 1	Construction of Parcel A and COSH buildings, and associated works	Phase 1 / Parcel A	P1	Civil, utilities and in-ground works Parcel building construction, including electrical substation, water and fuel storage tanks and loading dock. COSH construction Incoming electrical switching station and Statcom construction. Building fitout Campus and Parcel road works and carparking Commissioning	Year 1-2 1-2 years
Phase 2	Construction of Parcel B and associated works	Phase 2 / Parcel B	P2	Civil, utilities and in-ground works Parcel building construction, including electrical substation, water and fuel storage tanks and loading dock. Building fitout Parcel road works and carparking Commissioning	Year 2-3 1-2 years
Phase 3	Construction of Parcel C and associated works	Phase 3/ Parcel C	P3	Civil, utilities and in-ground works Parcel building construction, including electrical substation, water and fuel storage tanks and loading dock. Building fitout Parcel road works and carparking Commissioning	Year 3-4 1-2 years

Phase	Construction phase / works	Works area (Figure 7-1)	Modelling scenario reference	Construction activities	Approximate duration (subject to approval)[1,2]
Phase 4	Construction of Parcel D and associated works	Phase 4 / Parcel D	P4	Civil, utilities and in-ground works Parcel building construction, including electrical substation, water and fuel storage tanks and loading dock. Building fitout Parcel road works and carparking Commissioning	Year 4-6 1-3 years
	Road works	Road 1	P4R	Construction of a temporary road within the ultimate Road 1 corridor to provide emergency access out of the site.	
Phase 5	Bulk earthworks, cut/fill and excavation works (building footprint / staging areas)	Stage 2 - Phase 5/6	P5E	Site establishment Bulk earthworks, cut/fill and excavation works and retaining wall works for eastern portion of Proposal	Year 7-8 1-2 years
	Construction of Parcel E and associated works	Phase 5 / Parcel E	P5	Site establishment Civil, utilities and in-ground works Parcel building construction, including electrical substation, water and fuel storage tanks and loading dock. Building fitout Parcel road works and carparking Commissioning	
	Road works	Road 2	P5R	Construction of Road 2 between the roundabout and the eastern boundary of the site. Landscaping adjacent to road	
Phase 6	Construction of Parcel F and associated works	Phase 6 / Parcel F	P6	Civil, utilities and in-ground works Parcel building construction, including electrical substation, water and fuel storage tanks and loading dock. Building fitout Parcel road works and carparking Commissioning	Year 9-10 1-2 years
Phase 7	Construction of Road 1 and final utilities and landscaping works	Road 1 and turning head at north end	P7	Road works Civil, utilities and in-ground works Landscaping works	Year 10 1 year

Notes 1. In most cases, multiple construction phases will be occurring concurrently. As such there are overlaps between the various works and the approximate duration of construction phases.

2. Timeframes are indicative and may change.

Figure 7-1: Key construction work areas



Temporary access off Mamre Road (Phase 0)

Temporary turning head (Phase 0)

Table 7-2: Indicative Proposal construction scheduling

Phase No.	Construction activities	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Phase 0	Site establishment	■										
	Bulk earthworks, cut/fill and excavation works	■	■	■								
	Road works	■	■	■								
Phase 1	Construction of Parcel A and COSH buildings, and associated works		■	■								
Phase 2	Construction of Parcel B and associated works			■	■							
Phase 3	Construction of Parcel C and associated works				■	■						
Phase 4	Construction of Parcel D and associated works					■	■					
	Road works (Road 1 - temporary)						■	■				
Phase 5	Bulk earthworks, cut/fill and excavation works (building footprint / staging areas)								■	■		
	Construction of Parcel E and associated works								■	■		
	Road works (Road 2)								■	■		
Phase 6	Construction of Parcel F and associated works										■	■
Phase 7	Construction of Road 1 and final utilities and landscaping works											■

7.2.2 OOHW construction works

7.2.2.1 Proposed OOH construction works

The Proposal is seeking approval for an approval pathway or process for identified certain types of works construction works to occur during OOHW periods. It is recommended this would be in the form of the project CNVMP including an OOH management procedure or an OOHW protocol so that the required OOH works can be assessed separately when specific construction methods, locations, equipment which are known, so they can be approved separately to the satisfactory to the Planning Secretary.

As part of the early planning stages, these works have been identified as required to occur OOH or require contingency time outside of the standard construction hours as part of the expected construction program, although a contractor has not been appointed for the Proposal.

Presented in Table 7-3 are these identified construction works, the potentially required OOHW periods that they are proposed to occur, along with indicative durations currently expected, determined in a conservative manner at this early planning stage.

Table 7-3: Proposed OOH construction works

Proposed OOH construction works	Proposed OOHW periods	Potential OOH duration required
Temporary access off Mamre Road / Roadworks	OOHW evening period OOHW night period	As necessary, to be confirmed

This assessment is for the approval stage only and the final construction methodology is not known. This will be subject to further construction planning as part of future project stages. As such, although the identified construction works are expected to be required OOH, there is potential that the nature and duration of these works may change once a contractor is appointed. For this assessment, the proposed OOHW have been identified in a conservative manner with the aim of capturing the likely worst case required OOHW.

As part of further design development, when the specific construction methodology and likely construction equipment are known, the potential construction impacts for the required OOHW are to be assessed in detail through a works specific assessment to determine that they can be feasibly and reasonably managed within the construction noise management levels detailed in Section 4.1.2. This assessment would identify the specific feasible and reasonable mitigation and management measures that would be implemented are part of the OOHW.

7.2.2.2 Justification for extended and OOHW construction hours

As per the requirements of the ICNG, strong justification is required when proposing to undertake construction works outside of the standard construction hours during the proposed time periods. The reasons that OOHW is required and so is being proposed are as follows:

Table 7-4: Justification for proposing to undertake construction works outside of the standard construction hours

Proposed OOH construction works	Justifications for proposing to undertake construction works outside of the standard construction hours
Temporary access off Mamre Road / Roadworks	Due to the nature of roadworks, some roadworks need to occur after hours. Generally, roadworks will need to occur after hours if: • Carrying the proposed roadworks during standard construction hours would results in a high risk to construction personnel or public safety • The relevant Road Network Operator has advised the licensee in writing that carrying out the works and activities during standard construction hours would result in a high risk to road network operational performance • A relevant utility service operator has advised the licensee in writing that carrying out the works and activities during standard construction hours would result in a high risk to the operation and integrity of the utility network • Road authority refused to issue a road occupancy licence during standard construction hours

7.2.3 Construction traffic

The worksite will generate additional traffic movements in the form of:

- Light vehicle movements generated by construction personnel travelling to and from work
- Heavy vehicle movements generated by:
  - Delivery vehicles bringing raw materials, plant, and equipment to the site
  - Trucks removing excavated spoil material

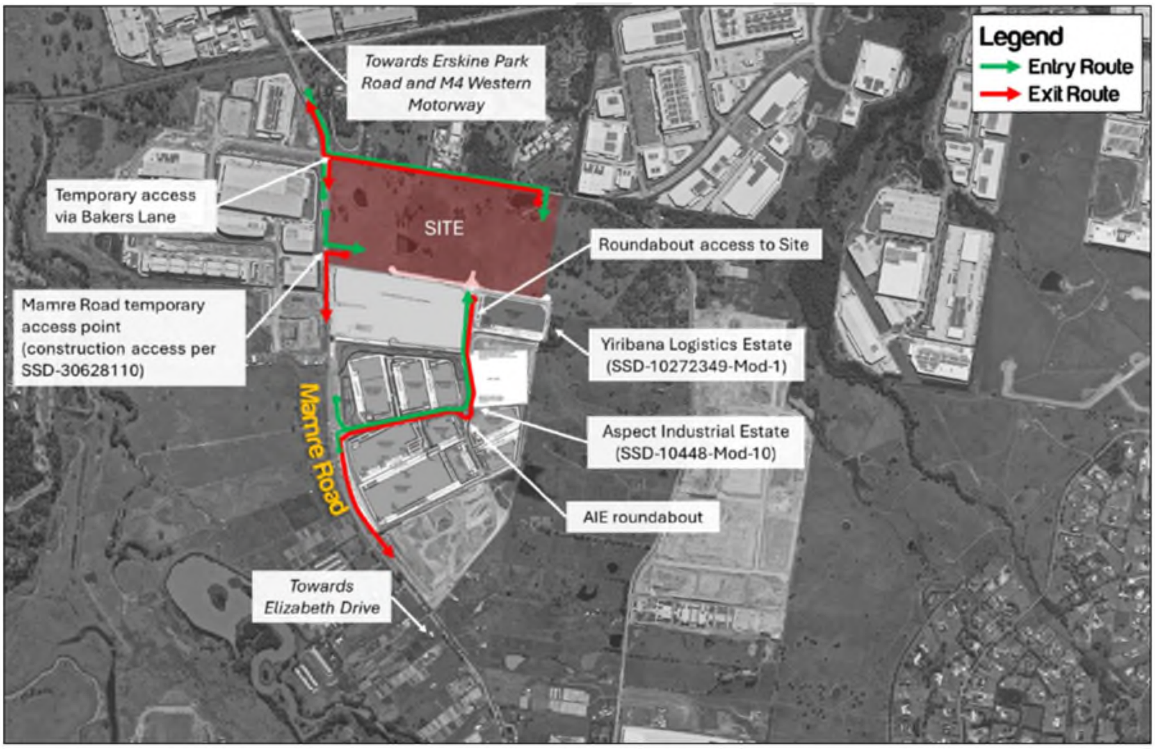
Construction traffic on the site is included as part of the construction noise assessment of the work activities identified in Section 7.3. When construction-related traffic moves on the public road network, a different noise assessment methodology is appropriate as vehicle movements would be regarded as additional road traffic on public roads rather than as part of the construction site's activities.

Construction access is proposed in 3 stages as detailed in Table 7-5. These routes are shown in Figure 7-2.

Table 7-5: Construction access routes

Construction stage	Construction access route	Comments
Phase 0 – Early works	Temporary access via Bakers Lane	Access arrangement will only be required until the temporary access via Mamre Road is constructed.
Phase 1	Temporary access via Mamre Road	Access the Site via the temporary access via Mamre Road
Phase 2 onward	Access via the roundabout and through Yiribana and Aspect Estates	Phase 1 works will construction a roundabout providing a connection to Yiribana and Aspect Estates and the Proposal

Figure 7-2: Construction vehicle route map (Ason)



Early works (Phase 0) and Bakers Lane access

Access for early works construction will be via the current driveway located on Bakers Lane. This access arrangement will only be required until the temporary access via Mamre Road is constructed. It should be noted that, upon construction of the temporary access via Mamre Road, the existing access on Bakers Lane will be removed. During this stage construction volumes are expected to be very low, as per Table 7-7.

Phase 1 onwards and Mamre Road access points

From Phase 1 onwards, access will be via Mamre Road, either via a temporary access constructed on Mamre Road at the south-west corner of the Proposal site, or via the intersection at Aspect Industrial Estate, south of the Proposal on Mamre Road. For all of these phases, construction traffic would travel either along Mamre Road, passing existing residences.

Given that Mamre Road currently carry high volumes of heavy vehicles, the Project is unlikely to have a significant impact on the performance of Mamre Road, and the subsequent arterial roads of Erskine Park Road, Elizabeth Road, the M4 Motorway or the M7 Motorway.

Existing traffic data on Bakers Lane and Mamre Road were measured in 2023 and 2024 respectively, and includes vehicle types for the daytime and night-time periods, shown in Table 7-6.

Existing traffic volumes

The daily existing traffic data on Mamre Road and Bakers Lane are presented in Table 7-6.

Table 7-6: Existing traffic volumes on construction access routes

Location	Direction	Day 7:00am – 10:00pm (15 hour)			Night 10:00pm – 7:00am (9 hour)		
		Total Vehicles	Light	Heavy	Total Vehicles	Light	Heavy
Mamre Road[1]	Both directions	13,543	11,345	2,198	3,342	2,875	467
Bakers Lane[2]	Both directions	3,445	3,144	301	241	209	32

Notes:
1. Traffic data based upon traffic survey between Bakers lane and Abbotts road, October 2023 by Matrix Traffic and Transport Data.
2. Traffic data based upon traffic survey data presented in Appendix D of the Mamre Road Upgrade Stage 2 Noise and vibration assessment report – Review of environmental factors (August 2025) (MRUS2 NVIA), Transport for NSW, location TCS02 for Bakers Lane

The stage with the largest number of heavy vehicles movements would likely be the bulk earthworks stage of the eastern portion of the site (Phase 5). However, the majority of the bulk excavated material is not proposed to be exported from the site. Rather, it will be internally redistributed. The construction vehicle movements are proposed during daytime period only.

Table 7-7: Predicted worst case construction traffic noise

Road	Vehicle type	Day - 7:00am – 10:00pm (15 hour)		Noise increase, dB(A)[1]	
		Typical construction movements	Peak construction movements	Typical construction movements	Peak construction movements
Bakers Lane and early access					
Bakers Lane	Light vehicles	20	40	0.3	0.5
	Heavy vehicles[3]	8	16		
Worst case construction phase (Phase 5 - Bulk Earthworks and Parcel F construction)[2]					
Mamre Road	Light vehicles	300	600	0.6	1.1
	Heavy vehicles – General construction[3-]	50	100		
	Heavy vehicles - Earthworks	200	400		

Notes
1. Based on daily volumes presented in Table 7-6.
2. Construction vehicles using both the Mamre Road temporary access, and accessing the site via the Aspect Industrial Estate and Yiribana Logistics Estate access routes, will be required to pass by the same residential receiver locations.
3. Assessment assumes worst case that all Proposal vehicles are large heavy vehicles, which may be a combinations of both medium and large heavy vehicles, which would result in reduced noise increases.

Calculations have been made to estimate the increase in noise level at the nearest sensitive receivers to the impacted roads during the construction period. As noted in Table 7-7, the predicted change in traffic noise levels from additional construction vehicles was less than 2 dB(A). Construction related road traffic noise is therefore expected to comply with the requirements of the RNP.

The increases presented in Table 7-7 are conservative as they are based upon existing traffic volumes, which are approximately 17,000 AADT on Mamre Road, which are expected to almost double to around 30,000 AADT at the opening year of Mamre Road Upgrade Stage 2 in 2029 (MRUS2 NVIA, Appendix D).

For the OOHW construction works identified in Section 7.2.2, considering the existing number of heavy vehicles on Mamre Road at night shown in Table 7-6, and the proposed construction works for the temporary access off Mamre Road, which is not expected to require a substantial number of heavy vehicles, the change in traffic noise levels from additional construction vehicles is expected to be less than 2 dB(A) for these construction works and therefore expected to comply with the requirements of the RNP and is not expected to cause any adverse impacts.

7.2.4 Construction noise sources

The schedule of items of plant and equipment likely to be used during the construction phases of the Proposal is presented in Table 7-8 below. This is not a comprehensive list of all potential plant and equipment but covers the key likely plant and equipment items for the approval assessment purposes.

The sound power levels for the majority of construction plant and equipment presented in the above table are based on maximum noise levels given in Table A1 of Australian Standard 2436 - 2010 '*Guide to Noise Control on Construction, Demolition and Maintenance Sites*', the ICNG, information from past projects and/or information held in the RTA library files.

The noise and vibration impacts from the final plant and equipment adopted by a contractor would be reviewed as part of the CNVMP developed for the Proposal during the construction planning stage.

Table 7-8: Typical construction equipment & sound power levels (standard construction hours)

Plant item	Estimated number of items	Individual source/activity sound power level ($L_{w\ re.\ 1pW}$), $L_{Aeq,15min}$, dB(A)
Site establishment (Site Est.)		
Tracked excavator with bucket (30t)	1	105
Hand tools	1	107
Elevated work platform (EWP)	1	95
Small truck	4 per hour	104
Franna crane	1	99
Truck with Hiab	1	96
Bulk earthworks, cut/fill and excavation works		
Excavator with rockhammer attachment	1	123[2]
Excavator w bucket (30t)	1	105
Hand tools	Multiple	107
Tipper truck	2	104
Non-powered hand tools	Multiple	90
Water cart	1	107

Plant item	Estimated number of items	Individual source/activity sound power level ($L_{w\ re.\ 1pW}$), $L_{Aeq,15min}$, dB(A)
Jackhammer	1	118[2]
Bulldozer (D8R)	1	116
Compactor	1	108
Grader	1	113
Rock crusher	1	118
Truck and Dog	2	106
Civil, utilities and in-ground works		
Excavator with rockhammer attachment	1	123[2]
Excavator with bucket (50t)	1	107
Excavator with bucket (30t)	1	105
Hand tools	Various	107
Tipper truck	2	104
Non-powered hand tools	Various	90
Water cart	1	107
Jackhammer	1	118[2]
Truck and Dog	2	106
Smooth drum roller (13t) - low vibration mode	1	114[2]
Drill rig	1	111[2]
Concrete agitator	1	108
Concrete pump	1	103
Piling rig - bored	1	112
Fibre cable winch	1	86
Generator	1	94
Trowelling machine	1	94
Parcel building construction (including electrical substation, water and fuel storage tanks and loading dock)		
Tower crane - diesel	1	110
Concrete pump	1	103
Concrete agitator	1	108
Mobile crane (300t)	1	105
Truck and Dog	2	106
Hand tools	Various	107
Concrete vibrator	4	97
Franna crane	1	99
EWP	1	95
Telehandler	1	98
Non-powered hand tools	Various	90
Trowelling machine	1	94
Shotcrete pump/compressor	1	104

Plant item	Estimated number of items	Individual source/activity sound power level ($L_{w\ re.\ 1pW}$), $L_{Aeq,15min}$, dB(A)
Compressor	1	100
Handtool - grout / hand mixer	Various	107
Pump	1	104
Small truck	1	104
Building fitout		
Hand tools	Various	107
Mobile crane (300T)	1	105
Concrete agitator	1	108
Concrete pump	2	103
Concrete vibrators	8	99
Hand tools (non-powered)	Various	98
Trowelling machine	1	94
Tower crane - diesel	1	110
Road works (parcel and other)		
Excavator with bucket (30t)	1	105
Compactor (Roller)	1	107
Bobcat	1	107
Truck & dog	1	108
Delivery truck	2 per hour	106
Asphalt truck & sprayer	1	103
Concrete/Road saw	1	119[2]
Commissioning		
Hand tools	Various	107
Mobile crane (300t)	1	105
EWP	1	95
Bobcat	2	107
Delivery truck	2 per hour	106
Hand tools (non-powered)	Various	98

Notes: 1. Activity unlikely to be required during the OOHW night period.

2. In accordance with the ICNG, a 5 dBA ‘penalty’ is applied for activities identified as particularly annoying, such as rock hammers.

The schedule of items of plant and equipment likely to be used during proposed construction works outside of the standard construction hours are presented in Table 7-9 below.

Table 7-9: Typical construction equipment & sound power levels (OOH works)

Plant item	Estimated number of items	Individual source/activity sound power level ($L_{w\ re.\ 1pW}$), $L_{Aeq,15min}$, dB(A)	Individual source/activity sound power level (L_w re. 1pW), L_{Amax}, dB(A)
Road works			
Excavator with bucket (30t)[3]	1	105	111
Compactor (Roller) [3]	1	107	112
Bobcat[3]	1	107	112
Truck & dog [3]	1	108	120
Delivery truck[3]	2 per hour	106	111
Asphalt truck & sprayer[3]	1	103	108
Concrete/Road saw[4]	1	118[2]	123

Notes:
1. Activity unlikely to be required during the OOHW night period.
2. In accordance with the ICNG, a 5 dBA 'penalty' is applied for activities identified as particularly annoying, such as rock hammers. Presented sound power is inclusive of penalty.
3. T: Typical noise source
4. H: High construction noise source

7.3 Construction noise and vibration assessment

7.3.1 Predicted construction noise levels

During the construction phase, noise levels at any receiver location resulting from construction works would depend on the location of the receiver with respect to the area of construction, shielding from intervening topography and structures, and the type and duration of construction being undertaken. Furthermore, noise levels at receivers would vary significantly over the total construction program due to the transient nature and large range of plant and equipment that could be used.

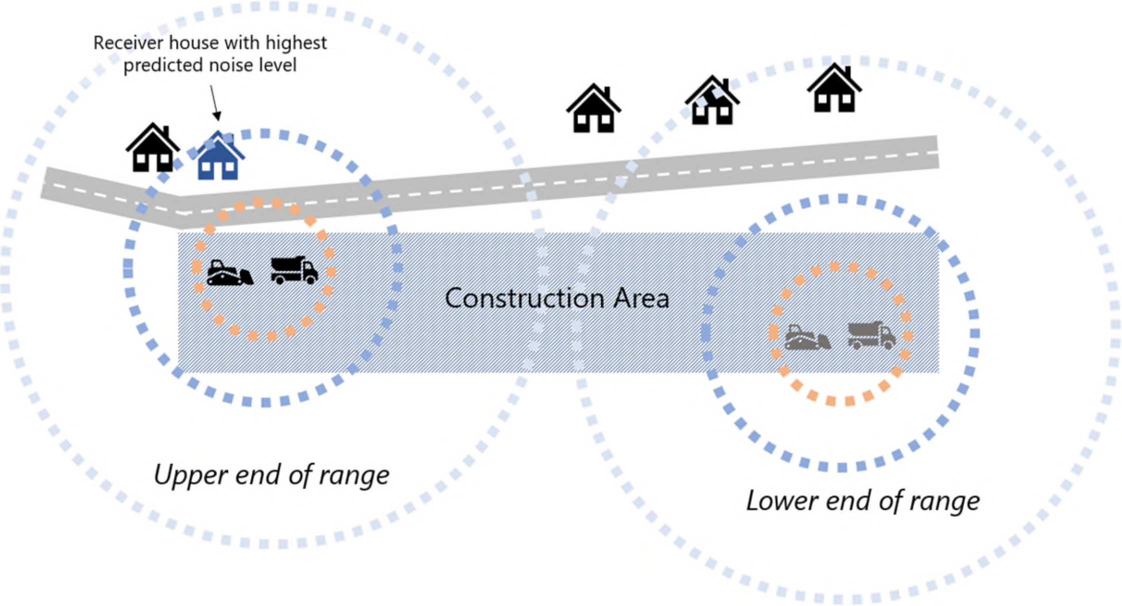
Potential construction noise levels at receivers have been determined by modelling the noise sources representing the proposed typical and noise intensive construction activities and operating times based on the information presented in Section 7.2 to the nearby representative receiver locations. The receiver locations presented in Figure 2-2 have been considered in the assessment. A 5 dB(A) penalty has been factored into the noise modelling levels where applicable to allow for particularly annoying activities, such as saw cutting and rockhammering.

The predicted levels are conservative and represent the identified typical or high noise equipment/plant operating continuously throughout the 15 minute period. It is important to distinguish between high noise equipment/plant and typical construction noise scenarios within this assessment. High noise equipment/plant scenarios represent a worst-case condition, with both worst case equipment and location modelled, which is not expected to reflect the common construction noise emissions generated throughout the Proposal construction works for various receivers. Predicted noise levels from high noise equipment/plant scenarios mostly relate to short-duration activities involving noise intrusive equipment such as saw cutting and rockhammering. These scenarios are modelled to ensure the assessment captures these intensive conditions but are expected to be infrequent and of limited duration. In contrast, typical construction works involve less noise intrusive equipment and capture typical expected operations and usage within any given 15-minute interval. As such, noise levels during the typical activities are generally lower and more representative of day-to-day site construction.

Table 7-10 presents noise levels likely to be experienced at the nearby receiver locations during the construction phase. The noise level ranges presented represent the plant item operating at a location furthest (or most acoustically shielded) from the receiver and at the location closest (or highest potential noise level) to the receiver, as shown in Figure 7-3.

For the prediction noise levels in Table 7-10 the upper end of the range, represents the assessed when they occur at the closest point to each receiver. While in practice, noise generating construction works would occur at different locations throughout the work area, resulting in differing noise levels at each receiver. This means that predicted noise levels are only likely to occur when works are at the closest point to each receiver. The noise impacts may be lower than predicted as the construction activities move around or progress around the construction site, as shown by the lower end of the range in Table 7-10. This concept is demonstrated in Figure 7-3 and should be considered when reviewing the predicted noise levels in this assessment.

Figure 7-3: Predicted range of construction noise levels



Noise levels were calculated taking into consideration attenuation due to distance between the construction works and the receiver locations and any intervening structures. Conservatively, Proposal structures have not been included in the modelling considering the uncertainty of staging timing at this early project stage, which would provide increased shielding to nearby receivers.

The worst affected receivers are typically the receivers with direct line-of-sight to the construction work area. Receivers located without direct line-of-sight to the construction area would typically be exposed to construction noise levels 5 to 10 dB(A) lower than the levels predicted for the worst affected receiver.

Table 7-10: Day (standard construction hours) – Predicted construction noise levels, dB(A) $L_{Aeq,15min}$ for construction activities

NCA	Receiver type	NML (external)	Stage 1 (Western parcels)																	Stage 2 (Eastern parcels)											
			Phase 0						Phase 1		Phase 2		Worst case stage cumulative[6]	Phase 3		Phase 4				Phase 5							Worst case stage cumulative[6]	Phase 6		Phase 7	
			Site estab.	Stage 1 bulk earthworks			Road works		Parcel A + COSH construction		Parcel B construction			Parcel C construction		Parcel D construction		Road construction		Stage 2 bulk earthworks			Parcel E construction		Road construction			Parcel F construction		Road construction	
			Typical	Typical	Loud earthmoving	High noise	Typical	High noise	Typical	High noise	Typical	High noise		Typical	High noise	Typical	High noise	Typical	High noise	Typical	Loud earthmoving	High noise	Typical	High noise	Typical	High noise		Typical	High noise	Typical	High noise
			P0-T	P0E-T	P0E-E	P0E-H	P0R-T	P0R-H	P1-T	P1-H	P2-T	P2-H		P3-T	P3-H	P4-T	P4-H	P4R-T	P4R-H	P5E-T	P5E-E	P5E-H	P5-T	P5-H	P5R-T	P5R-H		P6-T	P6-H	P7-T	P7-H
NCA01	Residential	54	<20 - 53	**24 - 58**	**25 – 64**	**39 - 71**	30 - 42	**45 - 55**	24 - 52	**39 - 67**	39 - 50	**54 - 63**	**40 - 60**	39 - 53	**54 - 64**	38 – 48	**53 - 59**	36 - 40	**51 - 55**	24 – 38	37 - 46	**46 - 62**	20 – 39	**33 - 52**	32 - 37	45 - 50	32 - 43	35 – 44	**53 - 57**	36 - 40	**51 - 55**
NCA01	Educational (Mamre Anglican School)	55	<20 - 50	<20 - 55	**25 - 61**	**33 - 69**	21 - 41	36 - 54	<20 - 49	**33 - 68**	33 - 50	**48 - 63**	**34 - 57**	40 – 54	**55 - 65**	39 – 54	**54 - 64**	38 - 45	**53 - 60**	35 – 49	41 - 54	**50 - 67**	38 – 46	**40 - 59**	36 - 41	49 - 54	39 - 51	38 – 51	**57 - 64**	39 - 49	**54 - 64**
NCA02	Residential	54	<20 - 35	<20 - 40	25 - 46	32 - 53	<20 - 32	31 - 45	<20 - 35	27 - 50	<20 - 39	34 – 54	22 - 44	31 - 40	46 - 51	30 – 41	45 - 52	31 - 36	46 - 51	25 – 43	31 - 49	**40 - 56**	28 – 41	40 - 54	27 - 35	40 - 48	29 - 46	29 – 43	49 - 54	33 - 38	48 - 53
NCA02	Educational (Trinity Primary School)	55	<20 - 41	<20 - 46	25 - 52	**32 - 59**	<20 - 38	32 - 51	<20 - 39	29 - 51	23 - 41	38 – 54	24 - 48	35 - 43	50 - 54	36 – 46	**51 - 57**	35 - 41	**50 - 56**	34 – 49	40 - 55	**49 - 65**	37 – 43	**49 - 56**	34 - 37	47 - 51	40 - 50	36 – 47	**54 - 60**	36 - 44	**51 - 59**
NCA02	Educational (Emmaus Catholic College)	55	<20 - 44	<20 - 49	25 - 55	**30 - 62**	<20 - 40	32 - 53	<20 - 41	**30 - 56**	21 - 43	**36 - 58**	22 - 51	37 - 46	**52 - 57**	38 – 49	**53 - 60**	38 - 44	**53 - 59**	36 – 53	**41 - 59**	**51 – 68**	36 – 51	**49 - 64**	38 - 41	51 - 54	41 - 55	39 – 53	**57 - 66**	39 - 48	**54 - 63**
NCA03-PW	Place of worship (BAPS)	55	<20 - 24	22 - 29	25 - 35	37 - 42	<20 - 28	27 - 41	<20 - 28	23 - 41	<20 - 31	28 – 46	22 - 35	23 - 29	38 - 40	23 – 29	38 - 40	<20 - 26	32 - 41	<20 – 30	25 - 39	29 - 49	<20 – 36	29 - 49	<20 - 28	26 - 41	<20 -37	25 – 30	33 - 40	22 - 25	37 - 40
NCA03	Residential	45	<20 - 34	<20 - 39	25 - 45	**30 - 52**	<20 - 36	**29 - 49**	<20 - 36	**29 - 49**	<20 - 37	**33 – 50**	22 - 43	32 - 37	**47 - 48**	33 – 39	**48 - 50**	34 - 35	**49 - 50**	34 – 44	**40 - 53**	**49 - 63**	34 – 45	**47 - 58**	34 - 40	**49 - 53**	**39 - 48**	35 – 43	**53 - 56**	34 - 36	**49 - 51**
NCA04	Residential	57	25 - 36	30 - 41	25 - 47	45 - 54	32 - 40	47 - 53	<20 - 40	31 - 53	29 - 42	44 – 55	30 - 47	31 - 39	46 - 50	30 – 37	45 - 48	21 - 34	36 - 49	20 – 35	33 - 48	42 - 55	27 – 35	40 - 48	21 - 38	36 - 51	28 - 41	29 – 40	46 - 56	31 - 34	46 - 49
NCA05	Residential	51	<20 - 24	<20 - 29	25 - 35	23 - 42	22 - 27	37 - 40	<20 - 28	25 - 41	23 - 31	38 – 46	24 – 35	22 - 28	37 - 39	22 – 28	37 - 39	22 - 23	37 - 38	<20 – 26	26 - 33	35 - 43	20 – 30	33 - 43	20 - 24	35 - 37	25 - 32	21 – 27	39 - 40	21 - 23	36 - 38
NCA05	Childcare	55	<20 - 24	<20 - 29	25 - 35	23 - 42	22 - 26	37 - 39	<20 - 28	23 - 41	23 - 31	38 – 46	24 – 35	23 - 29	38 - 40	23 – 28	38 - 39	22 - 24	37 - 39	<20 – 26	26 - 35	35 - 45	<20 – 26	30 - 39	21 - 24	36 - 37	24 - 30	22 – 29	40 - 42	22 - 24	37 - 39
NCA06	Residential	47	<20 - 28	23 - 32	26 - 38	38 - 43	24 - 30	39 - 43	<20 - 30	27 - 43	25 - 33	40 – 45	26 - 37	24 - 30	39 - 41	23 – 29	38 - 40	24 - 25	39 - 40	<20 – 26	25 - 35	29 - 45	<20 – 27	29 - 40	<20 - 27	32 - 40	25 - 31	23 – 29	43 - 45	24 - 25	39 - 40
NCA07	Residential	58	<20 - 24	20 - 29	23 - 35	35 - 42	<20 - 28	30 - 41	<20 - 28	23 - 41	<20 - 33	28 - 47	22 - 36	24 - 30	39 - 41	24 – 30	39 - 41	21 - 26	36 - 41	<20 – 29	25 - 37	27 - 47	<20 – 29	31 - 42	<20 - 28	25 - 41	26 - 33	20 – 31	35 - 41	24 - 26	39 - 41
NCA08	Residential	46	<20 - 21	<20 - 26	25 - 32	26 - 39	<20 - 24	23 - 37	<20 - 24	21 - 37	<20 - 27	23 - 42	22 - 31	20 - 25	35 - 36	20 – 26	35 - 37	<20 - 22	28 - 37	<20 – 26	25 - 35	32 - 45	<20 – 27	28 - 40	<20 - 25	28 - 38	25 - 31	<20 – 27	34 – 37	21 - 22	36 - 37
IND	Industrial directly to the west	75	24 - 56	29 - 61	32 - 67	44 - 74	35 - 59	50 - 72	22 - 55	37 - 68	38 - 48	53 - 63	39 - 64	36 - 45	51 - 56	35 - 42	50 - 53	34 - 36	49 - 51	23 - 41	29 - 47	38 - 56	23 - 44	38 - 57	23 - 38	38 - 51	29 - 46	28 - 39	43 - 49	32 - 35	47 - 50
IND	Industrial directly to the south[5]	75	21 – 65	26 - 70	**32 - 76**	**41 - 85**	**21 - 81**	**36 - 94**	21 - 72	**36 - 85**	30 - 51	45 - 66	**31 - 82**	39 - 49	54 - 64	40 - 54	55 - 69	**43 - 79**	**58 - 94**	27 - 59	33 - 63	42 - 72	32 – 49	48 - 62	**27 - 81**	**42 - 94**	**35 - 81**	38 - 53	53 - 68	40 - 59	55 - 74
IND	Industrial directly to the east[5]	75	<20 – 40	22 - 45	28 - 51	37 - 58	<20 - 44	32 - 57	<20 - 43	32 - 56	21 - 36	36 - 51	22 - 49	34 - 38	49 - 53	36 - 40	51 - 55	29 - 42	44 - 57	**32 - 84**	**38 - 90**	**47 - 97**	48 - 67	**56 - 80**	29 - 65	**44 - 78**	**50 - 84**	39 - 47	54 - 62	37 - 42	52 - 57

Notes:
1. T: Typical construction activities with a sound power level of 110 dB(A) accounting for equipment like excavators, tower crane, power hand tools, truck and dogs, as per in Table 7-8
2. H: High noise activities with a sound power level of 118+5 = 123 dB(A) accounting for equipment like excavators with rockhammers and road saws, as per in Table 7-8
3. Loud earthmoving equipment eg. dozer in operation, sound power level of 116 dB(A), as per in Table 7-8
4. Typical site establishment activities are modelled based upon a tracked excavator with bucket operating, at sound power level of 105dB(A), the typically louder activity as per in Table 7-8
5. Receiver not yet constructed
6. Worst case stage cumulative scenario predicted noise levels are based on the indicative scheduling in Table 7-2. For Stage 1 it includes the following concurrent activities: Stage 1 bulk earthworks (typical), Stage 1 road construction (typical), Parcel A + COSH construction (typical), and Parcel B construction (typical). For Stage 2, it includes Stage 2 bulk earthworks (typical), Stage 2 Phase 5 road construction (typical), Parcel E construction (typical)

Table 7-11: Proposed OOH construction activities – Temporary access off Mamre Road / Roadworks - Predicted construction noise levels, dB(A) $L_{Aeq,15min}$

NCA	Receiver type	Evening NML	Predicted construction noise levels, dB(A) $L_{Aeq,15min}$		Night NML	Predicted construction noise levels, dB(A) $L_{Aeq,15min}$		Sleep disturbance screening L_{Amax} dB(A)	Predicted construction noise levels, dB(A) L_{Amax}	
			Typical	High noise		Typical	High noise		Typical	High noise
			P0R-T	P0R-H		P0R-T	P0R-H		P0R-T	P0R-H
NCA01	Residential	48	30 - 42	**45 - 55**	42	30 - 42	**45 - 55**	52	46	**60**
NCA02	Residential	43	<20 - 32	**31 - 45**	42	<20 - 32	**31 - 45**	52	36	50
NCA03	Residential	38	<20 - 36	**29 - 49**	35	<20 - 36	**29 - 49**	52	40	**54**
NCA04	Residential	46	32 - 40	**47 - 53**	39	32 - 40	**47 - 53**	52	44	**58**
NCA05	Residential	46	22 - 27	37 - 40	40	22 - 27	37 - 40	52	31	45
NCA06	Residential	41	24 - 30	**39 - 43**	38	24 - 30	**39 - 43**	52	34	48
NCA07	Residential	51	<20 - 28	30 - 41	39	<20 - 28	**30 - 41**	52	32	46
NCA08	Residential	41	<20 - 24	23 - 37	38	<20 - 24	23 - 37	52	28	42

Notes:

1. T: Typical construction activities with a sound power level of 110 dB(A) accounting for a combination of typical equipment like compactor (roller), bobcat, truck and dogs, as per Table 7-9
2. H: High noise activities with a sound power level of 118+5 = 123 dB(A) accounting for equipment like road saws

7.3.2 Discussion of construction noise results

7.3.2.1 Standard daytime hours

The predicted noise levels presented above indicate that surrounding receivers are not expected to experience noise levels about the noise management levels, except for nearby sensitive receivers located in NCA01, NCA02 or NCA03, or the adjacent industrial premises.

The predictions show the following:

- Construction noise levels may be above the noise management levels during periods over the construction program, when high noise activities are being undertaken, such as rock-hammering/saw cutting, at locations closest to the nearest residential receiver in NCA01, NCA02 and NCA03 and the three adjacent schools in NCA02.

- Bulk earthworks is proposed to be undertaken using conventional earth-moving plant such as dozers and front-end-loaders, considering the existing ground types and the aim of avoiding extensive cut into bedrock sub-surface units, this will minimise the requirement to use high-noise plant such as excavators with hammer attachments. However, this may not always be possible to (i.e. encounter hard rock). This is anticipated to be sporadic, and may not be required at the worst case locations, while the predicted noise levels assume a constant rockhammering activity at the border of the earthworks boundary. Other loud equipment such as rock-crushers may be required, however, similarly due to the existing ground type this is expected to be sporadic, and can be transported offsite if required. Therefore, the predicted noise levels for high noise activities are not the expected during majority of the construction.

- During all construction phases, when typical constructions works are occurring for a phase or phase activity in isolation, the construction noise levels at the schools in NCA01 and NCA02 are not predicted to be above the NML. Where construction works are taking place concurrently on two overlapping phases or activities, there is the potential for noise levels to be higher (as shown in the predicted noise levels in the cumulative column). The increase in noise levels is generally up to 3 dB(A) above the predicted noise level during bulk earthworks.

- Phase 0 has the greatest potential for concurrent construction activities across Stage 1. There is potential for four construction activities to be undertaken concurrently; Stage 1 bulk earthworks, Stage 1 road construction, Parcel A + COSH construction and Parcel B construction. The predicted noise levels presented in Table 7-10 show the worst case cumulative noise level that could occur if construction staging is not optimised to manage the potential construction noise impacts from concurrent activities. For example, as the loudest activity is the bulk earthworks, the northern section of the bulk earthworks should be completed as much as possible before commencing parcel construction.

- The schools in NCA01 and NCA02 are predicted to experience construction noise levels above the NML when high noise construction activities are being undertaken at the closest locations. This could occur during various different stages, with construction noise levels from high noise activities predicted to be up to 14 dB(A) above the NML during the bulk earthworks or road construction (Phase 7) stages, and up to 13 dB(A) above the NML during the parcel construction stages. As described above, this is unlikely to be the case throughout actual construction The TfNSW *Construction Noise and Vibration Guideline* (CNVG), identifies construction noise levels 10 dB(A) above the NML but below 20 dB(A) during standard construction hours as moderately intrusive. When these activities are not occurring at the closest location, or with acoustic shielding noise levels are expected to be less.

- For the closest residences in NCA01, NCA02 and NCA03, during stages which are in close proximity to these receivers, construction noise levels are predicted to be above the NML during a range of construction activities.
- For all other residences or during typical construction activities, due to the substantial distance from the construction works, the construction noise levels are predicted to be below the standard hours NMLs.
- No residential receivers are predicted to be highly noise affected [i.e. exposed to noise levels greater than 75 dB(A)].
- The adjacent industrial facilities may experience construction noise levels above the noise management level when works are close to the shared boundary.
- When construction works are not taking place at the closest point to each receiver, they are expected to be less than the upper end of the range presented in Table 7-10, seen by the lower end of the range.

The noise predictions presented in this NVIA represent a realistic worst-case scenario when construction occurs at work locations close to sensitive receivers. At each receiver, noise levels will vary during the construction period based on the position of equipment within the worksite, the distance to the receiver, the construction activities being undertaken and the noise levels of particular plant items and equipment. This variation is shown by the predicted range presented in Table 7-10 results, with Figure 7-3 showing what this range means. This means the actual construction noise levels will often be less than the predicted levels presented in this NVIA following construction planning, which would incorporate the mitigation and management measures where feasible and reasonable detailed in Section 7.3.4.

Where similar construction works are taking place concurrently on two overlapping phases, there is the potential for noise levels to be higher (as shown in Table 7-10). They would likely increase in a similar manner to two nearby construction projects, generally by up to 3 dB(A) above the highest predicted noise level, in a similar manner to that shown in Figure 7-4, however this could be higher where there are more than two concurrent projects in similar proximity to a receiver. Noting the potential for construction noise levels to be higher than from an individual set of works, and the overall duration of construction impacts may be overall longer or impacts more frequent, the mitigation and management measures detailed in Section 7.3.4 are identified as needing to be applied with consideration of the concurrent construction stages of the Proposal that are underway, so that cumulative impacts are appropriately managed.

In light of the predicted noise levels above for residences and non-residences, it is recommended that a feasible and reasonable approach towards noise mitigation measures be applied to reduce noise levels as much as possible to mitigate the impact from construction noise. Further details on construction noise mitigation and management measures are provided in Section 7.3.4 below.

7.3.2.2 Outside of standard construction hours

The following works were assessed during the OOHW periods:

- Temporary access off Mamre Road / Roadworks

It can be seen in Table 7-11 that the predicted construction noise levels for typical activities are below the corresponding night NMLs during the proposed OOH. However, the predicted noise levels also indicate that nearby sensitive receivers are expected to experience construction noise levels above the NMLs during high noise activities such as rockhammering/saw cutting.

Maximum noise levels have been assessed and presented in Table 7-11. Predicted noise levels at residential receivers are below the screening level for typical activities. Predicted noise levels at residential receivers are above the screening level but below an 'awakening reaction' noise level, as per Section 4.1.3 and Table 4-3, during high noise activities.

Noting this level of exceedance, through construction planning and management, construction site layout adjustments, equipment selection, and localised acoustic shielding of key noise generating items, it would be feasible to mitigate these exceedances.

Specific feasible and reasonable mitigation and management measures should be investigated as part of a works specific assessment that should be undertaken during the construction stage by a contractor as detailed in Section 7.2.2.1. Specific controls that should be considered in this assessment, that could achieve the required level of mitigation are detailed are Section 7.3.4.

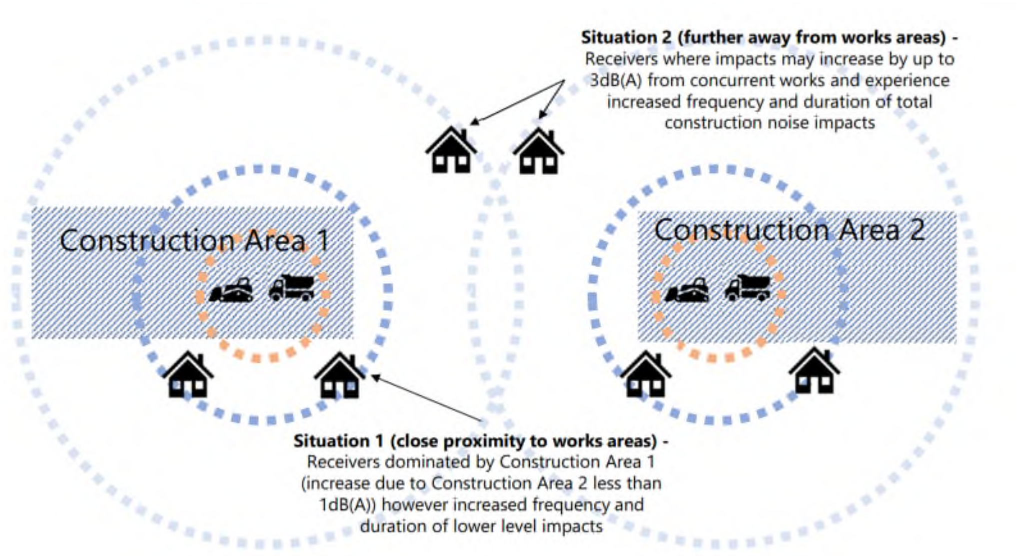
7.3.3 Cumulative construction noise impacts

The Proposal is located within the MRP, across which there are a large number where similar industrial facility construction projects will be taking place over the next couple of years, shown by the various proposed/approved projects presented in Figure 1-4 along with the extended timeframe (ie. 15-20 years) expected for the full development of the MRP and state approved project in the vicinity.

There will be multiple projects undergoing noise generating construction works concurrently or with overlapping timeframes with the Proposal. As such, there is potential for cumulative or consecutive noise impacts as a result of the Proposal combined with other project with concurrent or similar timeframes.

Typically, while impacts from one project or one construction site may be relatively short-term or noise intensive periods intermittent, when multiple construction projects are occurring at the same time near to a particular receiver cumulative construction noise impacts can occur. This can mean that construction noise impacting a sensitive receiver may be louder than from an individual set up works [by up to 3 dB(A)], the overall duration of construction impacts may be overall longer or impacts more frequent. Typically, concurrent projects can impact nearby receiver locations in one of two ways, as also shown in Figure 7-4. However, as the proposal will be construction over multiple phases, and there will be a range of other nearby construction projects, this will result in added complexity compared to the example in Figure 7-4.

Figure 7-4: Cumulative construction noise impacts (two concurrent projects)



It is noted that the construction works from the Proposal will likely be the dominant construction noise source in the vicinity of the Proposal site (with the exception of the proposed industrial development directly to the east of the site if its construction works are concurrent with the Proposal).

The following construction projects have been identified as potentially undertaking noise generating works in proximity to the same noise sensitive receivers during the construction of the Proposal. The location of all these project is presented in Figure 1-4

Table 7-12: Construction projects with potential for cumulative noise impact

DA Reference	Summary	Status
200 Aldington Road Industrial Estate – (SSD-10479)	Staged development including a Concept Proposal and Stage 1 Development Application comprising estate-wide earthworks, infrastructure and services, construction, fit-out and operation of Stage 1 warehouse building.	Approved
The Edge Estate – (SSD-17552047)	Development of a warehouse and logistics hub, including construction and operation of eight warehouses with a total of 153,343 m² of gross floor area, one collector road connecting, two estate roads, a 14-lot Torrens Title subdivision	Approved
Westgate Industrial Estate, 253-267 Aldington Road (SSD-23480429)	Construction and operation of three warehouse buildings with a total floor area of 45,530m$^{2.}$ Site preparation works, including demolition, bulk earthworks, road construction, site servicing, on-site detention, landscaping, and subdivision.	Approved
Kemps Creek Warehouse Logistics and Industrial Facilities Hub (The Yards) (SSD-9522)	Development of a warehouse, logistics and industrial facilities hub including construction and operation of eight warehouses comprising 162,355m² of floor space, 744 parking spaces and 21-lot Torrens Title Subdivision (over two stages).	Approved
Cardboard Manufacturing - 200 Aldington Road Lot F - (SSD-79300218) *(Part of SSD-10479)*	Fit out and use of the Stage 1 building on Lot F in the 200 Aldington Road Industrial Estate for the purposes of manufacturing and distribution of cardboard packaging.	Response to Submissions
1-51 Aldington Road Estate (SSD-74784709)	Site preparation works including demolition of all existing structures and bulk earthworks in development areas, subdivision of the site into three development lots and an environmental conservation lot, construction, and use of a warehouse of approximately 24,710m² within Lot 1 and construction and use of a warehouse of approximately 18,600m² within Lot 2.	Prepare EIS
Yiribana Industrial Estate (SSD-10272349)	Concept plan and stage 1 DA for an industrial estate. Stage 1 comprises two warehouses, site-wide bulk earthworks and retaining walls, an internal road network, storm water works, car parking, signage, and landscaping.	Approved
805 Mamre Road Kemps Creek Logistics (SSD-30871587)	Construction of an industrial logistics and distribution warehouse facility with 25,310m² of floor space, with associated office space (970m²), vehicle loading and parking areas, road access and internal roads for use by a single operator.	Under Assessment
Aspect Industrial Estate (SSD-10448)	Development seeks approval for earthworks, infrastructure and roads across the entire site, and the staged construction of warehouse and logistics facilities with associated car parking across 11 developable lots. Four warehouses have been constructed or are underway.	Approved
Dexus Warehouse and Distribution Centre – 113- 153 Aldington Road (SSD-32722834)	Concept proposal for an industrial estate comprising five (5) warehouse buildings and a stage 1 development comprising the construction of two (2) warehouses, demolition, bulk earthworks, internal roads, signage, stormwater infrastructure and subdivision.	Approved
Access Logistic Park (SSD-17647189)	Demolition and bulk earthworks, 13-lot Torrens Title subdivision, construction of internal roads, infrastructure and utilities, construction, and operation of warehouse 1 (27,800m²) with associated offices, car parks, hardstands, and landscaping.	Approved
Westlink Industrial Estate – Stage 1 (SSD-9138102)	Staged construction of two (2) warehouse buildings with ancillary office space with a total floor area of approximately 81,642m², demolition, bulk earthworks, road construction, site servicing and stormwater works, landscaping and subdivision.	Approved

DA Reference	Summary	Status
Westlink Industrial Estate – Stage 2 (SSD-46983729)	Site preparatory works, subdivision of the site into five individual lots with two being residual lots for future development, Construction of a new industrial estate at the site comprising two industrial allotments and a total gross floor area of approximately 40,720m^2, including two new industrial warehousing buildings with ancillary offices across the two allotments.	Approved

Additional construction projects or construction works (ie. utility providers) may also be required to take place in the vicinity of sensitive receivers nearby to the Proposal, during the construction of the Proposal, which should also be considered as part of construction planning where known.

Where construction works, in particular OOH works occur concurrently or during a similar timeframe (ie. within the same week), there is potential for cumulative noise impacts from the Proposal combined with other concurrent construction projects in the short term.

Concurrent construction projects or projects that overlap or follow on one after, can lead to common sensitive receivers being impacted by construction noise and/or vibration over an extended duration, with insufficient respite. This may lead to both cumulative impacts and/or construction fatigue.

To help to address the potential for construction impacts from cumulative or concurrent construction noise, recommended mitigation and management measures detailed in Section 7.3.4 (Table 7-15) are to be implemented during the construction works. As detailed in Section 7.3.4.2, the identified mitigation and management measures are be considered and implemented where feasible and reasonable where there is potential for the noise management levels presented in Section 4.1.2 to be exceeded by the construction works either individually or cumulatively.

Specific mitigation and management measures are also included in Table 7-15 to minimise the risk of cumulative construction noise impacts, and cover:

- Coordinating work between construction sites to manage cumulative noise impacts (including respite)
- Community consultation to gauge key noise impacts
- Consideration of cumulative construction noise impacts during the development of noise mitigation and management measures
- Management of cumulative impacts from concurrent construction phases of the Proposal.

These measures are to be used to mitigate and manage cumulative noise impacts and reduce the likelihood of construction fatigue:

These mitigation measures would be included in the CNVMP or CEMP and would include how the above measures would be incorporated during the works.

7.3.4 Construction noise mitigation measures

7.3.4.1 General engineering noise controls

Implementation of noise control measures, such as those suggested in Australian Standard 2436-2010 '*Guide to Noise Control on Construction, Demolition and Maintenance Sites*', are expected to reduce predicted construction noise levels.

Reference to Australian Standard 2436-2010, Appendix C, Table C1 suggests possible remedies and alternatives to reduce noise emission levels from typical construction equipment. Table C2 in Appendix C presents typical examples of noise reductions achievable after treatment of various noise sources. Table C3 in Appendix C presents the relative effectiveness of various forms of noise control treatment.

Table 7-13 below presents noise control methods, practical examples and expected noise reductions according to AS2436 and according to Renzo Tonin & Associates' opinion based on experience with past projects.

Table 7-13: Relative effectiveness of various forms of noise control

Noise control method	Practical examples	Typical noise reduction possible in practice, dB(A)		Maximum noise reduction possible in practice, dB(A)	
		AS 2436	RTA	AS 2436	RTA
Distance	Doubling of distance between source and receiver	6	6	6	6
Screening	Acoustic barriers such as temporary or permanent noise barriers where barrier breaks line-of-sight between the source and receiver	5 to 10	5 to 10	15	15
Acoustic enclosures	Engine casing lagged with acoustic insulation and plywood	15 to 25	10 to 20	50	30
Engine Silencing	Residential class mufflers	5 to 10	5 to 10	20	20
Substitution by alternative process	Use electric motors in preference to diesel or petrol	-	15 to 25	-	40

The RTA' listed noise reductions are conservatively low and should be referred to in preference to those of AS2436.

Table 7-14 below identifies possible noise control measures, which are applicable on the construction plant likely to be used on site.

Table 7-14: Possible noise control measures for likely construction plant

Plant description	Screening	Acoustic enclosures	Silencing	Alternative process
Tower crane - diesel	✖	✔	✔	✖
Excavator with rockhammer attachment	✔	✖	✖	✔
Jackhammers	✔	✖	✖	✔

Plant description	Screening	Acoustic enclosures	Silencing	Alternative process
Concrete truck/agitator	✓	✖	✓	✖
Delivery trucks	✓	✖	✓	✖
Electric / mobile crane	✓	✖	✖	✖
Concrete/Road saw	✓	✖	✖	✓
Drill rig	✓	✖	✓	✖
Hand tools	✓	✖	✓	✖

7.3.4.2 Noise management measures

The following recommendations provide feasible and reasonable noise control solutions to reduce noise impacts to sensitive receivers.

These should be considered and implemented where feasible and reasonable where there is potential for the noise management levels presented in Section 4.1.2 to be exceeded by the construction works either individually or cumulatively.

In accordance with the ICNG, feasible noise mitigation measures are those work practices or measures to reduce noise that are capable of being put into practice or of being engineered and are practical to build given project constraints such as safety and maintenance requirements. Reasonable noise mitigation measures are those feasible noise mitigation measures that are considered reasonable in the circumstances, based on a judgement that the overall noise benefits outweigh the overall adverse social economic and environmental effects, including the cost of implementing the measure. To make such a judgement, consideration is to be given to noise level impacts, duration of impacts, noise mitigation benefits, cost effectiveness of noise mitigation and community views.

Considering the predicted noise levels set out in Section 7.3.1 the following noise management are recommended for consideration by a contractor and implemented where feasible and reasonable. The advice provided here is in respect of acoustics only. Supplementary professional advice may need to be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like.

Table 7-15 summarises actions that can be applied to manage the potential for noise to impact on sensitive receivers near the Project construction works, which are to be applied where reasonable and feasible. Some measures will assist with minimising vibration impacts too, and are indicated where this is applicable, refer to Section 7.3.4.6 for vibration management measures.

Table 7-15: Noise mitigation and management measures

Action required	Applies to	Details	Estimated noise benefit
At-source mitigation measures			
Equipment selection	Airborne noise Vibration	Use quieter and less noise/vibration emitting construction methods where feasible and reasonable. Where loud plant and/or equipment are being used in construction works, where feasible and reasonable the selection of alternative quieter plant and/or equipment should be considered for tasks.	Variable. Minimise noise impact and reduce risk of annoyance.
Equipment noise and vibration levels	Airborne noise Vibration	Plant and equipment must be properly maintained. Provide special attention to the use and maintenance of 'noise control' or 'silencing' kits fitted to machines to ensure they perform as intended.	Variable. Minimise noise impact and reduce risk of annoyance.
Alternative construction methods to reduce vibration	Vibration	Alternative, less vibration generating construction methods will be reviewed where vibration significant works found to be within the site-specific minimum working distance of a structure, as determined by site vibration monitoring. For example, the use of rocksaw cutting instead of rockbreaking to excavate.	Variable. Minimise vibration impacts and reduce risk of structural damage and/or annoyance.
Rental plant and equipment	Airborne noise	The noise levels of plant and equipment items are to be considered in rental decisions, with quieter and less noise/vibration emitting construction methods where feasible and reasonable.	Variable. Minimise noise impact and reduce risk of annoyance.
Worksite planning and layout	Airborne noise Vibration	Locate noise-generating activities away from sensitive receivers, where practicable. Plan traffic flow, parking, loading/unloading, and other vehicle movements to keep vehicles away from sensitive receivers where possible and to minimise reversing movements. • Considerations should be given to minimising cumulative/concurrent impacts from other SSD 9138102 stages during layout planning (ie. access locations or parking locations).	Variable. Minimise noise impact and reduce risk of annoyance.
Use and siting of plant	Airborne noise Vibration	• Simultaneous operation of noisy plant within discernible range of a sensitive receiver is to be avoided. • 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. • Any equipment not in use for extended periods during construction work must be switched off.	Up to 20 dB reduction + reduce vibration
Non-tonal and ambient sensitive reversing alarms	Airborne noise	Alternative reverse or other audible alarms, such as 'quackers' instead of the tonal 'beeping" type will be installed on all vehicles, mobile plant and fixed plant regularly used on site and on all vehicles & plant required for OOHW. For example, avoid tonal alarms on plant items such as gantry cranes, EWPs etc. Consider limiting the volume of other audible alarms on plant/ equipment, while maintaining safe working. Consider the use of ambient sensitive alarms that adjust output relative to the ambient noise level.	5-10 dB reduction

Action required	Applies to	Details	Estimated noise benefit
Minimise disturbance arising from delivery of goods	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 if possible. Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible. Minimise unnecessary acceleration on site and avoid vigorous slamming of truck doors, or noise events from tailgates.	Variable. Reduce noise/ vibration impact + risk of annoyance.
Silencers on mobile plant	Airborne noise	Where possible reduce noise from mobile plant through additional fittings, or the selection of items with preinstalled noise mitigation measures, including: • Residential grade mufflers • Air Parking brake engagement is silenced. Ensure plant including the silencer is well maintained.	0-20 dB reduction Reduce annoyance + sleep disturbance.
Prefabrication of materials off-site	Airborne noise	Where practicable, pre-fabricate and/or prepare materials off-site to reduce noise with special audible characteristics occurring on site. Materials can then be delivered to site for installation.	5-20 dB reduction Reduce noise/ vibration impact + risk of annoyance
Engine compression brakes	Airborne noise	Limit the use of engine compression brakes 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.	5-20 dB reduction
Path mitigation measures			
Construction hoarding as noise barrier	Airborne noise	Any construction hoarding shall be installed on each worksite shall be constructed as a noise barrier, where practicable to provide shielding to the nearest affected receivers.	Receiver with line of site of the works area: 5-10 dB reduction Receiver without line of site of the works area: 0-5 dB reduction
Site sheds	Airborne noise	Site sheds to be strategically located to provide shielding to nearby residences.	Receiver with line of site of the works area: 5-10 dB reduction
Laydown and stockpiling	Airborne noise	Locate laydown and staging areas within the construction area as far from residences as practicably possible. Alternatively, where this is not possible or they would be effective as noise mounts, they should be considered for use as noise mounds. If constructed as noise mounds, they should be constructed such that noise sources are not between the mound and the nearest receivers.	Variable. Minimise noise impact and reduce risk of annoyance.
Shield stationary noise sources such as pumps, compressors etc	Airborne noise	Stationary noise sources should be enclosed or shielded whilst ensuring that the occupational health and safety of workers is maintained. materials	5-10 dB reduction

Action required	Applies to	Details	Estimated noise benefit
Use temporary noise barriers around work area	Airborne noise	Where works are to be completed as OOHW outside the construction hoarding area, relocatable noise barriers e.g. acoustic blankets hung from temporary construction fencing would be used, where practicable. This can include use of temporary barriers around noise generating works at elevated construction locations.	Receiver with line of site of the works area: 5-10 dB reduction Receiver without line of site of the works area: 0-5 dB reduction
Mobile noise screens	Airborne noise	Where practicable, a mobile noise screen/tent would be used to reduce noise from moving plant items e.g. concrete saw. Mobile noise screens utilise aluminium mobile scaffold (or similar), with acoustic blanket/ quilt (e.g. Echo-barrier, FlexShield or similar) attached on up to 4 sides (including the top, where no solid platform). Mobile noise screens can provide 5 to 10 dB noise reduction, where they can break line of sight between the source and the receiver.	Receiver with line of site of the works area: 5-10 dB reduction Receiver without line of site of the works area: 0-5 dB reduction
Management measures			
Construction Noise and Vibration Management Plan update (or Construction Environmental Management Plan)	Airborne noise Vibration	A Construction Noise and Vibration Management Plan (CNVMP) is to be prepared for the Proposal (or the CEMP is to include at minimum relevant section for construction noise and vibration management). This must be prepared prior to the commencement of construction and regularly updated to account for changes in noise management issues and strategies.	-
Implement stakeholder consultation measures	Airborne noise	Periodic notification (monthly letterbox drop and website notification) detailing all upcoming construction activities delivered to sensitive receivers at least 7 days prior to commencement of relevant works. This should include details considering cumulative impacts across other stages of where applicable. In addition to Periodic Notification, the following strategies may be adopted to notify the community of upcoming works: • Project Specific Website • Project Infoline • Email Distribution List • Web-based Surveys • Social Media • Community and Stakeholder Meetings.	Keeps stakeholders informed of the likely impact. Community may identify solution to assist in managing impacts. Management of cumulative impacts
Register of noise and vibration sensitive receivers	Airborne noise Vibration	A register of most affected noise and vibration sensitive receivers (NVSRs) would be kept on site. The register would include the following details for each NVSR: • Address of receiver • Category of receiver (e.g. Residential, Commercial etc.) • Contact name and phone number. The register may be included as part of the Project's Community Liaison Plan or similar document.	Assists with keeping stakeholders informed of the likely impact. Assists with planning and reducing potential noise/ vibration impact + risk of annoyance

Action required	Applies to	Details	Estimated noise benefit
Site inductions	Airborne noise Vibration	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: • All relevant project specific and standard noise and vibration mitigation measures • Permissible hours of work • Any limitations on noise generating activities with special audible characteristics • Location of nearest sensitive receivers • Construction employee parking areas • Designated loading/unloading areas and procedures • Site opening/closing times (including deliveries) • Environmental incident procedures.	Keeps construction workforce informed of actions required to minimise noise and vibration impact.
Construction hours and scheduling	Airborne noise Vibration	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating high noise levels and vibration intensive plant identified within minimum working distances for human response should be scheduled during less sensitive time periods, such as after 8 am and before 6 pm. If the work cannot be undertaken during the day, they would take place through a separate approval. As part of construction planning, these works should aim to be completed before 11 pm where feasible and reasonable. For works extending beyond 11 pm, noise intensive works should be scheduled to occur as early as possible.	Minimise noise and vibration impact and reduce risk of annoyance.
Respite coordination	Airborne noise	Consult with proponents of other construction works in the vicinity of the worksite and take reasonable steps to coordinate works to minimise cumulative impacts of noise and vibration and maximise respite for affected sensitive receivers (e.g. aligning respite periods).	Minimises noise impacts Management of cumulative impacts
High noise generating works impacting non-residential receivers (including schools)	Airborne noise	Where high noise generating works are expected to impact non-residential receivers and it is determined through consultation that noise impacts could affect the receiver operations, feasible and reasonable management measure could be considered to manage impacts. Scheduling and timing of noisy works should done considering consultation and feedback from the nearby school receivers. Management could include minimising noise levels during exam periods, and considering school holidays when scheduling loud works periods. See Section 7.3.4.3 for further details.	Minimises noise impacts
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. No excessive revving of plant and vehicle engines. Controlled release of compressed air.	0-20 dB reduction Reduce annoyance
Heavy vehicle routes	Airborne noise	Construction heavy vehicles and delivery vehicles should be scheduled during standard construction hours where feasible and reasonable.	Minimises noise impacts

Action required	Applies to	Details	Estimated noise benefit
Heavy vehicle code of conduct	Airborne noise	A Heavy Vehicle Code of Conduct (HVCC) is to be developed for all drivers to adhere to. The HVCC would require appropriate training of project contractors. It would include noise management methods such as limiting idling and compression braking, and traffic management practises to minimise noise emissions from vehicles entering and leaving the site.	Minimises noise impacts
Verification monitoring	Airborne noise	In response to noise complaints, a noise monitoring program should be carried out for the duration of works in accordance with the Construction Noise and Vibration Management Plan (CNVMP) or CEMP and any approval conditions.	Minimises noise impacts
Vibration measurements	Vibration	Attended vibration measurements and permanent unattended vibration monitoring should be undertaken at the commencement of vibration generating activities to confirm that vibration levels as per Section 7.4.3.	Minimises and manages vibration impacts
Plant noise audit	Airborne noise	All plant and equipment likely to significantly noise affect sensitive receivers for an extended duration must be tested to check if noise emissions are compliant with noise limits reasonable for that item.	Minimises noise impacts
Complaints management	Airborne noise Vibration	See Section 7.5 for further details. In addition to the noise mitigation measures outlined above, a management procedure will need to be put in place to deal with noise complaints that may arise from construction activities. Each complaint will need to be investigated, and appropriate noise amelioration measures put in place to mitigate future occurrences, where the noise in question is in excess of allowable limits.	Minimise noise impact and reduce risk of annoyance.
Cumulative noise management (external projects)	Airborne noise	Through the Mamre Road Precinct Working Group (MRPWG), identify any cumulative construction noise issues for developments under construction, considering community feedback. Where management measures to minimise, cumulative impacts are identified, implement them where feasible and reasonable.	Minimises cumulative noise impacts Management of cumulative impacts
Cumulative impact management - Coordination	Airborne noise	Consult with proponents of other construction works in the vicinity of the worksite and take reasonable steps to coordinate works to manage cumulative noise impacts, where feasible and reasonable. An example would be to ensure that where multiple sites are undertaking noise intensive works, such as demolition works, and these construction works could occur concurrently on multiple construction sites in proximity to the same noise sensitive receivers, these impacts are managed with consideration of both projects (eg. ensure that works from one project do not occur during designated respite periods of the other, or noise intensive works could occur concurrently to minimise overall duration).	Minimise risk of cumulative noise impacts Management of cumulative impacts

Action required	Applies to	Details	Estimated noise benefit
Cumulative impact management - Noise mitigation and management measure development	Airborne noise	Consideration of cumulative construction noise impacts during the development of noise mitigation and management measures for the worksites, where reasonable and feasible (eg. consideration of respite periods provided by other projects for approved OOH, so that timetables between projects don't result in other projects or the Proposal impacting the same noise sensitive receivers during designated periods of respite on consecutive OOH periods, or site layout designs to minimise cumulative impacts from adjacent sites).	Minimise risk of cumulative noise impacts Management of cumulative impacts
Cumulative noise management (concurrent Proposal phases)	Airborne noise	Noting the predicted noise levels presented in Table 7-10 and indicative construction scheduling in Table 7-2, the following mitigation measures should be considered to minimise the potential noise impacts: • Prioritise completing northern section of bulk earthworks as much as possible before commencing parcel construction. • Coordinate construction works to avoid as much as practicable having high noise activities for bulk earthworks and parcel construction concurrently. Or where these works are required, coordination of respite periods should be undertaken. • **Develop a detailed Construction Staging Plan (CSP)** showing sequence of works, timelines, access points, laydown areas, temporary facilities and exclusion zones. • **Implement respite periods** during stages closest to sensitive receivers (e.g. 1 hour break after 3 hours of rock breaking or during multiple suitable time periods). • For each week, produce a **daily activity schedule** and identify overlapping high-noise tasks, to identify suitable way to manage cumulative impacts	Minimises cumulative noise impacts Management of cumulative impacts

Additionally, implementation of noise control measures, such as those suggested in Australian Standard 2436-2010 'Guide to Noise Control on Construction, Demolition and Maintenance Sites', are expected to reduce predicted construction noise levels. Australian Standard 2436-2010, Appendix C, Table C1 suggests possible remedies and alternatives to reduce noise emission levels from typical construction equipment. Table C2 in Appendix C presents typical examples of noise reductions achievable after treatment of various noise sources. Table C3 in Appendix C presents the relative effectiveness of various forms of noise control treatment.

7.3.4.3 Noise impacts to nearby non-residential receivers

The surrounding educational and industrial receivers nearest to the Proposal are predicted to experience construction noise that are above the NMLs.

As such, for construction activities with high noise generating plant and equipment such as excavators with rockhammers and road saws, consultation with affected receivers should be conducted to determine all feasible and reasonable mitigation measures. The following types of management measure could be considered to manage impacts:

- Implement respite periods throughout the day from high noise impact activities. Typically respite periods should be at least 1 hour long. During these periods no high noise impact activities should be carried out.
- Where schools are nearby and it is practicable to do so, 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.
- Undertake high noise construction activities when potentially impacted non-residential receivers are not in use (ie. outside recommended standard hours) to better manage the overall impacts of construction noise and vibration.

7.3.4.4 Diesel tower crane operations

Diesel tower cranes are proposed to be required during work phases associated with construction of the building structure, building fit-out and major plant deliveries to the site. There will likely be multiple cranes required onsite concurrently and has the potential to be a key noise source during the construction periods.

As such, the specific feasible and reasonable mitigation and management measures recommended in Table 7-16 should be considered during the construction stage by a contractor as part of the works specific assessment, to manage the construction works within the construction noise management levels detailed in Section 4.1.2.

Table 7-16: Specific mitigation measures for diesel tower crane

Action required	Details	Estimated noise benefit
Equipment selection and substitution for quieter plant	• If feasible, quiet or acoustically mitigated cranes should be considered, noting that there may be multiple operating concurrently. • If feasible or reasonable, alternate electric tower crane or mobile crane instead of diesel for critical lifts. • Any ground-based generators associated with an electric tower crane should be located so that it is acoustically shielded by the Proposal building structure from critical nearby residential receivers. • Plant/equipment noise levels should be considered in rental decisions.	5-20 dB reduction Reduce annoyance +
Silencers / enclosures on diesel tower crane engine	• If feasible, noise emission from the engine exhaust is to be fitted with an industrial grade muffler and/or attenuator. • Mitigation to engine surface noise should be investigated, such as through the installation of an acoustic enclosure or similar.	0-20 dB reduction Reduce annoyance +
Siting and use of concurrent plant	• Plant used intermittently to be throttled down or shut down. • Noise-emissions with directive qualities are to be directed away from sensitive receivers where reasonably achieved, i.e. crane exhaust when not in use. • Plant is not in use for extended periods during construction work must be switched off.	< 5-10 dB(A)
Minimise disturbance from payload fitting	• Care must be taken when handling and fitting chains, straps etc. for lifting loads. Avoid dropping and dragging chains on the ground and metal surfaces.	Reduce annoyance

7.3.4.5 OOHW evening and night works

At this stage, the requirement for OOHW construction works is not confirmed, and will be determined during future construction planning. However, construction works outside of standard construction hours are proposed as part of the construction of the temporary site access on Mamre Road, as detailed in Section 7.2.2.

As per Section 7.3.2.2, although the proposed OOHW activities are predicted to achieve the OOHW NML during typical construction activities, during some noise intensive activities noise levels are predicted to be above the respective NML.

As such, the specific feasible and reasonable mitigation and management measures recommended in Table 7-17 should be considered during the construction stage by a contractor as part of the works specific assessment, to manage the construction works within the construction noise management levels detailed in Section 4.1.2.

Table 7-17: Specific mitigation measures for OOH works

Action required	Details	Estimated noise benefit
Construction site layout and planning	• As shown in the predictions, when locating construction works at the closest point compared with the furthest point could provide substantial reduction through distance alone, achieving the respective NML. As such, the offset distance between noisy plant and adjacent sensitive receivers is to be maximised. • Access points, internal truck routes, and plant staging areas are to be designed to maximise the distances from sensitive receivers. • Site layout should minimise the requirement for vehicle reversing, to avoid the requirement for reversing alarms to sound, especially during the OOHW night period. • Deliveries with supplies and equipment for OOHW are to occur during standard hours, where practicable.	> 5-10 dB(A)
Siting and use of concurrent plant	• Simultaneous operation of noisy plant sensitive receiver is to be minimised. • Plant used intermittently to be throttled down or shut down e.g. concrete pumps, mobile crane, etc. • Noise-emitting construction plant with directive qualities are to be directed away from sensitive receivers. • Any equipment not in use for extended periods during construction work must be switched off.	< 5-10 dB(A)
Equipment selection and activity noise levels	• Loud plant/equipment items such as concrete pumps and concrete agitators should be selected with known noise emissions levels. • Quieter and less noise emitting items adopted for the works where feasible and reasonable. • Plant/equipment noise levels should be considered in rental decisions.	> 5-10 dB(A) Minimise noise impact and reduce risk of annoyance.
Non-tonal and ambient sensitive reversing alarms	• Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used for any out of hours work. • Consider the use of ambient sensitive alarms that adjust output relative to the ambient noise level.	5-10 dB reduction

Action required	Details	Estimated noise benefit
Noise barriers / construction hoarding / acoustic shielding	• As the residential receivers are located further away and elevated and the adjacent commercial receivers have elevated receivers, the effectiveness of onsite noise barriers is substantially reduced. • Where noise barriers are proposed as part of the final construction planning, the actual effectiveness should be determined, considering the height of receiver, height of noise source, and proposed height of barrier. Line of sight is required to be broken between the source and receiver for the barrier to be effective. • For lower stationary sources (ie. concrete pumps, concrete agitator / truck air brakes releases), close fitting tall noise barriers could provide noise reduction to nearby receivers, including adjacent commercial receivers. • Acoustic blankets/temporary construction hoarding should be considered for screening the mobile concrete pump, and the staging area for concrete agitators where these will break line of sight between the source and nearby receivers. • Acoustic blankets/temporary construction hoarding should be considered for elevated OOHW construction works, where these works cannot be done within or shielded by the Proposal built structure.	Receiver with line of sight of the works area: 5-10 dB reduction Receiver without line of sight of the works area: 0-5 dB reduction

7.3.4.6 Noise monitoring

The following approach could be adopted regarding noise monitoring procedures during the construction works. In the event of a sustained complaint, noise monitoring may be carried out to examine noise impacts as follows:

- Reasonable and feasible noise reduction measures must be investigated, where necessary.
- Typically, short term (attended) noise monitoring would be undertaken to investigate a complaint as opposed to ongoing noise logging as this will enable a faster response time.
- In the event that short term (attended) noise measurements cannot produce a suitable outcome, long term noise monitoring will be considered. Typically, long term monitoring is useful primarily as a means to check if start/finish times or respite periods have been adhered to. Given this limitation, they are not typically proposed in the first instance.

During OOHW, as described in the relevant works specific assessment, to verify that noise levels at nearby receivers are achieving the applicable noise management levels or approved noise requirements.

As part of further design development, when a contractor is appointed and the specific construction methodology is known and the likely construction equipment are also known, the potential construction impacts are to be reviewed to determine that they are consistent with those presented in this SSDA NVIA and that the associated mitigation and management measures are appropriate.

7.4 Construction vibration assessment

7.4.1 Construction vibration sources

The pattern of vibration radiation is very different to the pattern of airborne noise radiation and is very site specific as final vibration levels are dependent on many factors including the actual plant used, its operation and the intervening geology between the activity and the receiver. Potential vibration generated to receivers is dependent on separation distances, the intervening soil and rock strata, dominant frequencies of vibration, and the receiver structure.

The recommended minimum working distances for vibration intensive plant are presented in Table 7-18 and Table 7-19. These distances are conservatively based on excavation of hard rock. Site specific minimum working distances for vibration intensive plant items must be measured on site where plant and equipment are likely to operate close to or within the minimum working distances for cosmetic damage, as detailed in Table 7-18

Unlike noise, vibration cannot be readily predicted. There are many variables from site to site, such as soil type and conditions, sub surface rock, building types and foundations, and actual plant on site.

The data relied upon in this assessment (tabulated below) is taken from a database of vibration levels measured at various sites or obtained from other sources (such as BS5228-2:2009). They are not specific to this proposal as final vibration levels are dependent on many factors including the actual plant used, its operation and the intervening geology between the activity and the receiver.

As such, potential vibration impacts are to be further reviewed during the construction design, planning stages to determine if the final selected plant and equipment could be located within the minimum working distances and/or result in vibration levels about the applicable vibration limits. Where then identified, and feasible and reasonable mitigation and management would be implemented to achieve the applicable vibration limits.

Table 7-18: Minimum working distances (m) for cosmetic damage (continuous vibration)

Plant item	Minimum working distance (m)[5]		
	Reinforced or framed structures (e.g. commercial buildings)[1,3]	Unreinforced or light framed structures (e.g. residential buildings)[1,3]	Sensitive structures (e.g. unsound heritage structures)[2,4]
Drill rig / bored piling	5	5	10
Smooth drum roller (13t) - High vibration	5	15	20
Smooth drum roller (13t) - Low vibration	5	5	10
Excavator with hammer attachment	5	10	15
Jackhammer	5	5	5

Notes
1. Criteria referenced from British Standard 7385: Part 2 'Evaluation and measurement of vibration in buildings'.
2. Criteria referenced from DIN 4150 Part 3, Structural Damage - Safe Limits for Short-term Building Vibration.
3. Initial screening test criteria reduced by 50% due to potential dynamic magnification in accordance with BS7385.
4. A site inspection should determine whether a heritage structure is structurally unsound.
5. Minimum working distances are in 5m increments only to account for the intrinsic uncertainty of this screening method.

Table 7-19: Minimum working distances (m) for human annoyance (continuous vibration)

Plant item	Minimum working distances (m)				
	Critical areas[2,3] 0.28 mm/s	Residences[4]		Offices / schools[2,4] 1.1 mm/s	Workshops[2] 2.2 mm/s
		Day[1] 0.56mm/s	Night[1] 0.40 mm/s		
Drill rig / bored piling	30	20	20	10	10
Smooth drum roller (13t) - High vibration	120	70	90	40	25
Smooth drum roller (13t) - Low vibration	75	40	55	20	10
Excavator with hammer attachment	65	45	55	30	20
Jackhammer	25	15	20	10	5

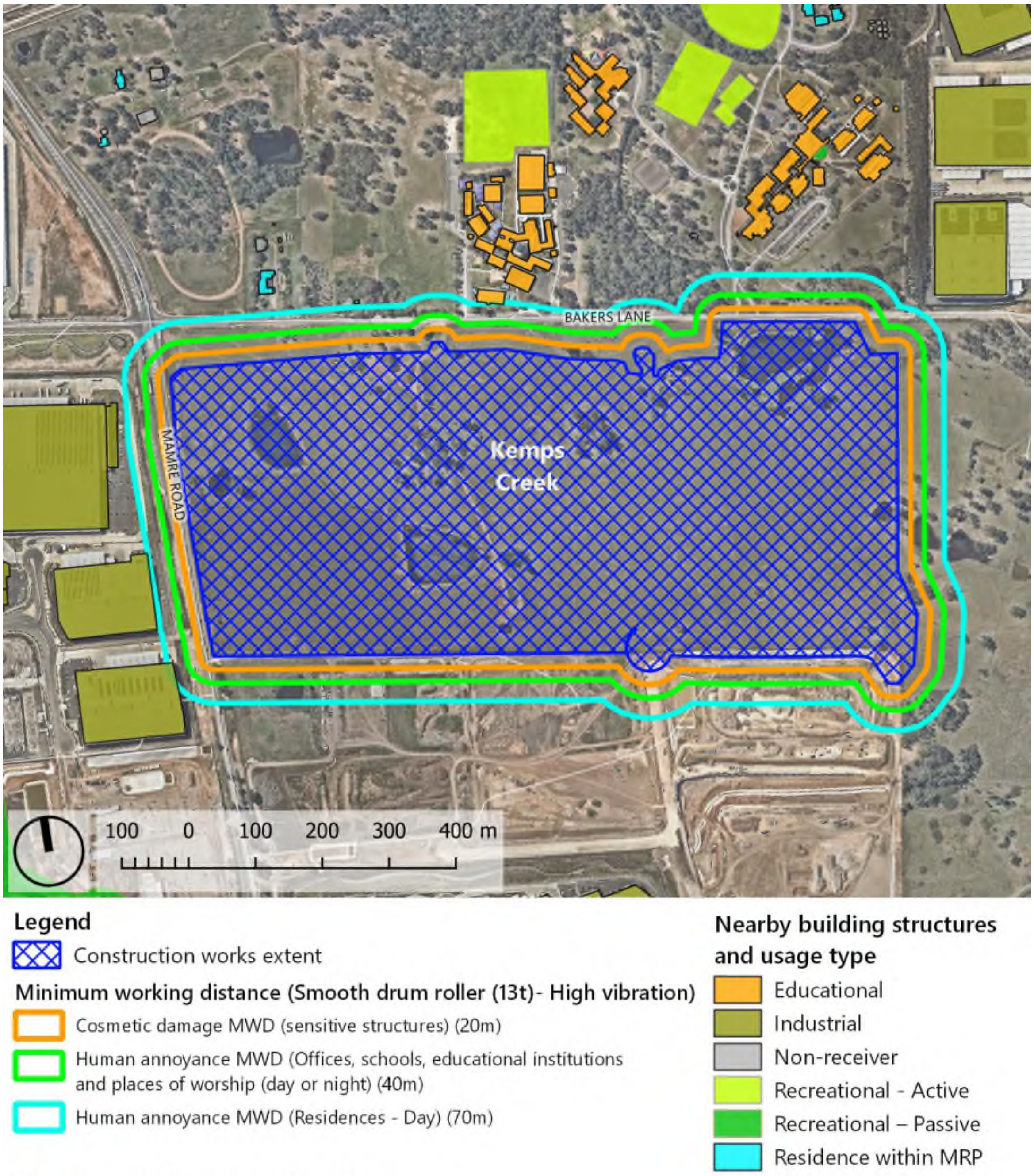
Notes:
1. Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am
2. Appliable when in use
3. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria specify above. Stipulation of such criteria is outside the scope of their policy and other guidance documents (e.g. relevant standards) should be referred to. Source: BS 6472-1992
4. Offices, schools, educational institutions and places of worship (day or night)

7.4.2 Construction vibration assessment

As a screening assessment, items potentially impacted by vibration were identified if they were located within worst case minimum working distances from the various proposed vibration intensive activities, for the worst case structure/receiver type.

The minimum working distance from the extent of the construction areas, based upon the most vibration intensive plant, are presented in Figure 7-5.

Figure 7-5 – Minimum working distances (MWD) for cosmetic damage from the construction area extents (most vibration intensive plant)



1. Imagery source: Nearmap (October 2025)

7.4.2.1 Cosmetic damage

Figure 7-5 indicates that the distance between the proposed construction works and the nearest sensitive receivers is likely to be sufficient for receiver buildings to be outside of the cosmetic damage minimum working distance for vibration intensive equipment.

The exception is for the proposed warehouses on the Yiribana Logistics Estate to the south, likely to be built prior to construction of the Proposal. These may be located within the cosmetic damage minimum working distance when vibratory rollers are in use nearby during proposed construction works.

Vibration monitoring shall be undertaken to determine site specific minimum working distances of vibration intensive equipment to be used as part of the construction process, such as vibratory rollers. Following this, the construction vibration management recommendations in Section 7.4.3 should be followed.

7.4.2.2 Heritage listed items

Based on a review of available data, there are no identified heritage listed items or vibration sensitive unsound structures within the vicinity of the Proposal.

7.4.2.3 Data centres

As the project is being constructed in stages, such that there will be construction works taking place adjacent to adjacent to operational data centre buildings which will include vibration sensitive equipment, there is potential for vibration impacts on adjacent data centre shells when vibration intensive works occur in close proximity.

Although some guidance is provided in Section 4.2.3 for typical acceptable vibration limits for building structures that house sensitive equipment, which could be used as a guide to determine if there could be potential vibration impacts from vibration intensive construction works, it is not known if this is appropriate for the data centre equipment.

It is recommended that the equipment specific recommended vibration levels should be obtained from instrument manufacturers to aid with construction vibration management. These limits should then be implemented into the construction design, planning and management in a feasible and reasonable manner.

If there is any risk of exceeding the established limits after all of the above options have been considered, the vibration management processes detailed in Section 7.4.3 should be followed.

7.4.2.4 Human annoyance

Figure 7-5 indicates that the nearest sensitive receivers are generally located outside of the human comfort minimum working distance for vibration intensive equipment when 13t vibratory rollers are in use nearby during proposed works. The nearest residences in NCA01, and the Mamre Anglican School in NCA02 are located close to but outside of the minimum working distances for human annoyance, while the nearest warehouses in Kemps Creek Estate to the south and east could be located within the minimum working distance. Should warehouses on the Yiribana Logistics Estate to the south be built prior to construction of the site, these may be located within the cosmetic damage minimum working distance when vibratory rollers are in use nearby during proposed construction works.

As such, as nearby sensitive receivers are close to the minimum working distances for the proposed construction works there is potential for human annoyance, noting the variability of construction vibration. The potential for human annoyance impacts should be further reviewed during construction planning and managed appropriately when vibration intensive works are proposed to take place within established site specific acceptable minimum working distances with the known construction methodologies. These approaches are further detailed in Section 7.4.3.

7.4.3 Construction vibration management measures

The following vibration management measures are provided to minimise vibration impact from construction activities to the nearest receivers:

7.4.3.1 Cosmetic damage

1. Where construction activities occur in close proximity to:
   a. sensitive receivers/structures or on material that will likely cause vibration to any identified receiver/structures, or;
   b. within the identified minimum work distances.

   Vibration testing of actual equipment on site should be carried out prior to their commencement of site operation to determine site specific acceptable minimum working distance to the nearby sensitive receiver/structures location/s.

   The minimum working distances and vibration limits for the Proposal will be based upon the vibration limits identified in Section 4.2.

   Undertake attended vibration measurements at the commencement of vibration-generating activities to establish site-specific minimum working distances and re-assess potential impacts (if required). This may include further detailed analysis based on the frequency content of the vibration levels.

2. If vibration intensive work is proposed to occur within the site specific acceptable minimum working distance, then the following would be carried out:
   a. Evaluate whether alternative construction methods, plant or equipment can be utilised for the works and re-assess potential impacts (if required).
   b. If there is any risk of exceeding the vibration objectives identified in Section 4.2 and after all of the above options have been considered, a permanent vibration monitoring system should be installed, to warn plant operators (via flashing light, audible alarm, SMS, etc) when vibration levels are approaching the structural/cosmetic damage limits. It is recommended that for the operator alerts, that multiple alert levels are set. Typically, this would be an alert trigger level at 75% of the vibration criteria (ie. amber alert), and an alert trigger level at 100% of the vibration criteria (ie. red alert).
   c. A management procedure would be developed prior to the works taking place to determine the response to each trigger level. It is recommended that this includes a

pause and management measures for an alert trigger level at 75% of the vibration criteria, and stop work at an alert trigger level at 100% of the vibration criteria. Where stop work is triggered, it is recommended that the following are undertaken:

STOP WORKS ACTIONS

i. Investigate cause of exceedance

ii. Visual inspection of the vibration sensitive building/structure/item including photos

iii. If no cosmetic damage is found, works and vibration monitoring can be resumed

iv. If cosmetic damage has been identified, repair damage or undertake any specific required action (ie. data centre notification) and a different construction method with lower source vibration levels is to be used.

d. If works are proposed within the cosmetic damage minimum working distance, prior to starting work a building/structure condition survey would be carried out on vibration sensitive items/structures within the minimum working distances and vibration limits determined to manage cosmetic damage.

3. Dilapidation surveys must be conducted for all receivers and structures within close proximity of the construction site, including those identified as within the vibration minimum working distances for cosmetic damage for the construction site, prior to commencement of activities with the potential to cause property damage.

7.4.3.2 Human annoyance

Many building occupants assume that building damage is occurring when they feel vibration or observe rattling of loose objects, however the level of vibration at which people perceive vibration or at which loose objects may rattle is far lower than vibration levels that can cause damage to structures. At properties near the construction works, nearby receivers may be able to feel vibration when vibration-generating equipment is being utilised. For this reason, it is appropriate identify properties where there is a probability of adverse comment so that impacts can be managed.

1. A management procedure should be implemented to deal with vibration complaints. Each complaint should be investigated and where vibration levels are established as exceeding the set limits, appropriate amelioration measures should be put in place to mitigate future occurrences.

2. Where vibration is found to be excessive, management measures should be implemented to ensure vibration compliance is achieved. Management measures may include modification of construction methods such as using smaller equipment, establishment of safe buffer zones as mentioned above, and if necessary, time restrictions for the most excessive vibration activities. Time restrictions are to be negotiated with affected receivers.

3. Attended vibration measurements for human annoyance should be carried out as required to appropriately manage the works. The proximity of neighbouring residences will be

communicated to subcontractors highlighting the relevant vibration restrictions and criteria for the area. This information will also be communicated during pre-tender meetings, start-up meetings and site inductions of personnel.

4. Notification by letterbox drop would be carried out for all buildings in the vicinity of the construction site. These measures are to address potential community concerns that perceived vibration may cause damage to property. Notification is to be provided to all occupants prior to any works that may cause vibration.

5. Following the implementation of feasible and reasonable mitigation and management measures, where construction vibration levels remain above the human annoyance limits when a premises is occupied, vibration intensive works, including the use of vibratory compactors, may continue where there is an agreement in place with the potentially impacted receiver.

7.5 Complaints management

Noise and vibration levels generated by construction activities associated with the construction of the development must aim to comply with the noise and vibration goals set by the relevant regulations and guidelines. The contractor is responsible for ensuring that all reasonable and feasible mitigation and management measures are implemented such as the provision of a Noise and Vibration Complaints Program, to minimise the generation of excessive noise and/or vibration levels from the site to nearby sensitive areas.

Owners and occupants of nearby affected properties are to be informed by direct mail/email or a direct telephone line and contact person to either make a noise and/or vibration complaint or request information.

Nearby development should be notified of the proposed works.

The notification should outline:

- Details of a site point of contact.
- The anticipated duration of the project construction works.
- Identify the duration of the construction stages.
- Identify what stages will have greatest potential impact on each resident. This will provide much clearer information for each party about how the site work will impact them specifically (the duration over which the greatest noise impact will occur).

All noise and/or vibration complaints associated with the construction works shall be investigated in accordance with the Noise / Vibration Complaint Management Procedure identified in APPENDIX G.

8 Operational noise assessment

8.1 Noise generating operations

8.1.1 Operational scenarios

The following operational scenarios have been considered in order to assess the noise from the site operation. These include:

- **Typical operations,** which are consider the following:
    - **Day:** all equipment operating and other concurrent site operations, in addition to maintenance testing of back-up generators with associated load backs under a scheduled testing regime (see Section 8.1.3)
    - **Evening and night:** all equipment operating and other concurrent site operations.
- **Emergency critical power failure** (see Section 5.4 and 8.1.4)

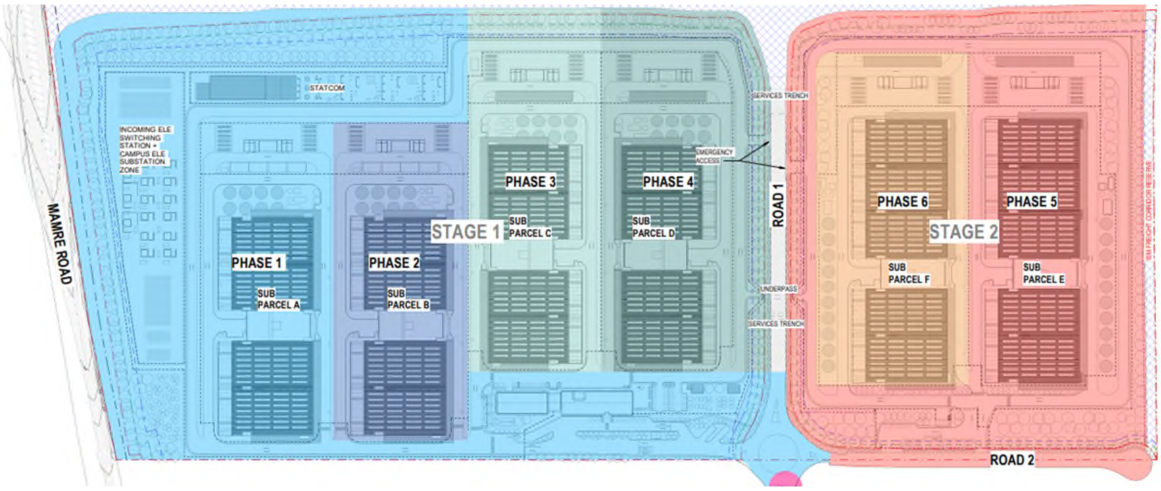
8.1.2 Development staging

The development of the Proposal is proposed to be staged. For the full campus development there will be six Parcels, as shown in Figure 8-1. The are to be developed in sequence from Phase 1 to Phase 6. Each Parcel will be constructed of either four Shells (Parcel A to D) or five Shells (Parcel E and F).

As part of the construction of each Parcel each Shell will be constructed separately and progressively.

As required by the SEARs, noise modelling has considered the staging shown in shown in Figure 8-1. The layout for the individual stages, and the structures that are considered are included in APPENDIX B.

Figure 8-1: Operational staging



8.1.3 Maintenance and testing operations

8.1.3.1 Backup generator maintenance testing

Maintenance testing of emergency plant and equipment (ie. backup generator systems) is proposed to occur during the daytime period (7am to 6pm Monday to Saturday; or 8am to 6pm on Sundays/Public Holidays). This would occur as part of typical operations, and has been incorporated into the noise modelling for the day period.

It is planned for a maximum of six generators to be tested at a time. The testing regime for the generators is summarised in Table 8-1 below.

Table 8-1: Standy generator maintenance testing schedule

Parameter	Details
Total number of generators to be tested	846
Testing frequency	Annual (once per year)
Generators tested simultaneously	Up to 6
Total run time per test	Up to 60 minutes
Testing hours	Daytime period (7am to 6pm Monday to Saturday; or 8am to 6pm on Sundays/Public Holidays)

The testing load bank will be located on the ground level and adjacent to each Shell. The current Proposal design is based on a single generator tested at any one time per Parcel. As there is only one load bank for each Shell, this means that only one generator within each Shell can be tested at a time. As such, this means that where simultaneous generator testing is taking place, this would be distributed across the data centre campus.

Due to the variation in locations for each generator tested, and as testing takes place one at a time in each Shell, this means that the combination of generators which result in the worst case noise levels would vary for each receiver. As such, the assessment methodology has been done to take this into account.

As detailed in Section 5.4, the Proposal will be served by a new 330 kV substation, located in the northwest corner of the site, directly fed from the Sydney West BSP via three redundant 330 kV feeders in an N-1 configuration, sized so that the full site load can be accommodated on 2 of the 3 feeders.

In the case of other required maintenance operations, where a Parcel transformer or Incoming electrical switching station transformer is required to be taken offline for maintenance or other purposes, then the incoming feeder would be changed such that the transformer could be taken offline without the requirement for generators to operate.

8.1.3.2 Other maintenance testing

8.1.3.2.1 Fire pumps rooms

The fire pump room is located on the southern side of Parcel D, adjacent to the COSH. This contains the hydrant pumps with associated mechanical ventilation for the room as per the SSDA NVIA. Maintenance testing of hydrant pumps is proposed to take place during the daytime period (7am to 6pm Monday to Saturday; or 8am to 6pm on Sundays/Public Holidays).

8.1.4 Emergency operations

During emergency critical power failure, where all electrical feeders to the site are compromised, it is expected that all generators would operate. For the fully developed campus, this would be for all generators identified in Table 8-1, while this would be less generators when not all stages have been constructed and are operational. This is reflected in the modelled number of generators as per Table 8-14.

As detailed in Section 5.4, this is expected to be an extremely rare occurrence of this scenario. As such, the predicted noise levels for emergency operations presented in Section 8.5.3 are for information purposes only.

8.2 Operational noise sources

8.2.1 Overview

To undertake a noise and vibration assessment for the facility, the NPfI requires a comprehensive assessment of the potential operational noise emissions from the Proposal. The basis of these noise emissions is what would be the “reasonable worst case 15-minute period” noise emissions for each of the Day (7:00am to 6:00pm), Evening (6:00pm to 10:00pm) and Night (10:00pm to 7:00am) periods.

The noise sources associated with the operation of the Proposal can be separated into the following categories:

- fixed mechanical and electrical plant/equipment, including emergency equipment (i.e. backup generators)
- staff vehicle movements and car parking
- loading dock activities

Although the internal noise level of some technical spaces can be high (eg. 80-85 dB(A)), as the internal spaces are conditioned, these spaces are sealed and are not expected to contribute to noise emissions. It has been assumed that noise breakout from internal noise levels via building services elements or through openings/penetrations identified during further design development will be acoustically designed so as to ensure that noise emission outcomes remain consistent with this assessment.

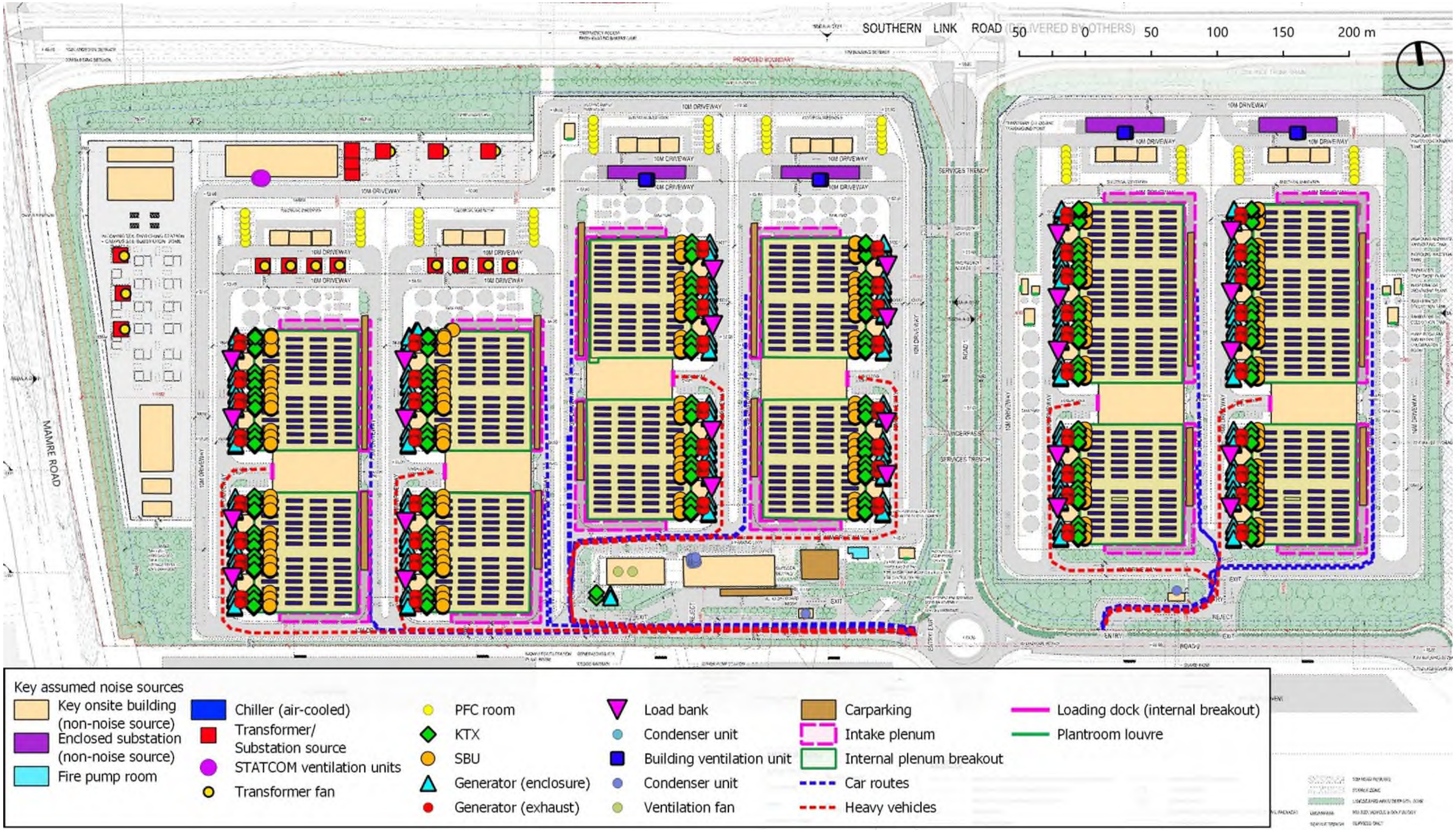
The following sections detail the key noise generating plant and equipment that will operate as part of typical operations of the facility. This section details the noise sources and associated operational assumptions.

The type and quantity for each of the various noise sources assessed across the operational scenarios are detailed in the relevant section of Section 8.1. For reference, the overall Proposal plan is presented in Figure 1-1.

8.2.2 Description of operational key noise sources

Figure 8-2 presents the Project plans showing the assumed locations of noise generating plant, equipment and activities that has been included in the noise modelling. This is based upon the project design combined with operational information provided by the client and project team in preparation of this NVIA.

Figure 8-2: Modelled noise generating components diagram (fully developed campus, with all Parcel A/B/C/D/E/F)



8.2.3 Key mechanical plant and equipment

Mechanical plant and equipment, along with other building services are the key sources of noise as part of a data centre's operations. The key building services and mechanical plant items likely to operate within the facility and which have been considered for the noise assessment are:

- Cooling systems
- Electrical distribution (low and high voltage) and storage
- Testing, auxiliary equipment, power generating equipment
- Additional building services and mechanical systems

At this early development approval stage of the Proposal the mechanical plant/equipment design and selection have not been finalised. For assessment purposes, the key likely plant and equipment have been identified and locations shown in Figure 8-2 and further details of the various items included in this section. These have then been used to determine likely noise emissions, and likely mitigation and management measures required to achieve the noise goals detailed in Section 5 and demonstrate the Proposal is able to achieve the PNTL with likely equipment.

The following section also detailed the assumed mitigation measure assumptions that have been developed with the project team and incorporated into the design in order to determine a design that would achieve the required NPfI project trigger levels detailed in Section 5.2.4.

It is assumed that all the identified mechanical plant noise sources could typically operate during all assessment periods and have been included in the noise modelling during all assessment periods as such.

The location of the main items of plant is shown in Figure 8-2. The sound level data for the equipment and operational quantities were provided by the project team with supplementary data from the RTA database used where appropriate.

8.2.3.1 Cooling systems

The main cooling system mechanical element will be the use of air-cooled chillers.

A range of cooling systems including both hybrid-dry coolers/ cooling towers, water cooled chillers, and air-cooled chillers were considered as part of design development. However, for acoustic purposes, the use of air-cooled chillers was preferred, as a focus on acoustic treatment at source was primary, and the lowest at-source noise levels could be obtained for the project through an air-cooled chiller selection, combination with on-unit mitigation. The modelled noise source levels for the day, evening and night periods for the cooling towers are detailed in Table 8-2.

Table 8-2: Assessment equipment noise levels – Air-cooled chiller selection

Plant/equipment	Full campus quantity operating	Period	Individual source/activity sound power level (Lw re. 1pW), $L_{Aeq,15min}$								
			Overall dB(A)[2,3]	Octave Band Centre Frequency - Hz dB[2,3]							
				63	125	250	500	1k	2k	4k	8k
Air cooled chiller Trithermal TACA1140B1NB[1]	728 (28 units per shell, 26 shells)	Day	87	83	87	87	83	82	78	76	80
		Evening	87	84	87	87	83	82	77	75	80
		Night	87	88	89	87	83	82	76	75	80

Notes:
1. Ambient dry-bulb temperature, Daytime = 35.2ºC, Evening = 32.1ºC, Night = 24.4ºC, based upon 99th percentile ambient condition
2. Assumed sound data modelled with a +/- 3 dB(A) tolerance.
3. Based upon source level information provided by the supplier.
4. Unit height is 2.7m.

These quietest units available were investigated and have been adopted for the Proposal, which include substantial acoustic mitigation. Details of the units are included in APPENDIX D.

Supplier data for the selected units was provided in octave band spectrums only. For assessment purposes, these have been converted to one-third octave band spectrum based upon RTA measurements of similar units from the same supplier at a similar design point.

As the base selected units were found to require further mitigation in order to achieve the overall noise requirements, a range of further mitigation measures were investigated and incorporated into the design. The focus of these noise mitigation measures was at source. These are detailed in Section 8.3.2.

As part of the mitigation investigation, the noise contributions from the intake and discharge components of the units have to be separated. This division was based upon RTA measurements of similar units from the same supplier at a similar design point.

The final cooling system operations and duty points will be further designed and refined as part of Proposal design development.

8.2.3.2 Low-voltage electrical distribution and storage

Located on the roof level and gantries on other levels are the following equipment items.

- Transformers kiosks (2250 kVA)
- Short Break Units (SBU)
- Power train units (noise breakout assumed not to contribute to overall noise levels)

The modelled noise source levels for the transformers are presented in Table 8-3 below.

Table 8-3: Noise source levels – Low-voltage electrical distribution and storage

Plant/equipment	Full campus quantity	Individual source/activity sound power level ($L_{w\ re.\ 1pW}$), $L_{Aeq,15min}$								
		Overall dB(A)	Octave Band Centre Frequency - Hz dB							
			63	125	250	500	1k	2k	4k	8k
Transformer kiosk (2250 kVA)[1,2,3]	780 (6 per level, 5 levels per shell, 26 shells)	65[2]	64	65	60	58	64	51	50	38
Short Break Units (SBU)[4]	780 (6 per level, 5 levels per shell, 26 shells)	65	77	76	70	53	46	46	49	77

Notes:

1. Based upon a dry type of distribution transformer, within kiosk
2. Mitigated noise level. Sound power level based upon supplier test certificate, with mitigation noting that the measured levels can be obtained although they are lower than the guaranteed sound power level.
3. Spectrum based upon RTA measured transformer
4. Breakout as a result of indicative internal ventilation fans, includes mitigation to ventilation openings (eg. 2.5m 100mm thick internally insulated ductwork). Unmitigated sound power level, L_w 84 dB(A).

8.2.3.3 Testing, auxiliary equipment, power generating equipment

These are located on the western side of Parcels A, B, E and F, and the eastern side of Parcels C and D. Generators are located across 5 levels of each shell. Further details about the operations of the generator maintenance testing and associated equipment (ie. load banks) are detailed in Section 8.1.3.

- All generators will be a containerised solution, with specifically designed acoustic enclosures.
- During a maintenance testing, up to six generators would operate during daytime testing, as detailed in Section 8.1.3.
- Testing will typically take place using the dedicated load bank for each shell as per detailed in Section 8.1.3.

The modelled noise source levels for the backup emergency generators are presented in Table 8-4.

Table 8-4: Noise source levels – Electrical distribution and storage

Plant/equipment	Location	Full campus quantity	Individual source/activity sound power level ($L_{w\ re.\ 1pW}$), $L_{Aeq,15min}$								
			Overall dB(A)	Octave Band Centre Frequency - Hz dB[4]							
				63	125	250	500	1k	2k	4k	8k
Containerised generator unit (backup power only) (2.5 kW)[1,2,4] Acoustic enclosure	Generator gantries	130 for each Parcel A-D 162 for each Parcel E/F Total=844	90[2]	109	103	82	45	21	26	59	86
Containerised generator unit (backup power only) (2.5 kW)[1,2,4] Discharge	Discharging through solid gantry façade wall		79[2]	98	92	71	34	10	15	48	75
Generator exhaust flue outlet[5,10]	Data centre rooftop (flue discharge)	Total=844	78[10]	90	90	76	67	71	71	58	35
Containerised generator unit (inclusive of exhaust flue)[4,5]	COSH	2	90[2]	109	103	82	45	21	26	59	86
Load bank[6]	Ground level, generator side of each parcel.	26	98[6]	101	98	96	92	92	91	89	82
Diesel fire hydrant pumps set - Internal sound pressure level (engine noise)	Fire pump room, Parcel D, southern end, adjacent to COSH (Exhaust flue discharge at roof level)	2[7]	112[8]	110	111	108	108	106	107	103	103
Diesel fire hydrant pumps set – Exhaust flue		2[7]	107[8]	105	106	96	96	98	102	101	93

Notes:

1. Overall unit sound power provided, this includes all containerised noise cumulatively, including, air intake, discharge, container breakout, exhaust flue.
2. Based upon a supplier data for containerised 2.5kW generators within custom acoustic enclosure. Based upon acoustic enclosure achieving 65 dB(A) at 1m, sound power L_w 90dB(A), with indicative generator enclosure dimensions 17m x 3m x 4m enclosure.
3. Spectrum based upon RTA measured transformer
4. Assumed enclosure sound data modelled with a +/- 2 dB(A) overall tolerance based upon supplier data.
5. Assumed exhaust flue sound data modelled with a +/- 3 dB(A) overall tolerance based upon supplier data.
6. Unmitigated load bank was, 91 dB(A) at 1m, sound power L_w 112 dB(A). Acoustic enclosure load bank 75 dB(A) @ 1 m , sound power L_w 97 dB(A), required, and assumed of modelling. Spectrum is based upon supplier data with indicative mitigation. Additional mitigation also required, see Section 8.3.3.
7. Assumed internal noise levels during testing (ie. with one engine operating).
8. An indicative fire pump has been adopted as no selection is currently available. This is based upon the following base assumed unmitigated noise levels, Engine = 126 Lw dB(A), Exhaust = 139 Lw dB(A). The noise levels presented above include typical level of mitigation for the exhaust, and assumed internal noise level within the fire pump room space. Critical grade exhaust muffler is assumed to installed and provide a minimum 32 dB(A) noise reduction.
9. Assumed plant room is constructed with minimum 150mm concrete walls, with roof construction of 1 x 0.48 mm Klip-lok roof cladding,100mm cavity filled with 75mm Bradford Fibertex 350 Mineral Wool insulation (or equivalent), 1 x 9 mm Compressed Fibre Cement internal roof lining (minimum R_w 53 system performance) or acoustically equivalent. Single sets of double solid core doors (west facade), minimum R_w 25. Acoustically equivalent alternatives are acceptable.
10. Based upon exhaust flue with muffler to achieve 70 dB(A) at 1m.

8.2.3.4 High voltage (HV) and medium-voltage (MV) electrical distribution

A 330/132kV incoming electrical switching station is to be constructed on the western side of the Campus. This is to be the connection point for the 132kV power supply on the Campus, serving six sub-parcels as follows:

- 4 x 4 shell sub-parcel (120MVA power supply) (Parcel A, B, C and D)
- 2 x 5 shell sub-parcel (140 MVA power supply) (Parcel E and F)

Each of the six sub-parcel includes one 132/33kV substation with two individually incoming 132kV underground feeders and four 132/33kV transformers.

Additionally, a STATic synchronous COMpensator (STATCOM) building and associated switching yard on the northern perimeter.

As part of the mitigation investigation identified in Section 8.3.1, the Parcel C, D, E and F substations would be enclosed buildings with transformers internal, with ventilation plant/equipment located on the southern side of the buildings.

The noise sources associated with the high voltage (HV) and medium-voltage (MV) electrical distribution system within the Proposal boundary are detailed in Table 8-5. The location of these sources is shown in Figure 8-2.

Table 8-5: Noise source levels – High-voltage electrical distribution and storage

Plant/equipment	Location	Full campus quantity	Individual source/activity sound power level ($L_{w\ re.\ 1pW}$), $L_{Aeq,15min}$								
			Overall dB(A)	Octave Band Centre Frequency - Hz dB[4]							
				63	125	250	500	1k	2k	4k	8k
Substation transformer (120 MVA)	Parcel A/B Statcom	4 per parcel 3 Statcom 11 total[5]	87[1]	78	89	94	88	74	64	51	37
Substation transformer (120 MVA)	Parcel C/D[5]	4 per parcel 8 total	See note 5								
Substation transformer (120 MVA)	Statcom	3	87[1]	78	89	94	88	74	64	51	37
Reactor[6]	Statcom	3	87[1]	78	89	94	88	74	64	51	37
Substation transformer (140 MVA)	Parcel E/F[5]	4 per parcel 8 total	See note 5								
Substation transformer (650 MVA)	Incoming electrical switching station	3	98[1]	89	100	105	99	85	75	62	48

Plant/equipment	Location	Full campus quantity	Individual source/activity sound power level ($L_{w\ re.\ 1pW}$), $L_{Aeq,15min}$								
			Overall dB(A)	Octave Band Centre Frequency - Hz dB[4]							
				63	125	250	500	1k	2k	4k	8k
Transformer fan	All transformers	6 per transformer	78 dB(A) per fan, 86 dB(A) for all fans	93	91	87	84	75	77	76	66
PFC rooms[3]	All Parcel substations	12 per parcel 72 overall	65[5]	77	76	70	53	46	46	49	77
Building ventilation unit[5]	Parcel C/D/E/F	2 per substation 8 overall	90	86	82	87	86	85	84	81	75

Notes:

1. Transformer sound power level based on AS/NZS 60076.10 (2023) - Outdoor Installation as a reduced maximum sound level and adjustment to achieve broadband levels provided by prospective manufacturer.
2. Spectrum based upon RTA measurements of similar large transformer, adjusted to achieve the identified AS/NZS 60076.10 (2023) overall broadband sound power level.
3. Breakout as a result of indicative internal ventilation fans, includes mitigation to ventilation openings (eg. 2.5m 100mm thick internally insulated ductwork). Unmitigated sound power level, L_w 84 dB(A).
4. This is a reduced noise (mitigated) noise level, as per Section 8.3.2.
5. Transformers for Parcel C/D/E/F are within an enclosed building with mechanical ventilation. Noise breakout will be designed not to contribute and so assumed negligible.
6. Reactors or capacitor banks have been assumed; the final equipment is subject to final design from Lumia.

8.2.3.5 Additional building services and mechanical systems

Additional building services and mechanical systems presented in Table 8-6 have been identified by the project team, and are also expected to operate, and have been included in the noise modelling. The location of these sources is shown in Figure 8-2.

Table 8-6: Noise source levels – Additional building services and mechanical systems

Location	Noise source	Number of sources	Individual source power level ($L_{w\ re.\ 1pW}$), $L_{Aeq,15min}$	Noise source emission location	Indicative mitigation assumptions
COSH warehouse	Ventilation fans	2	90	Roof	Indicative equipment. To be selected to achieve sound power level.
COSH	Condenser unit	9	78	Roof	Indicative COSH air-conditioning plant deck items. To be selected to achieve sound power level.
COSH	Exhaust fans	2	90	Roof	Indicative equipment. To be selected to achieve sound power level.
Guardhouse 1. Campus west 2. Campus east	Condenser unit	1 each guardhouse	78	Roof	Indicative air-conditioning plant items. To be selected to achieve sound power level.
Parcel D, E and F	Pump house (Internal breakout)	Opening 2 sqm	Internal sound pressure level (L_p) of 80 dB(A)	South facade	Internally would be multiple mechanical and building services plant/equipment items. Subject to final internal noise level. No additional mitigation measures recommended, considering open area and orientation to south.
Parcel C (north)	Pump house (Internal breakout)	Opening 2 sqm	Internal sound pressure level (L_p) of 80 dB(A)	South facade	Acoustic louvre (similar to Fantech SBL2)
Adjacent to Parcel E and F	Water (Rain/Waste) plant rooms	Opening 2 sqm	Internal sound pressure level (L_p) of 80 dB(A)	South facade	Internally would be multiple mechanical and building services plant/equipment items. Subject to final internal noise level. No additional mitigation measures recommended, considering open area and orientation to south.

Notes: 1. The sound power level includes assumed mitigation provided by the identified indicative treatment.

As part of further design development, the mechanical plant and equipment noise sources would be further assessed, and mitigated through typical building services acoustic treatment methods, such as attenuators, internally insulated ductwork, acoustic louvres and enclosures.

8.2.4 Offices and staff vehicle movements and car parking

The Proposal includes 619 at-grade car parking spaces; covering both the data centre parcels, and the COSH buildings. This includes 540 spaces across the 6 parcels, and 79 spaces surrounding the COSH buildings.

Access to the Proposal, either to the west (Parcels A, B, C, D) or east (Parcels E and F) will be via the new roundabout intersection on the southern side of the Proposal, as shown in Section 8.8. Once within the campus, car movements would then move along the internal facility roads to the respective parking areas either at a Parcel or to the COSH, nearby the entrance to the western side of the Proposal.

Once cars reach the respective parking areas, noise generated by car park activities includes vehicle doors closing, vehicle engines starting, vehicles accelerating and vehicles moving. To assess this noise, the $L_{Aeq\ 15\text{-}minute}$ noise level at the nearest affected receivers was determined for each relevant period based on the number of vehicle movements expected to occur during that period.

The assumed number of vehicles have been provided by the project traffic engineers (Ason). Further information on the traffic assumptions is detailed in Section 8.4.4 and Section 8.8 (public road assessment).

The project traffic engineers determine these movements based upon a first principles assessment, as detailed in the Transport Management & Accessibility Plan (TMAP), considering staff and customers, and two daily shifts.

Worst case 15-minute movements and carparking activities have been based upon the maximum provided movement data for a conservative assessment for each of the day, evening and night periods. These assumed movements for the fully developed campus are presented in Table 8-7.

Table 8-7: Light vehicle movement assumptions

Applicable development stage	Worst case 15-minute assumed movements		
	Day	Evening	Night
Fully developed campus	43	12	32

The sound power levels generated by carpark activities on site are presented in Table 8-8 sourced from the RTA database. The carparking activities will generate noise emissions both moving to and from carparking spaces, and from associated activities (engine starts and door slams).

Noise generated by car park activities includes vehicle doors closing, vehicle engines starting, vehicles accelerating and vehicles moving. To assess this noise, the $L_{Aeq\ 15\text{-}minute}$ noise level at the nearest affected residential premises was determined for each relevant period based on the number of vehicle movements expected to occur during that period.

Table 8-8: Staff vehicle movements and car parking activity sound power levels

Equipment / Plant	Noise source / noise generating operation	Individual source/activity sound power level ($L_{w,\ re.\ 1pW}$), $L_{Aeq,t}$, dB(A)	
		LAeq,15min	L_{Amax}
Vehicle moving (10km/h)	$L_{Aeq,t}$ - Moving point source (10km/h)	79[1]	90[2]
Carparking activities	Car engine starts	63	97
	Car door slams	56	96

Notes:
1. $L_{Aeq,t}$, sound power of moving point source. 15-minute level subject to movement duration.
2. During non-steady movement events

8.2.5 Loading dock activities

A loading dock is located centrally on one side of each parcel. These are located on western side of Parcels A, B E and F, and the eastern side of Parcels C and D. Access will be via the internal roads, via the newly constructed roundabout at the southern side of the Proposal.

A range of heavy vehicles could operate to and from the Proposal sites. It is assumed that typically up to a medium rigid vehicle could operate to and from the Parcel loading docks.

It is also expected that associated service/delivery truck movements would typically only occur during the daytime or evening period for typical operations, however, for a conservative assessment trucks have been modelled during all assessment periods.

Modelling of loading dock operations were based upon sound power levels presented in Table 8-9 which have been sourced from the Renzo Tonin & Associates database of previous measured levels.

Table 8-9: Loading dock area activities sound power levels

Equipment / Plant	Noise source / noise generating operation	Individual source/activity sound power level ($L_{w,\ re.\ 1pW}$), $L_{Aeq,t}$, dB(A)	
		$L_{Aeq,15min}$	L_{Amax}
Heavy vehicle	Moving onsite ~ 10km/h	103[1]	112
	Airbrake full release (when stopping at loading dock)	92	122
Loading dock activities	Loading dock internal activities	Internal pressure level 70 L_{Aeq}	

Notes:

1. Based upon a service/delivery truck (medium truck up to 12.5m rigid or similar) assumed to be the typical truck type.
2. $L_{Aeq,t,}$ sound power of moving point source. 15-minute level subject to movement duration.

8.3 Initial assessment and acoustic mitigation and management review

8.3.1 Initial assessment outcome

An initial assessment determined that noise emissions from site operations may exceed the SEARs cumulative project noise trigger levels without further review of noise inputs assumptions and reasonable mitigation and management measures applied across the facility.

Key noise sources that were contributing to the overall cumulative noise emission level at nearby receivers were:

- Cooling towers
- Other electrical distribution, mechanical and building services noise contributions.

As such, a detailed review of input assumptions across all contributing noise sources was undertaken, noise modelling inputs were reviewed and refined, and feasible and reasonable mitigation and management measures that could be implemented have been identified and recommended with the aim to achieve the SEARs cumulative project noise trigger levels.

Noting the elevated nature of the noise sources and their large number, combined with the varied distances to receivers, and located in multiple directions, the mitigation approach focused firstly on reducing noise at the source. At source noise mitigation included quieter unit selections, on-unit mitigation at-intake or discharge points, relocating noise sources, and enclosing noise sources where possible, before reducing noise along transmission paths to receivers were investigated (ie. noise barriers).

Consistent with the NPfI Section 3.1 control strategies were considered and implemented in a hierarchical way so that all the measures that reduce noise for a large number of receivers (that is, source controls) were considered before more localised mitigation measures were considered.

Table 8-10 identifies the items have been further investigated and identified for inclusion as part of the Proposal design:

Table 8-10: Key feasible and reasonable noise mitigation and management measure investigation

Item	Option	Outcome	Feasible / Reasonable
Chillers	Cooling system selection	Multiple cooling unit types were investigated, including cooling towers, hybrid dry coolers and air-cooled chillers. The quietest units determine were air-cooled chillers.	**Implemented**
	Unit selection	The quietest selected air-cooled chiller noise levels with acoustic mitigation measures including acoustic limiting modes were adopted. Reduction at source was prioritised, prior to secondary and in path mitigation measures.	**Implemented**

Item	Option	Outcome	Feasible / Reasonable
	Air-intake pathway	The air-intake pathway was closed off in a plenum space to minimise noise breakout from these sources. Air-pathways for this plenum pathway were acoustically treated.	**Implemented**
	Discharge pathway	Acoustic mitigation, with consideration of minimising unit static pressure requirements were investigated at implemented.	**Implemented**
		Noise walls around the roof plant area were investigated, following a focus on at-unit noise mitigation. These were then implemented around the perimeter of the roof area, in locations where they were deemed effective.	**Implemented**
		Increased height perimeter barriers. Alternative at-source mitigation was adopted as a more effective alternative method of noise control. Further height increases could not be accommodated for non-acoustic reasons.	**Not implemented** **Feasible but not reasonable**
Substation transformers and equipment	Transformers Parcel A/B	Reduced sound power levels in accordance with AS/NZS 60076.10 (2023) investigated and implemented. These were insufficient for Parcel C/D/E/F, and so enclosed substation designs will be further investigated during later design stages.	**Implemented**
	Transformers Parcel C/D/E/F	Where reduced sound power level transformers were insufficient, which was for Parcel C/D/E/F, enclosed substation designs will be further investigated during later design stages.	**Implemented**
Emergency power	Containerised generators	Low noise bespoke acoustic enclosure designs for the generators investigated and are to be implemented.	**Implemented**
	Load bank mitigation options	Load banks to be selected and designed with acoustic mitigation and would be located within dedicated locations that would be acoustically treated. Alternatively, they relocated on the southern end of each parcel.	**Implemented**
		Alternatively, they relocated on the southern end of each parcel.	**To be further investigated during future stages**

8.3.2 Summary of recommended design mitigation and management measures

Following the initial assessment of the site noise emissions, a range of feasible and reasonable mitigation and management measures were further investigated and identified in order to determine a design that would achieve the PNTLs and minimise noise emissions from the site.

Table 8-11 sets out recommended mitigation measures that have been included in this assessment. These are specific recommendations required for the Proposal, and further operational noise management measures that should be considered are detailed in Section 8.7.

The following acoustic mitigation measures have been developed with the project team in order to determine a design that would achieve the required PNTLs detailed in Section 5. For the site to achieve the PNTLs in Section 5 these mitigation or management measures are required to be implemented or are to be further investigated during design development to achieve the equivalent acoustic outcomes.

The mitigation and management measures in Table 8-11 are to be further reviewed as required during future design development stages so that they can be reasonably incorporated into the Proposal design as part of further design development where feasible, or alternative strategies developed to achieve the equivalent acoustic outcomes.

The predicted noise levels presented in Section 8.5.1 incorporate the indicative noise mitigation and management measures presented in Table 8-11.

Table 8-11: Recommended and incorporated design mitigation measures

ID	Plant/ equipment	Details of assumed mitigation measures		Figure ref.
M1	All	Select equipment with sound power no more than the one listed in Section 8.2, considering the source locations shown in Figure 8-2.		Figure 8-2
M2	Air-cooled chillers	Discharge path	Chillers are to be selected to not exceed the noise levels detailed in Section 8.2.3.1.	Figure 8-3
M3			Acoustic attenuators are to be installed on the discharge of each unit/fan (equivalent to 900mm long (1 diameter) circular attenuators, Fantech C1-045QS or similar).	Figure 8-3
M4			Solid noise barrier/wall, minimum 2.5m above top of the chiller attenuators. Acoustic absorption (approx. NRC 0.85) installed to the internal face of the noise barrier (ie. facing the chillers) for an area sufficient to reduce noise levels for receivers to the south. These are to be located along the west, north, and east sides of each set of two/three shells. See Figure 8-3 for proposed locations.	Figure 8-3 Figure 8-5
M5		Intake path	Acoustically mitigated closed off plenum spaces for the chillers, which is assumed to include: • Solid roof baffle installed at cowl level across the chiller area, closing off the intake room below (ie. Level 5). This is to be constructed of solid material, minimum acoustic transmission loss R_w 24. • Acoustic absorption (approx. NRC 0.85) installed to the underside of this roof and throughout the entire space or equivalent acoustic outcome. • Acoustically mitigated Parcel perimeter intake plenum. To designed during future design stages. The noise modelling assumed intake plenum to be 7m wide, minimum indicative 15m long (ie. 8m overlap from floor of Level 5), along the non-generator sides of each shell. This is to include insulated internal septum structures. Internally insulated with acoustic absorption (minimum 100mm thick, approx. NRC 0.85) on all surfaces, including the building wall (see Figure 8-3 and Figure 8-4), or equivalent acoustic outcome. • For the centre parcel intake attenuator (Parcel south north façade), the air-intake along the northern façade of southern parcel shells, install a 4m long 75% open attenuator (similar acoustic performance to the indicative attenuator selection NAP S75/400).	Figure 8-3 Figure 8-4

ID	Plant/ equipment	Details of assumed mitigation measures		Figure ref.
M6	Substation transformer (Parcel) – Parcel A/B	Transformers are to be designed with reduced noise levels, to not exceed the noise levels detailed in Section 8.2.3.4. This is to achieve the reduced noise levels for transformers as per AS-60076.10-2023 'Power transformers' for all transformers. This includes consideration of operating load.		Figure 8-2
M7		Minimum 9m noise/blast wall along the northern, eastern and western sides of each transformer foundation area (see Figure 8-5 for locations).		Figure 8-5
M8	Substation transformer (Parcel) – Parcel C/D/E/F	Transformers are to be housed in a dedicated enclosed substation with access doors (ie. closed roller doors) on the southern side. This is to be designed so that the noise breakout is a negligible contributor to noise emissions.		Figure 8-2
M9		All mechanical ventilation plant/equipment, including any required façade louvres, for the enclosed substations are to be located on the southern side of the building, and acoustically designed to minimise noise emissions.		
M10	STATCOM	Transformers	Transformers are to be designed with reduced noise levels, to not exceed the noise levels detailed in Section 8.2.3.4. This is to achieve the reduced noise levels transformer as per AS-60076.10-2023 'Power transformers' for all transformers. This includes consideration of operating load.	Figure 8-2
M11			Minimum 9m noise/blast wall along the northern, eastern and western sides of each transformer foundation area (see Figure 8-5 for locations).	Figure 8-5
M12		STATCOM building	The STATCOM building is to be designed so that the noise breakout is a negligible contributor noise emissions. This will likely include access doors (ie. closed roller doors) on the southern side.	Figure 8-2
M13		Chillers / ventilation / cooling units	Equipment to be selected to not exceed the noise levels detailed in Section 8.2.3.5.	Figure 8-2
M14			Units are to be located on the southern side of the building and acoustically designed to minimise noise emissions.	Figure 8-2
M15	Substation transformer (Incoming electrical switching station)	Transformers are to be designed with reduced noise levels, to not exceed the noise levels detailed in Section 8.2.3.4. This is to achieve the reduced noise levels for transformers as per AS-60076.10-2023 'Power transformers' for all transformers. This includes consideration of operating load.		Figure 8-2
M16		Minimum 9m noise/blast wall along the northern, eastern and western sides of each transformer foundation area (see Figure 8-5 for locations).		Figure 8-5
M17	PFC rooms	PFC rooms are to be designed to achieve the acoustic ratings as per Section 8.2.3.4 (Table 8-5), which includes acoustic mitigation to ventilation openings.		Figure 8-2
M18	SBU rooms	SBU rooms are to be designed to achieve the acoustic ratings as per Section 8.2.3.2 (Table 8-3) which includes acoustic mitigation to ventilation openings, (except where in enclosed space, ie. Level 5).		Figure 8-2
M19	Transformers (KTX)	Gantry transformers (KTX) provided by the supplier so designed to be no louder than detailed in Section 8.2.3.2 (Table 8-3).		Figure 8-2
M20	Pump house (Parcel C)	Any louvres would be located on the southern side. Noise emissions from openings to be assessed and designed during later design stages, based upon location, size and final internal noise levels. Allowance for 300mm deep acoustic louvres (Fantech SBL1 or similar) to be made.		Figure 8-2
M21	Containerised generator unit	Generator acoustic enclosures to be designed to achieve the acoustic ratings as per Section 8.2.3.3 (Table 8-4). This applies to the entire enclosure. Alternative generator enclosure rating can be adopted following detailed review, as per Section 8.3.2.1.		Figure 8-2
M22		Generator exhaust flues with silencers are be designed to achieve the acoustic ratings as per Section 8.2.3.3 (Table 8-4).		

ID	Plant/ equipment	Details of assumed mitigation measures	Figure ref.
M23		Generator maintenance testing would take place during the daytime period (7am to 6pm Monday to Saturday; or 8am to 6pm on Sundays/Public Holidays), as per Section 8.1.3. Where required testing would be managed as per Section 8.3.4.	
M24	Load bank	Selection of acoustically mitigated load bank to achieve the sound power requirement detailed in Section 8.2.3.3 9 (Table 8-4). Additionally, with the load bank operating position is to also incorporate a dedicated enclosure and/or high noise wall around mitigated load bank location (assumed and modelled as close fitting noise wall up to 2m above the unit). This is applicable for the load bank locations shown in Figure 8-5. These barriers are only required for Parcel C during the staging, when Parcel D is not present, with only the most northern most Shell required for the full campus development. Alternative design solutions should be investigated, such installation in dedicated internal spaces with acoustic mitigation, or relocated to acoustic shielded locations (eg. relocated to the southern end of the parcel in a shielded location).	Figure 8-2
M25	Fire pumps	Fire pump maintenance testing would take place during the daytime period (7am to 6pm Monday to Saturday; or 8am to 6pm on Sundays/Public Holidays), as per Section 8.1.3.	-
M26		Fire pump room to be designed to achieve the acoustic ratings as per Section 8.2.3.3 (Table 8-4).	-
M27	Additional building services and mechanical systems	The indicative mitigation measures assumed and recommended in Section 8.2.3.5 are to be further investigated as part of future design development.	-
M28	Proposal wide - To be undertaken as part of future design stages.	A detailed assessment of noise emissions is to be undertaken during detailed design considering the final mechanical plant and equipment items at the 'reasonable' worst case expected operational state, along with the building services, mechanical plant, plantroom spaces and any other typical operational noise sources. This should specifically consider the following items: • Cooling system operations • Substations and high-voltage distribution plant/equipment • Containerised generators, load banks and generator testing requirements and management • Building services and mechanical systems Cumulative noise emissions from the Proposal operations to be designed to achieve the project noise trigger levels presented in Section 5. This will likely include incorporation of mitigation and management measures detailed in this section (Section 8.3), where they remain appropriate. This could include selection of quiet plant/equipment, acoustic absorption, noise barriers, and the use of acoustic louvres and attenuators as part of the design, with consideration of Section 8.3.5.	-
M29	Proposal wide - To be undertaken as part of future design stages	Noise barriers are to be installed as recommended in Section 8.3.3 unless further detailed analysis demonstrates that further or different acoustic mitigation measures can be implemented to achieve the project noise trigger levels presented in Section 5, considering the final plant and equipment selections and operations. Noise barriers are to be constructed as per Section 8.3.3.	-

ID	Plant/ equipment	Details of assumed mitigation measures	Figure ref.
M30	Proposal wide - To be undertaken as part of future design stages	Breakout façade penetrations and openings, in addition to breakout via materials of the facility facade and roof construction, including plantrooms, are to be considered as part of the above detailed assessment of noise emissions. These are to be designed to maintain the acoustic outcomes in Section 8.5.	-

Figure 8-3: Indicative intake mitigation (typical parcel) (Section location see Figure 8-4)

Section view

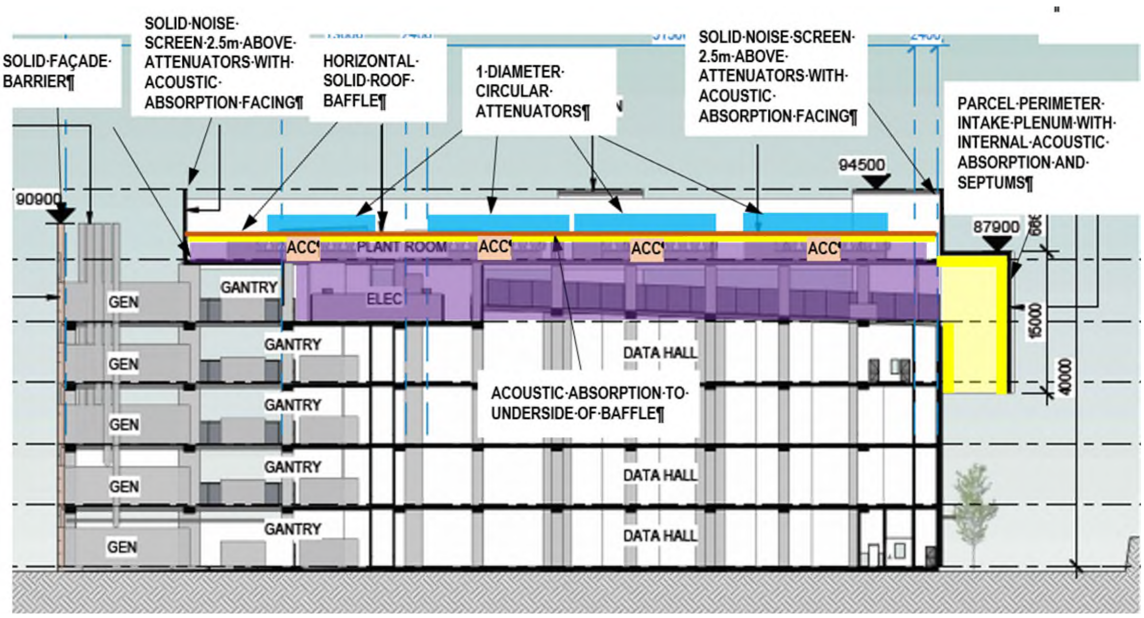
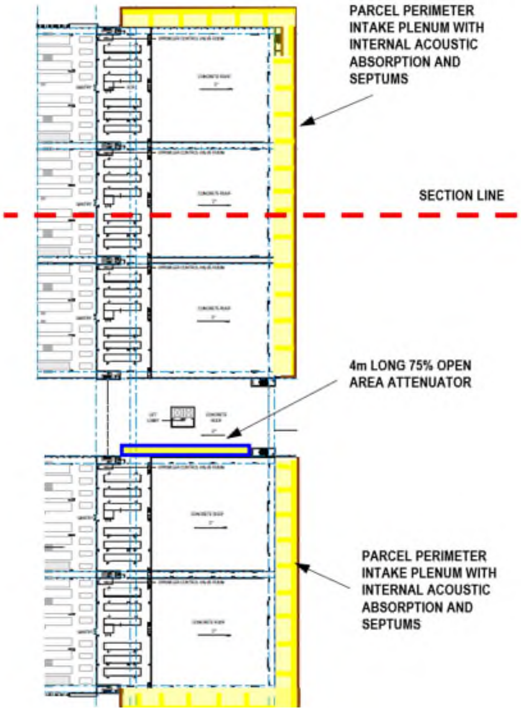


Figure 8-4: Indicative intake mitigation (typical parcel)

Plan view (indicative for 3 shell configuration, similar for 2 shell)



8.3.2.1 Generators acoustic treatment

The generator enclosures are to be designed to achieve the overall sound power level presented in Table 8-3. This overall unit sound power provided is to include the noise cumulatively from all elements including air intake, discharge, container breakout (except where specified separately for the exhaust).

However, this sound power has been identified based upon the worst case generator locations which are on the most northern or southern extent of each set of joined Shells as outlined in Section 8.4.2.

Furthermore, the exhaust flue is identified as a separate item in Table 8-3, noting it is in a different location to the generator enclosure.

Because each Shell has a solid wall covering the discharge of the generators (see Figure 8-3), noise emissions from generators closer to the centre of each Shell, and at lower floors would result in lower noise emission levels during testing from the generator enclosures. During future design development, the noise requirement for all generator enclosures can be reviewed to refine the required enclosure noise level, with detailed consideration of location and shielding. This may allow for different acoustic enclosure specifications, or just a focus on the discharge attenuator, and allow for the same acoustic outcomes as detailed in Section 8.

8.3.2.2 Additional building services and mechanical systems

Additional building services and mechanical systems presented in Table 8-6 have been identified by the project team and are also expected to operate. However, at this stage of the Proposal, the required mechanical plant/equipment design and selection have not been finalised at this early development approval stage of the project.

For assessment purposes, it is assumed that all the identified building services and mechanical plant noise sources could operate as typical during all assessment periods and have been included in the noise modelling during all assessment periods as such.

For enclosed spaces such as the pump rooms, enclosed substations, plantrooms, switch rooms, etc. similarly noise breakout through openings/penetrations from internal activity noise levels is not expected to contribute to noise emissions. As part of further design development, these spaces are to be acoustically designed so as to ensure that noise emissions outcomes remain consistent with this assessment.

8.3.3 Noise barriers and enclosures

A range of noise barriers are incorporated into the Proposal as detailed in Table 8-11. Noise barriers have been identified in Table 8-11 for the following items:

- Substation transformers – Blast walls / noise barriers, including:
  - Incoming electrical switching station

  - Statcom
  - Parcel substations (Parcel A and B)
- Generator gantries
- Roof plant area perimeter of each Parcel

The recommended barrier locations, extents are shown in Figure 8-5 with minimum heights detailed in Table 8-11.

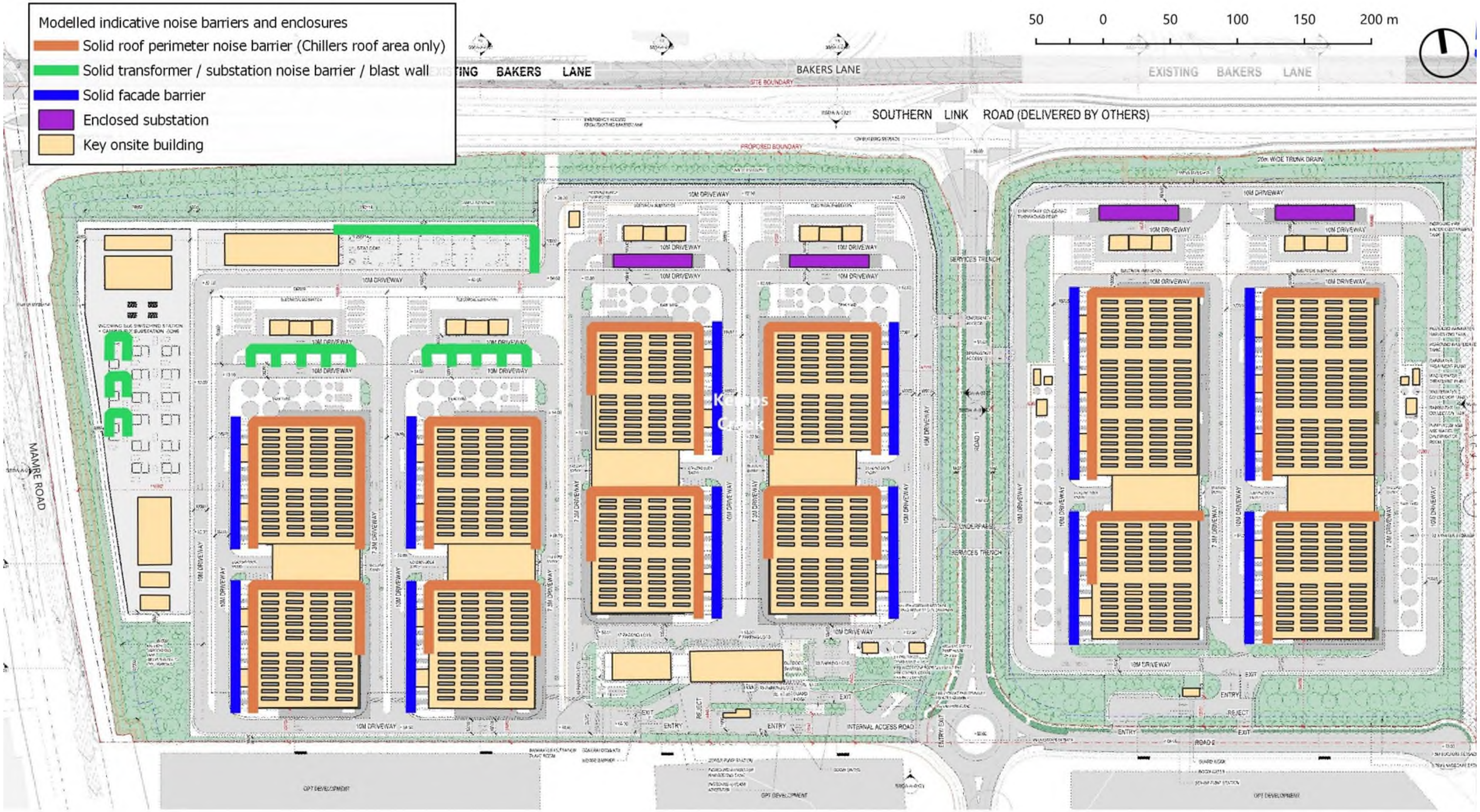
These barriers are to be constructed from any durable material with sufficient mass to prevent direct noise transmission (e.g. masonry, steel, fibrous-cement, timber, acrylic or polycarbonate) selected to withstand weather elements. In addition to the above, all noise barriers, noise screen and enclosures should give regard to the following to maintain acoustic integrity and to perform effectively as noise barriers:

- any penetrations through should be sealed airtight
- all joints and gaps between barriers or noise screens and adjacent structures should be sealed airtight.
- where joints and gaps cannot be closed off or sealed airtight, they are to be acoustically designed to not compromise the barrier/screen performance.
- any gaps between the walls and the roof should be filled to ensure that the wall provides appropriate noise attenuation.

Where gaps are required through a noise barrier (eg. for airflow or drainage), further investigation should take place such that any gaps, openings, louvres, have been sufficiently acoustically treated such that noise breakout via the opening pathway does not compromise the acoustic performance of the noise barrier. This would include acoustic louvres with sufficient insertion loss, or gaps having overlapping elements large overlaps that include acoustic absorption.

During detailed design, if gaps are required, a separate acoustic investigation should be undertaken to demonstrate and document that the gaps/openings/louvres provide sufficient acoustic performance as to not impact the outcomes presented in Section 8.5.

Figure 8-5: Proposed noise barrier locations and enclosures



8.3.4 Maintenance testing noise management

In order to manage the potential for noise impacts, including low-frequency impacts, the locations of concurrent generating testing will be managed when required in proximity to the schools within NCA02.

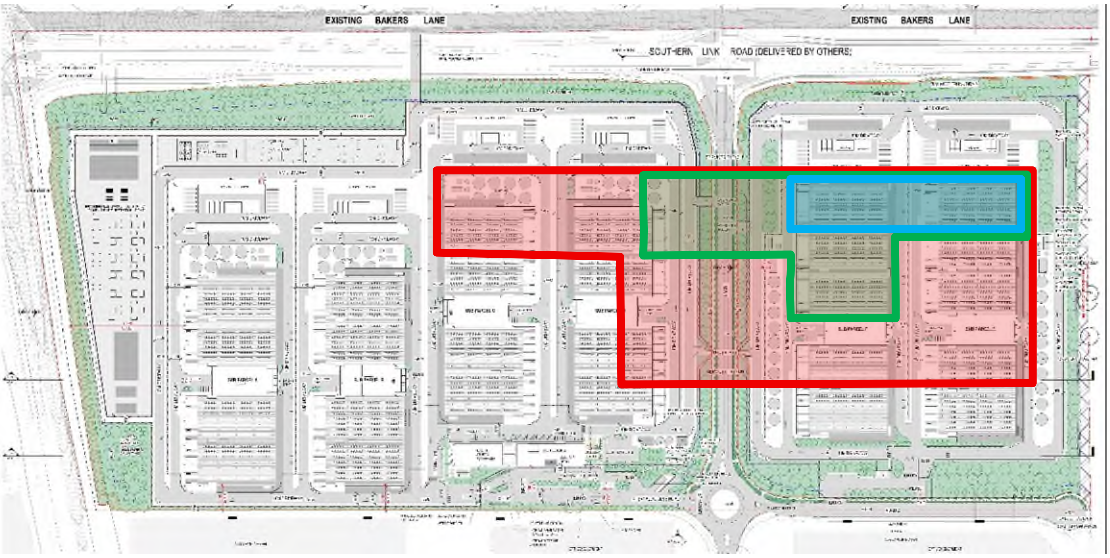
Presented in Figure 8-6 is the generator testing management area, to manage noise impacts from concurrent testing and minimise the potential for low-frequency impacts the following management measures should be incorporated into the generator testing planning.

Further investigation of undertaking testing for the generators in the identified areas outside of school hours (ie. weekends or during school holidays), as long as the combinations can achieve the required noise levels at other applicable receiver locations during these hours.

If testing is required during school hours, then the following should be followed:

- When generators are required to be tested in the blue area (ie. northern most shell of Parcel E), only up to **four generators** can be tested concurrently - allowing up to three other generators across the campus to be tested concurrently from outside of the red area.
- When generators are required to be tested in the green area (ie. northern most shells of Parcel D and F), only up to **five generators** can be tested concurrently – allowing up to four other generators across the campus to be tested concurrently from outside of the red area.
- When generators are required to be tested in the red area then up to **six generators** can be tested concurrently, allowing up to four other generators across the campus to be tested concurrently from outside of the red area.

Figure 8-6: Generator testing location management



As part of the various stages, different parcel buildings may not be present to provide shielding. Further investigation of which areas can be tested during school hours, to ensure the combination of generators being tested remain below the PNTL at the critical receivers.

8.3.5 In principle building services and mechanical plant and equipment measures

At this stage of the development, appropriate detail for all mechanical plant to undertake a quantitative assessment and determine the 'best achievable noise levels' is not available. Preferred equipment suppliers have not been confirmed and therefore a preliminary schedule of equipment was developed with the project team. In the absence of an appointed supplier, this noise and vibration assessment is based on the Project concept design and a range of supplier data to demonstrate the projects feasibility.

Upon appointment of the successful supplier, confirmation should be provided that the selected equipment is able to perform within the predictions of this assessment. As part of further design development, the final operations and duty points of the mechanical and electrical systems will be further designed and refined.

However, the biggest noise emitting items have been reviewed and addressed above and indicative plant and equipment outlined in Section 8.2.3 have been assumed for the remaining mechanical systems plant items.

Indicative mitigation measures (ie. acoustic louvres, attenuation to air openings, acoustic absorption lining, etc.) have also been identified and assumed as part of the modelling as detailed in Section 8.2.3.

As part of this further design development, these items would be readily treated with the below in-principle noise management measures, so that they would not increase to the overall site noise emissions in order to achieve the criteria presented in Section 5.2.4 during further design development stages. To ensure this, the following is required:

The following in-principle noise management measures should be considered during further design development stages:

- Acoustic assessment of mechanical services equipment should be undertaken during the detailed design phase of the development to ensure that the cumulative noise of all noise generating items and operations as part of typical operations (ie. building services and mechanical plant cumulatively with other noise sources such as trucks and loading activities) does not exceed the applicable noise criteria. This includes the detailed specification and location of mechanical plant on site.

- Noise control treatment can affect the operation of the mechanical services system. An acoustic engineer should be consulted during the initial design phase of mechanical services system to reduce potential redesign of the mechanical system.

- Mechanical plant noise emission can be controlled by appropriate mechanical system design and implementation of common engineering methods, which may include:
    - procurement of 'quiet' plant
    - strategic positioning of plant away from sensitive neighbouring premises to maximise intervening acoustic shielding between the plant and sensitive neighbouring premises
    - commercially available acoustic attenuators for air discharge and air intakes of plant
    - acoustically lined and lagged ductwork
    - acoustic barriers between plant and sensitive neighbouring premises
    - partial or complete acoustic enclosures over plant
- Fans shall be mounted on vibration isolators and balanced in accordance with Australian Standard 2625 '*Rotating and Reciprocating Machinery – Mechanical Vibration*'.

8.3.6 Considerations of the recommended mitigation and management measures

The above recommendations provide in-principle solutions to address project acoustic requirements. This information is presented for the purpose of the consent authority approvals process and for preliminary cost planning. It shall not be used for detailed design and construction purposes without approval in writing by the acoustic consultant.

The final acoustic performance, extents and quantities of noise mitigation measures and materials required, will largely depend on the final design, final selections and locations of noise generating plant and equipment across the facility and associated operations.

Assistance of the acoustic consultant must be sought during the detailed design phase of the project to confirm all details, material quantities and performance specifications are consistent with the outcomes of this assessment.

8.4 Noise prediction methodology

8.4.1 Modelling overview

Modelling and assessment of airborne noise impacts from the Proposal were determined by modelling the noise sources, receiver locations and topographical features, and possible noise mitigation measures using a 3D noise modelling package, CadnaA (Version 2025). Noise modelling algorithms were used to calculate the contribution of each noise source at each identified sensitive receiver location and to predict the total noise from the site for the various reasonable worst-case scenarios developed for the Proposal.

Critical internal spaces within the facility that could emit noise (ie. chiller intake plenum), were acoustically modelled using CadnaR (Version 2025) to determine the noise levels at the internal noise levels and noise levels at the openings to these spaces. These modelled noise levels were then incorporated into the overall CadnaA noise model.

The noise prediction modelling has considered the following:

- Location of noise sources and sensitive receiver locations (including multi-storey buildings). Each noise-sensitive building in the project has been assessed separately. Where required, multiple buildings or assessment points (including for upper floors) were included and the assessment is based upon the highest predicted noise level for the multiple locations.
- Heights of sources and receivers referenced to digital ground contours (1 metre contour intervals) or relative to the Proposal building structure.
- Noise source levels of individual plant and equipment.
- Internal noise levels within key facility spaces (ie. chiller intake plenum), and the breakout of these noise levels through the facade building elements (ie. air-intake openings).
- Separation distances between sources and receivers.
- Ground type and reflections between sources and receivers
- Ground type and reflections between sources and receivers
  - ground absorption value of 0 for the Proposal site, warehouse and industrial areas, including the future MRP extent and road network.
  - ground absorption value of 0.75 outside of this area (ie. from grassed areas / rural residential areas).
- Attenuation from barriers, buildings and structures (natural terrain and purpose built). This includes changes to the Proposal onsite buildings and structures through each of the assessed development phases as shown in APPENDIX B so that the progressive development is captured in the modelling.
- Indicative future warehouse buildings in the MRP have been included in the noise model. The future warehouse buildings are based on an indicative layout of the MRP which considered the MRP Development Control Plan built form controls, including proposed road corridors and other easements, and existing ground levels. The buildings are shown in Figure 2-1. The indicative layout of buildings within the MRP is based upon those adopted by other approved MRP developments, such as the Aspect Industrial Estate (AIE) as part of the design noise verification assessments for submission to DPHI. The indicative buildings have been modified based on approved development plans, where appropriate, or have been updated where the buildings have been constructed. All future buildings are indicative and subject to change in their respective development applications.

- Atmospheric losses and meteorological conditions.
- Feasible and reasonable noise mitigation/treatments and management measures that have been determined for the Proposal.
- Noise prediction undertaken in 1/3 octave bands, using 1/3 octave band data for key noise sources, to enable assessment of low-frequency characteristics as per NPfI Fact Sheet C.

The noise enhancing conditions presented in Section 8.4.3 have been adopted for the assessment. Both ISO 9613-2 (implemented in CadnaA in accordance with ISO 17534-3) and CONCAWE noise propagation algorithms have been implemented in the noise modelling, with the reported value based upon the highest of each algorithm, to assess potential noise impacts because:

- The surrounding potentially impacted receivers include receivers within a couple of hundred meters and up to 2-3 kilometres away, and as such distance considerations for both algorithms are address through the implementation of both.
- CONCAWE allows for the meteorological conditions presented in NPfI Fact Sheet D to be directly considered.
- 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, this approach allows for prevailing noise enhancing weather conditions in accordance with the NPfI Fact Sheet D to be included and accounted for in the assessment and provides for a conservative assessment.

8.4.2 Maintenance testing noise modelling

Each Shell has a solid wall covering the discharge of the generators, which acts as a noise barrier across the generator gantry, as shown in Figure 8-3. This means that loudest and worst case generator locations for noise emissions during testing are located at the most northern or southern extent of each set of joined Shells, in the locations shown in Figure 8-7. Generators closer to the centre of each shell, and at lower floors would result in lower noise emission levels during testing from the generator enclosures.

As such, the 24 worst case locations, based upon generators at the top most exposed floor, shown in Figure 8-7 have been modelled across all Shells across the entire Proposal, in order to determine the worst case noise level from the worst case combination of generators during testing at each receiver, as this combination changes for each receiver location. This modelling was also completed for each stage to capture the relevant acoustic shielding of the progressively build data centre buildings.

This worst case combination of generators has then been added onto the typical operations to determine the worst case daytime noise level. For example, for the for the fully developed campus for

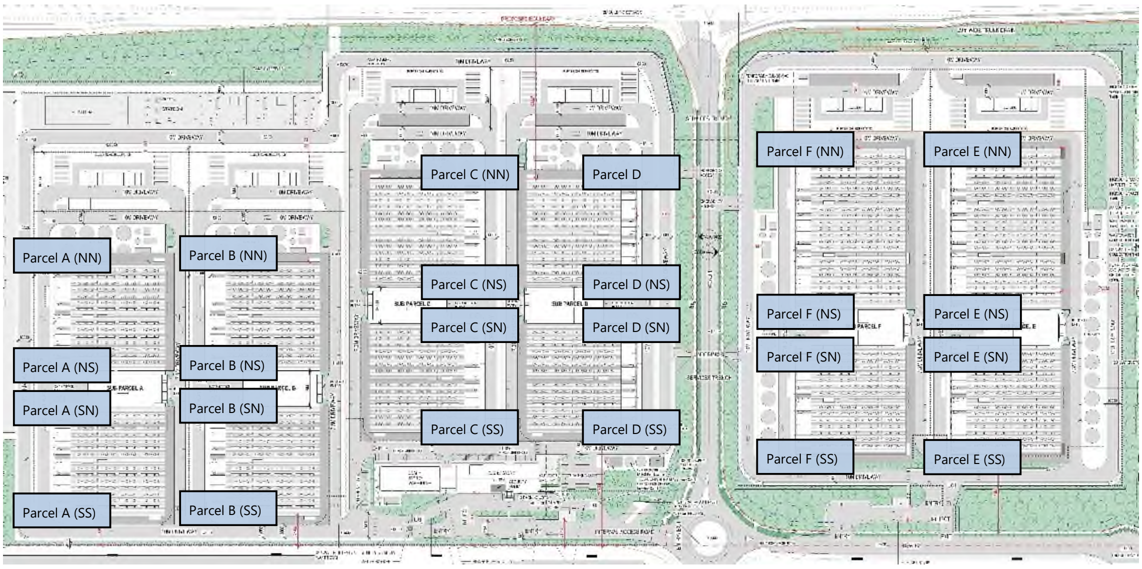
Emmaus Catholic College (N2_E01) is shown in Table 8-12. This combination of generator varies for every receiver location, and the predicted noise levels took into account that unique combination. Where different generators are tested, the cumulative noise levels are expected to be less than those presented in Table 8-16. This aimed to capture the worst-case noise levels as required by the SEARs.

The noise contour maps presented in APPENDIX E only show the worst case generator testing scenario for Emmaus Catholic College, as per the example in in Table 8-12. This has been provided as an example only. The predictions in Section 8.5.1 are based upon the worst case combination for each assessment receiver location.

Table 8-12: Example of worst case concurrent generators considered in maintenance testing modelling

Receiver	Generator 1	Generator 2	Generator 3	Generator 4	Generator 5	Generator 6
N2_E01 - Emmaus Catholic College	Parcel E (NN)	Parcel F (NN)	Parcel E(SN)	Parcel D (NN)	Parcel (SN)	Parcel E (NS)

Figure 8-7: Generator testing modelled locations for receiver specific worst case combination



8.4.3 Meteorological conditions

In accordance with the NPfI, the noise assessment is required to consider the effects of adverse meteorological conditions such as wind and temperature inversions. The NPfI recommends that project noise criteria are to apply under weather conditions characteristic of an area. These may include standard meteorological conditions (ie. calm) and noise-enhancing meteorological conditions (ie. winds and temperature inversions). In this regard, the increase in noise that results from atmospheric temperature inversions and winds may need to be assessed. The noise levels predicted under characteristic meteorological conditions for each receiver are then compared with the criteria, to establish whether the meteorological effects will cause a significant impact.

The NPfI permits two approaches for assessing these effects, either use of default parameters or use of site-specific parameters. For the purpose of this noise assessment, default parameters were used for a conservative assessment. By using default parameters, general meteorological values are used to predict noise levels, foregoing detailed analyses of site-specific meteorological data. This approach assumes that meteorological effects are conservative, in that it is likely to predict the upper range of increases in noise levels. Actual noise levels may be less than predicted.

Considering that receivers are both within a couple of hundred meters and up to 2-3 kilometres away, both ISO 9613-2 (implemented in CadnaA in accordance with ISO 17534-3) and CONCAWE noise propagation algorithms have been implemented in the noise modelling, to implement the NPfI noise-enhancing meteorological conditions. In accordance with Table D1 of the NPfI, the following default parameters have been used for the CONCAWE algorithm when modelling to assess noise-enhancing meteorological conditions.

Table 8-13: NPfI Fact Sheet D (Option 1) noise-enhancing parameters for meteorological conditions

Meteorological conditions	Default parameters	Assessment periods
Noise-enhancing conditions	Wind • Stability Category D • 3m/s wind speeds[1]	• Day (7am to 6pm) • Evening (6pm to 10pm) • Night (10pm to 7am)
	Temperature Inversions • Stability Category F • 2m/s wind speeds[1]	• Night (10pm to 7am)

8.4.4 Assessment scenarios

To assess noise impacts from the Proposal, 'reasonable' worst-case scenarios (15-minute period) assessment scenarios have been developed for assessing noise emissions from the facility for each assessment period (ie. day, evening and night). These scenarios have been developed based upon the aforementioned operational assumptions, operational inputs from the project team. The operational scenarios considered are detailed in Section 8.1.

Additionally, as required by the SEARs, these scenarios have been established for each phase, so that the progressive noise emissions from the Proposal are predicted and understood, capturing both the change in the number of noise sources, and the relative differences in acoustic shielding of the Proposal through the phases.

Table 8-14 details the 'reasonable' worst-case scenarios (15-minute period), covering the key noise generating activities detailed in Section 8.1 and noise intensive periods for the main areas of noise generation across the Proposal site, for each of the development phases. The locations of these key areas are shown in Figure 8-2 for reference.

Table 8-14: Assessment 15-minute noise generating assessment scenarios

Activity / noise sources group	Location	Activity / noise sources	Details	Quantity modelled for the reasonable' worst-case scenarios (15-minute period)						Modelling assumptions
Typical operations				**Parcel A**	**Parcels A/B**	**Parcels A/B/C**	**Parcels A/B/C/D**	**Parcels A/B/C/D/E**	**Full campus (A/B/C/D/E/F)**	
Cooling system	Roof of each parcel	Air cooled chiller	728 = Up to 28 units per shell, 26 shells	112 units	224 units	336 units	448 units	588 units	728 units	Section 8.2.3.1
Low-voltage electrical distribution and storage	Generator gantries	Transformer (KTX)	780 = 6 per level, 5 levels per shell, 26 shells	120	240	360	480	630	780	Section 8.2.3.2
		SBU	780 = 6 per level, 5 levels per shell, 26 shells	120	240	360	480	630	780	Section 8.2.3.2
	COSH	Transformer (KTX)	2	2	2	2	2	2	2	Section 8.2.3.2
High voltage (HV) and medium-voltage (MV) electrical distribution	Substation north of each Parcel	Substation transformer	4 per parcel Parcel A/B/C/D = 94 (100MVA) Parcel E/F = 96 (140MVA)	4	8	12	16	20	24	Section 8.2.3.4
		Transformer fan	6 per transformer	24	48	72	96	120	144	Section 8.2.3.4
		PFC rooms	12 per parcel 72 overall	12	24	36	48	60	72	Section 8.2.3.4
		Building ventilation unit	2 per enclosed substation	-	-	2	4	6	8	Section 8.2.3.4
	STATCOM area	Substation transformer	3 transformers (subject to final design from Lumia)	3	3	3	3	3	3	Section 8.2.3.4
		Transformer fan	6 per transformer	18	18	18	18	18	18	Section 8.2.3.4
		Reactor/capacitor bank	3 reactors (subject to final design from Lumia)	3	3	3	3	3	3	Section 8.2.3.4
		Building ventilation unit	2	2	2	2	2	2	2	Section 8.2.3.4
	Intake substation	Substation transformer	3 x 650MVA	3	3	3	3	3	3	Section 8.2.3.4
		Transformer fan	6 per transformer	18	18	18	18	18	18	Section 8.2.3.4
Additional building services and mechanical systems	COSH warehouse	Ventilation fans	Indicative warehouse ventilation	2	2	2	2	2	2	Section 8.2.3.5
	COSH	Condenser unit	Indicative air-conditioning	9	9	9	9	9	9	Section 8.2.3.5
		Exhaust fans	Indicative exhaust fan	2	2	2	2	2	2	Section 8.2.3.5
	Guardhouses	Condenser unit	Indicative air-conditioning	1	1	1	1	2	2	Section 8.2.3.5

Activity / noise sources group	Location	Activity / noise sources	Details	Quantity modelled for the reasonable' worst-case scenarios (15-minute period)						Modelling assumptions
	Multiple locations	Pump house	4 pumps rooms across campus	1	1	2	2	3	4	Section 8.2.3.5
	Parcel E/F	Water (Rain/Waste) plant rooms	2 pumps rooms across campus	-	-	-	-	1	2	Section 8.2.3.5
Carparking activities	Adjacent to each parcel	Carpark movements	Each movement is modelled on internal road and with associated carpark activity.	Campus wide = D/E/N = 43/12/32, Per parcel = D/E/N = 7/2/5, each movement is modelled on internal road and with associated carpark activity.						Section 8.2.4
Loading dock	At each parcel	Truck movements to loading dock	Each movement is modelled on internal road and with airbrake at loading dock.	Campus wide = Day = Up to 6 (one per parcel), Eve/Night = Up to 3 arrivals or departures						Section 8.2.5
Maintenance testing										
Typical operations			All typical operations taking place	As above						
Maintenance testing activities	Worst combination of multiple generator locations for each receiver (Section 8.4.2) Load bank at ground level, generator side of each parcel.	Containerised generator unit	Daytime testing only Up to 6 generators operating concurrently across the campus (except where managed as per Section 8.3.4)	4	Up to 6	Up to 6	Up to 6	Up to 6	Up to 6	Section 8.2.3.3
		Generator exhaust flue outlet		4	Up to 6	Up to 6	Up to 6	Up to 6	Up to 6	
		Load bank		4	Up to 6	Up to 6	Up to 6	Up to 6	Up to 6	
		Fire pump		Up to 1	Up to 1	Up to 1	Up to 1	Up to 1	Up to 1	
Emergency critical power failure										
Typical operations			All typical operations taking place	As above						
Main power failure – emergency equipment			All 846 generators in operation 130 generators for each Parcel A-D, 162 generators for Parcel E/F. Two located adjacent to the COSH.	132	262	392	522	684	846	Section 8.2.3.3

Across these operational noise generating activities, the majority of the noise sources are steady-state, and as such do not result in instantaneous noise events with the potential to disturb sleep. Presented in Table 8-15 are the potential noise sources that could result in instantaneous noise events that could occur as part of operations that have been assumed in the sleep disturbance assessment at night.

Table 8-15: Instantaneous maximum noise events assessment scenarios (night period)

Location / activity	Instantaneous noise sources (L_{Amax} event)
Loading dock and delivery activities	Truck airbrake at dock Truck working brake air-releases
Carpark	Car engine start Car vehicle door slam

8.5 Noise predictions

8.5.1 Predicted $L_{Aeq,15min}$ operational noise levels (Typical operations, including maintenance testing)

To assess operational noise emissions from the Proposal, the assessment scenarios identified in Section 8.4.4 (Table 8-14) were modelled.

As the Proposal includes six phases, noise predictions are provided for each phase. The assumed operating equipment for each phase is detailed in in Section 8.4.4 (Table 8-14) and the layout and staging diagrams are provided in APPENDIX B.

Each of these assessment scenarios have assessed the reasonable worst-case operating scenarios that would take place, with all identified equipment operating. Similarly, the onsite buildings and structures shown in APPENDIX B form part of the modelling for each phase, so that the progressive development is captured in the modelling.

Predicted noise levels have been assessed to the nearby receivers, and a summary of these results are presented in the following tables for typical operations:

- Table 8-16 - Day, including testing of worst case six generators, and worst case managed generator testing (as per Section 8.3.4)
- Table 8-17 - Day (without generator testing)
- Table 8-18 - Evening
- Table 8-19 - Night

The predicted noise levels shown in Table 8-16 to Table 8-19 are based upon the highest noise level for each receiver including upper floors of buildings for each relevant receiver/NCA.

Noise contour maps at 1.5 metres above the local ground level for each of the scenarios assessed are presented in APPENDIX E.

The key likely noise generating plant and equipment have been identified along with likely locations, operating states, and potential mitigation and management requirements to achieve the PNTLs identified in Section 5.

The predicted noise levels presented in this section include all feasible and reasonable mitigation and management measures presented in Section 8.3, which have been recommended based upon an initial evaluation and the progressive assessment process to determine the Proposal mitigation and management measures to achieve the PNTLs identified in Section 5.

Noise levels have been reviewed for annoying characteristics as per NPfI Fact Sheet C, and adjustments applied where required (see Section 8.5.2 and APPENDIX E). During the daytime period, as different generators will impact different receiver locations during testing making a detailed annoying characteristics assessment prohibitively complex, conservatively, a 2 dB(A) adjustment has been applied to all predicted noise levels in accordance with NPfI Fact Sheet C to take into account the potential for low-frequency impacts during generator testing.

From Table 8-16 the predicted operational noise levels indicate that with the recommended mitigation and management measures presented in Section 8.3, the Proposal can achieve the project noise trigger levels at all nearby assessment receivers for all assessment periods.

As part of the noise assessment process, as per NPfI Figure 2, the noise assessment is to determine the 'best achievable noise levels', however, at this early development approval stage of the Proposal design, including the mechanical plant/equipment design and selection have not been finalised. As such, the 'best achievable noise levels' from the Proposal can only be determined as part of further design development during later design stages. These will depend upon final decisions to balance design requirements, project costs, allowance for future unknown flexibility and tenant mitigation obligations when they come into the facility, and other factors. The predicted noise levels presented in this section, demonstrate it is possible for the Proposal to operate within the established PNTLs using conservative assumptions.

Table 8-16: Typical operations - Predicted operational noise levels – Day (with testing of 6 concurrent generators[7] / with management[5]) – $L_{Aeq,15minute}$, dB(A)

Assessment scenario					Parcel A		Parcels A/B		Parcels A/B/C		Parcels A/B/C/D		Parcels A/B/C/D/E		Full campus (A/B/C/D/E/F)	
NCA	Receiver type	Receiver	Address	PNTL, $L_{Aeq\ 15min}$, dB(A)	Predicted noise level, dB(A) $L_{Aeq,15min}$[1]	Exceedance, dB(A) $L_{Aeq,15min}$	Predicted noise level, dB(A) $L_{Aeq,15min}$[1]	Exceedance, dB(A) $L_{Aeq,15min}$	Predicted noise level, dB(A) $L_{Aeq,15min}$[1]	Exceedance, dB(A) $L_{Aeq,15min}$	Predicted noise level, dB(A) $L_{Aeq,15min}$[1]	Exceedance, dB(A) $L_{Aeq,15min}$	Predicted noise level, dB(A) $L_{Aeq,15min}$[1]	Exceedance, dB(A) $L_{Aeq,15min}$	Predicted noise level, dB(A) $L_{Aeq,15min}$[1]	Exceedance, dB(A) $L_{Aeq,15min}$
NCA01	Residential	N1_R01	654-674 Mamre Road, Kemps Creek	48	36 / 36	- / -	36 / 36	- / -	40 / 40	- / -	40 / 40	- / -	41 / 41	- / -	40 / 40	- / -
	Residential	N1_R02	676-702 Mamre Road, Kemps Creek	48	42 / 41	- / -	40 / 39	- / -	43 / 42	- / -	43 / 42	- / -	43 / 42	- / -	43 / 42	- / -
	Residential	N1_R03	1 Bakers Lane, Kemps Creek	48	47 / 46	- / -	48 / 47	- / -	50 / 49	2 / 1	50 / 49	2 / 1	50 / 49	2 / 1	50 / 49	2 / 1
	Educational	N1_E01	Mamre Anglican School	43	40 / 40	- / -	46 / 44	3 / 1	45 / 44	2 / 1	48 / 48	5 / 5	49 / 48	6 / 5	49 / 48	6 / 5
	Passive Rec (School)	N1_P01	Mamre Anglican School	48	34 / 33	- / -	36 / 35	- / -	38 / 37	- / -	39 / 38	- / -	40 / 38	- / -	43 / 41	- / -
	Active Rec (School)	N1_A01	Mamre Anglican School	53	35 / 35	- / -	37 / 36	- / -	39 / 38	- / -	39 / 38	- / -	39 / 39	- / -	40 / 39	- / -
NCA02	Residential	N2_R01	Emmaus Retirement Village	44	33 / 32	- / -	37 / 35	- / -	38 / 37	- / -	39 / 38	- / -	40 / 39	- / -	40 / 39	- / -
	Educational	N2_E01	Emmaus Catholic College	43	38 / 37	- / -	43 / 42	- / -	42 / 40	- / -	44 / 41	1 / -	45 / 43	2 / -	46 / 43	3 / -
	Passive Rec (School)	N2_P01	Emmaus Catholic College	43	37 / 36	- / -	40 / 39	- / -	41 / 39	- / -	41 / 39	- / -	41 / 40	- / -	41 / 40	- / -
	Active Rec (School)	N2_A01	Emmaus Catholic College	48	35 / 34	- / -	39 / 37	- / -	40 / 38	- / -	41 / 39	- / -	41 / 40	- / -	42 / 41	- / -
	Educational	N2_E02	Trinity Primary School	43	35 / 34	- / -	39 / 37	- / -	40 / 38	- / -	43 / 41	- / -	43 / 42	- / -	43 / 42	- / -
	Passive Rec (School)	N2_P02	Trinity Primary School	43	35 / 34	- / -	39 / 37	- / -	40 / 38	- / -	43 / 41	- / -	43 / 42	- / -	43 / 42	- / -
	Active Rec (School)	N2_A02	Trinity Primary School	48	35 / 34	- / -	40 / 38	- / -	40 / 39	- / -	43 / 42	- / -	43 / 42	- / -	43 / 42	- / -
NCA03-PW	Place of worship	N3_PW01	BAPS Temple and Cultural Precinct	43	30 / 29	- / -	31 / 30	- / -	32 / 31	- / -	34 / 33	- / -	34 / 33	- / -	35 / 35	- / -
NCA03	Residential	N3_R01	20 Aldington Road, Kemps Creek	40	35 / 34	- / -	37 / 36	- / -	38 / 37	- / -	40 / 38	- / -	42 / 41	2 / 1	43 / 41	3 / 1
	Residential	N3_R02	53 Aldington Road, Kemps Creek	40	35 / 34	- / -	36 / 36	- / -	38 / 37	- / -	39 / 39	- / -	42 / 41	2 / 1	43 / 42	3 / 2
NCA04	Residential	N4_R01	799-803 Mamre Road, Kemps Creek	48	46 / 46	- / -	45 / 44	- / -	48 / 47	- / -	48 / 47	- / -	48 / 47	- / -	48 / 47	- / -
	Residential	N4_R02	819 Mamre Road, Kemps Creek	48	45 / 44	- / -	45 / 45	- / -	48 / 47	- / -	48 / 48	- / -	48 / 48	- / -	48 / 47	- / -
	Residential	N4_R03	833A Mamre Road, Kemps Creek	48	43 / 43	- / -	45 / 44	- / -	47 / 46	- / -	47 / 46	- / -	47 / 46	- / -	47 / 46	- / -
	Residential	N4_R04	833B Mamre Road, Kemps Creek	48	42 / 41	- / -	43 / 42	- / -	46 / 45	- / -	46 / 45	- / -	46 / 45	- / -	45 / 45	- / -
	Residential	N4_R04	845A Mamre Road, Kemps Creek	48	42 / 41	- / -	43 / 43	- / -	45 / 45	- / -	46 / 45	- / -	46 / 45	- / -	45 / 44	- / -
	Residential	N4_R06	845-857 Mamre Road, Kemps Creek	48	41 / 40	- / -	42 / 41	- / -	44 / 43	- / -	44 / 43	- / -	44 / 43	- / -	44 / 43	- / -
	Residential	N4_R07	859-869 Mamre Road, Kemps Creek	48	39 / 39	- / -	40 / 39	- / -	43 / 42	- / -	43 / 42	- / -	43 / 42	- / -	42 / 41	- / -
	Residential	N4_R08	885-899 Mamre Road, Kemps Creek	48	36 / 36	- / -	37 / 36	- / -	40 / 39	- / -	40 / 39	- / -	40 / 39	- / -	40 / 39	- / -
NCA05	Residential	All[2]	Orchard Hills	43	30 / 30	- / -	29 / 28	- / -	32 / 31	- / -	32 / 31	- / -	32 / 32	- / -	31 / 30	- / -
	Childcare	N5_CC1	Old MacDonald's Child Care	43	30 / 30	- / -	28 / 27	- / -	32 / 31	- / -	32 / 31	- / -	32 / 32	- / -	31 / 31	- / -
NCA06	Residential	All[2]	Luddenham	42	34 / 33	- / -	33 / 32	- / -	35 / 35	- / -	36 / 35	- / -	36 / 35	- / -	35 / 35	- / -
NCA07	Residential	All[2]	Kemps Creek	43	32 / 31	- / -	32 / 31	- / -	35 / 34	- / -	36 / 35	- / -	36 / 35	- / -	36 / 35	- / -
NCA08	Residential	All[2]	Mount Vernon	43	26 / 25	- / -	27 / 26	- / -	29 / 28	- / -	30 / 29	- / -	31 / 30	- / -	31 / 30	- / -
IND	Industrial	I01	East	68	45 / 44	- / -	50 / 50	- / -	48 / 47	- / -	50 / 49	- / -	53 / 52	- / -	53 / 52	- / -
	Industrial	I02	South	68	59 / 58	- / -	59 / 58	- / -	59 / 58	- / -	60 / 59	- / -	60 / 59	- / -	61 / 60	- / -
	Industrial	I03	West	68	62 / 62[6]	- / -	62 / 62[6]	- / -	63 / 62[6]	- / -	63 / 62[6]	- / -	63 / 62[6]	- / -	63 / 62[6]	- / -

Notes:

1. As different generators will impact different receiver locations during testing, conservatively, a 2 dB(A) adjustment has been applied to **all predicted noise levels** in accordance with NPfI Fact Sheet C.
2. Predicted noise level based upon highest predicted level across multiple receivers
3. Dark Grey = Receivers expected to have relocated during this period, as receiver is planning on relocating in 2029.
4. Light Grey = Short-term residences within MRP
5. Generator management as per Section 8.3.4. The predictions are based upon the worst case combination of generators for each assessment receiver location with management.
6. A 5 dB(A) adjustment has been applied in accordance with NPfI Fact Sheet C for tonality, in addition to a 2 dB(A) adjustment for low-frequency, as per Note 1, resulting in an overall 7 dB(A) adjustment being applied.
7. The predictions are based upon the worst case combination of 6 generators for each assessment receiver location.

Table 8-17: Typical operations - Predicted operational noise levels – Day (without generator testing) – $L_{Aeq,15minute}$, dB(A)

Assessment scenario					Parcel A		Parcels A/B		Parcels A/B/C		Parcels A/B/C/D		Parcels A/B/C/D/E		Full campus (A/B/C/D/E/F)	
NCA	Receiver type	Receiver	Address	PNTL, $L_{Aeq\ 15min}$, dB(A)	Predicted noise level, dB(A) $L_{Aeq,15min}$	Exceedance, dB(A) $L_{Aeq,15min}$	Predicted noise level, dB(A) $L_{Aeq,15min}$	Exceedance, dB(A) $L_{Aeq,15min}$	Predicted noise level, dB(A) $L_{Aeq,15min}$	Exceedance, dB(A) $L_{Aeq,15min}$	Predicted noise level, dB(A) $L_{Aeq,15min}$	Exceedance, dB(A) $L_{Aeq,15min}$	Predicted noise level, dB(A) $L_{Aeq,15min}$	Exceedance, dB(A) $L_{Aeq,15min}$	Predicted noise level, dB(A) $L_{Aeq,15min}$	Exceedance, dB(A) $L_{Aeq,15min}$
NCA01	Residential	N1_R01	654-674 Mamre Road, Kemps Creek	48	30	-	32	-	34	-	34	-	35	-	35	-
	Residential	N1_R02	676-702 Mamre Road, Kemps Creek	48	33	-	33	-	35	-	35	-	36	-	36	-
	Residential	N1_R03	1 Bakers Lane, Kemps Creek	48	39	-	39	-	40	-	41	-	41	-	41	-
	Educational	N1_E01	Mamre Anglican School	43	38	-	39	-	40	-	41	-	42	-	42	-
	Passive Rec (School)	N1_P01	Mamre Anglican School	48	30	-	31	-	32	-	33	-	35	-	35	-
	Active Rec (School)	N1_A01	Mamre Anglican School	53	32	-	33	-	34	-	35	-	35	-	35	-
NCA02	Residential	N2_R01	Emmaus Retirement Village	44	30	-	32	-	33	-	34	-	36	-	37	-
	Educational	N2_E01	Emmaus Catholic College	43	36	-	37	-	38	-	37	-	39	-	41	-
	Passive Rec (School)	N2_P01	Emmaus Catholic College	43	35	-	36	-	37	-	37	-	38	-	38	-
	Active Rec (School)	N2_A01	Emmaus Catholic College	48	32	-	34	-	35	-	34	-	36	-	36	-
	Educational	N2_E02	Trinity Primary School	43	33	-	34	-	34	-	35	-	36	-	37	-
	Passive Rec (School)	N2_P02	Trinity Primary School	43	33	-	34	-	34	-	35	-	36	-	37	-
	Active Rec (School)	N2_A02	Trinity Primary School	48	33	-	34	-	35	-	35	-	36	-	36	-
NCA03-PW	Place of worship	N3_PW01	BAPS Temple and Cultural Precinct	43	28	-	29	-	29	-	31	-	31	-	33	-
NCA03	Residential	N3_R01	20 Aldington Road, Kemps Creek	40	33	-	34	-	35	-	36	-	39	-	41	-
	Residential	N3_R02	53 Aldington Road, Kemps Creek	40	33	-	34	-	35	-	36	-	40	-	41	-
NCA04	Residential	N4_R01	799-803 Mamre Road, Kemps Creek	48	41	-	42	-	43	-	43	-	43	-	43	-
	Residential	N4_R02	819 Mamre Road, Kemps Creek	48	40	-	41	-	42	-	43	-	43	-	42	-
	Residential	N4_R03	833A Mamre Road, Kemps Creek	48	39	-	40	-	41	-	41	-	42	-	41	-
	Residential	N4_R04	833B Mamre Road, Kemps Creek	48	39	-	40	-	41	-	41	-	41	-	41	-
	Residential	N4_R05	845A Mamre Road, Kemps Creek	48	39	-	39	-	40	-	41	-	41	-	40	-
	Residential	N4_R06	845-857 Mamre Road, Kemps Creek	48	38	-	38	-	39	-	39	-	39	-	40	-
	Residential	N4_R07	859-869 Mamre Road, Kemps Creek	48	37	-	37	-	38	-	38	-	39	-	38	-
	Residential	N4_R08	885-899 Mamre Road, Kemps Creek	48	34	-	35	-	36	-	36	-	36	-	37	-
NCA05	Residential	All[2]	Orchard Hills	43	24	-	25	-	26	-	27	-	28	-	28	-
	Childcare	N5_CC1	Old MacDonald's Child Care	43	24	-	24	-	25	-	26	-	27	-	27	-
NCA06	Residential	All[2]	Luddenham	42	30	-	31	-	31	-	32	-	32	-	33	-
NCA07	Residential	All[2]	Kemps Creek	43	30	-	31	-	31	-	32	-	32	-	34	-
NCA08	Residential	All[2]	Mount Vernon	43	23	-	25	-	26	-	27	-	28	-	29	-
IND	Industrial	I01	East	68	43[1]	-	45[1]	-	44[1]	-	45[1]	-	52[1]	-	52[1]	-
	Industrial	I02	South	68	58[1]	-	58[1]	-	58[1]	-	58[1]	-	59[1]	-	59[1]	-
	Industrial	I03	West	68	56[5]	-	57[5]	-	57[5]	-	57[5]	-	57[5]	-	58[5]	-

Notes:

1. A 2 dB(A) adjustment has been applied for low-frequency in accordance with NPfI Fact Sheet C.
2. Predicted noise level based upon highest predicted level across multiple receivers
3. Dark Grey = Receivers expected to be relocated during this period, as receiver is planning on relocating in 2029.
4. Light Grey = Short-term residences within MRP
5. A 5 dB(A) adjustment has been applied in accordance with NPfI Fact Sheet C for tonality.

Table 8-18: Typical operations - Predicted operational noise levels - Evening – $L_{Aeq,15minute}$, dB(A)

Assessment scenario					Parcel A		Parcels A/B		Parcels A/B/C		Parcels A/B/C/D		Parcels A/B/C/D/E		Full campus (A/B/C/D/E/F)	
NCA	Receiver type	Receiver	Address	PNTL, $L_{Aeq\ 15min}$, dB(A)	Predicted noise level, $L_{Aeq\ 15min}$, dB(A)[1]	Exceed	Predicted noise level, $L_{Aeq\ 15min}$, dB(A)[1]	Exceed	Predicted noise level, $L_{Aeq\ 15min}$, dB(A)[1]	Exceed	Predicted noise level, $L_{Aeq\ 15min}$, dB(A)[1]	Exceed	Predicted noise level, $L_{Aeq\ 15min}$, dB(A)[1]	Exceed	Predicted noise level, $L_{Aeq\ 15min}$, dB(A)[1]	Exceed
NCA01	Residential	N1_R01	654-674 Mamre Road, Kemps Creek	43	30	-	31	-	33	-	34	-	34	-	34	-
		N1_R02	676-702 Mamre Road, Kemps Creek	43	33	-	33	-	34	-	35	-	35	-	35	-
		N1_R03	1 Bakers Lane, Kemps Creek	43	39	-	39	-	40	-	40	-	40	-	40	-
	Educational	N1_E01	Mamre Anglican School	43	38	-	39	-	40	-	40	-	41	-	42	-
	Passive Rec (School)	N1_P01	Mamre Anglican School	48	30	-	31	-	31	-	33	-	34	-	35	-
	Active Rec (School)	N1_A01	Mamre Anglican School	53	31	-	32	-	33	-	34	-	35	-	35	-
NCA02	Residential	N2_R01	Emmaus Retirement Village	43	30	-	31	-	33	-	33	-	35	-	36	-
	Educational	N2_E01	Emmaus Catholic College	43	35	-	36	-	37	-	36	-	39	-	40	-
	Passive Rec (School)	N2_P01	Emmaus Catholic College	43	34	-	36	-	37	-	37	-	37	-	37	-
	Active Rec (School)	N2_A01	Emmaus Catholic College	48	32	-	33	-	34	-	34	-	35	-	36	-
	Educational	N2_E02	Trinity Primary School	43	32	-	33	-	34	-	34	-	36	-	36	-
	Passive Rec (School)	N2_P02	Trinity Primary School	43	32	-	33	-	34	-	34	-	36	-	36	-
	Active Rec (School)	N2_A02	Trinity Primary School	48	32	-	33	-	34	-	34	-	36	-	36	-
NCA03-PW	Place of worship	N3_PW01	BAPS Temple and Cultural Precinct	43	27	-	29	-	28	-	30	-	31	-	33	-
NCA03	Residential	N3_R01	20 Aldington Road, Kemps Creek	38	33	-	33	-	35	-	36	-	39	1	40	2
		N3_R02	53 Aldington Road, Kemps Creek	38	33	-	34	-	35	-	36	-	39	1	40	2
NCA04	Residential	N4_R01	799-803 Mamre Road, Kemps Creek	43	41	-	42	-	42	-	43	-	43	-	42	-
		N4_R02	819 Mamre Road, Kemps Creek	43	40	-	41	-	42	-	42	-	43	-	42	-
		N4_R03	833A Mamre Road, Kemps Creek	43	39	-	40	-	41	-	41	-	41	-	41	-
		N4_R04	833B Mamre Road, Kemps Creek	43	38	-	39	-	40	-	40	-	41	-	41	-
		N4_R04	845A Mamre Road, Kemps Creek	43	38	-	39	-	40	-	40	-	40	-	40	-
		N4_R06	845-857 Mamre Road, Kemps Creek	43	37	-	38	-	38	-	39	-	39	-	39	-
		N4_R07	859-869 Mamre Road, Kemps Creek	43	36	-	37	-	37	-	38	-	38	-	38	-
		N4_R08	885-899 Mamre Road, Kemps Creek	43	34	-	35	-	35	-	35	-	36	-	36	-
NCA05	Residential	All[1]	Orchard Hills	38	24	-	25	-	26	-	26	-	27	-	27	-
NCA05	Childcare	N5_CC1	Old MacDonald's Child Care	43	23	-	24	-	25	-	25	-	26	-	27	-
NCA06	Residential	All[1]	Luddenham	38	29	-	30	-	31	-	31	-	32	-	33	-
NCA07	Residential	All[1]	Kemps Creek	38	30	-	30	-	31	-	32	-	32	-	33	-
NCA08	Residential	All[1]	Mount Vernon	38	23	-	25	-	25	-	26	-	28	-	29	-
IND	Industrial	I01	East	68	43[4]	-	45[4]	-	44[4]	-	45[4]	-	52[4]	-	52[4]	-
		I02	South	68	58[4]	-	58[4]	-	58[4]	-	58[4]	-	59[4]	-	59[4]	-
		I03	West	68	56[5]	-	57[5]	-	57[5]	-	57[5]	-	57[5]	-	57[5]	-

Notes:

1. Predicted noise level based upon highest predicted level across multiple receivers
2. Dark Grey = Receivers expected to be relocated during this period, as receiver is planning on relocating in 2029.
3. Light Grey = Short-term residences within MRP
4. 2 dB(A) annoyance penalty applied for low-frequency noise in accordance with NPfI Fact Sheet C.
5. A 5 dB(A) adjustment has been applied in accordance with NPfI Fact Sheet C for tonality

Table 8-19: Typical operations - Predicted operational noise levels - Night – $L_{Aeq,15minute}$, dB(A)

Assessment scenario					Parcel A		Parcels A/B		Parcels A/B/C		Parcels A/B/C/D		Parcels A/B/C/D/E		Full campus (A/B/C/D/E/F)	
NCA	Receiver type	Receiver	Address	PNTL, $L_{Aeq\ 15min}$, dB(A)	Predicted noise level, $L_{Aeq\ 15min}$, dB(A)[1]	Exceed	Predicted noise level, $L_{Aeq\ 15min}$, dB(A)[1]	Exceed	Predicted noise level, $L_{Aeq\ 15min}$, dB(A)[1]	Exceed	Predicted noise level, $L_{Aeq\ 15min}$, dB(A)[1]	Exceed	Predicted noise level, $L_{Aeq\ 15min}$, dB(A)[1]	Exceed	Predicted noise level, $L_{Aeq\ 15min}$, dB(A)[1]	Exceed
NCA01	Residential	N1_R01	654-674 Mamre Road, Kemps Creek	38	30	-	31	-	33	-	34	-	34	-	34	-
		N1_R02	676-702 Mamre Road, Kemps Creek	38	33	-	33	-	34	-	35	-	35	-	35	-
		N1_R03	1 Bakers Lane, Kemps Creek	38	39	1	39	1	40	2	40	2	40	2	40	2
	Educational	N1_E01	Mamre Anglican School	43	38	-	39	-	40	-	40	-	41	-	42	-
	Passive Rec (School)	N1_P01	Mamre Anglican School	48	30	-	31	-	31	-	33	-	34	-	35	-
	Active Rec (School)	N1_A01	Mamre Anglican School	53	31	-	32	-	33	-	34	-	35	-	35	-
NCA02	Residential	N2_R01	Emmaus Retirement Village	38	30	-	31	-	33	-	33	-	35	-	36	-
	Educational	N2_E01	Emmaus Catholic College	43	35	-	36	-	37	-	36	-	39	-	40	-
	Passive Rec (School)	N2_P01	Emmaus Catholic College	43	34	-	36	-	37	-	37	-	37	-	37	-
	Active Rec (School)	N2_A01	Emmaus Catholic College	48	32	-	33	-	34	-	34	-	35	-	36	-
	Educational	N2_E02	Trinity Primary School	43	32	-	33	-	34	-	34	-	36	-	36	-
	Passive Rec (School)	N2_P02	Trinity Primary School	43	32	-	33	-	34	-	34	-	36	-	36	-
	Active Rec (School)	N2_A02	Trinity Primary School	48	32	-	33	-	34	-	34	-	36	-	36	-
NCA03-PW	Place of worship	N3_PW01	BAPS Temple and Cultural Precinct	43	27	-	29	-	29	-	30	-	31	-	33	-
NCA03	Residential	N3_R01	20 Aldington Road, Kemps Creek	35	33	-	33	-	35	-	36	1	39	4	40	5
		N3_R02	53 Aldington Road, Kemps Creek	35	33	-	34	-	35	-	36	1	39	4	40	5
NCA04	Residential	N4_R01	799-803 Mamre Road, Kemps Creek	38	41	3	42	4	42	4	43	5	43	5	42	4
		N4_R02	819 Mamre Road, Kemps Creek	38	40	2	41	3	42	4	42	4	43	5	42	4
		N4_R03	833A Mamre Road, Kemps Creek	38	39	1	40	2	41	3	41	3	41	3	41	3
		N4_R04	833B Mamre Road, Kemps Creek	38	38	-	39	1	40	2	40	2	41	3	41	3
		N4_R04	845A Mamre Road, Kemps Creek	38	38	-	39	1	40	2	40	2	40	2	40	2
		N4_R06	845-857 Mamre Road, Kemps Creek	38	37	-	38	-	38	-	39	1	39	1	39	1
		N4_R07	859-869 Mamre Road, Kemps Creek	38	36	-	37	-	37	-	38	-	38	-	38	-
		N4_R08	885-899 Mamre Road, Kemps Creek	38	34	-	35	-	35	-	35	-	36	-	36	-
NCA05	Residential	All[1]	Orchard Hills	33	24	-	25	-	26	-	26	-	27	-	27	-
NCA05	Childcare	N5_CC1	Old MacDonald's Child Care	43	23	-	24	-	25	-	25	-	26	-	27	-
NCA06	Residential	All[1]	Luddenham	33	29	-	30	-	31	-	31	-	32	-	33	-
NCA07	Residential	All[1]	Kemps Creek	33	30	-	30	-	31	-	32	-	32	-	33	-
NCA08	Residential	All[1]	Mount Vernon	33	23	-	25	-	25	-	26	-	28	-	29	-
IND	Industrial	I01	East	68	43[4]	-	45[4]	-	44[4]	-	45[4]	-	52[4]	-	52[4]	-
		I02	South	68	58[4]	-	58[4]	-	58[4]	-	58[4]	-	59[4]	-	59[4]	-
		I03	West	68	56[5]	-	57[5]	-	57[5]	-	57[5]	-	57[5]	-	57[5]	-

Notes:

1. Predicted noise level based upon highest predicted level across multiple receivers
2. Dark Grey = Receivers expected to be relocated during this period, as receiver is planning on relocating in 2029.
3. Light Grey = Short-term residences within MRP
4. 2 dB(A) annoyance penalty applied for low-frequency noise in accordance with NPfI Fact Sheet C.
5. A 5 dB(A) adjustment has been applied in accordance with NPfI Fact Sheet C for tonality,

8.5.2 Annoying noise characteristics adjustments

Where the character of the industrial noise is assessed as particularly annoying at a receiver location (ie. if the resulting noise level at a receiver location is tonal, low frequency or is intermittent at night), then an adjustment is to be added to penalise the predicted noise for its potential increase in annoyance. The Fact Sheet C of the NPfI provides procedures for determining whether a modifying factor should be applied which is assessed as part of the Proposal. The corrections are to be added to the predicted noise levels at the receiver before comparison with the project noise trigger levels. The characteristics that require evaluation include:

- Tonality
- Low frequency
- Intermittent noise

The outcomes of the NPfI Fact Sheet C annoyance assessment for tonality and low-frequency for critical receivers, which includes a review of the combination of worst case generators for Emmaus Catholic College is included APPENDIX E.

8.5.2.1 Tonality

The key noise sources associated with both the existing data centre and the Proposal which dominate the noise emissions are the cooling systems, which operate continuously and are steady-state or quasi-steady-state noise sources. Other operational noise sources that can typically exhibit tonal noise at source are:

- the reversing alarms on heavy vehicles
- substation transformers

These noise sources are both minor contributors to the overall noise emissions (ie. substation transformers) or occur infrequently and for small periods of time (ie. heavy vehicle reversing operations) and would not result in overall noise emissions from either facility or combined to result in tonal noise emissions.

As per NPfI Fact Sheet C1, the modifying factor corrections should be applied having regard to the contribution noise level from the premises when assessed/measured at a receiver location. As such, for predictions it is appropriate that the assessment also consider the existing background noise environment. Where the existing noise levels are sufficient to mask any tonal characteristics, then the tonal modifying factor correction is not applicable. However, for a conservative and simplified assessment the existing background noise environment has not been considered, and the assessment is of the predicted noise level contribution in isolation at the receivers with the highest noise predictions in each NCA.

As a result of this assessment, tonality was identified for the adjacent industrial sites, when at the closest assessment points within the industrial boundary, but at no other receiver locations.

In accordance with the requirements of the NPfI Fact Sheet C1 (Table C1), a 5 dB(A) penalty has been applied where applicable, for the industrial receiver to the west. No other locations were identified where one-third octave bands was found to exceed the level of the adjacent bands on both sides by more than the requirement in NPfI Fact Sheet C1 (Table C1).

8.5.2.2 Intermittent noise

The key noise sources associated with both the existing data centre and the Proposal are the cooling systems, which operate continuously and are steady-state or quasi-steady-state noise sources. Therefore, there is unlikely to be significant variation in noise emissions resulting in intermittent noise level contributions at receivers. As such, as there are no known likely intermittent noise sources no intermittent penalty is applicable.

8.5.2.3 Low frequency assessment

The low frequency noise analysis was undertaken in accordance with Fact Sheet C of the NPfI. The NPfI requires this analysis to be undertaken for third octave bands ranging from 10 Hz to 160 Hz. Limitations in both the modelling software in addition to the supplier data only allow for noise predictions down to and including the 25 Hz third octave band. Hence, a best practice approach to apply the low frequency noise analysis was applied as detailed in the journal paper prepared by the NSW Environment Protection Authority published by Acoustics Australia (Downey, 2020).

As the modelled data does not extend below 25Hz, the data between 10Hz to 20 Hz has been extended by extrapolation based upon the 25Hz to 40Hz band data. The estimate of predicted levels from 10 Hz to 160 Hz allowed for an analysis of the low frequency noise impacts in accordance with Fact Sheet C of the NPfI, however, only so far as practicable through the data limitations. Noting the limitations of this approach, the potential for noise sources to result in low-frequency impacts are to be reviewed in detail by an acoustic consultant once actual plant/equipment are known to confirm the outcomes of this low-frequency screening assessment.

Daytime operations and generator maintenance testing

A review of critical receivers, including, with the combination of worst case generators for Emmaus Catholic College, has been undertaken, and the outcomes are shown in APPENDIX E.

Several receiver locations were found to exceed the overall C- minus A-weighted noise levels derived from the estimated noise predictions. Typically, where overall C- minus A-weighted noise levels were above 15 dB, and there was the potential for low-frequency impacts during worst case combination of generators, then the assessment determine the noise levels were not more than 5 dB above the corresponding NPfI Table C2 noise thresholds. The exception is for one assessment location across the school. The only other locations identified was for the adjacent industrial sites to the south and east, when at the closest assessment points within the industrial boundary, but at no other receiver locations.

As a complex combination of generators have the potential to impact different receiver locations during testing, conservatively, a 2 dB(A) adjustment has been applied to all predicted noise levels during the daytime.

Evening and night operations

Although several receiver locations were found to exceed the overall C- minus A-weighted noise levels derived from the estimated noise predictions for the night period, other than for the adjacent industrial sites to the and east, no other receiver locations had predicted noise level above the low frequency thresholds defined in Table C2 of the NPfI. For the industrial receivers a 2 dB(A) adjustment has been applied to all predicted noise levels.

8.5.3 Emergency critical power failure operations

As detailed in Section 5.4, the emergency operating conditions, i.e. the event of a mains power failure, is expected to be a very rare occurrence and it would be considered unreasonable to implement noise treatment due to this. As such, consistent with the feasible and reasonable approach as required by the NPfI, existing regulations, and in absence of any relevant specific NSW guideline for emergency generators, noise limits for emergency operations are not required and have not been proposed.

Presented in Table 8-21 are the predicted noise levels for emergency operations for the fully developed campus, when all Parcels A/B/C/D/E/F have been completed, to demonstrate the worst case noise levels. As detailed in Section 5.4, these noise predictions are presented for information purposes only.

Table 8-10 identifies the items have been further investigated and identified for inclusion as part of the Proposal design.

Table 8-20: Key feasible and reasonable noise mitigation and management measure investigation

Key noise generating source	Noise mitigation and management measure element investigated	Estimated noise benefit	Comments on feasibility/ reasonableness	Design result
Containerised generator unit (emergency operations)	Further upgraded acoustic performance of generator acoustic enclosure	At most 5 dB(A)	Note feasible or not reasonable. To address potential impacts during maintenance testing, the acoustic enclosures of the generators, combined with the exhaust flues have already had substantial acoustic mitigation measures upgrades. This is 20 dB(A) quieter than typical generator acoustic enclosures, and it at the limit of reductions that can be gained from generator acoustic enclosures.	Further mitigation not adopted. Not feasible or reasonable.

Table 8-21: Predicted mains failure emergency operations noise levels - $L_{Aeq,15minute}$, dB(A)

Receiver information				Predicted noise level, $L_{Aeq\ 15min}$, dB(A)[1]					
NCA	**Receiver type**	**Receiver**	**Address**	**Parcel A**	**Parcels A/B**	**Parcels A/B/C**	**Parcels A/B/C/D**	**Parcels A/B/C/D/E**	**Full campus (A/B/C/D/E/F)**
NCA01	Residential	N1_R01	654-674 Mamre Road, Kemps Creek	44	47	47	48	48	49
		N1_R02	676-702 Mamre Road, Kemps Creek	48	49	49	50	50	50
		N1_R03	1 Bakers Lane, Kemps Creek	55	54	55	56	56	56
	Educational	N1_E01	Mamre Anglican School	45	50	55	57	58	59
	Passive Rec (School)	N1_P01	Mamre Anglican School	41	46	50	51	52	54
	Active Rec (School)	N1_A01	Mamre Anglican School	42	47	50	50	51	53
NCA02	Residential	N2_R01	Emmaus Retirement Village	34	39	45	48	50	51
	Educational	N2_E01	Emmaus Catholic College	40	44	49	55	59	60
	Passive Rec (School)	N2_P01	Emmaus Catholic College	38	43	48	50	52	53
	Active Rec (School)	N2_A01	Emmaus Catholic College	39	44	49	52	55	57
	Educational	N2_E02	Trinity Primary School	40	44	50	53	54	55
	Passive Rec (School)	N2_P02	Trinity Primary School	40	44	50	53	54	55
	Active Rec (School)	N2_A02	Trinity Primary School	40	44	50	54	56	56
NCA03-PW	Place of worship	N3_PW01	BAPS Temple and Cultural Precinct (BAPS)	29	33	38	39	40	41
NCA03	Residential	N3_R01	20 Aldington Road, Kemps Creek	33	36	43	46	47	48
		N3_R02	53 Aldington Road, Kemps Creek	33	36	40	45	45	47
NCA04	Residential	N4_R01	799-803 Mamre Road, Kemps Creek	48	50	50	51	51	51
		N4_R02	819 Mamre Road, Kemps Creek	50	51	52	53	53	54
		N4_R03	833A Mamre Road, Kemps Creek	50	50	50	53	53	53
		N4_R04	833B Mamre Road, Kemps Creek	47	49	50	50	51	51
		N4_R04	845A Mamre Road, Kemps Creek	46	49	49	50	50	50
		N4_R06	845-857 Mamre Road, Kemps Creek	45	48	49	49	50	50
		N4_R07	857 Mamre Road, Kemps Creek	43	47	48	48	49	49
		N4_R08	859 Mamre Road, Kemps Creek	40	45	46	47	48	48
NCA05	Residential	All[1]	Orchard Hills	34	36	37	38	39	39
	Childcare	N5_CC1	Old MacDonald's Child Care	36	37	38	39	40	40
NCA06	Residential	All[1]	Luddenham	34	36	37	38	39	39
NCA07	Residential	All[1]	Kemps Creek	34	37	41	43	45	46
NCA08	Residential	All[1]	Mount Vernon	28	31	35	36	37	38
IND	Industrial	I01	East	40	45	50	54	55	56
		I02	South	55	63	63	63	63	64
		I03	West	56	55	55	56	56	56

Notes: 1. Predicted noise level based upon highest predicted level across multiple receivers, 2. Dark Grey = Receivers expected to be relocated during this period, as receiver is planning on relocating in 2029., 3. Light Grey = Short-term residences within MRP

8.5.4 Sleep disturbance assessment

This section assesses the potential for sleep disturbance impacts, specifically looking at the maximum noise levels (L_{AFmax}).

The night-time noise sources associated with the Proposal are steady-state or quasi-steady-state. Therefore, there is unlikely to be significant variation between $L_{Aeq,15min}$ values and L_{AFmax} values, and no significant peak noise events are expected.

The only potentially loud instantaneous noise events that could occur across the Proposal operations with the potential to disturb sleep could be loading dock or carpark related activities. As per Section 8.2.5, service/delivery truck movements would typically only occur during the daytime period for typical operations, however, occasional night deliveries may be required. These activities are detailed in Table 8-15 and Section 8.4.4, and could include airbrake events and truck movement sources. Carparks are located adjacent to each Parcel and at the COSH, as detailed in Section 8.2.4. Considering the loudest potential noise events Table 8-22 shows the highest predicted noise level for each of the residential NCAs for the fully developed campus. Sleep disturbance impacts are not predicted.

Table 8-22: Sleep disturbance assessment (Fully developed campus) (Night – 10:00pm to 7:00am); L_{Amax}, dB(A)

NCA	Representative receiver location with highest predicted noise level	Sleep disturbance assessment level, L_{Amax}	Awakening reaction, L_{Amax}	Highest predicted noise level, L_{AFmax}, dB(A)	Exceedance	
					Screening level	Awakening reaction
NCA01	654-674 Mamre Road, Kemps Creek	52	65	37	-	-
NCA01	676-702 Mamre Road, Kemps Creek	52	65	46	-	-
NCA01	1 Bakers Lane, Kemps Creek	52	65	51	-	-
NCA02	Emmaus Retirement Village	52	65	42	-	-
NCA03	20 Aldington Road, Kemps Creek	52	65	41	-	-
NCA03	53 Aldington Road, Kemps Creek	52	65	45	-	-
NCA04	799-803 Mamre Road, Kemps Creek	52	65	49	-	-
NCA04	819 Mamre Road, Kemps Creek	52	65	51	-	-
NCA04	833A Mamre Road, Kemps Creek	52	65	50	-	-
NCA04	833B Mamre Road, Kemps Creek	52	65	48	-	-
NCA04	845A Mamre Road, Kemps Creek	52	65	49	-	-
NCA04	845-857 Mamre Road, Kemps Creek	52	65	49	-	-
NCA04	859-869 Mamre Road, Kemps Creek	52	65	40	-	-
NCA04	885-899 Mamre Road, Kemps Creek	52	65	40	-	-
NCA05	Orchard Hills[1]	52	65	37	-	-
NCA06	Luddenham[1]	52	65	40	-	-
NCA07	Kemps Creek[1]	52	65	34	-	-
NCA08	Mount Vernon[1]	52	65	30	-	-

Notes: 1. Predicted noise level based upon highest predicted level across multiple receivers

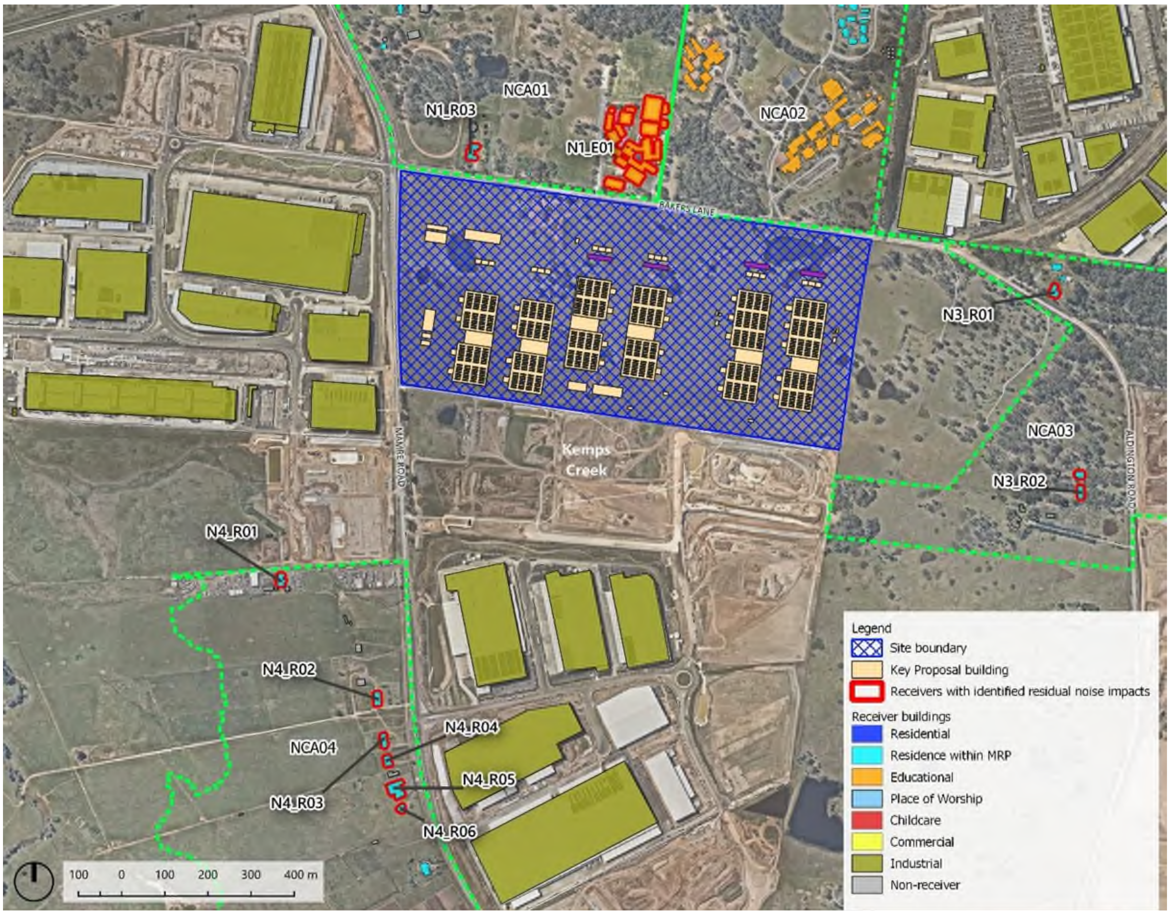
8.6 Review of residual noise impacts

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

Residual noise impacts that exceed the PNTLs 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.

NCA01, NCA03 and NCA04 includes existing residences within the MRP that has been rezoned IN1 *General Industrial*, there are residual noise levels that remain over the PNTLS at the receivers identified in Table 8-23 and Figure 8-8.

Figure 8-8: Residual exceedances of the PNTLs at residences within the MRP



However, it is important to note that these receivers are identified, based upon the ultimate fully developed campus, and noise levels are generally expected to be lower during previous stages, residual noise levels also vary across the assessment periods, which is as shown in the predicted noise levels in Section 8.5.1. Impacts are also identified during periods when the receiver may no longer be receivers, however, this information has been provided in case there is changes for timings.

Furthermore, the daytime impacts will also substantially vary based upon the combination of generator being tested during the daytime period, shown by Table 8-17 which shows that during daytime, without generators being tested there are no residual impacts predicted.

Table 8-23: Receivers with identified residual noise impacts (Within the MRP - short term receivers)

NCA	Receiver number	Address / location	Receiver type	Phases with predicted residual noise levels (Worst case predicted exceedances of PNTL with all mitigation and management, all periods, $L_{Aeq, 15minute}$, dB(A)) Day^{1} / Night^{2} Operational Parcels					
				A	AB	ABC	ABCD	ABCDE	ABCDEF
NCA01	N1_R03	1 Bakers Lane, Kemps Creek	Residential	- / 1	- / 1	- / 2	- / 2	- / 2	- / 2
NCA01	N1_E01	Mamre Anglican School	Educational	- / -	1^{3} / -	1^{3} / -	5^{3} / -	5^{3} / -	5^{3} / -
NCA03	N3_R01	20 Aldington Road, Kemps Creek	Residential	- / -	- / -	- / -	- / 1	1 / 4	1 / 5
NCA03	N3_R02	53 Aldington Road, Kemps Creek	Residential	- / -	- / -	- / -	- / 1	1 / 4	2 / 5
NCA04	N4_R01	799-803 Mamre Road, Kemps Creek	Residential	- / 3	- / 4	- / 4	- / 5	- / 5	- / 4
NCA04	N4_R02	819 Mamre Road, Kemps Creek	Residential	- / 2	- / 3	- / 4	- / 4	- / 5	- / 4
NCA04	N4_R03	833A Mamre Road, Kemps Creek	Residential	- / 1	- / 2	- / 3	- / 3	- / 3	- / 3
NCA04	N4_R04	833B Mamre Road, Kemps Creek	Residential	- / -	- / 1	- / 2	- / 2	- / 3	- / 3
NCA04	N4_R05	845A Mamre Road, Kemps Creek	Residential	- / -	- / 1	- / 2	- / 2	- / 2	- / 2
NCA04	N4_R06	845-857 Mamre Road, Kemps Creek	Residential	- / -	- / -	- / -	- / 1	- / 1	- / 1

Notes:

1. Daytime noise level, driven by worst case combination of generators
2. Night period predicted noise level
3. This receiver (shaded) is expected to relocated in 2029 (see Section 2.4), and so not expected to be a receiver during these phases, noting construction is expected to commence 2027 as per indicative program in Section 7.2, and Parcel A will take 1 to 2 years to construct prior to then commencing operations.

All receivers are identified with residual impacts not greater than 5 dB(A) above the PNTL and also under the NPfI recommended amenity noise level. This level of impact would be considered Marginal, as per NPfI Table 4.1, noting the cumulative MRP criteria that is being implemented as per Section 5.

The majority of identified properties expected to experience residual impacts of up to 3 dB(A) above the PNTL, which would remain considered Marginal, during the early Phases of the Proposal development.

As detailed in Section 2.3.3 and Section 5, as these receivers would likely be in place for only a short time, it would not be reasonable to provide mitigation or management measures in order to achieve the same acoustic amenity as for long-term receivers, and the feasible and reasonable mitigation or management measures considered in this assessment have taken that into account.

Substantial mitigation has already been included into the design to minimise noise emissions for the long-term sensitive receivers within MRP and receivers outside of the MRP, which substantially reduced potential impacts on these identified receivers. The substantial costs of any onsite mitigation measures would not be considered reasonable. This is consistent with the feasible and reasonable approach to mitigation in the NPfI (Fact Sheet F).

It would be proposed that for a feasible and reasonable approach to mitigation, a negotiated agreement would be entered into with these receivers, which may include at-property noise mitigation treatments, to manage noise impacts on these receivers until the existing residential use ceases.

The agreement should be with consideration of the predicted level of noise impact, which may be reviewed and updated as part of the detailed design review, or when a tenant and their associated noise emissions become known, determined as part of mitigation measures in Section 8.3.2.

This may mean that receivers identified in this NVIA (ie. the residences identified with residual noise levels of 3 dB(A) or greater) may no longer be identified as above the PNTL following a refinement of design and operations.

Furthermore, where it is found that a receiver is subject to and existing commercial agreement, or at-property treatments have already been applied, this may be further considered as part of the reasonable approach to manage residual impacts.

Consideration of at-property noise mitigation treatments would only be proposed should the receivers be occupied at the commencement of operations, and the predicted impacts are still expected following the detailed design review. If minor exceedances have been removed through mitigation and management through further detailed analysis, further information can be provided to DPHI, and these residences will not be considered for further mitigation.

To implement these agreements and controls, a noise mitigation consultation plan would be prepared and provided to DPHI prior as a proposed reasonable method of entering into an agreement with the identified receivers. The consultation with potentially impacted receiver would then be undertaken according to this plan. A reasonable approach would be to offer at-property treatments, to achieve suitable internal noise levels, which would likely involve upgrading of the building shell (eg. window upgrades) and the provision of mechanical ventilation to all impacted habitable rooms.

8.7 Operational noise mitigation and management

8.7.1 Proposal operational noise mitigation management

The mitigation and management measures presented in Section 8.3.2 to 8.3.6 should be further reviewed as required so that they can be reasonably incorporated into the Proposal design where feasible. These are specific recommendations required for the Proposal.

For the site to achieve the requirements of the NPfI, these mitigation or management measures are required to be implemented or further investigated during design development, to achieve the outcomes consistent with this NVIA.

8.7.2 Noise compliance monitoring

It is recommended that noise compliance measurements are conducted once operations commence and are at a typical operating state, to determine that noise emissions are consistent with those documented in this assessment, and to determine that the mitigation measures are effective.

The method for measuring the performance and/or noise compliance of the Proposal should be undertaken in accordance with Section 7 '*Monitoring performance*' of the NPfI and consideration of *Approved Methods for measurement and Analysis of Environmental Noise in NSW* (EPA 2022).

8.7.3 Ongoing management

As part of the site's Operational Noise Management Plan (ONMP) or relevant section of the Operational Environmental Management Plan (OEMP), there should also be regular reviews of on-site noise mitigation and management practices to incorporate and capture opportunities for reductions of site noise emissions where feasible and reasonable, with considerations of the following:

- Review of noise emission levels, and identification of reduction opportunities during changes or refinements of site noise generating activities in the case that noise emission levels are not consistent with those expected in this NVIA.
- Reviewing noise levels of plant, equipment and activities, during both ongoing compliance checks and in response to complaints.
- Improvements in Best Management Practice (BMP).
- Improvements in Best Available Technology Economically Achievable (BATEA).

8.8 Operational road traffic

8.8.1 Proposal vehicle movements and traffic generation

Vehicle movements for operational traffic to and from the Proposal site will be along newly constructed sub-arterial roads within the MRP, and then along Mamre Road and connecting to the nearby major arterial roads. These are shown in Figure 8-9 which shows likely access points and routes, which are as follows:

- Departing the site/travel to the Proposal via Mamre Road:
    - from for the M4 Western Motorway
    - from Elizabeth Drive / M7 Motorway

The traffic volumes used for traffic noise predictions and assessment were based on traffic movement data provided by the project team.

Vehicle movements associated with the operations of the facility will access or depart via Mamre Road, and through a newly constructed connection constructed through Yiribana and Aspect Estates connecting to new roundabout intersection at the Proposal at shown in Figure 8-9, and then via the four access points shown in Figure 8-10.

Figure 8-9: Detailed site access arrangements (Ason)

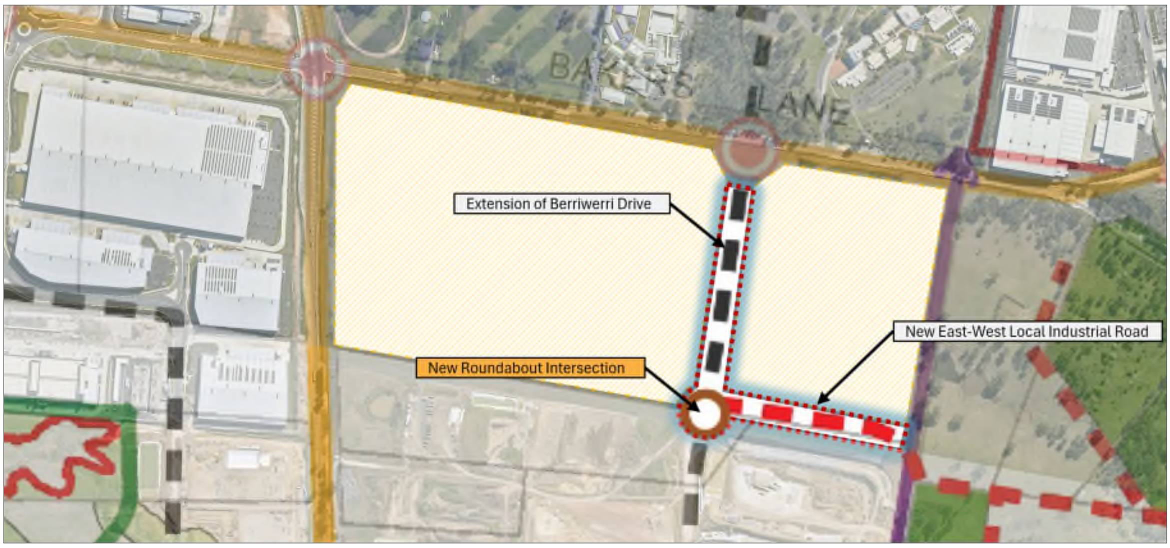
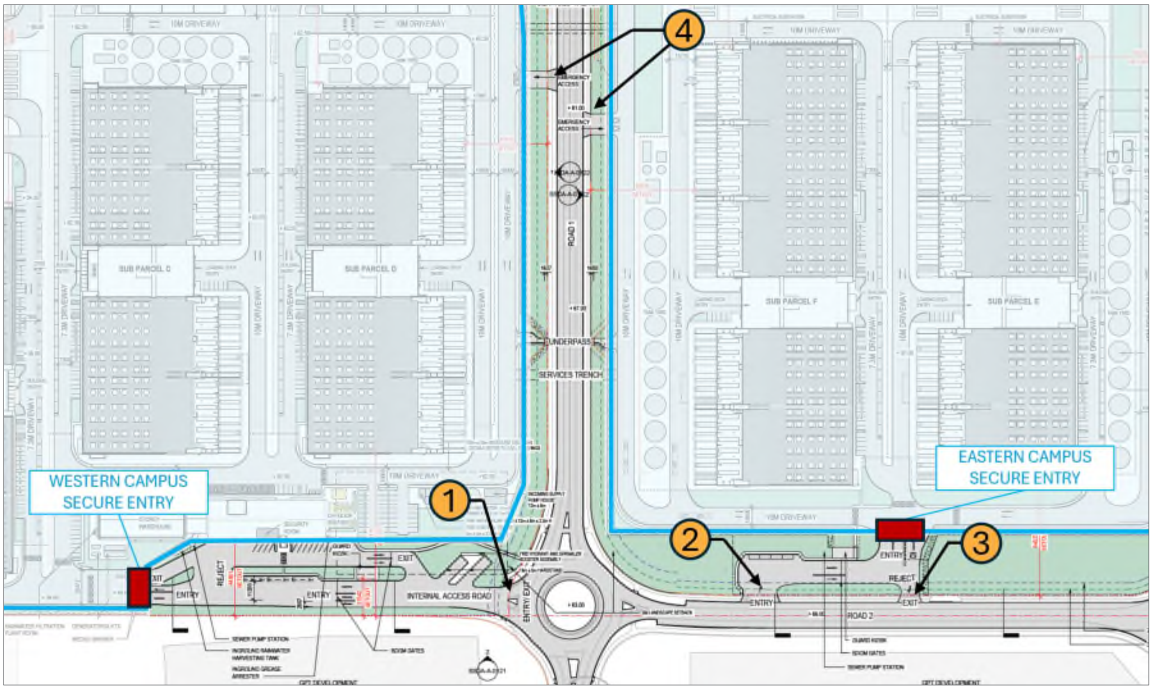


Figure 8-10: Detailed site access arrangements (Ason)



8.8.2 Existing traffic volumes

The daily existing traffic data on Mamre Road is presented in Table 8-24.

Table 8-24: Existing traffic volumes on access routes

Location	Direction	Day 7:00am – 10:00pm (15 hour)			Night 10:00pm – 7:00am (9 hour)		
		Total Vehicles	Light	Heavy	Total Vehicles	Light	Heavy
Mamre Road	Both directions	13,543	11,345	2,198	3,342	2,875	467

Notes: 1. Traffic data based upon traffic survey between Bakers Lane and Abbotts Road, October 2023 by Matrix Traffic and Transport Data.

8.8.3 Proposed traffic volumes

Daily traffic volumes for the Proposal have been provided by the Proposal traffic engineers (Ason) and are summarised in Table 8-25 below.

For a conservative traffic noise assessment, it has been assumed that all traffic could travel along the same route, passing by residential receivers on Mamre Road, even though in reality these vehicles would not all travel in the same direction along Mamre Road to then connect to nearby arterial roads.

Table 8-25: Assumed Proposal typical generated daily traffic movements

Details	Total movements	Day 7:00am to 10:00pm (15 hour)		Night 10:00pm to 7:00am (9 hour)	
		Light	Heavy	Light	Heavy
Fully developed campus	1,624	1,166	98	354	6

8.8.4 Predicted road traffic noise increase

The potential increase in road traffic noise levels has been calculated based upon the Proposal in isolation considering existing traffic volumes on Mamre Road, without consideration of future growth. The assessment is based upon the existing traffic volumes presented in Table 8-24 and the Proposal traffic generating presented in Table 8-25. Potential traffic noise levels at key potentially impacted residences on Mamre Road have been assessed and the presented in Table 8-26.

Table 8-26: Predicted traffic noise increase on public roads

Road	Vehicle type	Noise increase, dB(A)	RNP increase criterion, dB(A)	Compliance
Mamre Road	Day (15 hour - 7:00am to 10:00pm)	0.3	2.0	Yes
	Night (9 hour - 10:00pm to 7:00am)	< 0.1		Yes

As seen by the outcome in in Table 8-26, the portion of traffic generated by the Proposal makes up an insignificant amount of traffic compared to the potential future traffic volumes along the Mamre Road, without consideration of the future expected growth.

From the above tables, it can be seen that road traffic noise level contributions from the vehicle movements associated with the Proposal are not expected to increase the existing traffic noise levels by more than 2 dB(A) as required by the RNP.

Furthermore, the road network in the general vicinity of the MRP is due to receive significant road upgrades in the future as part of the Mamre Road Upgrade (MRU) strategy. During August 2025, the Review of Environmental Factors (REF) for the proposed Mamre Road Upgrade Stage 2 (MRUS2) was release for public display, and is currently on exhibition at the time of drafting this report. It is noted that traffic generated as part of the MRP has also been considered as part of the upgrade assessments.

Section 3.5 "*Cumulative impacts from traffic generating developments*" of the RNP is important for consideration with regard to the MRP. However, as the potential generation by the Mamre Road precinct and proposed inter-modal terminal are being considered as part of the Mamre Road Upgrade (MRU), Elizabeth Drive Upgrade (EDU) and M12 Motorway projects, then this requirement of the RNP will be addressed by those road projects accordingly.

Therefore, following the above assessment, the traffic noise levels as a result of the operational traffic from the Proposal on public roads would meet the RNP requirements, and potential impacts from the road traffic generated by the Proposal on public roads does not require further consideration.

9 Conclusion

Renzo Tonin & Associates (RTA) has been engaged by Plan Project Management (PPM) to undertake an operational and construction noise and vibration impact assessment (NVIA) to accompany the State Significant Development Application (SSD) 92743706 for the proposed Mamre Road Data Centre at 706–752 Mamre Road, Kemps Creek, NSW (the Proposal). The Proposal site is located within the Mamre Road Precinct (MRP). The MRP is located within the Western Sydney Employment Area.

This report assesses noise and vibration impacts during the construction and operational phases of the Proposal. It proposes mitigation and management measures to reduce impacts during the construction and operational phases of the Proposal. The report has been prepared to address the requirements of the Secretary of the Department of Planning, Housing and Infrastructure (DPHI) ('the Secretary's environmental assessment requirements') (SEARs).

9.1 Operational noise assessment

Operational noise impacts from the proposed Mamre Road Data Centre have been assessed, potential noise impacts identified, and a range of feasible and reasonable mitigation measures incorporated into the Proposal design to minimise noise impacts on sensitive receivers nearby and further removed from the site.

The assessment has reviewed the existing noise environment and established the noise emission objectives in accordance with the NSW Noise Policy for Industry (NPfI) (EPA 2017) and the Mamre Road development control plan (MRP DCP) requirements.

As the site is located within the rezoned Mamre Road Precinct (MRP), which rezoned about 850 hectares of existing rural and rural residential into industrial land, the potential for cumulative industrial noise was an important aspect of determining acceptable noise levels from the Proposal. As part of the MRP Development Control Plan (DCP), Clause 4.3.1(5) *Noise and Vibration* of MRP DCP states: *Acoustic Reports for individual developments must assess cumulative noise impacts, including likely future noise emissions from the development and operation of the Precinct. The consultant should liaise with the relevant consent authority to determine acceptable amenity goals for individual industrial developments and background noise levels.*

DPHI has developed over the period since the rezoning, an approach for managing the cumulative noise build up from the MRP, consistent with the approaches in the NPfI. This has been done using a conservative approach, and in a progressive and managed way, considering unknowns across the MRP at the early development stages. Noting that the MRP now consists of around 50% approved developments and expected noise levels presented in noise assessments for MRP developments, along with issued consent noise limits, have identified that a review of the approach would be appropriate to efficiently use the industrial land. Therefore this assessment has included a number of aspects to address cumulative noise which refine the current approach.

This assessment has reviewed the potential noise generating plant items and activities that are likely take place as part of operations of the Proposal. The assessment has predicted the potential noise impacts from the reasonable worst case site operations under the prevailing noise-enhancing meteorological conditions in accordance with the NPfI.

A detailed mitigation investigation was undertaken to determine the feasible and reasonable controls required to achieve the project noise trigger levels. Noting the elevated nature of the noise sources and their large number, combined with the varied distances to receivers, and located in multiple directions, the mitigation approach focused firstly on reducing noise at the source. At source noise mitigation included quieter unit selections, on-unit mitigation at-intake or discharge points, relocating noise sources, and enclosing noise sources where possible, before reducing noise along transmission paths to receivers were investigated (ie. noise barriers).

Following the implementation of a range of in-principle mitigation and management measures, the predicted noise levels have demonstrated that during typical operations of the data centre, which includes maintenance testing of generators, the predicted noise levels comply with the required PNTLs at receivers that surround the Proposal site, with the exception of some existing residences and school, which are likely to only be receivers in the short term and/or are planning on relocating prior to when impacts are predicted. As part of further design development during later design stages detailed analysis will be undertaken to ensure that the design will achieve the project noise trigger levels presented in Section 5.2.4 considering the final plant and equipment selections and operations.

There are up to 9 existing residences in addition to Mamre Anglican School which are within the rezoned MRP area, where there is residual noise impacts predicted.

These receivers were identified, based upon the ultimate fully developed campus, and noise levels are generally expected to be lower during previous stages. Impacts are also identified during periods when the receivers may no longer be present, however this information has been provided in case there is changes for timings. It is expected that the land where these receivers are located will be progressively redeveloped in future into industrial developments. Considering this, it would not be feasible and reasonable to strictly achieve the project noise trigger levels. It is proposed that for a feasible and reasonable approach to mitigation, a negotiated agreement would be entered into with these receivers, which may include at-property noise mitigation treatments, to manage noise impacts on these receivers until the receivers are no longer present.

The assessment has found that any potential sleep disturbance and operational road traffic noise increases attributed to the Project, would respectively meet the NPfI and RNP requirements.

9.2 Construction noise and vibration assessment

An assessment of construction noise impact from the Proposal construction works has been undertaken. Noise emissions from the proposed construction works have been predicted and assessed against the relevant noise management levels (NML) set by the NSW *Interim Construction Noise Guideline* (ICNG) (DECC 2009) during the recommended standard hours for construction.

During standard construction hours, noise levels at are generally expected to be below the ICNG NMLs for nearby affected receivers, except when high noise generating plant and equipment are in use, such as excavators with rockhammers, which may be required during the bulk excavation and civil works / utilities stages of work, and these works are required in close proximity to the nearby receivers. The nearby schools and residences may experience construction noise levels above the NMLs if high noise activities are required during the bulk earthworks, but other typical and loud-earthmoving activities are expected to be under the NML. No residential receivers are predicted to be highly noise affected [experience construction noise levels above 75 dB(A)].

Additionally, the proposal is seeking approval for construction activities to occur outside of the standard construction hours, which will likely be required for the temporary access off Mamre Road, as the works will likely need to take place under a road occupancy licence (ROL). Justifications for why it is required to undertake construction works outside of the standard construction hours (OOHW) have been provided, along with the potential impacts, and ways that impacts can feasibly and reasonably be managed to achieve the appropriate noise management levels.

The final construction methodology at this stage of the proposal is not known as a contractor has not been appointed for the Proposal. For this assessment, the proposed OOHW have been identified in a conservative manner with the aim of capturing the likely worst case required OOHW, along with identifying a specific mitigation and management measure that are to be considered by the contractor as part of a works specific assessment during the construction stage. As part of further design development and when the specific construction methodology is known, a works specific assessment would be undertaken to determine the feasible and reasonable controls required to be implemented to manage the construction works within the construction noise management levels.

As the Proposal is located within the MRP there are a large number of similar industrial facility construction projects that will take place in the near future and as the MRP further develops. As such, there is potential for cumulative or consecutive noise impacts as a result of the Proposal combined with other project with concurrent or similar timeframes, which may lead to both cumulative impacts and/or construction fatigue. As such, recommended mitigation and management measures have been included to be considered during further construction planning.

Construction related road traffic noise is expected to achieve the requirements of the NSW *Road Noise Policy* and is not expected to cause any adverse impacts at nearby receivers.

The expected construction noise levels have been predicted and presented in Section 7.3.1 Noise mitigation and management measures have been presented in Section 7.3.4 to aid in providing additional noise reduction benefits where exceedance of the objectives occurs.

A number of vibration intensive construction activities are likely to be required such as use of rock hammering and vibratory rolling. No structures have been identified within the minimum working distance for cosmetic damage. There are receivers that have been identified within the minimum working distances for human annoyance. A further review of potential vibration impacts and construction methodology, along with mitigation and management approaches to appropriately manage potential impacts would be required during further design development phases to ensure that potential vibration impacts are adequately mitigated and managed.

References

1. NSW Department of Climate Change and Water (2011), *Road Noise Policy* (RNP)
2. NSW Department of Environment and Climate Change (2009), *Interim Construction Noise Guideline* (ICNG)
3. NSW Environment Protection Authority (2017), *Noise Policy for Industry* (NPfI)
4. NSW Environment Protection Authority (2022), *Approved methods for measurement and analysis of environmental noise in NSW*
5. Standards Australia (2016), *Guide to Noise Control on Construction, Demolition and Maintenance Sites*, AS 2436:2010 (R2016)
6. Standards Australia (2018), *Acoustics—Description and measurement of environmental noise*, AS1055:2018
7. G. Downey, NSW Environment Protection Authority, *"An example approach to consider low frequency noise in the context of the NSW noise policy for industry"*, 2020, Acoustics Australia 48:149-180, Parramatta, Australia

APPENDIX A Technical terms and concepts

A.1 Glossary of terminology - Noise

The following is a brief description of the technical terms used to describe noise and to assist in understanding the technical issues presented.

Absorption Coefficient α	The absorption coefficient of a material, usually measured for each octave or third-octave band and ranging between zero and one. For example, a value of 0.85 for an octave band means that 85% of the sound energy within that octave band is absorbed on coming into contact with the material. Conversely, a low value below about 0.1 means the material is acoustically reflective.
Adverse weather	Weather effects that enhance noise (particularly wind and temperature inversions) occurring at a site for a significant period of time. In the NSW INP this occurs when wind occurs for more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of nights in winter.
Air-borne noise	Noise which is fundamentally transmitted by way of the air and can be attenuated by the use of barriers and walls placed physically between the noise source and receiver.
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Amenity	A desirable or useful feature or facility of a building or place.
AS	Australian Standard
Assessment period	The time period in which an assessment is made. e.g. Day 7am-10pm & Night 10pm-7am.
Assessment Point	A location at which a noise or vibration measurement is taken or estimated.
Attenuation	The reduction in the level of sound or vibration.
Audible Range	The limits of frequency which are audible or heard as sound. The normal hearing in young adults detects ranges from 20 Hz to 20 kHz, although some people can detect sound with frequencies outside these limits.
A-weighting	A filter applied to the sound recording made by a microphone to approximate the response of the human ear.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the LA90 noise level if measured as an overall level or an L90 noise level when measured in octave or third-octave bands.
Barrier (Noise)	A natural or constructed physical barrier which impedes the propagation of sound and includes fences, walls, earth mounds or berms and buildings.
Berm	Earth or overburden mound.
Buffer	An area of land between a source and a noise-sensitive receiver and may be an open space or a noise-tolerant land use.
Bund	A bund is an embankment or wall of brick, stone, concrete or other impervious material, which may form part or all of the perimeter of a compound.
BS	British Standard
CoRTN	United Kingdom Department of Environment entitled "Calculation of Road Traffic Noise (1988)"
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of common sounds in our environment:

	threshold of hearing	0 dB	The faintest sound we can hear, defined as 20 micro Pascal
		10 dB	Human breathing
	almost silent	20 dB	
		30 dB	Quiet bedroom or in a quiet national park location
	generally quiet	40 dB	Library
		50 dB	Typical office space or ambience in the city at night
	moderately loud	60 dB	CBD mall at lunch time
		70 dB	The sound of a car passing on the street
	loud	80 dB	Loud music played at home
		90 dB	The sound of a truck passing on the street
	very loud	100 dB	Indoor rock band concert
		110 dB	Operating a chainsaw or jackhammer
	extremely loud	120 dB	Jet plane take-off at 100m away
	threshold of pain	130 dB	
		140 dB	Military jet take-off at 25m away
dB(A)	A-weighted decibel. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter is denoted as dB(A). Practically all noise is measured using the A filter.		
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies. The dB(C) level is not widely used but has some applications.		
Deemed-to-Satisfy Provisions	The Deemed-to-Satisfy Provisions are an optional means of achieving compliance with the mandatory Performance Requirements of the National Construction Code. (also see Alternate Solution)		
Diffraction	The distortion of sound waves caused when passing tangentially around solid objects.		
DIN	German Standard		
Discontinuous Construction	A wall system having a minimum 20mm cavity between two separate leaves, where, for other than masonry there is no mechanical linkage between leaves except at the periphery.		
DnT,w	Weighted Standardised Field Level Difference A measure of sound insulation performance of a building element. It is characterised by the difference in noise level on each side of a wall or floor. It is measured in-situ. It is a field measurement that relates to the Rw laboratory measured value but is not equal to it because an in-situ space is not of the same quality as a laboratory space. The value is indicative of the level of speech privacy between spaces. The higher its value the better the insulation performance.		
ECRTN	Environmental Criteria for Road Traffic Noise, NSW, 1999		
ENMM	Environmental Noise Management Manual, Roads and Maritime Services (Transport for NSW)		
EPA	Environment Protection Authority		
Field Test	A test of the sound insulation performance in-situ. See also 'Laboratory Test' The sound insulation performance between building spaces can be measured by conducting a field test, for example, early during the construction stage or on completion. A field test is conducted in a non-ideal acoustic environment. It is generally not possible to measure the performance of an individual building element accurately as the results can be affected by numerous field conditions.		

FIIC	Field Impact Isolation Class. A measure of the noise impact performance of a floor. The value indicates the resistance of the floor to the transmission of impact sound and is measured using a standard tapping machine. It is measured in-situ and is therefore subject to the inherent accuracies involved in such a measurement. The term is defined in ASTM E492 and E1007. It is a field measure of the level of impact sound transmitted to a space via a floor. The equivalent measurement in a laboratory is termed the IIC. The higher the value the better the performance.
Flanking	Flanking is the transfer of sound through paths around a building element rather than through the building element material directly. For example, sound travelling through a gap underneath a door or a gap at the top of a wall.
Fluctuating Noise	Noise that varies continuously to an appreciable extent over the period of observation.
Free-field	An environment in which there are no acoustic reflective surfaces. Free field noise measurements are carried out outdoors at least 3.5m from any acoustic reflecting structures other than the ground.
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
FSTC	Field Sound Transmission Class A measure of the sound insulation performance of a building element. It is characterised by the difference in noise level on each side of a wall or floor. It is measured in the field and is therefore subject to the inherent inaccuracies involved in such a measurement. The term was referred to in older superseded versions of the Building Code of Australia and has now been replaced with the term DnT,w.
Ground-borne noise	Vibration propagated through the ground and then radiated as noise by vibrating building elements such as wall and floor surfaces. This noise is more noticeable in rooms that are well insulated from other airborne noise. An example would be vibration transmitted from an underground rail line radiating as sound in a bedroom of a building located above.
Habitable Area	Includes a bedroom, living room, lounge room, music room, television room, kitchen, dining room, sewing room, study, playroom, family room, home theatre and sunroom. Excludes a bathroom, laundry, water closet, pantry, walk-in wardrobe, corridor, hallway, lobby, photographic darkroom, clothes drying room, and other spaces of a specialised nature occupied neither frequently nor for extended periods.
Heavy Vehicle	A truck, transporter or other vehicle with a gross weight above a specified level (for example: over 8 tonnes).
IGANRIP	Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects, NSW DEC 2007
IIC	Impact Isolation Class A measure of the noise impact performance of a floor. It is measured in very controlled conditions in a laboratory and is characterised by how much sound reaches the receiving room from the operation a standard tapping machine placed on the floor. The term is defined in ASTM E492 and E1007. The higher the number the better the performance.
Impact Noise	The noise in a room, caused by impact or collision of an object onto the walls or the floor. Typical sources of impact noise are footsteps on the floor above a tenancy and the slamming of doors on cupboards mounted on the common wall between tenancies.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
INP	NSW Industrial Noise Policy, EPA 1999
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation.
Intertenancy wall	Walls that separate buildings or units within a building. They may provide sound resistance or serve as a fire wall. Synonymous with 'party wall'.
Intrusive noise	Refers to noise that intrudes above the background level by more than 5 dB(A).

ISEPP	State Environmental Planning Policy (Infrastructure), NSW, 2007
ISEPP Guideline	Development Near Rail Corridors and Busy Roads - Interim Guideline, NSW Department of Planning, December 2008
L1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L10	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L10(1hr)	The L10 level measured over a 1 hour period.
L10(18hr)	The arithmetic average of the L10(1hr) levels for the 18 hour period between 6am and 12 midnight on a normal working day.
L90	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
LAeq or Leq	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time, which would produce the same energy as a fluctuating sound level. When A-weighted, this is written as the LAeq.
LAeq(1hr)	The LAeq noise level for a one-hour period. In the context of the NSW EPA's Road Noise Policy it represents the highest tenth percentile hourly A-weighted Leq during the period 7am to 10pm, or 10pm to 7am (whichever is relevant).
LAeq(8hr)	The LAeq noise level for the period 10pm to 6am.
LAeq(9hr)	The LAeq noise level for the period 10pm to 7am.
LAeq(15hr)	The LAeq noise level for the period 7am to 10pm.
LAeq (24hr)	The LAeq noise level during a 24 hour period, usually from midnight to midnight.
Lmax	The maximum sound pressure level measured over a given period. When A-weighted, this is usually written as the LAmax.
Lmin	The minimum sound pressure level measured over a given period. When A-weighted, this is usually written as the LAmin.
Ln,w	Weighted Normalised Impact Sound Pressure Level A measure of the sound level transmitted from impacts on a floor to a tenancy below. It is measured in very controlled conditions in a laboratory and is characterised by how much sound reaches the receiving room from a standard tapping machine. A lower value indicates a better performing floor.
LnT,w	Weighted Standardised Field Impact Sound Pressure Level As for Ln,w but measured in-situ and therefore subject to the inherent accuracies involved in such a measurement. The equivalent measurement in a laboratory is the Ln,w. A lower value indicates a better performing floor.
Laboratory Test	The performance of a building element when measured in a laboratory. The sound insulation performance of a building element installed in a building however can differ from its laboratory performance for many reasons including the quality of workmanship, the size and shape of the space in which the measurement is conducted, flanking paths and the specific characteristics of the material used which may vary from batch to batch.
Loudness	A rise of 10 dB in sound level corresponds approximately to a doubling of subjective loudness. That is, a sound of 85 dB is twice as loud as a sound of 75 dB which is twice as loud as a sound of 65 dB and so on. That is, the sound of 85 dB is four times or 400% the loudness of a sound of 65 dB.
Microphone	An electro-acoustic transducer which receives an acoustic signal and delivers a corresponding electric signal.
NCA	Noise Catchment Area. An area of study within which the noise environment is substantially similar.
NCG	Noise Criteria Guideline, Roads and Maritime Services (Transport for NSW)

NMG	Noise Mitigation Guideline, Roads and Maritime Services (Transport for NSW)
Noise	Unwanted sound
Normalised	A method of adjusting the measured noise indices in a laboratory so that they are independent of the measuring space. The noise level in a room is affected by reverberation in the room. For example, the Ln,w impact sound pressure level measured in a laboratory is dependent upon the amount of absorptive material in the receiving room. The value is adjusted to what would be measured if the sound absorption in the receiving room is set at 10m2. This enables all laboratories to report the same value when measured under slightly different conditions. See also 'Standardised'.
NRC	Noise Reduction Coefficient. A measure of the ability of a material to absorb sound. The NRC is generally a number between 0 and 1 but in some circumstances can be slightly greater than 1 because of absorption at the edges of the material. A material with an NRC rating of 1 absorbs 100% of incoming sound, that is, no sound is reflected back from the material. The NRS is the average of the absorption coefficient measured in the octave bands 250Hz, 500Hz, 1kHz & 2kHz which correspond to the predominant frequencies associated with the human voice.
Partition wall	A wall dividing two rooms.
Party wall	A wall dividing two tenancies. Synonymous with 'Intertenancy Wall'.
Pre-construction	Work in respect of the proposed project that includes design, survey, acquisitions, fencing, investigative drilling or excavation, building/road dilapidation surveys, minor clearing (except where threatened species, populations or ecological communities would be affected), establishing ancillary facilities such as site compounds, or other relevant activities determined to have minimal environmental impact (e.g. minor access roads).
RBL	Rating Background Level is the representative LA90 background noise level for a period, as defined in the NSW EPA's noise policies.
Reflection	Sound wave reflected from a solid object obscuring its path.
RING	Rail Infrastructure Noise Guideline, NSW, May 2013
RMS	Root Mean Square value representing the average value of a signal.
Rw	Weighted Sound Reduction Index A measure of the sound insulation performance of a building element. It is measured in very controlled conditions in a laboratory. The term supersedes the value STC which was used in older versions of the Building Code of Australia. Rw is measured and calculated using the procedure in ISO 717-1. The related field measurement is the DnT,w. The higher the value the better the acoustic performance of the building element.
R'w	Weighted Apparent Sound Reduction Index. As for Rw but measured in-situ and therefore subject to the inherent accuracies involved in such a measurement. The higher the value the better the acoustic performance of the building element.
RNP	Road Noise Policy, NSW, March 2011
Sabine	A measure of the total acoustic absorption provided by a material. It is the product of the Absorption Coefficient (alpha) and the surface area of the material (m2). For example, a material with alpha = 0.65 and a surface area of 8.2m2 would have 0.65 x 8.2 = 5.33 Sabine. Sabine is usually calculated for each individual octave band (or third-octave).
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sole-occupancy Unit	An area within a building for the exclusive use of the owner or occupier.
Sound	A fluctuation of air pressure which is propagated as a wave through air.

Sound absorption	The ability of a material to absorb sound energy by conversion to thermal energy.
Sound Insulation	Sound insulation refers to the ability of a construction or building element to limit noise transmission through the building element. The sound insulation of a material can be described by the Rw and the sound insulation between two rooms can be described by the DnT,w.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 pico watt.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone referenced to 20 micro Pascal.
Spoil	Soil or materials arising from excavation activities.
Standardised	A method of adjusting the measured noise indices in-situ so that they are independent of the measuring space. The noise level in a room is affected by reverberation in the room. For example, the L'n,w impact sound pressure level measured in a room is dependent upon the amount of absorptive material in the receiving room. The value is adjusted to what would be measured if the reverberation time in the receiving room is set at 0.5 seconds. This enables the same value to be reported independent of whether the room contains carpet and furnishings and the like. See also 'Normalised'.
STC	Sound Transmission Class A measure of the sound insulation performance of a building element. It is measured in controlled conditions in a laboratory. The term has been superseded by Rw.
Structure-borne Noise	Audible noise generated by vibration induced in the ground and/or a structure. Vibration can be generated by impact or by solid contact with a vibrating machine. Structure-borne noise cannot be attenuated by barriers or walls but requires the isolation of the vibration source itself. This can be achieved using a resilient element placed between the vibration source and its support such as rubber, neoprene or springs or by physical separation (using an air gap for example). Examples of structure-borne noise include the noise of trains in underground tunnels heard to a listener above the ground, the sound of footsteps on the floor above a listener and the sound of a lift car passing in a shaft. See also 'Impact Noise'.
Tonal Noise	Sound containing a prominent frequency and characterised by a definite pitch.
Transmission Loss	The sound level difference between one room or area and another, usually of sound transmitted through an intervening partition or wall. Also the vibration level difference between one point and another. For example, if the sound level on one side of a wall is 100dB and 65dB on the other side, it is said that the transmission loss of the wall is 35dB. If the transmission loss is normalised or standardised, it then becomes the Rw or R'w or DnT,w.

A.2 Glossary of terminology - Vibration

The following is a brief description of the technical terms used specifically to describe vibration and to assist in understanding the technical issues presented.

Acceleration	The rate of change of velocity, often measured in m/s2 or g's. 1 g = 9.81 m/s2. Commonly used to assess human response to vibration and for machine condition monitoring.
Accelerometer	A vibration transducer sensor that is used to measure acceleration.
ANC	The Association of Noise Consultants, UK.
Ambient vibration	The all-encompassing vibration occurring at a given location, at a given time, composed of all vibration sources near and far.

Amplification	Vibration amplification refers to an increase in vibration. Amplification may occur due to resonance, when an object or structure is excited at its natural frequency.
Attenuation	Attenuation refers to a reduction in vibration. This may occur due to damping of a vibration system, the inclusion of attenuating devices or, in the case of ground vibration, during propagation through the ground. Ground attenuation is determined by the dynamic properties of the site's soil and rock.
AVTG	Assessing Vibration: A Technical Guideline. NSW Department of Environment and Conservation's (DEC) 2006 guideline for assessing human responses to vibration. Based on BS 6472–1992.
Axis	A fixed reference line for the measurement for the measurement of vibration in a particular direction. Vibration is commonly measured in transverse (T), longitudinal (L) and vertical (V) axes (or X, Y and Z).
Background vibration	The underlying level of vibration present in the ambient environment, measured in the absence of the vibration sources of interest.
Blasting	Excavation or demolition using explosives.
Borehole transducer	A geophone transducer rigidly mounted at the bottom of a borehole (either permanently or temporarily) to measure underground vibration.
Broadband vibration	The overall vibration level which encompasses a wide range of frequencies. As opposed to vibration levels for specific frequency bands (see Octave) or narrowband vibration levels as produced by FFT.
BS	British Standard.
Continuous vibration	Vibration that continues uninterrupted over a defined period.
Cosmetic damage	Damage to a structure due to vibration that only affects the appearance of the structure and can be easily repaired, e.g. hairline cracks in mortar joints of brick or concrete constructions, or cracks in plasterwork.
Coupling loss	The change in vibration level when vibration is transmitted from the ground to a building's foundations.
Crest factor	The ratio of the peak value of a vibration event to the RMS value of a vibration event.
Damping	Reduction of vibrational energy due to friction or other forces.
DEC	NSW Department of Environment and Conservation, now the Department of Planning, Industry and Environment.
Decibel [dB]	The logarithmic unit used to represent sound and vibration levels. A vibration level in dB equals 20 times the logarithm to the base 10 of the ratio of the vibration level relative to the reference level. For vibration velocity, the reference level is commonly 1 nm/s. For vibration acceleration, the reference level is commonly 1 mm/s2. Other reference values are commonly used. The reference value should always be stated.
DIN	German Standard.
Displacement	Change in position of a body from a reference point. Usually measured in m or mm.
EPA	Environment Protection Authority.
eVDV	Estimated Vibration Dose Value. See also VDV.
Filter	An electrical circuit that allows signals of certain frequency ranges to pass through, and blocks all other frequencies. Types of filters include low pass filters, high pass filters, and band pass filters.
FFT	Fast Fourier Transform. An algorithm that converts a signal from the time domain to the frequency domain.
Frequency	In the case of vibration, frequency is the number of oscillations that occurs per second. Frequency is measured in units of Hertz (Hz).
Geophone	A vibration transducer sensor that is used to measure velocity.

Ground-borne noise	Vibration propagated through the ground and then radiated as noise by vibrating building elements such as wall and floor surfaces. This noise is more noticeable in rooms that are well insulated from other airborne noise. An example would be vibration transmitted from an underground rail line radiating as sound in a bedroom of a building located above.
Ground spike	A metal stake with a flat top that is driven into the ground and used to mount a vibration transducer to measure vibration levels.
Habitable Area	Includes a bedroom, living room, lounge room, music room, television room, kitchen, dining room, sewing room, study, playroom, family room, home theatre and sunroom. Excludes a bathroom, laundry, water closet, pantry, walk-in wardrobe, corridor, hallway, lobby, photographic darkroom, clothes drying room, and other spaces of a specialised nature occupied neither frequently nor for extended periods.
Intermittent vibration	Either interrupted periods of continuous vibration or repeated periods of impulsive vibration.
Impulsive vibration	Vibration that rapidly builds up to a peak followed by a damped decay. May consist of multiple impulsive events, typically less then 2 seconds in duration.
Isolation	The process of reducing the vibrational energy transmitted to an object, such as a piece of equipment or building, from the source of vibrations.
Minor damage	Damage to a structure due to vibration that affects the serviceability of residential style buildings or other sensitive structures but does not affect the structural elements. E.g. cracks in plastered or rendered surfaces, existing cracks enlarged or partitions detached.
Mode	A mode of vibration is a characteristic pattern or shape in which a mechanical system will vibrate. The actual vibration of a structure is a combination of all the vibration modes, but to varying degrees, depending on the vibration source.
Natural frequency	The frequency at which a system tends to oscillate in the absence of any driving or damping force.
Noise floor	The residual level of unwanted signal measured by an instrumentation system. The signal of interest must be above the noise floor to be measured accurately. See also Signal to noise ratio.
Octave	An octave represents a doubling or halving in frequency. Noise or vibration levels across a frequency spectrum are commonly given in octave or one-third octave frequency bands.
Peak-to-peak	The difference between the highest positive peak level and the lowest negative peak of a vibration event.
Peak vibration velocity	The absolute maximum value of the vibration velocity signal measured in the X, Y or Z axis during a given time interval. Also referred to as the peak component particle velocity.
PPV	Peak Particle Velocity. The absolute maximum value of the vibration velocity signal measured in any axis during a given time interval.
PVS	Peak Vector Sum. The vector sum of the peak vibration velocities measured in the three orthogonal axes.
Resonance	The phenomenon of increased amplitude that occurs when the frequency of an applied force is equal or close to the natural frequency of the system.
RMS	Root Mean Square value representing the average value of a signal.
Sampling rate	The number of samples per second taken from a continuous signal to make a discrete or digital signal. Measured in Hertz. To accurately record the signal and determine the spectrum, the sampling rate must two or more times the maximum frequency of interest.
Settlement	The movement of soil due to vibration or other forces, often in relation to a building’s foundations. The indirect effect of settlement and ground movement may cause building damage, separately from the direct of effect of building vibration.
Signal to noise ratio	A ratio of the level of a desired signal to the level of the background, often expressed in decibels.
Source vibration	A source that generates vibration. Can be quantified by the amplitude, frequency content and duration of the vibration. Common sources of vibration include rail and road traffic, construction and demolition activities and blasting.
Spectrum	The result of transforming a signal from the time domain to the frequency domain.

Structural damage	Damage to a structure due to vibration that may affect its serviceability due to damage to structural elements. May result in the reduced stability of the building and/or reduction in load-bearing capacities.
Structural fatigue	The weakening of a material caused by cyclic loading that results in progressive and localised structural damage and the growth of cracks.
Structure-borne Noise	Audible noise generated by vibration induced in the ground and/or a structure. Vibration can be generated by impact or by solid contact with a vibrating machine. Structure-borne noise cannot be attenuated by barriers or walls but requires the isolation of the vibration source itself. This can be achieved using a resilient element placed between the vibration source and its support such as rubber, neoprene or springs or by physical separation (using an air gap for example). Examples of structure-borne noise include the noise of trains in underground tunnels heard to a listener above the ground, the sound of footsteps on the floor above a listener and the sound of a lift car passing in a shaft.
Tactile vibration	Vibration of a level that can be felt by humans, dependant on the amplitude and frequency of the source. Note that vibration may also be perceived through indirect effects such as ground-borne noise or the shaking of building elements.
Transducer	A device that converts energy from one form to another. Vibration transducers convert either acceleration, velocity or displacement to an electrical signal that is processed by the monitoring system.
Triaxial	Three axes. Measurement systems often consist of three vibration transducers arranged triaxially – oriented at 90° from each other.
VDV	Vibration Dose Value. A measure of tactile vibration levels used to assess intermittent vibration.
Velocity	The rate of change of vibration displacement, usually measured in mm/s.
Vibration	A mechanical phenomenon whereby oscillations occur about an equilibrium point; a periodic back-and-forth motion of an elastic body or medium, commonly resulting when almost any physical system is displaced from its equilibrium condition.
Vrms	Root mean square (RMS) vibration level for the train passby, typically expressed in mm/s
Waveform	A graphical representation of a vibration event in the time domain, showing the measured vibration levels for each sample.

A.3 Acoustic concepts

A.3.1 Sound and noise

The terms 'sound' and 'noise' are almost interchangeable, except that in common usage 'noise' is often used to refer to unwanted sound. Sound is a vibration that travels as an audible wave of pressure through the air from a source to a receiver location such as the human ear. The loudest sound pressure to which the human ear responds is ten million times greater than the softest. The decibel (abbreviated as dB) is a unit of measurement used to express the ratio of a quantity to another on a logarithmic scale to make the wide range of sound pressure more manageable.

Sound power is the rate at which a source emits acoustic energy and is unaffected by the environment. It is a property of the source that is emitting acoustic energy.

In contrast, sound pressure is the effect, and it is affected by factors associated with the built and natural environment such as distance, direction, obstacles etc. The sound pressure is the acoustic energy or 'noise level' at a distance away from the noise source. The relationship between sound power and sound pressure can be explained by considering the analogy of an electric heater, which radiates heat into a room and temperature is the effect. Like sound pressure, temperature also reduces with distance from the source following the inverse square law.

In this technical working paper, sound power level is identified by the symbols SWL or Lw, while sound pressure level is represented by SPL or Lp, and both have the same scientific unit in dB.

A.3.2 Individual's perception of sound

The loudness of sound depends on its sound pressure level. The A-weighted decibel [dB(A)] is generally used for the purposes of environmental noise impact assessment as it has been adjusted to account for the varying sensitivity of the human ear to different frequencies of sound. People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4000 Hz), and less sensitive at lower and higher frequencies. Thus, the level of a sound in dB(A) is a good measure of the loudness of environmental noise to the human ear as it considers this frequency dependant sensitivity.

Different noise sources having the same dB(A) level generally sound equally loud. However, the frequency of a sound is what gives it a distinctive pitch or tone – for example, the rumble of distant thunder is an example of a low frequency sound and a whistle is an example of a high frequency sound. Most sounds we hear in our daily lives have sound pressure levels in the range of 30 to 90 dB(A). The following table provide some points of reference, measured in dB(A), of familiar sounds and those from construction activities.

Table A-1 Perception of sound - familiar sounds and construction noise

Common sounds	Construction noise	Sound pressure level
Leaf blower at operator's ear	Concrete saw or jack hammer 7 metres away	90 dB(A)

Common sounds	Construction noise	Sound pressure level
Airplane cabin during cruise (Airbus 321)	Excavator (with bucket) 7 metres away	80 dB(A)
General traffic noise kerbside next to Military Road	Towable compressor 7 metres away	75 dB(A)
Normal conversation at 1 metre		60 dB(A)
Outdoor air conditioning unit 1 metre away	Towable compressor 50 metres away	55 dB(A)
General office		50 dB(A)
Inside private office	Ground-borne noise from road header tunnel excavation between depths of 20 metres to 50 metres	40 dB(A)
Inside bedroom		30 dB(A)

In terms of sound perception, a change of 1 dB(A) or 2 dB(A) in the sound pressure level is difficult for most people to detect, whilst a 3 dB(A) to 5 dB(A) change corresponds to a small but noticeable change in loudness. An increase in sound level of 10 dB(A) is perceived as a doubling of loudness. However, individuals may perceive the same sound differently since many factors can influence an individual's response, including:

- The specific characteristics of the noise (eg. frequency, intensity, duration of the noise event)
- Time of day noise events occur
- Individual sensitivities and lifestyle
- Reaction to an unfamiliar sound
- Understanding of whether the noise is avoidable and the notions of fairness.

A.3.3 Environmental noise assessment indicators

Environmental noise is an accumulation of noise pollution that occurs outside and is most commonly attributed to various modes of transport as well as industrial and construction activities. Environmental noise has been shown to have an adverse effect on the quality of life, especially following long-term exposure. The focus of the present technical assessment is on annoyance and sleep disturbance as they constitute most of the burden related to the impact of environmental noise on health outcomes. Noise annoyance is defined by the World Health Organization as a feeling of displeasure, nuisance, disturbance or irritation caused by a specific sound. Sleep disturbance relates to difficulty with sleep initiation, consolidation as well as awakening and reduced quality of sleep.

In New South Wales, contemporary environmental noise assessment criteria for addressing noise annoyance and sleep disturbance are specified by the Environment Protection Authority (EPA). Potential road traffic noise impact is assessed in accordance with the NSW Road Noise Policy. For industrial facilities where the associated noise emissions are long-term in nature, noise criteria have been adopted in accordance with the Noise Policy for Industry. For enabling construction activities which are temporary in nature and highly variable, EPA's Interim Construction Noise Guideline provides the underlying assessment principles for the determination of potential construction noise impact. Each policy/guideline is discussed in detail in the body of this report:

- Section 5.4 details the NSW Road Noise Policy
- Section 5.1 details the Noise Policy for Industry
- Section 4 details the EPA's Interim Construction Noise Guideline.

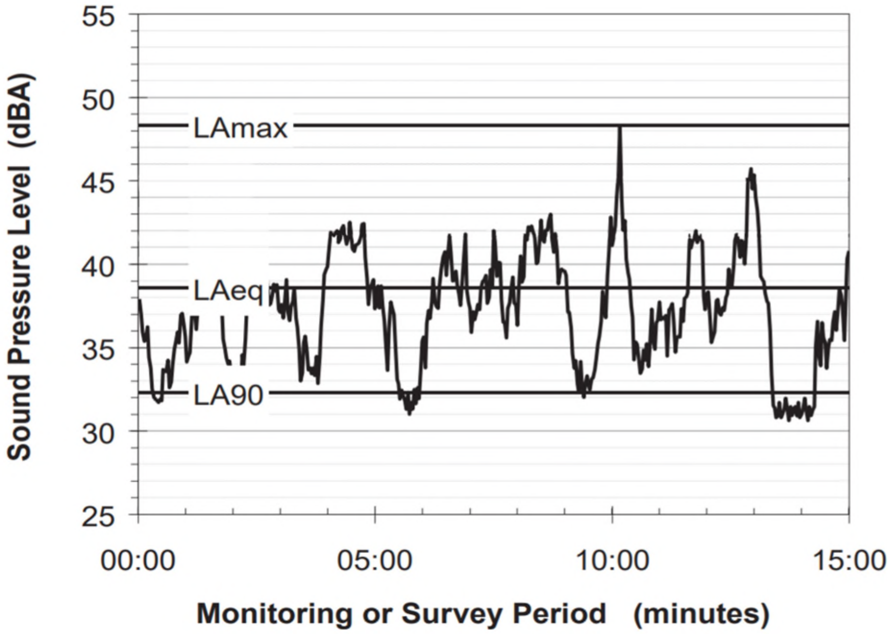
LAeq - To protect against long-term repeated noise exposure, the indicator for assessing the cumulative noise exposure level over a specific time interval is the equivalent sound pressure level, denoted as LAeq. The LAeq indicator accounts for the total energy content from all sources of sound under consideration. The fact that the LAeq is a cumulative measure means that louder activities have greater influence over the LAeq level than do quieter ones, and activities that last longer in time have greater LAeq than do shorter ones. An increase in the number of events also increases the LAeq. Further, people react to the duration of noise events, judging longer events to be more annoying than shorter ones, assuming equal maximum noise levels.

LAmax - It is important to note that LAeq levels are numerically lower than maximum noise levels (denoted as LAmax). None of the noise is ignored, just as all the rain that falls in the rain gauge in one hour counts toward the total. In the case of noisy but short-lived maximum noise events, which can sometime result in immediate short-term awakening reaction, potential impact is assessed using the LAmax indicator in which its emergence above the background noise environment is evaluated.

LA90 - The LA90 is the level of noise that is present almost constantly, or for 90 per cent of the time and is commonly referred to as the background noise. Typical examples of what types of noise may contribute to the background noise levels are continuously flowing traffic or air conditioner noise.

These three noise indicators of LAmax, LAeq and LA90 are presented in Figures A-1 for a sample noise monitoring survey period showing the sound pressure level of a varying noise environment such as environmental noise.

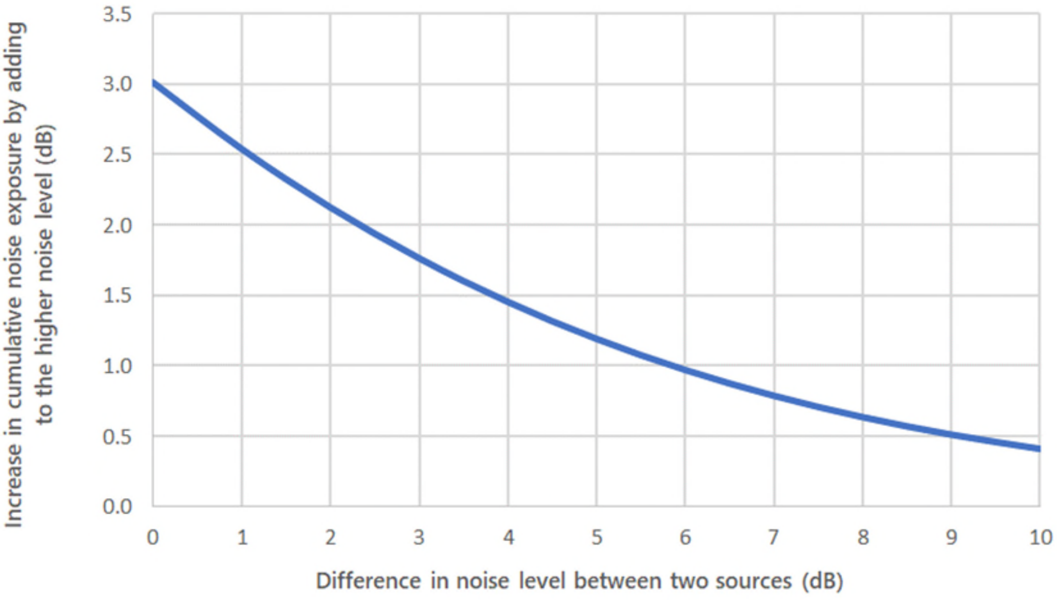
Figure A-1: Environmental noise assessment indicators



A.3.4 Cumulative sound exposure

As illustrated in Figure A-2, for two activities that result in the same amount of acoustical energy or noise level at a receiver location, the cumulative sound exposure level would be 3 dB higher than the level of just one single activity. This is because the decibel (dB) scale is logarithmic. Conversely, if the activity closer to your home results in noise exposure level that is 10 dB higher than the activity occurring further away, the quieter works would contribute very little to the cumulative noise exposure level.

Figure A-2: Difference in noise level between two sources



APPENDIX B Development staging diagrams

The following section provides and overview of the stages and phases, and figures for each of the phases (Figure 9-2 to Figure 9-7), so that the relevant buildings and structures that are operating during each phase can be understood.

Figure 9-1: Overview of stages and phases

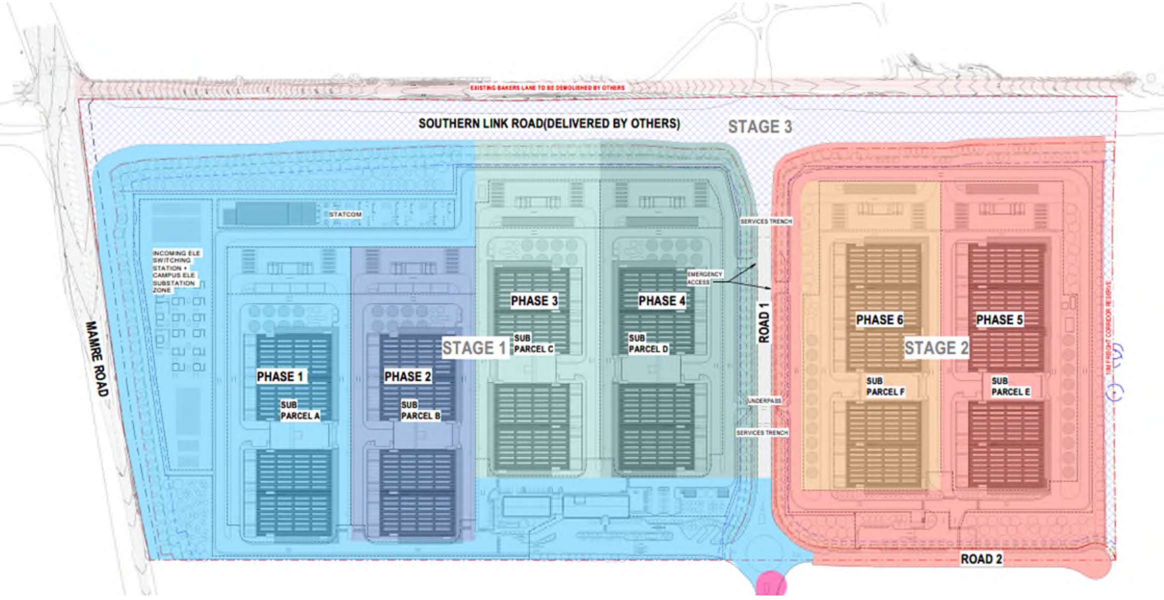


Figure 9-2: Phase 1 – Parcel A operational stage layout

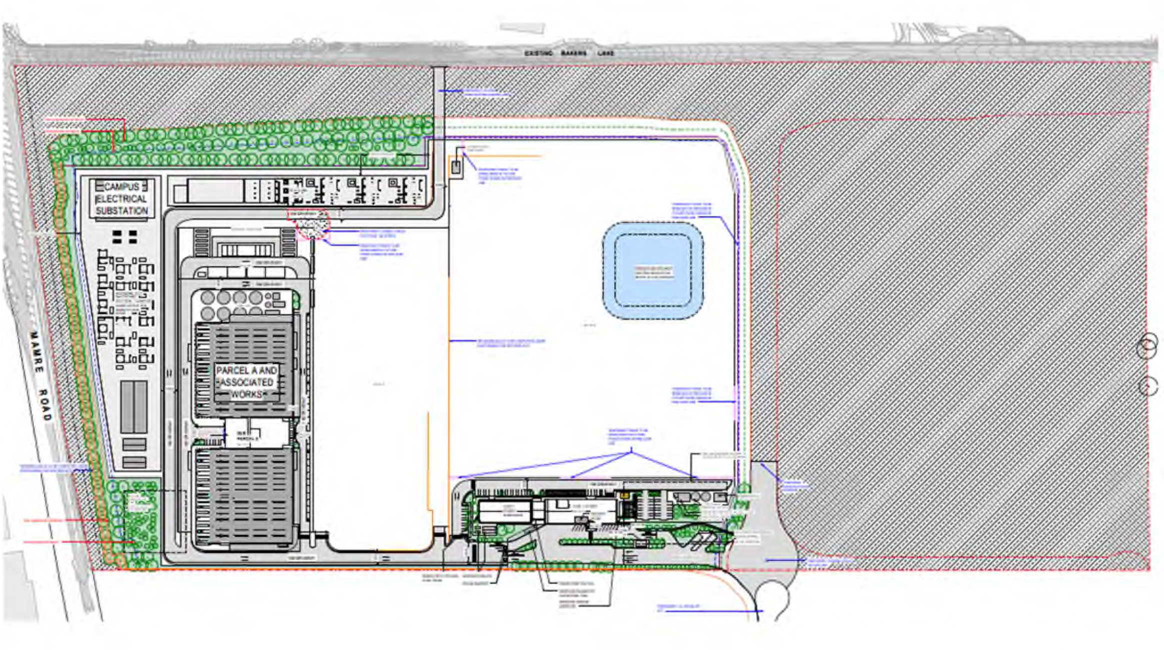


Figure 9-3: Phase 2 – Parcel B operational stage layout

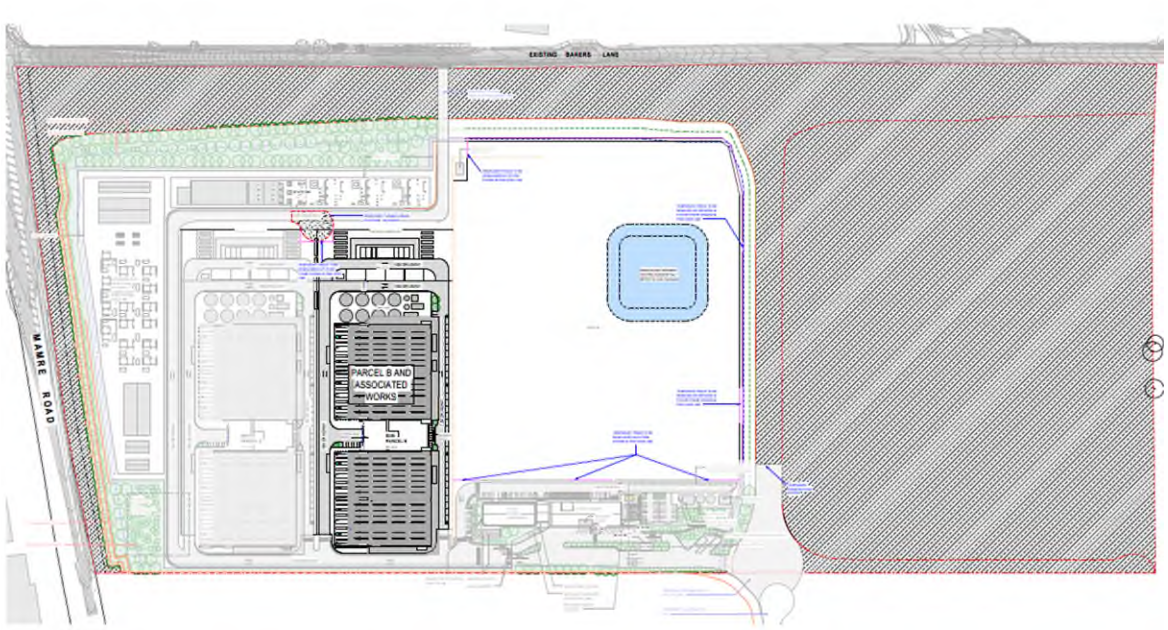


Figure 9-4: Phase 3 – Parcel C operational stage layout

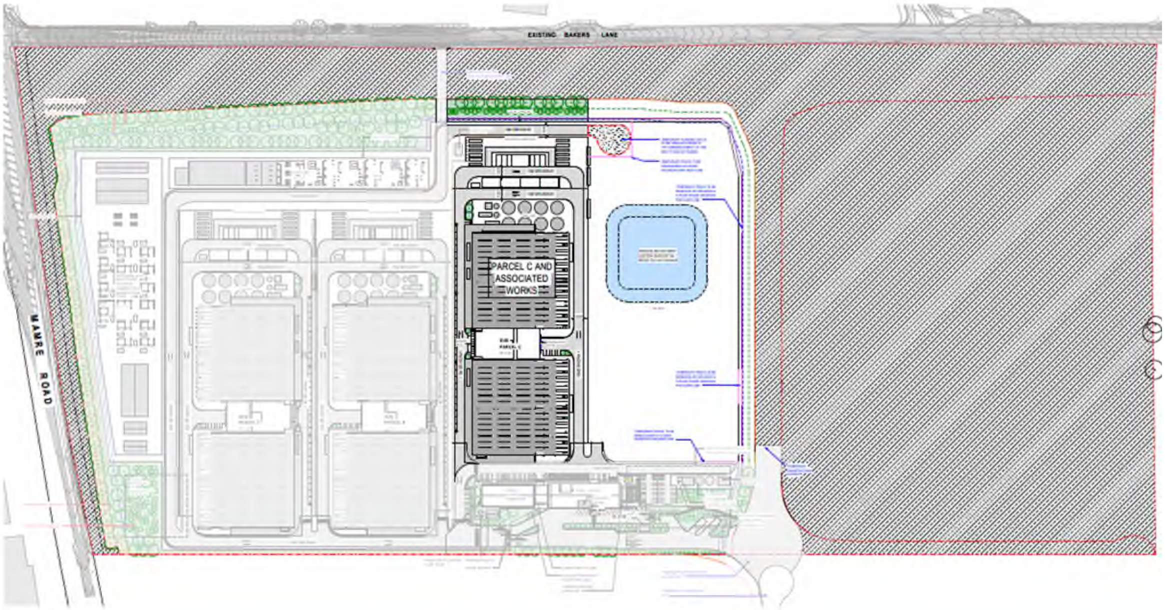


Figure 9-5: Phase 4 – Parcel D operational stage layout

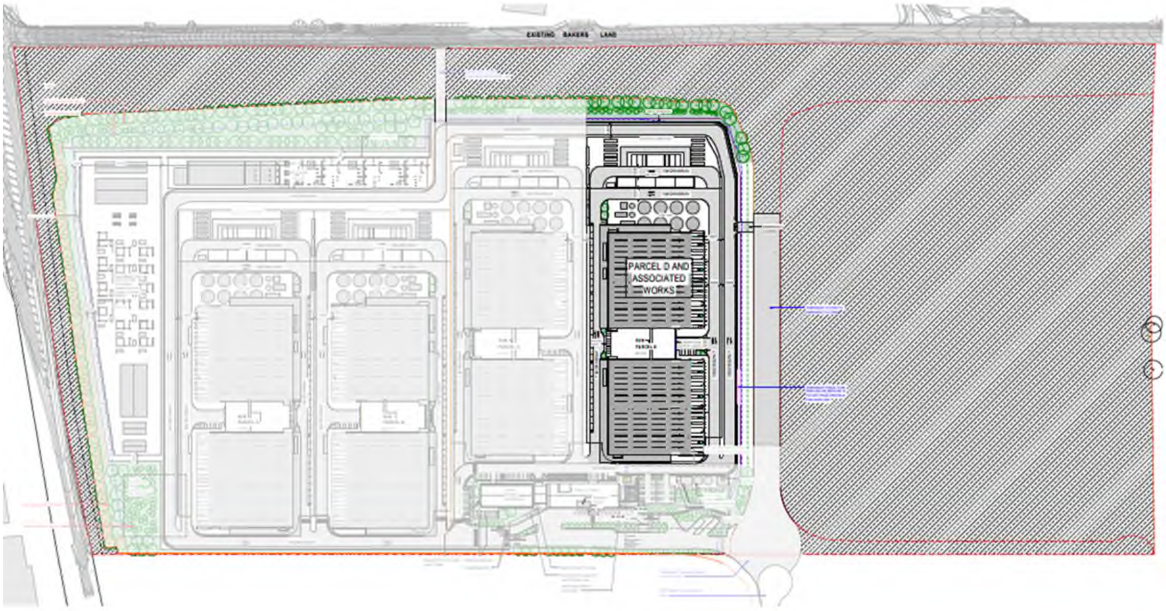


Figure 9-6: Phase 5 – Parcel E operational stage layout

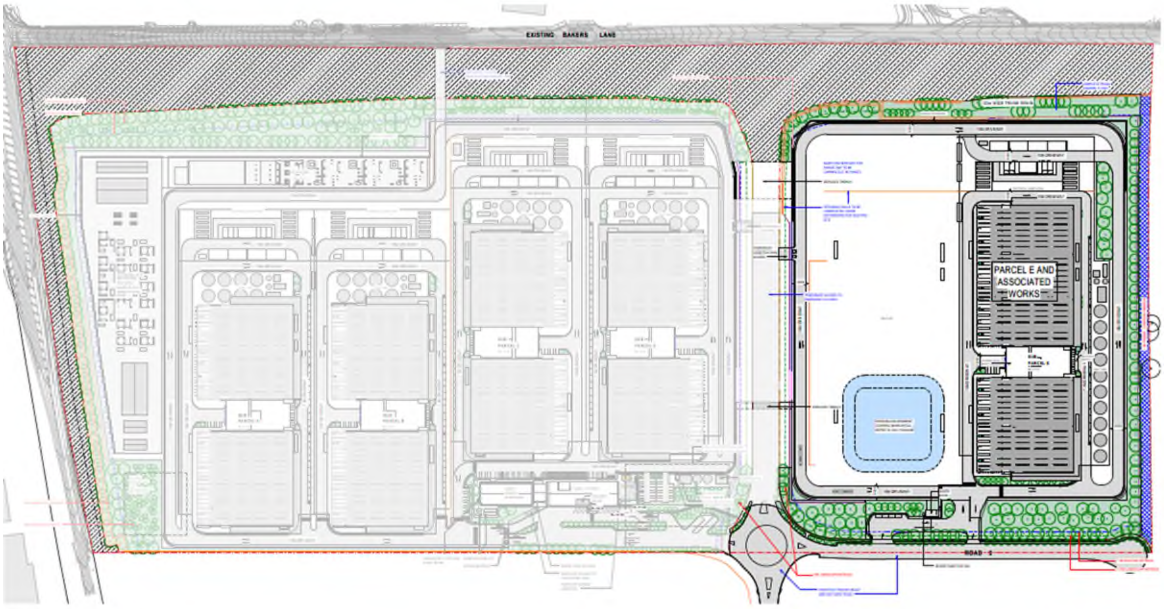
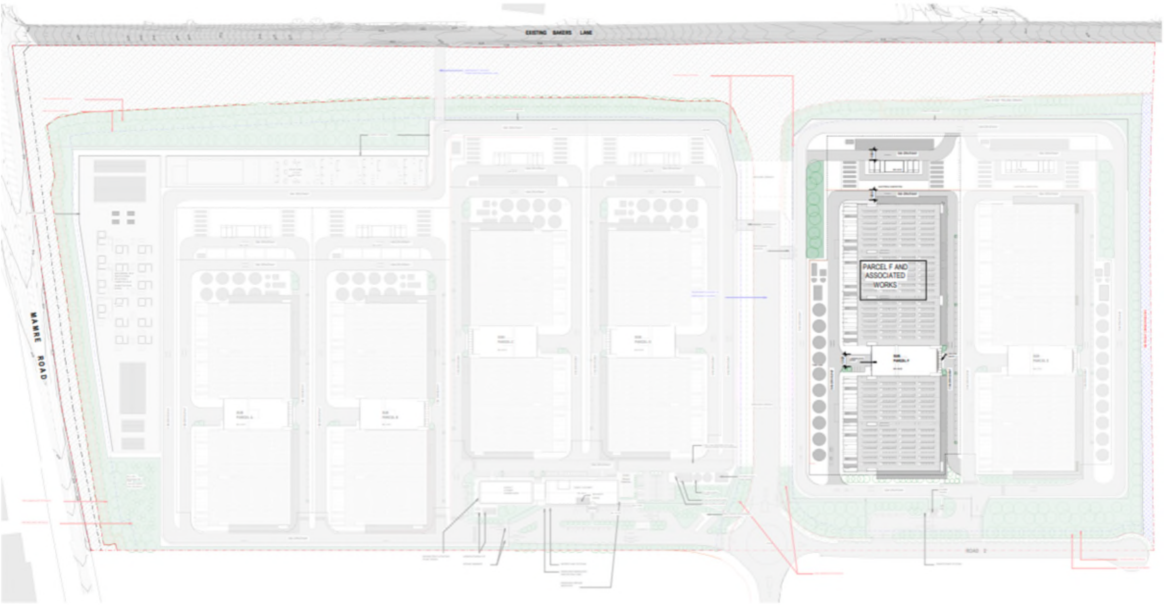


Figure 9-7: Phase 6 – Parcel F operational stage layout



APPENDIX C Cumulative criteria analysis

C.1 Large industrial cluster criteria considerations – Capacity review

To determine if further adjustments were appropriate considering the large industrial cluster and mature MRP factor considerations, and if separation factors due to the large size of the MRP, including the capacity for sites to all influence different receiver locations, noise assessments and approved noise limits for developments within the MRP were reviewed.

Predicted noise levels were either sourced or extrapolated based upon the noise assessments supporting applications. This was combined with the review of approved consent condition noise limits, to determine the cumulative predicted noise levels and cumulative noise limit status, considering all sites could achieve these levels concurrently and residences in Luddenham and Mount Vernon.

This data is compiled in Figure 9-8, and the outcomes summarised in Table 9-1.

Furthermore, the capacity for the east and west sides of the MRP to contributed to the opposition side were reviewed, to determine the potential capacity for east and western sides (as shown in Figure 9-9 to contribute to the opposite side.

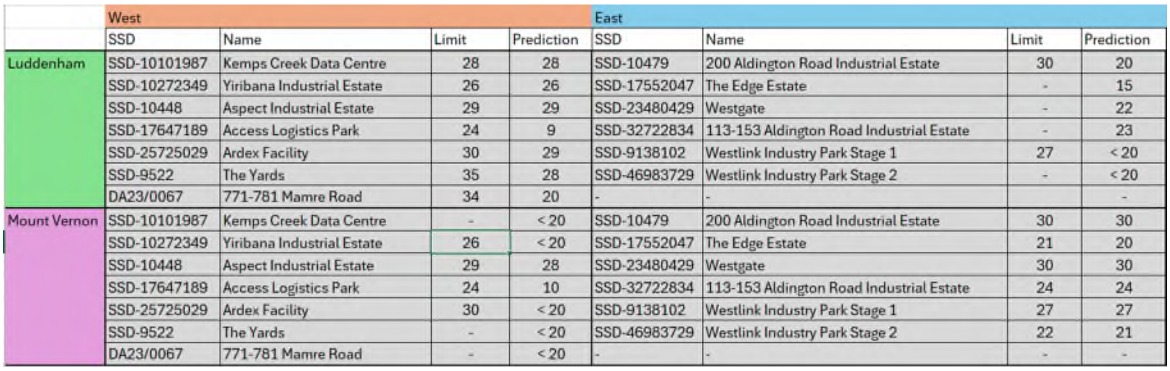
The outcome determine that the contribution of the opposite side worst case noise levels has a very minor affected (combined increase of only 1 dB(A)), as the combined predicted level from the opposite side is generally around 7 dB(A) below the opposite side, with the exception of the contribution of the Aspect Industrial estate to residences in Mount Vernon.

Table 9-1: MRP area review of predicted noise levels and approved noise limits for contribution and capacity differences for Luddenham and Mount Vernon receivers

Receiver location	MRP sites (West) dB(A)	MRP sites (East), dB(A)	MRP (Total) (East + West), dB(A)	Increase due to far side contribution (east or west), dB(A)	Level below far side (east or west), dB(A)
Combined predicted (or estimated) noise levels, $L_{Aeq, 15min}$					
Luddenham (west of MRP)	35	28	36	1	7
Mount Vernon (east of MRP)	31 (27)[1]	35	36 (35) [1]	1	4 (8) [1]
Noise limits, $L_{Aeq, 15min}$					
Luddenham (west of MRP)	39	32	40	1	8
Mount Vernon (east of MRP)	34	35	37	3	1
Difference (Limit minus predictions)					
Luddenham (west of MRP)	4	3	4	-	-
Mount Vernon (east of MRP)	3 (7)	0	1 (2)	-	-

Notes: 1. Number in brackets is without SSD-10448 (Aspect Industrial Estate) contribution

Figure 9-8: Summary of compiled night period predicted noise level and consent condition limits, $L_{Aeq, 15minute}$

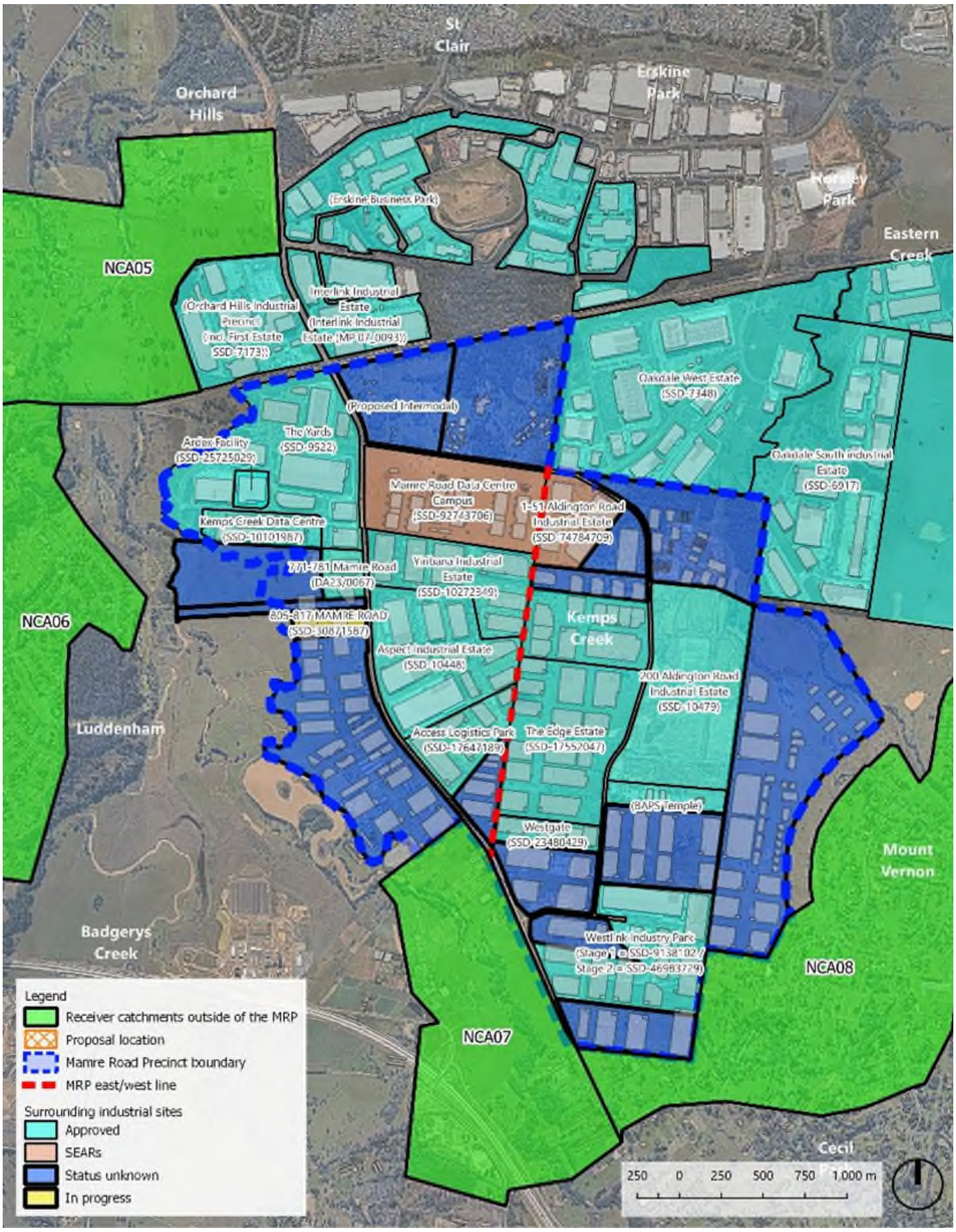


	West				East			
	SSD	Name	Limit	Prediction	SSD	Name	Limit	Prediction
Luddenham	SSD-10101987	Kemps Creek Data Centre	28	28	SSD-10479	200 Aldington Road Industrial Estate	30	20
	SSD-10272349	Yiribana Industrial Estate	26	26	SSD-17552047	The Edge Estate	-	15
	SSD-10448	Aspect Industrial Estate	29	29	SSD-23480429	Westgate	-	22
	SSD-17647189	Access Logistics Park	24	9	SSD-32722834	113-153 Aldington Road Industrial Estate	-	23
	SSD-25725029	Ardex Facility	30	29	SSD-9138102	Westlink Industry Park Stage 1	27	< 20
	SSD-9522	The Yards	35	28	SSD-46983729	Westlink Industry Park Stage 2	-	< 20
	DA23/0067	771-781 Mamre Road	34	20	-	-		-
Mount Vernon	SSD-10101987	Kemps Creek Data Centre	-	< 20	SSD-10479	200 Aldington Road Industrial Estate	30	30
	SSD-10272349	Yiribana Industrial Estate	26	< 20	SSD-17552047	The Edge Estate	21	20
	SSD-10448	Aspect Industrial Estate	29	28	SSD-23480429	Westgate	30	30
	SSD-17647189	Access Logistics Park	24	10	SSD-32722834	113-153 Aldington Road Industrial Estate	24	24
	SSD-25725029	Ardex Facility	30	< 20	SSD-9138102	Westlink Industry Park Stage 1	27	27
	SSD-9522	The Yards	-	< 20	SSD-46983729	Westlink Industry Park Stage 2	22	21
	DA23/0067	771-781 Mamre Road	-	< 20	-	-	-	-

Notes:

1. Some site contributions were estimated of extrapolated based upon prediction information in the relevant noise impact assessment. The following reports were used to determine the above noise levels.
2. West - SSD-10101987 - Kemps Creek Data Centre: ARUP, Noise Verification Report, Project: SYD05-06-07, Job: 277863, ReferenceAC06, 10 July 2023.
3. West - SSD-10272349 - Yiribana Industrial Estate: RWDI, Yiribana Logistics Estate Mamre Road, Kemps Creek Noise & Vibration Impact Assessment, RWDI#2105533, Revision G, 29 May, 2023
4. West - SSD-10448-Aspect Industrial Estate: SLR, SSD-10448 MOD 10 & Warehouse 8 SSD-80331959, SLR Ref: 610.19127-R16, Version No: -v1.0, 13 June 2025
5. West - SSD-17647189-Access Logistics Park: Acoustic Works, 1023083 R01E 155-251 Aldington Road, Kemps Creek ENV, Revision R01ZL, 24 July 2023
6. West - SSD-25725029-Ardex Facility: Renzo Tonin & Associates, reference: TM312-01F05 Ardex Kemps Creek NVIA (r11), Revision 11, dated 20 July 2022
7. West - SSD-9522-The Yards: Acoustic Works, Reference: 1023059 L01C The Yards Kemps Creek ENV, 23 November 2023
8. West - DA23/0067-771-781 Mamre Road: Acoustic Works, 1022116 R01A 771-797 Mamre Road Kemps Creek ENV, 6 December 2022
9. East - SSD-10479-200 Aldington Road Industrial Estate: SLR, SSD-10479 Modification 5, Noise Impact Assessment and SSDA for Lot K (SSD-80264236), Project No: 610.31010.00001, 18 June 2025, Revision 1.1
10. East - SSD-17552047-The Edge Estate: Acoustic Works, 1023083 R01E 155-251 Aldington Road, Kemps Creek ENV, 31 October 2023
11. East - SSD-23480429-Westgate: EMM, Noise Impact Assessment Westgate Estate - 253-267 Aldington Road, Kemps Creek NSW, Reference: E230916 RP1, Revision 5, 28/2/25
12. East - SSD-32722834-113-153 Aldington Road Industrial Estate: Acoustic Dynamics, Reference: 5649R001.BC.241210, Revision 9, 10 December 2024
13. East - SSD-9138102-Westlink Industry Park Stage 1: RWDI, ESR Westlink Stage 1, Reference: RWDI#2101343, Revision F, 6 October 2022
14. East - SSD-46983729-Westlink Industry Park Stage 2: SLR, Reference: 610.30893.00100-R02, Version No: -v5.0, 1 April 2025

Figure 9-9: MRP and the review of the east and west sites



C.2 Methdology for NCA02 cumulative criteria

Although it can be conservatively assumed that receivers in NCA02 may not currently or in the short-term be affected by industrial noise (see further discussion in Section 5.2.1.4), it is appropriate for receivers located within the MRP to be considered affected by noise from industrial noise sources in the long term by the fully developed MRP. This is a result of the proposed future planning outcomes envisaged by the MRP rezoning and associated state planning instruments for the area, and is of particular importance for receiver that are within the rezoned MRP area.

As such, for the long term receivers in NCA02, the following methods has been adopted to address cumulative industrial noise considering the above points. The method considers noise contributions from the developable industrial zoned land within the MRP and from any other existing/approved industrial sites near the precinct.

Sites with the potential for contributing industrial noise to NCA02 were identified considering their proximity and their potential to impact NCA02. The potential for sites (existing, proposed and future unknown operations) to contribute industrial noise were considered including allowances for future changes. Where available, the predictions from noise assessments were reviewed to assist with determining each site's potential to contribute to cumulative industrial noise levels at NCA02.

To derive appropriate amenity noise levels in areas near existing or proposed cluster of industry, sites were classified based upon whether they are expected to directly contribute (ie. adjacent site and /or without intervening acoustic shielding) or indirectly contribute (ie. greater distance with intervening acoustic shielding) to the cumulative industrial noise levels at NCA02. These identified sites are shown in Figure 9-10. This method considers the developable industrial zoned land within the MRP and any existing/approved industrial sites near the precinct. This method remains consistent with the NPfI Section 2.4.2.

Table 9-2 presents the method used to determine the assumed contributions from direct and indirect sites. The method adopts a conservative approach to allow for unknowns and future flexibility for the operation of sites contributing to the industrial noise at NCA02.

Table 9-2: Derivation of the cumulative correction for NCA02

Item	Description	Assumed contribution of each individual site
Directly contributing sites (existing and future)	Adjacent site and /or without intervening acoustic shielding	Each site is allocated even contribution, independent of current predictions or distance. This allows for maximum equal share for sites that could directly contribute.
Indirectly contributing sites (existing and future)	Site with greater distance to NCA with intervening acoustic shielding	Each site is allocated a contribution, 5 dB(A) less than a directly contributing site (above). This allows for maximum equal share for sites that could indirectly contribute. This 5dB(A) correction is conservative approach, noting that there are a range of unknown factors for potentially contributing sites. However, the basis of the 5dB(A) is justified as follows: i. This conservatively accounts for distance (most indirect sites are approximately 500m from the NCA02 boundary, compared to direct sites which can be adjacent) [potential reduction in contribution >5dB(A)]. ii. Additionally, indirect sites have industrial sites located between it and NCA02, which would provide acoustic shielding to NCA02 [acoustic shielding loss likely 5-10 dB(A)].

The steps in the process to determine the cumulative correction and appropriate site contribution level were:

1. Identify the likely direct and indirectly contributing sites (see Figure 9-10)

2. Determine the overall cumulative industrial noise level from all industrial noise sources from NPfI Table 2.2 *Amenity noise levels* at each NCA02 receiver.

3. Calculate the maximum allowed noise level for the likely direct and indirectly contributing sites, following the conservative approach in Table 9-2 that would not result in the NPfI Table 2.2 *Amenity noise levels* being exceeded.

4. Based upon the above, determine the required cumulative correction for the direct and indirectly contributing sites for NCA02 receivers.

Table 9-3 provides the worked example for a school receiver. The same process and cumulative correction were adopted for the residences located within NCA02.

Table 9-3: Derivation of the cumulative correction for NCA02 (example for school classroom)

Item	NPfI Table 2.2 *Amenity noise levels* (internal / external[4]) for total industrial noise	Number of sites	Calculated individual site cumulative correction, dB(A)	Confirmation calculation, dB(A)			
				$L_{Aeq, 1\text{-}hour}$		$L_{Aeq, 15\text{-}minute}$[5]	
				Assumed contribution of each individual site (internal / external[4])[1]	Total contribution from all sites (internal / external[4])	Assumed contribution of each individual site (internal / external[4])[1]	Total contribution from all sites (internal / external[4])
Directly contributing sites (existing and future)	40 / 50 dB(A)[3] $L_{Aeq, 1\text{-}hour}$	6	-10	30 / 40	38 / 48	33 / 43	41 / 51
Indirectly contributing sites (existing and future)[2]		10	-15[2]	25 / 35	35 / 45	28 / 38	38 / 48
Total		**16**	-	-	**40 / 50**[3]	-	**43 / 53**[3]

Notes:

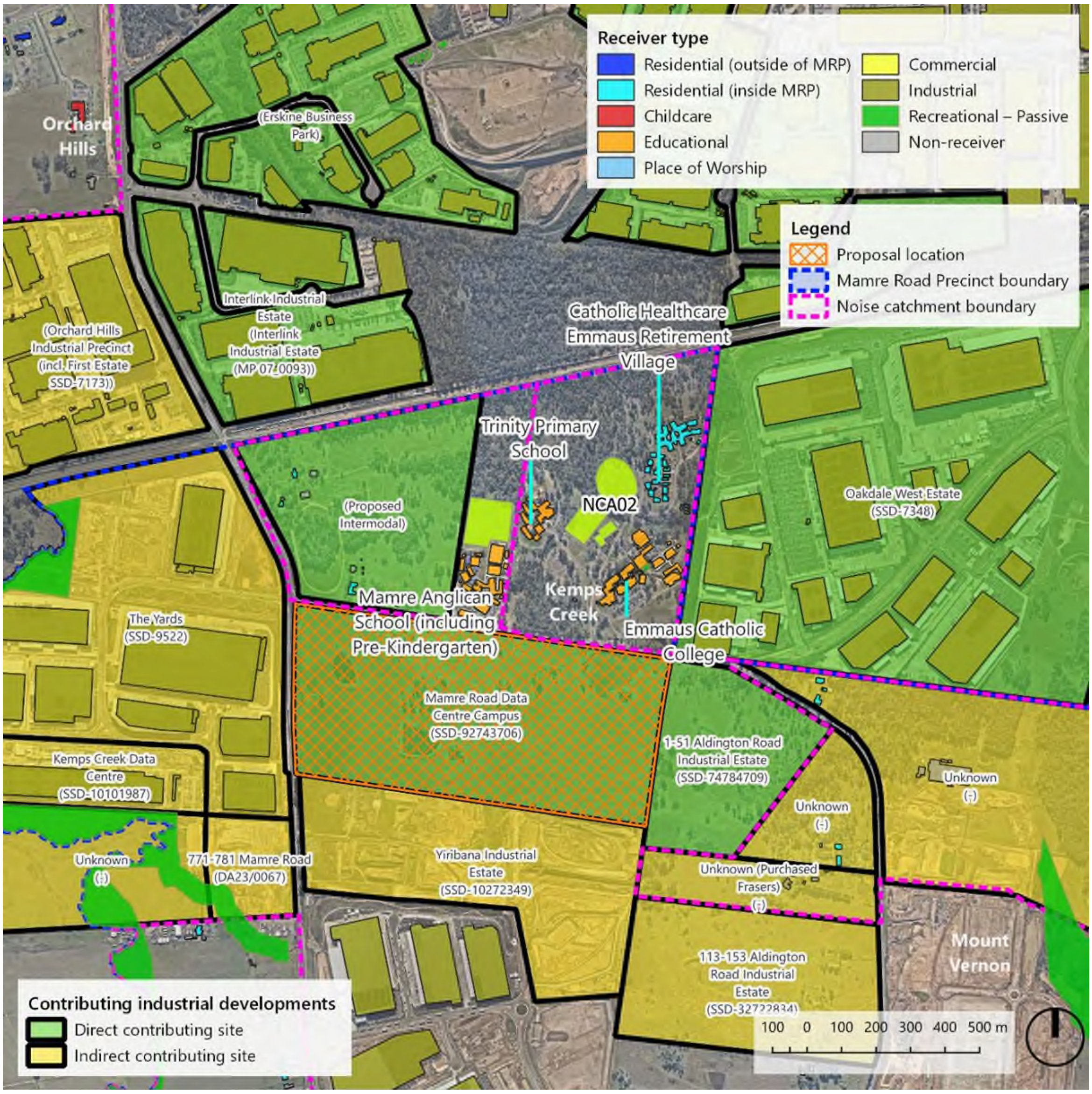
1. Sites allocated an even contribution for direct and indirect developments instead of adopting noise predictions to allow for future MRP development changes and flexibility. In most cases, the current expected contribution is much less than this (eg. SSD 10272349 Yiribana Logistics Estate, prediction of 25 dB(A) LAeq, 15min without consideration of any shielding from the Proposal).
2. Indirect developments considered contributing 5 dB(A) less than the direct developments, as per Figure 9-10
3. This is the overall cumulative industrial noise level from all industrial noise sources from NPfI Table 2.2 *Amenity noise levels*.
4. Conversion of trigger levels from internal to external for school classroom assumes 10dB(A) loss from outside to inside loss, as per NPfI Section 2.6.
5. Converted to NPfI standardised 15-minute time period noise level, as per NPfI Section 2.2.

The Table 9-3 cumulative correction remains appropriate even with the number of indirectly contributing sites increased to 16, which equates to 6 more than have been identified for NCA02.

Furthermore, a review of NVIA assessments conducted for approved sites within the MRP show predicted noise levels to be substantially below the assumed individual site contributions presented in Figure 9-8.

Based upon the above method, a **10 dB(A) correction** from the recommended amenity noise level, is appropriate for the Proposal given that it is a direct contributing site to NCA02. This would result in a project noise trigger level of 43 dB(A) $L_{Aeq, 15minute}$ externally at the school.

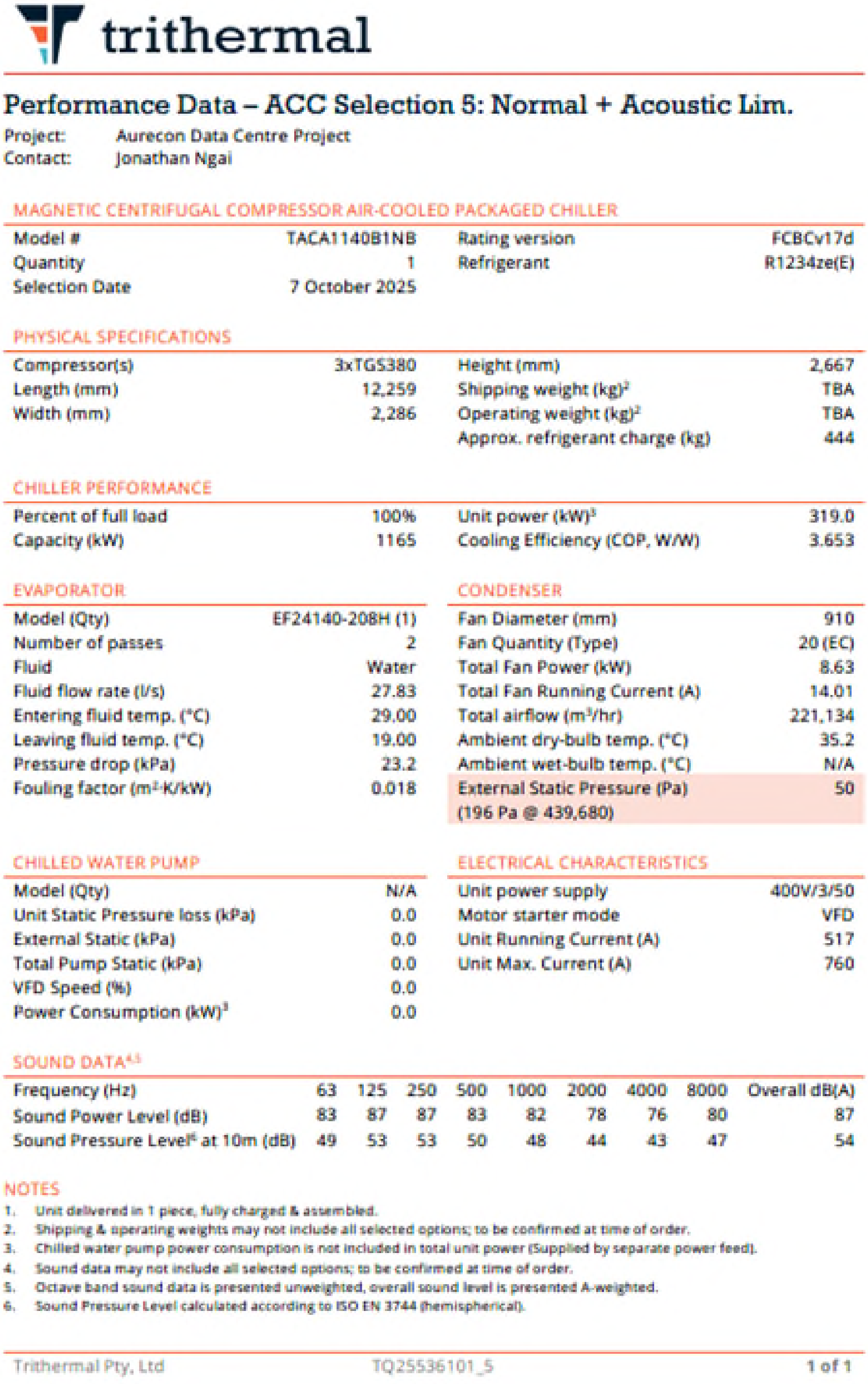
Figure 9-10: Contributing developments surrounding NCA02



APPENDIX D Plant and equipment manufacturer data for noise source inventory

(a) Air-cooled chiller units

Day selection



trithermal

Performance Data – ACC Selection 5: Normal + Acoustic Lim.

Project: Aurecon Data Centre Project
Contact: Jonathan Ngai

MAGNETIC CENTRIFUGAL COMPRESSOR AIR-COOLED PACKAGED CHILLER

Model #	TACA1140B1NB	Rating version	FCBCv17d
Quantity	1	Refrigerant	R1234ze(E)
Selection Date	7 October 2025		

PHYSICAL SPECIFICATIONS

Compressor(s)	3xTG5380	Height (mm)	2,667
Length (mm)	12,259	Shipping weight (kg)[2]	TBA
Width (mm)	2,286	Operating weight (kg)[2]	TBA
		Approx. refrigerant charge (kg)	444

CHILLER PERFORMANCE

Percent of full load	100%	Unit power (kW)[3]	319.0
Capacity (kW)	1165	Cooling Efficiency (COP, W/W)	3.653

EVAPORATOR		CONDENSER	
Model (Qty)	EF24140-208H (1)	Fan Diameter (mm)	910
Number of passes	2	Fan Quantity (Type)	20 (EC)
Fluid	Water	Total Fan Power (kW)	8.63
Fluid flow rate (l/s)	27.83	Total Fan Running Current (A)	14.01
Entering fluid temp. (°C)	29.00	Total airflow (m³/hr)	221,134
Leaving fluid temp. (°C)	19.00	Ambient dry-bulb temp. (°C)	35.2
Pressure drop (kPa)	23.2	Ambient wet-bulb temp. (°C)	N/A
Fouling factor (m²·K/kW)	0.018	External Static Pressure (Pa) (196 Pa @ 439,680)	50

CHILLED WATER PUMP		ELECTRICAL CHARACTERISTICS	
Model (Qty)	N/A	Unit power supply	400V/3/50
Unit Static Pressure loss (kPa)	0.0	Motor starter mode	VFD
External Static (kPa)	0.0	Unit Running Current (A)	517
Total Pump Static (kPa)	0.0	Unit Max. Current (A)	760
VFD Speed (%)	0.0		
Power Consumption (kW)[3]	0.0		

SOUND DATA[4,5]

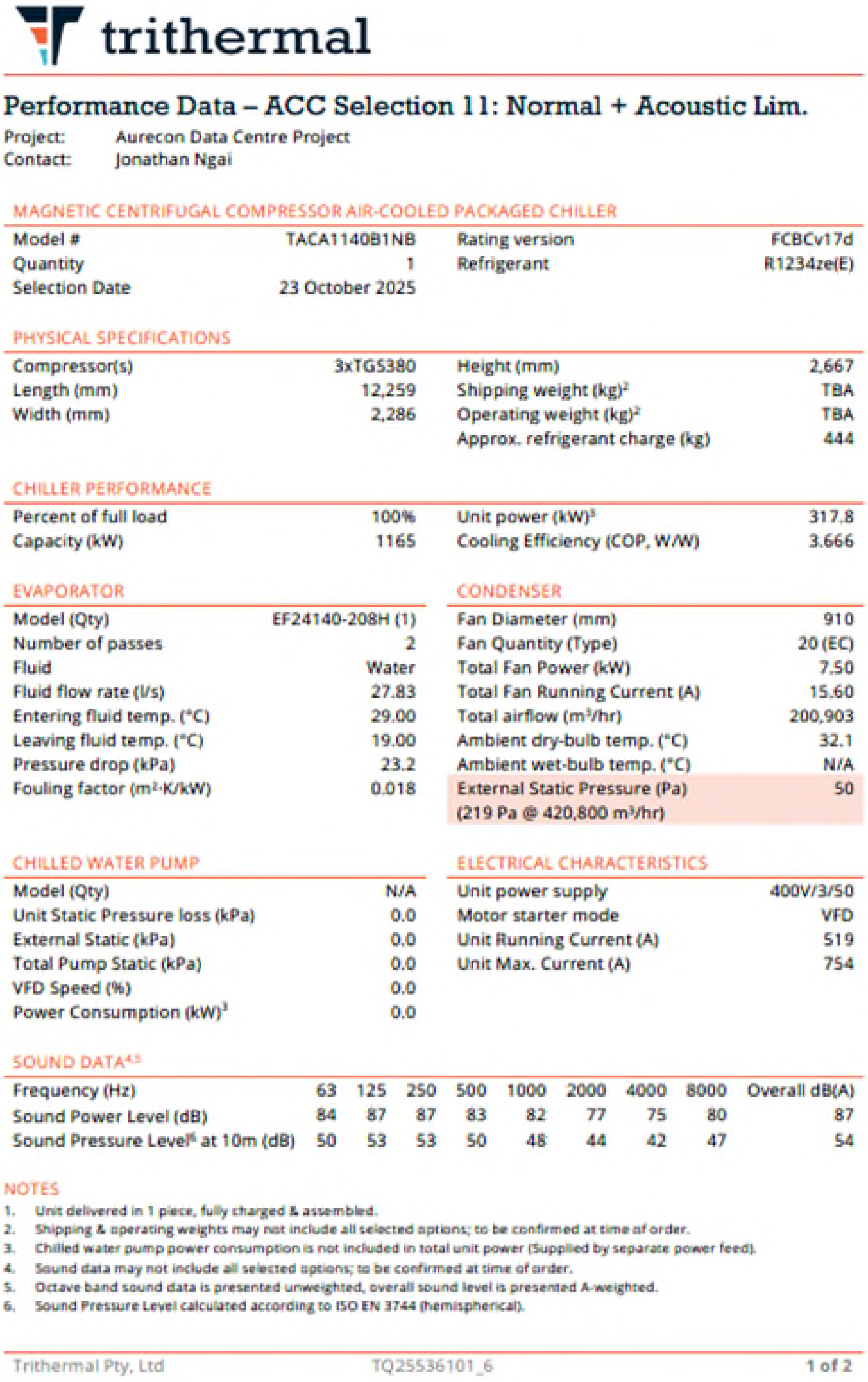
Frequency (Hz)	63	125	250	500	1000	2000	4000	8000	Overall dB(A)
Sound Power Level (dB)	83	87	87	83	82	78	76	80	87
Sound Pressure Level[6] at 10m (dB)	49	53	53	50	48	44	43	47	54

NOTES

1. Unit delivered in 1 piece, fully charged & assembled.
2. Shipping & operating weights may not include all selected options; to be confirmed at time of order.
3. Chilled water pump power consumption is not included in total unit power (Supplied by separate power feed).
4. Sound data may not include all selected options; to be confirmed at time of order.
5. Octave band sound data is presented unweighted, overall sound level is presented A-weighted.
6. Sound Pressure Level calculated according to ISO EN 3744 (hemispherical).

Trithermal Pty, Ltd TQ25536101_5 1 of 1

Evening selection



trithermal

Performance Data – ACC Selection 11: Normal + Acoustic Lim.

Project:	Aurecon Data Centre Project
Contact:	Jonathan Ngai

MAGNETIC CENTRIFUGAL COMPRESSOR AIR-COOLED PACKAGED CHILLER

Model #	TACA1140B1NB	Rating version	FCBCv17d
Quantity	1	Refrigerant	R1234ze(E)
Selection Date	23 October 2025		

PHYSICAL SPECIFICATIONS

Compressor(s)	3xTGS380	Height (mm)	2,667
Length (mm)	12,259	Shipping weight (kg)^{2}	TBA
Width (mm)	2,286	Operating weight (kg)^{2}	TBA
		Approx. refrigerant charge (kg)	444

CHILLER PERFORMANCE

Percent of full load	100%	Unit power (kW)^{3}	317.8
Capacity (kW)	1165	Cooling Efficiency (COP, W/W)	3.666

EVAPORATOR		CONDENSER	
Model (Qty)	EF24140-208H (1)	Fan Diameter (mm)	910
Number of passes	2	Fan Quantity (Type)	20 (EC)
Fluid	Water	Total Fan Power (kW)	7.50
Fluid flow rate (l/s)	27.83	Total Fan Running Current (A)	15.60
Entering fluid temp. (°C)	29.00	Total airflow (m³/hr)	200,903
Leaving fluid temp. (°C)	19.00	Ambient dry-bulb temp. (°C)	32.1
Pressure drop (kPa)	23.2	Ambient wet-bulb temp. (°C)	N/A
Fouling factor (m²-K/kW)	0.018	External Static Pressure (Pa) (219 Pa @ 420,800 m³/hr)	50

CHILLED WATER PUMP		ELECTRICAL CHARACTERISTICS	
Model (Qty)	N/A	Unit power supply	400V/3/50
Unit Static Pressure loss (kPa)	0.0	Motor starter mode	VFD
External Static (kPa)	0.0	Unit Running Current (A)	519
Total Pump Static (kPa)	0.0	Unit Max. Current (A)	754
VFD Speed (%)	0.0		
Power Consumption (kW)^{3}	0.0		

SOUND DATA^{4,5}

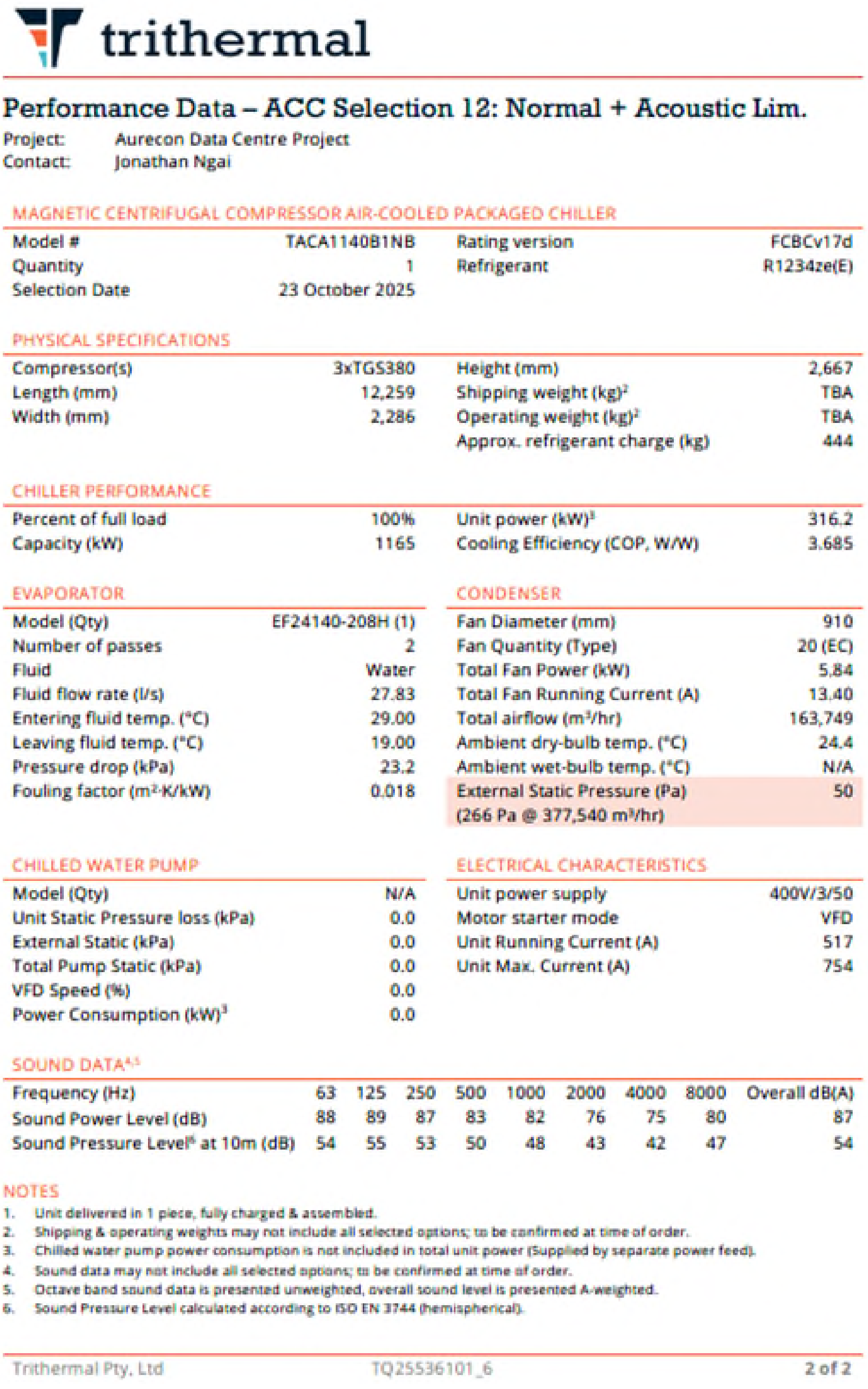
Frequency (Hz)	63	125	250	500	1000	2000	4000	8000	Overall dB(A)
Sound Power Level (dB)	84	87	87	83	82	77	75	80	87
Sound Pressure Level^{6} at 10m (dB)	50	53	53	50	48	44	42	47	54

NOTES

1. Unit delivered in 1 piece, fully charged & assembled.
2. Shipping & operating weights may not include all selected options; to be confirmed at time of order.
3. Chilled water pump power consumption is not included in total unit power (Supplied by separate power feed).
4. Sound data may not include all selected options; to be confirmed at time of order.
5. Octave band sound data is presented unweighted, overall sound level is presented A-weighted.
6. Sound Pressure Level calculated according to ISO EN 3744 (hemispherical).

Trithermal Pty, Ltd TQ25536101_6 1 of 2

Night selection



trithermal

Performance Data – ACC Selection 12: Normal + Acoustic Lim.

Project:	Aurecon Data Centre Project
Contact:	Jonathan Ngai

MAGNETIC CENTRIFUGAL COMPRESSOR AIR-COOLED PACKAGED CHILLER

Model #	TACA1140B1NB	Rating version	FCBCv17d
Quantity	1	Refrigerant	R1234ze(E)
Selection Date	23 October 2025		

PHYSICAL SPECIFICATIONS

Compressor(s)	3xTGS380	Height (mm)	2,667
Length (mm)	12,259	Shipping weight (kg)^2	TBA
Width (mm)	2,286	Operating weight (kg)^2	TBA
		Approx. refrigerant charge (kg)	444

CHILLER PERFORMANCE

Percent of full load	100%	Unit power (kW)^3	316.2
Capacity (kW)	1165	Cooling Efficiency (COP, W/W)	3.685

EVAPORATOR		CONDENSER	
Model (Qty)	EF24140-208H (1)	Fan Diameter (mm)	910
Number of passes	2	Fan Quantity (Type)	20 (EC)
Fluid	Water	Total Fan Power (kW)	5.84
Fluid flow rate (l/s)	27.83	Total Fan Running Current (A)	13.40
Entering fluid temp. (°C)	29.00	Total airflow (m^3/hr)	163,749
Leaving fluid temp. (°C)	19.00	Ambient dry-bulb temp. (°C)	24.4
Pressure drop (kPa)	23.2	Ambient wet-bulb temp. (°C)	N/A
Fouling factor (m^2·K/kW)	0.018	External Static Pressure (Pa) (266 Pa @ 377,540 m^3/hr)	50

CHILLED WATER PUMP		ELECTRICAL CHARACTERISTICS	
Model (Qty)	N/A	Unit power supply	400V/3/50
Unit Static Pressure loss (kPa)	0.0	Motor starter mode	VFD
External Static (kPa)	0.0	Unit Running Current (A)	517
Total Pump Static (kPa)	0.0	Unit Max. Current (A)	754
VFD Speed (%)	0.0		
Power Consumption (kW)^3	0.0		

SOUND DATA^{4,5}

Frequency (Hz)	63	125	250	500	1000	2000	4000	8000	Overall dB(A)
Sound Power Level (dB)	88	89	87	83	82	76	75	80	87
Sound Pressure Level^6 at 10m (dB)	54	55	53	50	48	43	42	47	54

NOTES

1. Unit delivered in 1 piece, fully charged & assembled.
2. Shipping & operating weights may not include all selected options; to be confirmed at time of order.
3. Chilled water pump power consumption is not included in total unit power (Supplied by separate power feed).
4. Sound data may not include all selected options; to be confirmed at time of order.
5. Octave band sound data is presented unweighted, overall sound level is presented A-weighted.
6. Sound Pressure Level calculated according to ISO EN 3744 (hemispherical).

Trithermal Pty. Ltd TQ25536101_6 2 of 2

(b) Kiosk transformer (KTX) – Assumed unit

Schneider Electric

TRANSFORMER DIVISION

TYPE TEST CERTIFICATE OF SOUND-LEVEL PERFORMANCE

Report No	**S 2020-02**		
Contract		Site	**Schneider Electric Transformers**
Manufacturer	**Schneider Electric**	Place of Manufacture	**Benalla, Victoria, Australia**
Date of measurement	**20-Aug-2020**		

Details of transformer

Serial Number	**MG201018**	Rating	**2250 kVA**
Tapping range	**+5% to -5% in steps of 2.5%**	Voltage ratio	**22000/433V**
Connections	**Dyn11**	Rated frequency	**50 Hz**
Rated Current	**59.0 A**	Rated Voltage	**22000 V**

Details of guaranteed level

Sound ~~pressure~~/power level	**70.9 dB(A)**	Measurement distance	**300 mm**

~~OIL IMMERSED DISTRIBUTION TRANSFORMER~~
~~OIL IMMERSED DISTRIBUTION TRANSFORMER IN ENCLOSURE~~
~~DRY TYPE DISTRIBUTION TRANSFORMER~~
DRY TYPE DISTRIBUTION TRANSFORMER IN ENCLOSURE

Details of measurement method

Measurement standard AS/NZS60076.10:2009
Sound intensity
Time-synchronous

Details of measuring instrument

Make	*Brüel & Kjær*	*2260 Investigator serial no. 2554014*
Microphone spacer	*50 mm*	*Microphone pair type 4197 serial number 2561197*
Accoustic Calibrator	*Brüel & Kjær*	*Sound Level Calibrator Type 4230 serial number 1606877*

Calibration information Calibration procedure carried out before measurements using 93.8dB acoustic calibrator.

Temperature : **16.0** °C
Amb. Pressure : **1006.0** hPa
Sensitivity
Probe Ch.1 : **-38.23** dB re 1V/Pa
Probe Ch.2 : **-38.31** dB re 1V/Pa

Details of test result

Calculated A-weighted sound intensity level	**44.3 dB(A)**
Calculated A-weighted sound power level	**60.3 dB(A)**
	The transformer passed the sound level test.

Schneider Electric (Australia) Pty Limited ABN 42 004 969 304

88 Sydney Road , PO Box 122, Benalla Vic 3672
Tel (03) 5762 3411, Fax (03) 5762 8062

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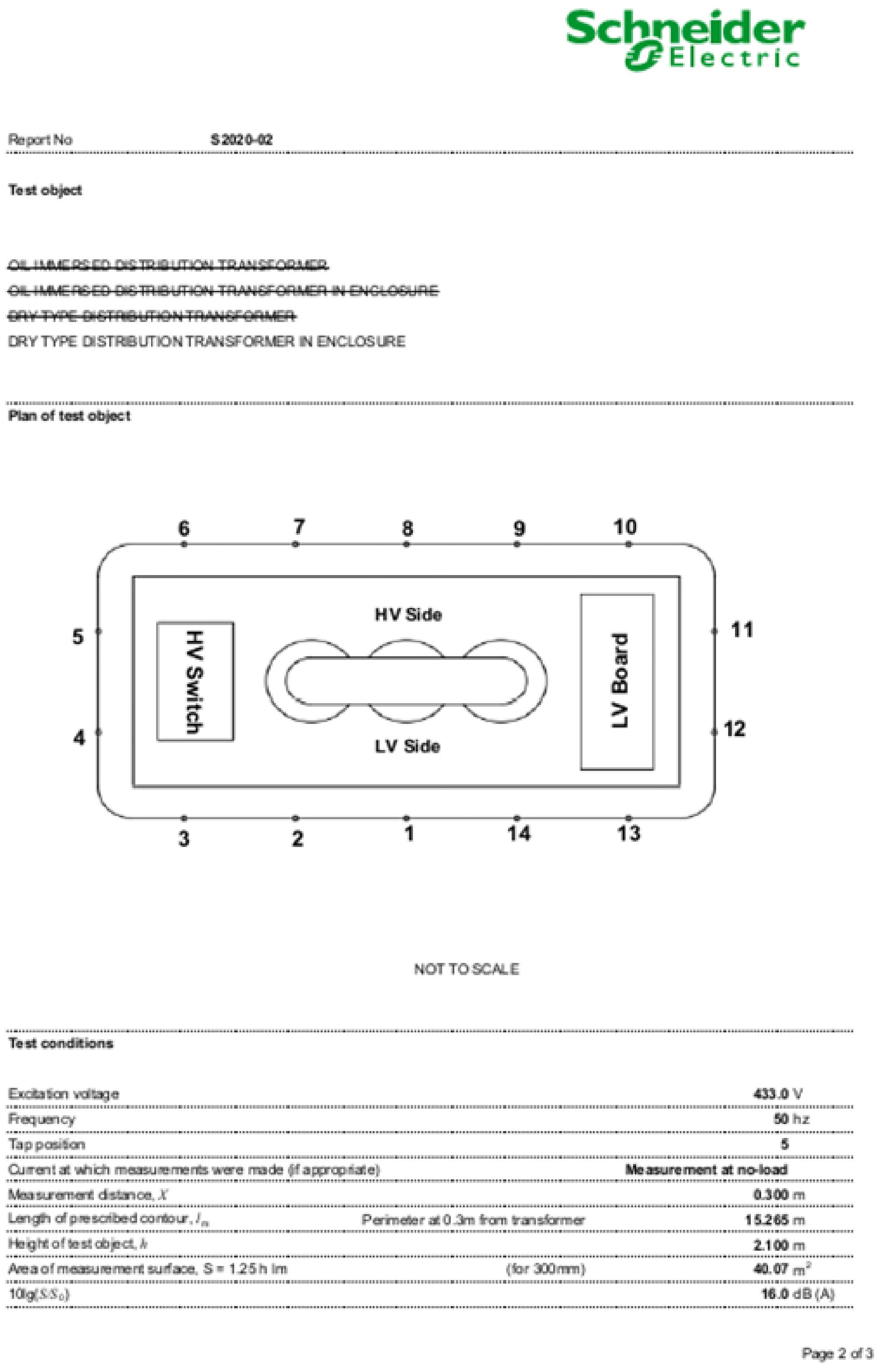

Schneider Electric

Report No	**S2020-02**

Test object

~~OIL IMMERSED DISTRIBUTION TRANSFORMER~~
~~OIL IMMERSED DISTRIBUTION TRANSFORMER IN ENCLOSURE~~
~~DRY TYPE DISTRIBUTION TRANSFORMER~~
DRY TYPE DISTRIBUTION TRANSFORMER IN ENCLOSURE

Plan of test object

NOT TO SCALE

Test conditions

Excitation voltage		**433.0** V
Frequency		**50** hz
Tap position		**5**
Current at which measurements were made (if appropriate)		**Measurement at no-load**
Measurement distance, X		**0.300** m
Length of prescribed contour, l_m	Perimeter at 0.3m from transformer	**15.265** m
Height of test object, h		**2.100** m
Area of measurement surface, S = 1.25 h lm	(for 300mm)	**40.07** m^2
10lg(S/S_0)		**16.0** dB (A)

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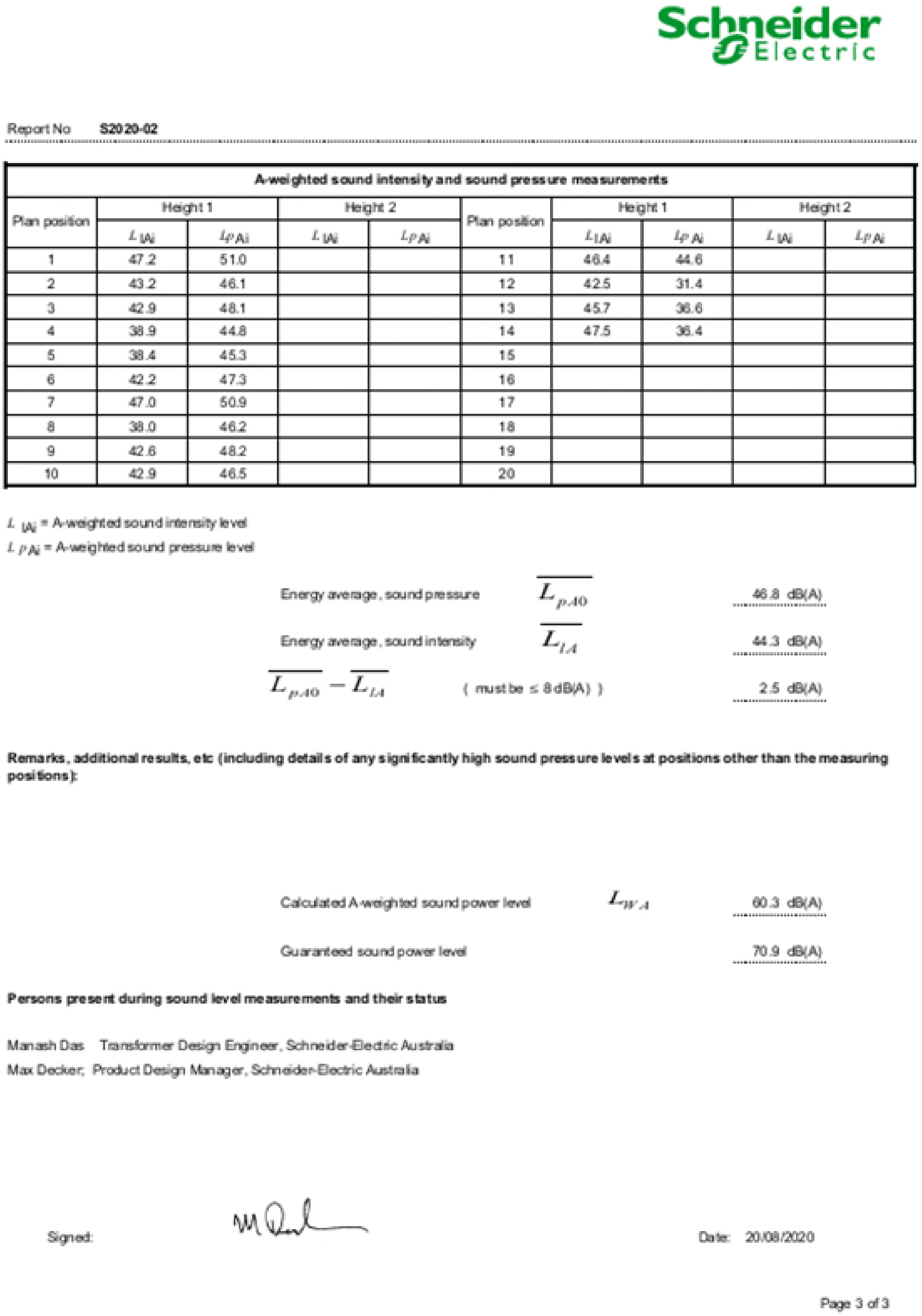

Report No **S2020-02**

A-weighted sound intensity and sound pressure measurements

Plan position	Height 1		Height 2		Plan position	Height 1		Height 2	
	L_{IAi}	L_{pAi}	L_{IAi}	L_{pAi}		L_{IAi}	L_{pAi}	L_{IAi}	L_{pAi}
1	47.2	51.0			11	46.4	44.6		
2	43.2	46.1			12	42.5	31.4		
3	42.9	48.1			13	45.7	36.6		
4	38.9	44.8			14	47.5	36.4		
5	38.4	45.3			15				
6	42.2	47.3			16				
7	47.0	50.9			17				
8	38.0	46.2			18				
9	42.6	48.2			19				
10	42.9	46.5			20				

L_{IAi} = A-weighted sound intensity level

L_{pAi} = A-weighted sound pressure level

Energy average, sound pressure	$\overline{L_{pA0}}$	46.8 dB(A)
Energy average, sound intensity	$\overline{L_{IA}}$	44.3 dB(A)
$\overline{L_{pA0}} - \overline{L_{IA}}$	(must be ≤ 8 dB(A))	2.5 dB(A)

Remarks, additional results, etc (including details of any significantly high sound pressure levels at positions other than the measuring positions):

Calculated A-weighted sound power level	L_{WA}	60.3 dB(A)
Guaranteed sound power level		70.9 dB(A)

Persons present during sound level measurements and their status

Manash Das Transformer Design Engineer, Schneider-Electric Australia

Max Decker; Product Design Manager, Schneider-Electric Australia

Signed:

Date: 20/08/2020

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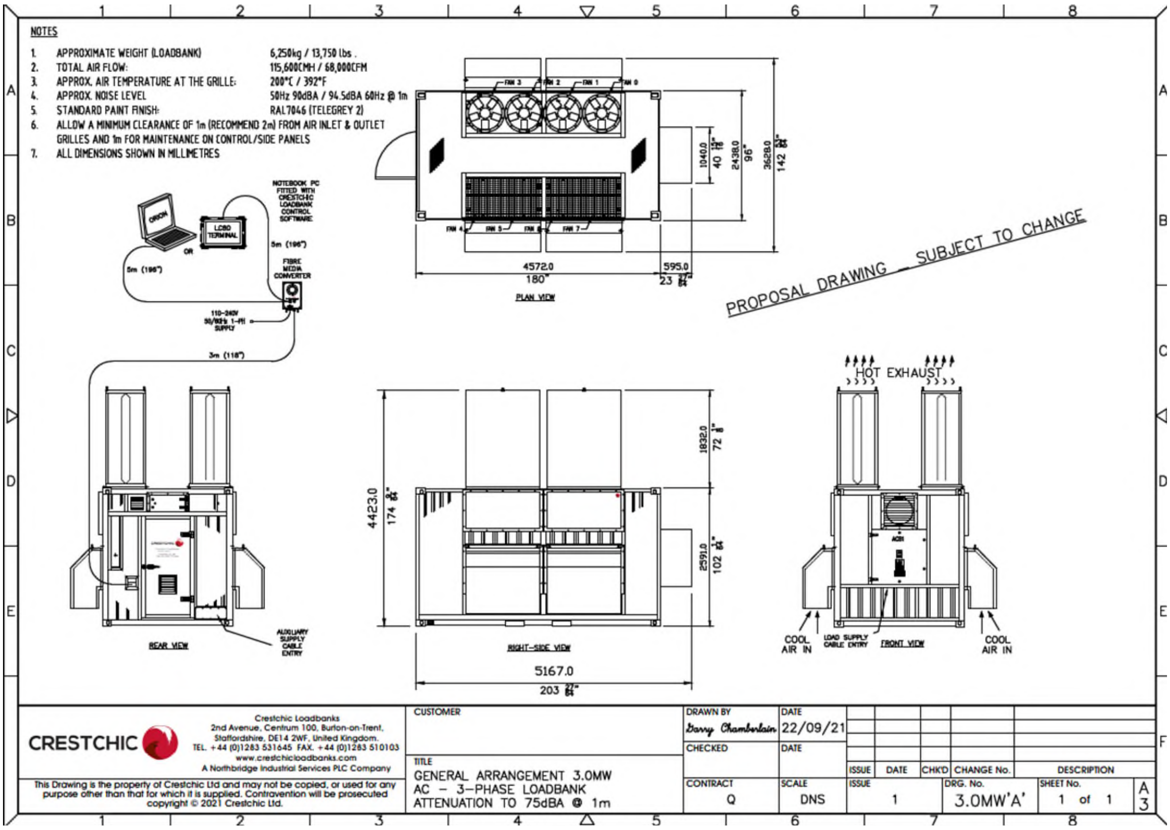
(c) Load bank (mitigated)



NOTES

1. APPROXIMATE WEIGHT (LOADBANK) 6,250kg / 13,750 lbs .
2. TOTAL AIR FLOW: 115,600CMH / 68,000CFM
3. APPROX. AIR TEMPERATURE AT THE GRILLE: 200°C / 392°F
4. APPROX. NOISE LEVEL 50Hz 90dBA / 94.5dBA 60Hz @ 1m
5. STANDARD PAINT FINISH: RAL7046 (TELEGREY 2)
6. ALLOW A MINIMUM CLEARANCE OF 1m (RECOMMEND 2m) FROM AIR INLET & OUTLET GRILLES AND 1m FOR MAINTENANCE ON CONTROL/SIDE PANELS
7. ALL DIMENSIONS SHOWN IN MILLIMETRES

Crestchic Loadbanks
2nd Avenue, Centrum 100, Burton-on-Trent,
Staffordshire, DE14 2WF, United Kingdom.
TEL. +44 (0)1283 531645 FAX. +44 (0)1283 510103
www.crestchicloadbanks.com
A Northbridge Industrial Services PLC Company

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CUSTOMER:

TITLE: GENERAL ARRANGEMENT 3.0MW AC – 3-PHASE LOADBANK ATTENUATION TO 75dBA @ 1m

DRAWN BY: Garry Chamberlain

DATE: 22/09/21

CHECKED:

DATE:

CONTRACT: Q

SCALE: DNS

ISSUE: 1

DRG. No.: 3.0MW'A'

SHEET No.: 1 of 1

A3

ISSUE	DATE	CHK'D	CHANGE No.	DESCRIPTION

APPENDIX E NPfI Fact Sheet C annoying characteristics analysis (Low frequency and tonality)

Annoyance analysis (Low frequency and tonality)

Scenario: Day - Typical operations plus worst case 6 generators for Emmanus Catholic College (E_NN/F_NN/D_NN/D_SN/E_NS/C_NS)

			Leq, 15min																					1/3 Octave Band Centre Frequency, Hz																
Item / Description			dB	dB(C)	dB(A)	dBLCeq - dBLAeq	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k	LF (Day)	LF (Night)	Tonal
	NPfI Table C2 - LF noise threshold		Note 1	Note 1	Note 1		92	89	86	77	69	61	54	50	50	48	48	46	44																					
NCA	Address	Receiver type																																						
			🟦	Exceeds NPfI Table C2 - LF noise threshold and dB(C) - dB(A) > 15																																				
			🟩	Exceeds NPfI Table C2 LF noise threshold by more than 5dB and dB(C) - dB(A) > 15																																				
			🟨	Excees NPfI Fact Sheet C tonality thresholds																																				
			🟥	dB(C) - dB(A) > 15																																	Required adjustment		
							Extrapolated data				Predicted noise levels																											LF (Day)	LF (Evening	Tonal
-	Adjacent warehouse (east)	Industrial	73	66	52	15	67	66	65	64	62	60	59	53	55	54	51	52	51	49	47	47	43	43	43	42	42	41	40	39	37	36	32	28	30	23	15	-	-	-
-	Adjacent warehouse (east)	Industrial	72	66	49	17	65	65	64	63	61	58	59	53	59	57	51	54	51	47	45	45	40	39	39	39	38	37	36	35	33	31	27	23	23	16	5	2	5	-
-	Adjacent warehouse (south)	Industrial	74	69	57	12	67	67	66	65	63	61	64	55	59	58	53	55	54	50	49	50	47	47	50	47	48	47	47	45	44	41	37	34	30	26	21	-	-	-
-	Adjacent warehouse (south)	Industrial	72	65	46	19	66	65	64	63	60	59	60	51	52	52	47	47	47	43	41	41	37	36	38	35	36	35	34	31	30	27	24	21	19	14	9	2	5	-
-	Adjacent warehouse (west)	Industrial	67	62	51	11	60	59	58	57	55	53	54	47	47	47	51	45	45	55	43	47	48	41	43	38	39	38	37	34	32	28	24	18	12	3	-10	-	-	5
NCA01	Mamre Anglican School (45-59 Bakers Lane, Kemps Creek)	Educational	68	62	44	17	62	61	60	58	57	52	54	47	54	53	45	48	46	42	40	40	35	34	35	34	34	33	31	30	28	23	19	12	2	-6	-25	LF=Y	2	-
NCA01	Mamre Anglican School (45-59 Bakers Lane, Kemps Creek)	Passive Rec (School)	64	58	37	21	58	57	56	55	54	49	50	44	51	49	40	44	41	35	32	32	26	25	25	26	26	24	22	19	16	11	4	-5	-15	-26	-54	LF=Y	2	-
NCA01	654-674 Mamre Road, Kemps Creek	Residential	62	56	34	22	57	56	55	53	51	48	49	42	47	46	37	39	36	33	29	29	24	23	22	24	23	21	19	15	10	3	-8	-24	-41	-68	-71	-	-	-
NCA01	1 Bakers Lane, Kemps Creek	Residential	65	59	40	19	60	59	58	56	54	52	52	45	50	49	43	43	40	42	34	35	33	29	29	30	30	28	26	23	21	16	11	4	-4	-16	-30	LF=Y	2	-
NCA01	676-702 Mamre Road, Kemps Creek	Residential	63	56	35	21	57	56	55	54	52	49	49	42	47	46	38	39	37	36	30	30	27	24	24	25	25	22	21	17	12	6	-4	-18	-33	-59	-71	-	-	-
NCA01	Mamre Anglican School (45-59 Bakers Lane, Kemps Creek)	Active Rec (School)	64	58	36	22	58	57	56	55	53	50	50	44	50	49	39	42	39	34	31	30	25	24	24	26	25	23	21	17	13	7	-2	-14	-26	-44	-71	LF=Y	2	-
NCA02	Trinity Primary School (61-83 Bakers Lane, Kemps Creek)	Active Rec (School)	65	59	39	20	58	57	56	55	54	50	51	46	52	52	41	44	42	36	33	33	28	28	28	30	30	28	26	24	21	15	9	0	-15	-27	-60	LF=Y	2	-
NCA02	Emmaus Catholic College (87-109 Bakers Lane, Kemps Creek)	Educational	69	63	43	20	62	61	60	59	58	53	55	49	56	55	44	48	45	40	38	38	33	33	34	32	33	31	29	26	23	18	13	6	1	-5	-29	2	5	-
NCA02	Emmaus Catholic College (87-109 Bakers Lane, Kemps Creek)	Active Rec (School)	66	60	39	21	59	58	57	56	55	51	52	46	53	52	41	44	42	36	33	33	28	27	27	29	29	27	25	21	18	12	4	-6	-16	-28	-61	LF=Y	2	-
NCA03	20 Aldington Road, Kemps Creek	Residential	64	58	40	18	58	57	56	55	53	50	50	43	49	48	43	45	43	40	37	36	32	30	30	30	29	27	26	23	18	15	6	-7	-15	-39	-69	-	-	-
NCA03	53 Aldington Road, Kemps Creek	Residential	63	57	40	17	57	57	55	54	52	49	49	43	46	45	42	43	42	39	37	36	32	31	32	31	30	28	27	23	17	13	3	-13	-21	-48	-71	-	-	-
NCA03	BAPS Shri Swaminarayan Hindu Mandir and Cultural Precinct (BAPS Temple)	BAPS	58	52	33	19	52	51	50	49	47	44	45	38	40	40	37	38	36	34	31	30	26	25	25	23	21	18	14	6	-5	-20	-45	-71	-71	-71	-71	-	-	-
NCA04	799-803 Mamre Road, Kemps Creek	Residential	62	56	43	14	56	55	54	53	50	48	49	42	43	43	43	43	43	46	39	40	38	34	35	32	32	29	28	24	18	12	1	-15	-27	-55	-71	-	-	-
NCA04	819 Mamre Road, Kemps Creek	Residential	63	57	43	14	56	55	54	53	51	49	50	43	46	45	44	44	42	44	38	39	37	34	36	33	33	31	30	25	20	13	2	-15	-31	-63	-71	-	-	-
NCA04	833B Mamre Road, Kemps Creek	Residential	62	56	40	15	56	55	54	53	51	48	49	42	45	44	43	42	41	42	36	37	35	31	33	30	30	28	26	21	16	8	-5	-24	-45	-71	-71	-	-	-
NCA04	833A Mamre Road, Kemps Creek	Residential	62	56	42	14	56	55	54	53	51	48	49	42	45	44	43	42	41	43	36	37	36	33	35	33	32	30	29	24	18	11	-2	-21	-40	-70	-71	-	-	-
NCA04	845-857 Mamre Road, Kemps Creek	Residential	61	55	41	14	55	54	53	52	50	47	48	41	43	43	42	41	40	42	37	37	35	32	33	31	31	28	27	22	16	7	-7	-28	-51	-71	-71	-	-	-
NCA04	845A Mamre Road, Kemps Creek	Residential	61	55	41	14	55	54	53	52	50	48	48	42	44	44	42	42	41	43	37	38	35	33	34	32	31	29	28	22	17	8	-6	-26	-49	-71	-71	-	-	-
NCA04	857 Mamre Road, Kemps Creek	Residential	60	54	39	15	54	53	52	51	49	47	47	40	43	42	41	40	39	41	35	36	33	31	31	29	29	26	24	18	11	2	-14	-37	-63	-71	-71	-	-	-
NCA04	859 Mamre Road, Kemps Creek	Residential	60	54	38	16	53	53	51	50	49	46	46	40	44	43	42	42	40	42	35	35	33	29	30	28	27	24	21	16	8	-1	-18	-43	-69	-71	-71	-	-	-
NCA05	Old MacDonald's Child Care (21A Mandalong Cl, Orchard Hills)	Childcare	58	51	27	24	52	51	50	49	46	44	44	37	41	40	31	32	30	27	22	22	18	16	15	18	16	12	9	1	-10	-23	-48	-71	-71	-71	-71	-	-	-
NCA05	Orchard Hills	Residential	57	51	27	23	52	51	50	48	46	44	44	37	41	40	31	32	30	28	23	22	19	16	17	18	16	13	10	3	-8	-22	-46	-71	-71	-71	-71	-	-	-
NCA06	Luddenham	Residential	59	52	33	19	53	52	51	50	48	46	46	39	42	41	35	34	33	36	30	30	28	25	26	23	22	19	15	7	-2	-16	-39	-68	-70	-70	-70	-	-	-
NCA07	Kemps Creek	Residential	58	52	33	19	52	51	50	49	47	44	45	39	43	42	36	37	36	36	30	30	27	24	24	24	23	19	16	9	0	-14	-37	-68	-72	-72	-72	-	-	-
NCA08	Mount Vernon	Residential	57	50	29	21	51	50	49	48	46	43	43	37	40	39	32	33	31	30	27	27	23	22	22	19	17	13	7	-2	-16	-36	-66	-70	-70	-70	-70	-	-	-
NCA02	Emmaus Catholic College (87-109 Bakers Lane, Kemps Creek)	Passive Rec (School)	64	58	37	21	58	57	56	55	53	49	50	44	51	49	40	44	41	37	34	33	28	27	27	26	26	24	21	18	14	8	-1	-12	-22	-34	-68	LF=Y	2	-
NCA02	Trinity Primary School (61-83 Bakers Lane, Kemps Creek)	Educational	64	59	39	20	58	57	56	55	54	50	51	45	52	51	40	43	40	37	35	35	30	30	30	29	29	27	25	22	19	12	4	-7	-23	-39	-71	LF=Y	2	-
NCA02	Emmaus Retirement Village (Kemps Creek) (85 Bakers Lane, Kemps Creek)	Residential	65	59	39	20	59	58	57	56	55	51	52	45	52	50	40	43	41	38	35	35	31	30	30	29	29	26	25	21	16	9	-3	-18	-35	-57	-69	LF=Y	2	-

Note 1: The overall noise levels are based upon the worst case spectral data for each receiver location.

Annoyance analysis (Low frequency and tonality)

Scenario: Day - Typical operations plus worst case generators for Emmanus Catholic College (with management) (E_NN/E_SS/D_SS/C_NS)

			Leq, 15min																					1/3 Octave Band Centre Frequency, Hz																
Item / Description			dB	dB(C)	dB(A)	dBLCeq - dBLAeq	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k	LF (Day)	LF (Night)	Tonal
	NPfI Table C2 - LF noise threshold		Note 1	Note 1	Note 1		92	89	86	77	69	61	54	50	50	48	48	46	44																					
NCA	Address	Receiver type																																						
			🟦	Exceeds NPfI Table C2 - LF noise threshold and dB(C) - dB(A) > 15																																				
			🟩	Exceeds NPfI Table C2 LF noise threshold by more than 5dB and dB(C) - dB(A) > 15																																				
			🟨	Excees NPfI Fact Sheet C tonality thresholds																																				
			🟥	dB(C) - dB(A) > 15																																	Required adjustment		
							Extrapolated data				Predicted noise levels																											LF (Day)	LF (Night)	Tonal
-	Adjacent warehouse (east)	Industrial	73	66	52	14	67	66	65	64	62	60	59	53	54	54	52	52	51	50	48	47	43	43	43	43	42	41	41	39	38	36	32	28	30	24	15	-	-	-
-	Adjacent warehouse (east)	Industrial	72	66	49	17	65	64	63	62	60	59	59	53	57	56	50	53	51	47	45	45	40	39	39	39	39	38	37	35	33	32	28	23	23	16	5	2	5	-
-	Adjacent warehouse (south)	Industrial	74	69	57	12	68	67	66	65	63	61	64	55	58	58	52	54	53	49	48	49	46	46	50	46	48	47	47	44	43	40	37	33	30	26	21	-	-	-
-	Adjacent warehouse (south)	Industrial	72	65	46	19	66	65	64	63	60	59	60	52	52	53	47	49	48	43	42	41	37	37	38	36	36	35	34	32	30	27	24	21	19	15	9	2	5	-
-	Adjacent warehouse (west)	Industrial	67	62	51	11	60	60	59	58	55	54	55	47	48	49	52	46	45	56	43	48	48	42	43	39	40	38	38	34	33	29	24	18	12	3	-10	-	-	5
NCA01	Mamre Anglican School (45-59 Bakers Lane, Kemps Creek)	Educational	67	60	45	15	61	60	59	57	56	52	53	46	51	50	44	46	45	42	40	40	35	35	36	36	36	35	34	32	31	26	22	15	2	-9	-25	-	-	-
NCA01	Mamre Anglican School (45-59 Bakers Lane, Kemps Creek)	Passive Rec (School)	63	56	35	21	57	56	55	54	52	49	49	43	47	46	39	41	38	34	31	31	25	24	24	26	26	24	21	18	15	11	3	-6	-17	-33	-55	-	-	-
NCA01	654-674 Mamre Road, Kemps Creek	Residential	62	55	33	22	56	55	54	53	51	49	48	42	45	44	37	38	36	34	29	29	25	23	23	24	23	21	19	15	10	3	-8	-23	-41	-69	-73	-	-	-
NCA01	1 Bakers Lane, Kemps Creek	Residential	65	58	40	19	59	59	57	56	54	52	51	45	48	47	43	41	40	42	34	35	33	29	30	30	30	28	26	23	21	17	11	4	-4	-16	-30	-	-	-
NCA01	676-702 Mamre Road, Kemps Creek	Residential	62	56	35	21	57	56	55	53	51	49	49	42	45	44	38	38	36	36	30	30	27	24	24	26	25	23	21	17	12	6	-4	-17	-33	-59	-73	-	-	-
NCA01	Mamre Anglican School (45-59 Bakers Lane, Kemps Creek)	Active Rec (School)	64	57	35	22	58	57	56	54	53	50	50	43	48	47	39	40	38	35	31	30	25	24	24	26	25	23	21	17	13	7	-2	-14	-26	-46	-72	-	-	-
NCA02	Trinity Primary School (61-83 Bakers Lane, Kemps Creek)	Active Rec (School)	64	58	40	18	58	57	56	55	53	50	51	45	49	49	40	42	40	36	33	33	29	28	29	31	31	30	29	27	24	18	12	2	-16	-34	-62	LF=Y	2	-
NCA02	Trinity Primary School (61-83 Bakers Lane, Kemps Creek)	Educational	64	58	39	18	58	57	56	55	53	50	50	45	49	48	40	42	40	35	33	32	28	28	28	31	31	30	28	26	24	17	11	1	-17	-36	-64	-	-	-
NCA02	Emmaus Catholic College (87-109 Bakers Lane, Kemps Creek)	Educational	67	61	42	19	61	60	59	58	56	53	54	47	53	52	42	45	42	40	38	38	33	32	34	32	33	31	29	26	23	18	12	6	0	-7	-30	LF=Y	2	-
NCA02	Emmaus Catholic College (87-109 Bakers Lane, Kemps Creek)	Active Rec (School)	64	58	38	20	58	57	56	55	54	50	51	45	49	48	40	42	40	35	33	32	27	27	27	29	29	27	25	21	18	12	4	-6	-18	-32	-63	-	-	-
NCA03	20 Aldington Road, Kemps Creek	Residential	64	57	40	17	58	57	56	54	52	50	49	43	46	45	43	43	42	40	37	36	32	30	30	30	29	27	27	23	19	15	6	-7	-15	-38	-70	-	-	-
NCA03	53 Aldington Road, Kemps Creek	Residential	64	57	40	17	58	57	56	54	52	50	50	43	47	46	43	44	43	40	37	36	32	32	32	31	30	28	27	23	18	13	3	-12	-21	-48	-73	-	-	-
NCA03	BAPS Shri Swaminarayan Hindu Mandir and Cultural Precinct (BAPS Temple)	BAPS	58	52	33	19	52	52	50	49	47	45	45	38	41	40	38	38	37	34	31	31	26	25	25	23	21	18	14	6	-5	-19	-44	-72	-73	-73	-73	-	-	-
NCA04	799-803 Mamre Road, Kemps Creek	Residential	62	57	43	14	56	55	54	53	51	49	49	42	45	44	43	43	44	46	39	40	38	34	35	33	32	30	28	24	19	12	1	-14	-27	-55	-73	-	-	-
NCA04	819 Mamre Road, Kemps Creek	Residential	63	57	43	14	56	56	55	53	51	49	50	43	46	46	44	44	43	44	38	39	37	35	36	34	34	31	30	25	20	14	2	-15	-31	-63	-73	-	-	-
NCA04	833B Mamre Road, Kemps Creek	Residential	62	56	41	15	56	55	54	53	51	49	49	43	44	44	43	42	41	43	36	37	35	32	33	31	31	28	27	22	16	8	-5	-24	-45	-72	-73	-	-	-
NCA04	833A Mamre Road, Kemps Creek	Residential	62	56	42	14	56	55	54	53	51	49	49	43	45	44	43	43	41	43	36	37	36	34	35	33	33	30	29	24	19	11	-2	-20	-40	-71	-73	-	-	-
NCA04	845-857 Mamre Road, Kemps Creek	Residential	61	55	41	14	55	54	53	52	50	48	48	42	44	43	42	41	41	42	37	37	35	33	34	31	31	29	27	22	16	8	-7	-27	-51	-73	-73	-	-	-
NCA04	845A Mamre Road, Kemps Creek	Residential	61	56	41	14	55	54	53	52	50	48	49	42	44	43	42	42	41	43	38	38	35	33	35	32	32	29	28	23	17	9	-5	-25	-48	-73	-73	-	-	-
NCA04	857 Mamre Road, Kemps Creek	Residential	60	54	39	15	54	54	52	51	49	47	47	41	43	42	41	41	39	41	35	36	34	31	32	30	29	26	24	18	12	2	-14	-36	-63	-73	-73	-	-	-
NCA04	859 Mamre Road, Kemps Creek	Residential	60	54	39	16	53	53	52	50	49	46	46	40	44	43	43	42	41	42	35	36	34	30	30	28	27	24	22	16	8	-1	-18	-43	-69	-73	-73	-	-	-
NCA05	Old MacDonald's Child Care (21A Mandalong Cl, Orchard Hills)	Childcare	57	50	26	24	52	51	50	48	46	44	44	37	38	37	31	31	29	27	23	22	18	16	16	18	16	12	9	2	-10	-23	-48	-72	-73	-73	-73	-	-	-
NCA05	Orchard Hills	Residential	57	50	27	23	51	51	49	48	46	44	43	37	38	37	31	31	29	28	23	22	19	17	17	19	17	13	10	3	-8	-21	-45	-72	-73	-73	-73	-	-	-
NCA06	Luddenham	Residential	59	53	33	19	53	52	51	50	48	46	46	40	42	41	35	35	33	36	31	30	28	26	26	23	22	19	15	8	-2	-16	-39	-69	-72	-72	-72	-	-	-
NCA07	Kemps Creek	Residential	58	52	33	18	52	51	50	49	47	44	45	38	42	41	36	37	36	36	30	30	28	24	25	24	23	19	16	9	0	-14	-37	-69	-73	-73	-74	-	-	-
NCA08	Mount Vernon	Residential	57	50	30	21	51	51	49	48	46	44	44	37	40	39	32	33	31	31	28	27	23	22	22	19	17	13	8	-2	-16	-35	-66	-71	-72	-72	-72	-	-	-
NCA02	Emmaus Catholic College (87-109 Bakers Lane, Kemps Creek)	Passive Rec (School)	63	57	36	20	58	57	55	54	52	49	49	43	47	46	39	41	39	36	33	33	28	27	27	26	26	24	21	17	13	7	-1	-12	-25	-40	-70	-	-	-
NCA02	Emmaus Retirement Village (Kemps Creek) (85 Bakers Lane, Kemps Creek)	Residential	65	58	39	19	59	58	57	55	54	51	51	45	49	48	40	42	40	38	35	35	31	30	30	30	30	27	25	21	17	9	-2	-18	-35	-59	-71	-	-	-

Note 1: The overall noise levels are based upon the worst case spectral data for each receiver location.

Annoyance analysis (Low frequency and tonality)

Scenario: Day - Typical operations - Without generator testing

			Leq, 15min				1/3 Octave Band Centre Frequency, Hz																																	
Item / Description			dB	dB(C)	dB(A)	dBLCeq - dBLAeq	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k	LF (Day)	LF (Night)	Tonal
	NPfI Table C2 - LF noise threshold		Note 1	Note 1	Note 1		92	89	86	77	69	61	54	50	50	48	48	46	44																					
NCA	Address	Receiver type																																						
			🟦	Exceeds NPfI Table C2 - LF noise threshold and dB(C) - dB(A) > 15																																						
			🟩	Exceeds NPfI Table C2 LF noise threshold by more than 5dB and dB(C) - dB(A) > 15																																						
			🟨	Excees NPfI Fact Sheet C tonality thresholds																																						
			🟥	dB(C) - dB(A) > 15																																		Required adjustment		
							Extrapolated data				Predicted noise levels																											LF (Day)	LF (Night)	Tonal
-	Adjacent warehouse (east)	Industrial	70	64	50	14	64	64	63	61	59	58	57	51	51	51	49	50	49	47	45	45	41	41	41	40	40	39	38	37	35	34	30	26	28	21	13	-	-	-
-	Adjacent warehouse (east)	Industrial	70	64	48	16	64	63	62	61	59	58	58	52	51	51	49	49	49	47	45	45	40	39	39	39	38	37	36	35	33	31	27	23	23	15	5	LF=Y	2	-
-	Adjacent warehouse (south)	Industrial	73	68	56	11	67	66	65	64	62	61	63	54	54	55	52	52	52	49	48	48	46	46	49	46	48	47	47	44	43	40	37	33	30	26	21	-	-	-
-	Adjacent warehouse (south)	Industrial	71	65	46	19	66	65	64	62	60	59	60	51	51	51	47	47	46	43	42	41	37	36	38	35	36	35	34	31	30	27	24	21	19	14	9	2	5	-
-	Adjacent warehouse (west)	Industrial	67	62	51	11	60	59	58	57	55	54	54	47	46	47	52	45	45	55	43	47	48	41	43	38	39	38	37	34	32	28	24	18	12	3	-10	-	-	5
NCA01	Mamre Anglican School (45-59 Bakers Lane, Kemps Creek)	Educational	65	58	41	17	59	58	57	56	54	52	51	45	43	44	43	42	41	40	37	37	32	31	32	31	32	31	29	26	23	18	13	6	-1	-12	-26	-	-	-
NCA01	Mamre Anglican School (45-59 Bakers Lane, Kemps Creek)	Passive Rec (School)	61	54	34	20	56	55	54	52	50	48	48	41	40	40	38	37	36	34	31	30	25	24	24	25	25	23	20	18	14	10	3	-7	-17	-34	-55	-	-	-
NCA01	654-674 Mamre Road, Kemps Creek	Residential	61	54	32	21	55	55	53	52	50	48	47	41	40	40	36	36	35	33	29	28	24	22	22	24	23	21	19	15	9	3	-8	-24	-41	-71	-80	-	-	-
NCA01	1 Bakers Lane, Kemps Creek	Residential	64	57	39	18	59	58	57	55	53	52	51	45	43	44	43	40	39	42	34	35	33	29	29	30	30	28	26	23	21	16	11	4	-4	-16	-30	-	-	-
NCA01	676-702 Mamre Road, Kemps Creek	Residential	62	55	34	20	56	55	54	53	50	49	48	42	40	40	38	37	36	36	30	30	27	24	24	25	25	22	21	17	12	6	-4	-18	-33	-59	-80	-	-	-
NCA01	Mamre Anglican School (45-59 Bakers Lane, Kemps Creek)	Active Rec (School)	62	55	34	21	56	56	54	53	51	49	49	42	41	41	38	37	36	34	30	30	25	24	24	25	25	22	20	17	12	7	-3	-15	-27	-50	-78	-	-	-
NCA02	Trinity Primary School (61-83 Bakers Lane, Kemps Creek)	Active Rec (School)	63	55	35	20	57	56	55	54	51	50	49	43	41	42	38	38	37	35	31	30	26	24	25	27	27	25	23	19	16	10	3	-7	-19	-38	-63	-	-	-
NCA02	Emmaus Catholic College (87-109 Bakers Lane, Kemps Creek)	Educational	65	58	40	18	60	59	58	56	54	53	52	45	44	44	41	40	39	39	36	36	32	31	33	31	32	30	28	24	22	17	12	5	-2	-14	-31	-	-	-
NCA02	Emmaus Catholic College (87-109 Bakers Lane, Kemps Creek)	Active Rec (School)	63	56	36	20	57	56	55	54	51	50	49	43	41	42	38	37	36	34	31	30	25	25	26	27	28	25	23	19	16	10	3	-8	-19	-38	-64	-	-	-
NCA03	20 Aldington Road, Kemps Creek	Residential	63	56	39	17	57	56	55	54	51	50	48	42	41	41	42	42	41	40	36	36	32	30	30	30	29	27	26	23	18	15	6	-7	-15	-39	-73	-	-	-
NCA03	53 Aldington Road, Kemps Creek	Residential	62	56	40	16	57	56	55	53	51	49	49	42	41	42	42	42	42	40	37	36	32	31	32	31	30	28	27	23	18	13	3	-13	-21	-48	-79	-	-	-
NCA03	BAPS Shri Swaminarayan Hindu Mandir and Cultural Precinct (BAPS Temple)	BAPS	57	51	33	18	51	51	50	48	46	45	44	38	37	37	37	37	36	34	31	30	26	25	25	23	21	18	14	6	-5	-20	-45	-78	-80	-80	-80	-	-	-
NCA04	799-803 Mamre Road, Kemps Creek	Residential	62	56	43	13	55	55	54	52	50	49	49	42	41	41	43	42	43	46	39	40	38	34	35	33	32	30	28	24	18	12	1	-15	-27	-55	-80	-	-	-
NCA04	819 Mamre Road, Kemps Creek	Residential	62	56	43	13	56	55	54	53	51	49	49	43	42	43	44	42	42	44	38	39	37	34	36	33	33	31	30	25	20	13	2	-15	-31	-64	-80	-	-	-
NCA04	833B Mamre Road, Kemps Creek	Residential	61	55	40	15	55	54	53	52	50	48	49	42	41	42	43	41	41	43	36	37	35	32	33	30	30	28	26	22	16	8	-5	-24	-45	-78	-80	-	-	-
NCA04	833A Mamre Road, Kemps Creek	Residential	61	55	42	14	55	54	53	52	50	49	49	42	41	42	43	41	41	43	36	37	36	33	35	33	33	30	29	24	18	11	-2	-21	-40	-75	-80	-	-	-
NCA04	845-857 Mamre Road, Kemps Creek	Residential	60	54	41	14	54	53	52	51	49	47	48	41	40	41	42	40	40	42	37	37	35	32	34	31	31	28	27	22	16	7	-7	-28	-51	-80	-80	-	-	-
NCA04	845A Mamre Road, Kemps Creek	Residential	61	55	41	14	54	54	53	52	49	48	48	42	41	41	42	41	41	43	37	38	35	33	34	32	32	29	28	23	17	8	-6	-26	-49	-79	-80	-	-	-
NCA04	857 Mamre Road, Kemps Creek	Residential	60	53	39	15	53	53	52	50	48	47	47	40	39	40	41	39	38	41	35	36	34	31	31	29	29	26	24	18	11	2	-14	-37	-64	-80	-80	-	-	-
NCA04	859 Mamre Road, Kemps Creek	Residential	59	53	38	15	52	52	51	50	48	46	46	40	40	41	42	41	40	42	35	35	33	29	30	28	27	24	21	16	8	-1	-18	-43	-72	-80	-80	-	-	-
NCA05	Old MacDonald's Child Care (21A Mandalong Cl, Orchard Hills)	Childcare	57	50	26	24	51	50	49	48	45	44	43	37	35	35	31	30	29	27	22	22	18	16	16	18	16	12	9	1	-10	-23	-48	-79	-80	-80	-80	-	-	-
NCA05	Orchard Hills	Residential	57	49	26	23	51	50	49	48	45	44	43	37	35	35	31	30	29	28	23	22	19	16	17	18	16	13	10	3	-8	-22	-46	-78	-80	-80	-80	-	-	-
NCA06	Luddenham	Residential	58	52	33	19	52	52	51	49	47	46	46	39	38	39	35	33	33	36	30	30	28	26	26	23	22	19	15	8	-2	-16	-39	-71	-79	-79	-79	-	-	-
NCA07	Kemps Creek	Residential	57	50	33	18	51	50	49	48	46	44	44	37	36	36	36	35	35	36	29	29	27	23	24	23	22	18	16	8	-1	-15	-38	-71	-80	-80	-80	-	-	-
NCA08	Mount Vernon	Residential	56	49	29	20	51	50	49	47	45	43	43	37	35	36	32	31	30	31	28	27	23	22	22	19	17	13	7	-2	-16	-36	-67	-79	-79	-79	-79	-	-	-
NCA02	Emmaus Catholic College (87-109 Bakers Lane, Kemps Creek)	Passive Rec (School)	62	55	35	20	57	56	55	53	51	49	48	42	41	40	38	38	37	36	33	32	28	26	26	26	26	23	20	17	13	8	-1	-12	-24	-43	-68	-	-	-
NCA02	Trinity Primary School (61-83 Bakers Lane, Kemps Creek)	Educational	62	55	35	19	56	55	54	53	51	49	48	42	40	41	38	37	36	36	32	32	27	26	27	26	27	24	22	18	14	8	-1	-13	-27	-50	-77	-	-	-
NCA02	Emmaus Retirement Village (Kemps Creek) (85 Bakers Lane, Kemps Creek)	Residential	63	56	37	19	58	57	56	54	52	50	50	43	42	42	39	38	38	37	34	33	29	28	29	28	28	25	23	19	13	7	-5	-20	-36	-66	-78	-	-	-

Note 1: The overall noise levels are based upon the worst case spectral data for each receiver location.

Annoyance analysis (Low frequency and tonality)

Scenario: Night - Typical operations

			Leq, 15min				1/3 Octave Band Centre Frequency, Hz																																	
Item / Description			dB	dB(C)	dB(A)	dBLCeq - dBLAeq	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k	LF (Day)	LF (Night)	Tonal
	NPfI Table C2 - LF noise threshold		Note 1	Note 1	Note 1		92	89	86	77	69	61	54	50	50	48	48	46	44																					
NCA	Address	Receiver type																																						
			🟦	Exceeds NPfI Table C2 - LF noise threshold and dB(C) - dB(A) > 15																																						
			🟩	Exceeds NPfI Table C2 LF noise threshold by more than 5dB and dB(C) - dB(A) > 15																																						
			🟨	Excees NPfI Fact Sheet C tonality thresholds																																						
			🟥	dB(C) - dB(A) > 15																																		Required adjustment		
							Extrapolated data				Predicted noise levels																											LF (Day)	LF (Night)	Tonal
-	Adjacent warehouse (east)	Industrial	71	65	50	14	65	64	63	62	60	58	57	52	51	51	50	50	49	48	46	45	42	41	41	41	40	40	39	38	36	34	31	27	28	22	14	-	-	-
-	Adjacent warehouse (east)	Industrial	71	65	49	16	64	64	63	62	59	59	59	52	52	52	50	50	49	48	46	45	40	39	39	39	39	38	37	35	33	32	28	23	23	16	5	LF=Y	2	-
-	Adjacent warehouse (south)	Industrial	71	64	45	19	65	64	63	62	60	59	59	52	51	51	47	47	46	44	42	41	37	36	37	35	35	35	33	31	30	27	24	21	19	14	8	LF=Y	2	-
-	Adjacent warehouse (south)	Industrial	77	71	56	15	71	70	69	68	65	65	66	58	58	58	53	53	53	51	50	51	46	46	48	46	47	46	45	43	43	40	38	36	35	32	29	-	-	-
-	Adjacent warehouse (west)	Industrial	67	63	52	11	59	59	58	57	55	53	53	48	48	48	54	46	46	58	44	50	51	43	44	37	37	35	34	31	30	27	24	20	8	0	-11	-	-	5
NCA01	Mamre Anglican School (45-59 Bakers Lane, Kemps Creek)	Educational	65	58	41	17	60	59	58	56	54	52	51	45	44	44	43	42	41	41	38	38	32	32	32	32	32	31	29	26	24	19	14	7	0	-11	-26	-	-	-
NCA01	Mamre Anglican School (45-59 Bakers Lane, Kemps Creek)	Passive Rec (School)	62	55	34	20	56	55	54	53	50	49	48	42	40	40	38	37	36	34	31	31	25	24	24	26	26	23	21	18	15	11	3	-6	-17	-34	-55	-	-	-
NCA01	654-674 Mamre Road, Kemps Creek	Residential	62	54	33	22	56	55	54	53	50	49	48	41	40	40	37	36	35	34	29	29	25	23	22	24	23	21	19	15	10	4	-8	-23	-40	-70	-79	-	-	-
NCA01	1 Bakers Lane, Kemps Creek	Residential	65	58	40	18	59	58	57	56	54	52	51	45	44	44	44	40	39	42	34	35	34	29	30	30	31	28	26	23	21	17	11	5	-4	-16	-30	-	-	-
NCA01	676-702 Mamre Road, Kemps Creek	Residential	62	55	35	20	56	56	54	53	51	49	49	42	41	41	38	37	36	36	30	30	28	24	25	26	25	23	21	17	12	6	-4	-17	-33	-59	-79	-	-	-
NCA01	Mamre Anglican School (45-59 Bakers Lane, Kemps Creek)	Active Rec (School)	63	56	34	21	57	56	55	54	51	50	49	43	42	42	38	37	36	35	31	30	25	24	24	26	25	23	20	17	13	7	-2	-14	-27	-50	-77	-	-	-
NCA02	Emmaus Catholic College (87-109 Bakers Lane, Kemps Creek)	Educational	66	59	40	18	60	59	58	57	54	53	52	46	45	45	41	40	39	39	37	36	32	31	32	31	32	30	27	24	22	17	12	5	-2	-14	-31	-	-	-
NCA02	Emmaus Catholic College (87-109 Bakers Lane, Kemps Creek)	Active Rec (School)	63	56	35	21	57	57	55	54	52	50	49	43	42	42	39	38	37	35	31	31	25	25	25	27	28	25	21	18	15	10	2	-7	-19	-37	-63	-	-	-
NCA03	20 Aldington Road, Kemps Creek	Residential	63	56	40	17	58	57	55	54	52	50	49	43	41	41	43	42	41	41	37	36	32	30	30	30	29	27	27	24	19	16	7	-7	-14	-38	-72	-	-	-
NCA03	53 Aldington Road, Kemps Creek	Residential	63	56	40	16	57	56	55	53	51	50	48	43	42	42	43	43	42	40	37	37	32	31	31	31	30	28	27	23	17	13	3	-12	-21	-48	-79	-	-	-
NCA03	BAPS Shri Swaminarayan Hindu Mandir and Cultural Precinct (BAPS Temple)	BAPS	58	51	33	18	52	51	50	49	46	45	44	38	37	37	38	37	36	35	32	31	26	25	25	23	21	17	13	6	-5	-19	-44	-77	-79	-79	-79	-	-	-
NCA04	799-803 Mamre Road, Kemps Creek	Residential	62	56	43	13	56	55	54	52	50	49	48	42	41	42	43	43	43	46	40	40	38	34	35	33	32	30	28	24	19	13	2	-14	-27	-55	-79	-	-	-
NCA04	819 Mamre Road, Kemps Creek	Residential	62	56	43	14	56	55	54	53	51	49	49	43	42	43	44	43	42	44	39	39	37	34	35	33	33	31	29	25	20	13	1	-15	-31	-63	-79	-	-	-
NCA04	833B Mamre Road, Kemps Creek	Residential	61	55	40	15	55	54	53	52	50	49	48	42	42	42	43	42	41	43	36	37	35	31	32	30	30	27	26	21	15	8	-5	-24	-44	-78	-79	-	-	-
NCA04	833A Mamre Road, Kemps Creek	Residential	61	56	42	14	55	55	54	52	50	49	48	43	42	42	43	42	41	43	37	37	36	33	34	32	32	30	28	24	18	11	-2	-21	-40	-75	-79	-	-	-
NCA04	845-857 Mamre Road, Kemps Creek	Residential	60	55	41	14	54	53	52	51	49	48	47	42	41	41	42	41	41	43	37	38	35	32	33	31	30	28	26	21	15	7	-7	-28	-51	-79	-79	-	-	-
NCA04	845A Mamre Road, Kemps Creek	Residential	61	55	41	14	55	54	53	52	50	48	48	42	41	41	42	41	41	43	38	38	35	33	34	32	31	28	27	22	16	8	-6	-26	-48	-79	-79	-	-	-
NCA04	857 Mamre Road, Kemps Creek	Residential	60	54	39	15	54	53	52	51	49	47	46	41	40	40	41	40	39	41	35	36	34	31	31	29	28	25	23	18	11	2	-14	-37	-64	-79	-79	-	-	-
NCA04	859 Mamre Road, Kemps Creek	Residential	59	53	39	15	53	52	51	50	48	46	45	40	41	41	43	41	40	42	35	36	34	30	30	28	27	23	21	16	8	-1	-18	-44	-71	-79	-79	-	-	-
NCA05	Old MacDonald's Child Care (21A Mandalong Cl, Orchard Hills)	Childcare	57	50	26	24	52	51	50	48	46	45	44	37	36	36	31	30	29	28	23	22	19	17	16	18	16	12	9	2	-9	-23	-48	-78	-79	-79	-79	-	-	-
NCA05	Orchard Hills	Residential	57	50	27	23	51	50	49	48	46	44	43	37	36	36	31	31	30	28	23	22	19	17	17	19	17	13	10	3	-8	-21	-45	-77	-79	-79	-79	-	-	-
NCA06	Luddenham	Residential	58	52	33	19	53	52	51	50	48	46	45	40	39	39	35	34	33	36	31	31	28	26	26	23	22	19	15	8	-2	-16	-39	-71	-78	-78	-78	-	-	-
NCA07	Kemps Creek	Residential	57	51	33	18	51	51	49	48	46	44	43	38	36	37	36	36	35	36	29	30	28	24	24	23	22	18	15	8	-2	-15	-38	-71	-80	-80	-80	-	-	-
NCA08	Mount Vernon	Residential	57	50	29	20	51	50	49	48	46	44	43	37	36	36	32	32	31	31	28	27	23	22	21	19	17	13	7	-2	-16	-35	-67	-78	-78	-78	-78	-	-	-
NCA02	Emmaus Catholic College (87-109 Bakers Lane, Kemps Creek)	Passive Rec (School)	63	56	36	20	57	56	55	54	51	50	49	42	41	41	39	38	37	37	33	33	28	26	26	26	26	23	20	17	13	8	-1	-12	-23	-43	-68	-	-	-
NCA02	Trinity Primary School (61-83 Bakers Lane, Kemps Creek)	Active Rec (School)	63	56	35	20	57	56	55	54	52	50	49	43	41	41	39	38	37	35	31	31	26	25	25	27	27	25	23	19	16	10	3	-8	-19	-38	-64	-	-	-
NCA02	Trinity Primary School (61-83 Bakers Lane, Kemps Creek)	Educational	62	55	36	20	57	56	55	53	51	49	48	42	41	41	38	38	36	36	33	32	28	26	27	27	27	24	21	17	13	8	-1	-13	-27	-49	-77	-	-	-
NCA02	Emmaus Retirement Village (Kemps Creek) (85 Bakers Lane, Kemps Creek)	Residential	64	57	37	20	58	57	56	55	52	51	50	44	42	42	39	39	38	38	34	34	29	28	28	28	28	25	23	19	13	7	-4	-20	-36	-65	-77	-	-	-

Note 1: The overall noise levels are based upon the worst case spectral data for each receiver location.

APPENDIX F Predicted operational noise contours

F.1 Predicted operational noise levels, $L_{Aeq,15minute}$ – Daytime (with example of testing of 6 worst case concurrent generators for Emmaus College)

F.2 Predicted operational noise levels, $L_{Aeq,15minute}$ – Daytime (with example of testing of worst case concurrent generators with management for Emmaus College)

F.3 Predicted operational noise levels, $L_{Aeq,15minute}$ – Typical operations - Evening

F.4 Predicted operational noise levels, $L_{Aeq,15minute}$ – Typical operations - Night

Plot Date: 10/12/25 - 01:42 Layout: TP886 NOISE CONTOURS SSDA NVIA (r1)

GIS File: R:\AssocSydProjects\TP851-TP900\TP886 ale SYD6 Kemps Creek\6 Figures & CAD Out\01 GIS\00 GIS\TP886-01 MAMRE RD PRECINT-SYD6 (r5) qgsi 345.qgz

Legend

- ▭ Noise catchment boundary (NCA)
- ▭ Mamre Road Precinct Boundary
- ▨ Proposal operational area
- ▭ Key Proposal buildings
- ▭ Future assumed MRP building outlines

Receiver buildings

- 🟦 Residential
- ▭ Existing residence within MRP
- 🟥 Childcare
- 🟧 Educational
- 🟨 Commercial
- ▭ Industrial
- ▭ Place of Worship
- ▭ Recreational - Active
- 🟩 Recreational – Passive

Assessment receivers

- ● Residential (outside MRP)
- ● Residential (within MRP)
- ● Educational
- ● Childcare
- ● Place of worship
- ● Active recreation
- ● Passive recreation
- ● Industrial

Predicted noise level, LAeq 15min, dB(A)

- ▭ < 33
- ▭ 33 - 38
- ▭ 38 - 43
- ▭ 43 - 48
- ▭ 48 - 53
- ▭ 53 - 58
- ▭ 58 - 63
- ▭ 63 - 68
- ▭ > 68

Client:

Plan Project
Management Pty Ltd

Project:

Mamre Road Data Centre Campus
706–752 Mamre Road, Kemps Creek, NSW
State Significant Development (SSD) 92743706

Description

Operational noise contour (1.5m NPfI assessment height)
Daytime (7:00am - 6:00pm) - LAeq 15minute
Typical operations with testing of 6 concurrent generators
(worst case generators for Emmanus Catholic College
(E_NN/F_NN/D_NN/D_SN/E_NS/C_NS))

Notes

1. Imagery source: Nearmap (October 2025) and Sixmaps (Department Finance, Services and Innovation [10/12/2025])
2. Landuse classification based upon a desktop review only, subject to further review and detailed design.
3. Contours are maximum of CONCAWE and ISO9613

All noise contours are calculated based upon a grid, and interpolated between the grid resolution. All noise contours should be interpreted considering this calculation method and its limitations. Noise contours are presented to provide the required representation of predicted noise levels, at the NPfI assessment height. Noise levels are approximate due to interpolation of contours and should be used for reference only. Noise contours are not to be used for determining noise limits, or determining specific noise levels at locations. For information only and not for determinig final operational noise levels or construction purposes.
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Legend	
🟩	Noise catchment boundary (NCA)
▨	Mamre Road Precinct Boundary
▨	Proposal operational area
■	Key Proposal buildings
■	Future assumed MRP building outlines

Receiver buildings	
■	Residential
■	Existing residence within MRP
■	Childcare
■	Educational
■	Commercial
■	Industrial
■	Place of Worship
■	Recreational - Active
■	Recreational – Passive

Assessment receivers	
●	Residential (outside MRP)
●	Residential (within MRP)
●	Educational
●	Childcare
●	Place of worship
●	Active recreation
●	Passive recreation
●	Industrial

Predicted noise level, LAeq 15min, dB(A)	
■	< 33
■	33 - 38
■	38 - 43
■	43 - 48
■	48 - 53
■	53 - 58
■	58 - 63
■	63 - 68
■	> 68

Client:

Plan Project
Management Pty Ltd

Project:

Mamre Road Data Centre Campus
706–752 Mamre Road, Kemps Creek, NSW
State Significant Development (SSD) 92743706

Description

Operational noise contour (1.5m NPfI assessment height)
Daytime (7:00am - 6:00pm) - LAeq 15minute
Typical operations with testing of worst case generators (with management) for Emmanus Catholic College (E_NN/E_SS/D_SS/C_NS)

Notes

1. Imagery source: Nearmap (October 2025) and Sixmaps (Department Finance, Services and Innovation [10/12/2025])
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Legend

- 🟩 Noise catchment boundary (NCA)
- 🟥 Mamre Road Precinct Boundary
- ▨ Proposal operational area
- 🟧 Key Proposal buildings
- ⬜ Future assumed MRP building outlines

Receiver buildings

- 🟦 Residential
- 🟦 Existing residence within MRP
- 🟥 Childcare
- 🟧 Educational
- 🟨 Commercial
- 🟫 Industrial
- 🟦 Place of Worship
- 🟩 Recreational - Active
- 🟩 Recreational – Passive

Assessment receivers

- ● Residential (outside MRP)
- ● Residential (within MRP)
- ● Educational
- ● Childcare
- ● Place of worship
- ● Active recreation
- ● Passive recreation
- ● Industrial

Predicted noise level, LAeq 15min, dB(A)

- ⬜ < 33
- 🟨 33 - 38
- 🟩 38 - 43
- 🟩 43 - 48
- 🟩 48 - 53
- 🟦 53 - 58
- 🟦 58 - 63
- 🟪 63 - 68
- 🟪 > 68

Client:

Plan Project
Management Pty Ltd

Project:

Mamre Road Data Centre Campus
706–752 Mamre Road, Kemps Creek, NSW
State Significant Development (SSD) 92743706

Description

Operational noise contour (1.5m NPfI assessment height)
Evening (6:00pm - 10:00pm) - LAeq 15minute
Typical operations

Notes

1. Imagery source: Nearmap (October 2025) and Sixmaps (Department Finance, Services and Innovation [10/12/2025])
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Legend

🟩 Noise catchment boundary (NCA)
🟥 Mamre Road Precinct Boundary
▨ Proposal operational area
🟧 Key Proposal buildings
⬜ Future assumed MRP building outlines

Receiver buildings

🟦 Residential
🟦 Existing residence within MRP
🟥 Childcare
🟧 Educational
🟨 Commercial
🟫 Industrial
🟦 Place of Worship
🟩 Recreational - Active
🟩 Recreational – Passive

Assessment receivers

● Residential (outside MRP)
● Residential (within MRP)
● Educational
● Childcare
● Place of worship
● Active recreation
● Passive recreation
● Industrial

Predicted noise level, LAeq 15min, dB(A)

⬜ < 33
🟨 33 - 38
🟩 38 - 43
🟩 43 - 48
🟩 48 - 53
🟦 53 - 58
🟦 58 - 63
🟪 63 - 68
🟪 > 68

Client:

Plan Project
Management Pty Ltd

Project:

Mamre Road Data Centre Campus
706–752 Mamre Road, Kemps Creek, NSW
State Significant Development (SSD) 92743706

Description

Operational noise contour (1.5m NPfI assessment height)
Night (10:00pm - 7:00am) - LAeq 15minute
Typical operations

Notes

1. Imagery source: Nearmap (October 2025) and Sixmaps (Department Finance, Services and Innovation [10/12/2025])
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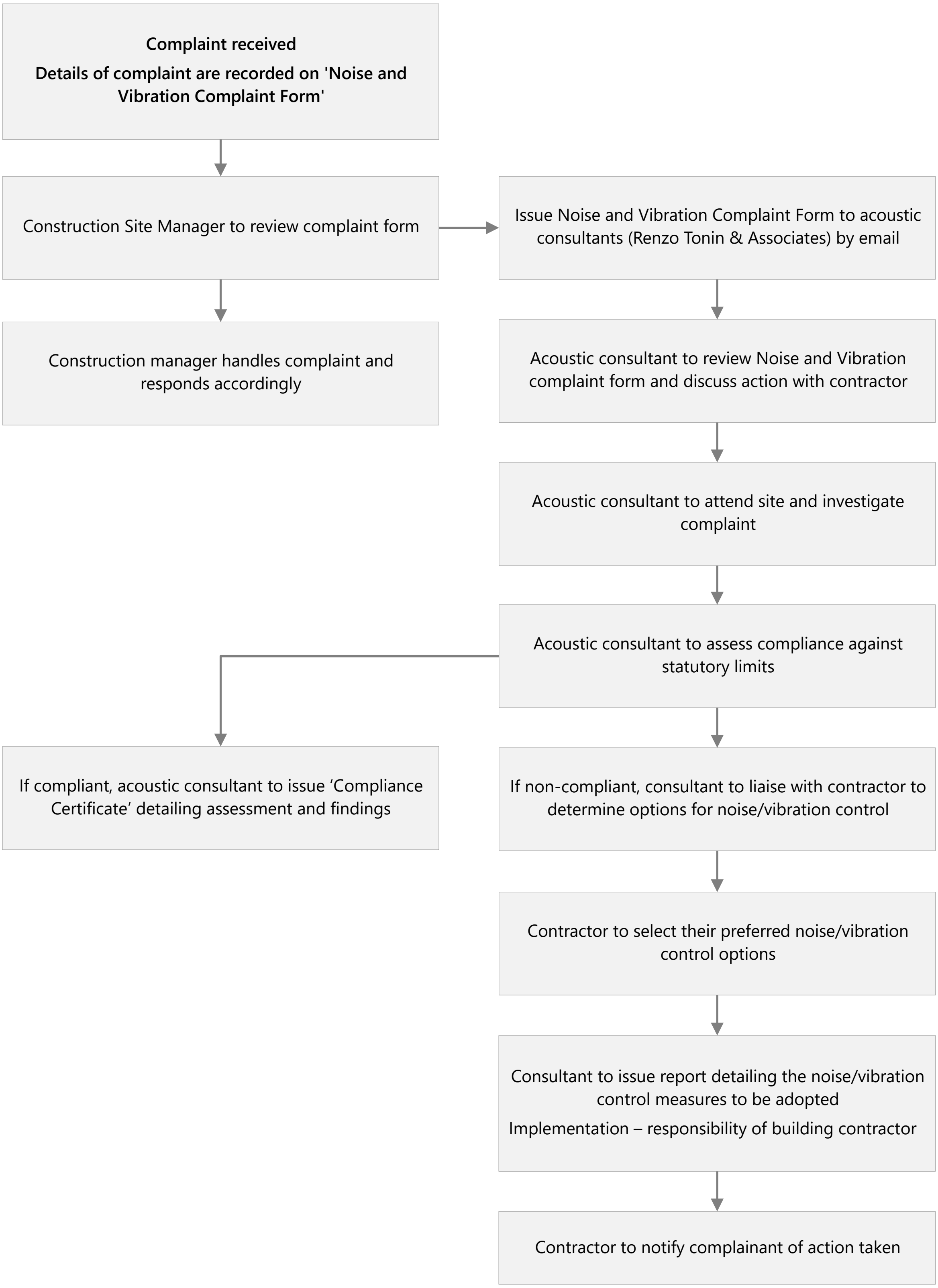
Co-ordinate system: GDA 2020 MGA Zone 56

APPENDIX G Noise / vibration complaint management procedure



Complaint received

Details of complaint are recorded on 'Noise and Vibration Complaint Form'

Construction Site Manager to review complaint form

Construction manager handles complaint and responds accordingly

Issue Noise and Vibration Complaint Form to acoustic consultants (Renzo Tonin & Associates) by email

Acoustic consultant to review Noise and Vibration complaint form and discuss action with contractor

Acoustic consultant to attend site and investigate complaint

Acoustic consultant to assess compliance against statutory limits

If compliant, acoustic consultant to issue 'Compliance Certificate' detailing assessment and findings

If non-compliant, consultant to liaise with contractor to determine options for noise/vibration control

Contractor to select their preferred noise/vibration control options

Consultant to issue report detailing the noise/vibration control measures to be adopted

Implementation – responsibility of building contractor

Contractor to notify complainant of action taken

NOISE/ VIBRATION COMPLAINT FORM

Project title: **Date:**

Site contractor: **Phone:**

Site contact: **Email:**

Complaint details

Received by (circle): Phone / Email / In person / Other:

Name: H Ph:

Address: W Ph

Email: M Ph

Describe when the problem occurred (date and time), what equipment caused the complaint (if known) and where person was standing when he/she experienced the noise/vibration:

Investigation

Question foreman responsible on site and obtain information on what equipment or processes would most likely have caused the complaint:

Following approval from the Project Manager, email this form to Renzo Tonin & Associates