Sydney Datacentre SYD08 – SSDA Acoustic Assessment Report

LCI Consultants

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1 INTRODUCTION

1.1 Purpose

This acoustic assessment report has been prepared by Pulse White Noise Acoustics (PWNA) on behalf of Lehr Consultants International (Australia) Pty Ltd (LCI) in support of a State Significant Development Application (SSDA) submitted to the Department of Planning and Environment (DPE) under Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act 1979).

LCI is seeking to secure approval for the construction of a new data storage centre development on the site known as 57 Station Road, Seven Hills, located within the Blacktown City Council local government area (LGA). The proposed development will comprise the erection of a new two-storey data centre at the rear of the site, associated plant and equipment, car parking areas, landscaping, and civil works.

This report provides a noise and vibration impact assessment and responds to the Industry Specific Secretary's Environmental Assessment Requirements (SEARs) issued by DPE on 23 December 2021. An outline of the SEARs relevant to this acoustic assessment, and how they have been responded to, is summarised in the table below.

Table 1 SEARs relevant to the Acoustic Assessment

Issue and Assessment Requirements	Documentation	Response
12. Noise and Vibration • *Provide a noise and vibration assessment prepared in accordance with the relevant EPA guidelines and Australian/International Standards. The assessment must detail construction and operational noise and vibration impacts (including testing of any back-up power system) on nearby sensitive receivers and structures, and outline the proposed mitigation, management and monitoring measures that would be implemented.*	• *Noise and Vibration Impact Assessment*	Feasibility and Mitigation and management measures are detailed in Section 4.6.4.

This document provides high level acoustic advice for the proposed datacentre, including an assessment of noise emissions to external receivers.

Regarding noise emissions to external receivers, this document includes receptor identification, unattended noise measurements, criteria derivation, and conceptual noise control measures recommended for the facility to address potential noise and vibration impacts.

1.2 Site Location

The site is within the Blacktown local government area (LGA), however is on the boundary of the Parramatta LGA also. The site is in the Seven Hills Industrial Area, approximately 3.8km east of the Blacktown CBD and 6.8km west of the Parramatta CBD, and approximately halfway between Toongabbie and Seven Hills railway stations. The subject site and surrounding areas are shown in Figure 1 below.

Figure 1 Site location – sourced from SIX Maps NSW

1.3 Site Description

The site is located on land known as 57 Station Road, Seven Hills, described legally as Lot B / DP 404669. The site is rectangular in shape with an area of 2.57ha and a northeast-southwest orientation. It is a corner lot with a frontage of around 111m to Station Road to the southwest, and 242m to McCoy Street road reserve to the southeast. The majority of the McCoy Street road reserve is unformed, with a formed 80m long driveway providing access to the adjoining McCoy Park.

The site is currently occupied by a range of buildings and structures associated with the previous industrial uses. An HV transmission tower is also located on the Site in the south, at the corner of Station Road and McCoy Street. Vehicular access is provided via three separate crossings along Station Road.

1.3.1 Overview of Approved Development

The Site is subject to an existing development approval, issued by Blacktown City Council under DA-21-01058 on 10 January 2022. The development consent permits:

> *Removal of trees, bulk earthworks, stormwater drainage works and construction of a single storey data centre to operate 24 hours a day 7 days a week with ancillary offices, on-site parking and associated landscaping.*

The existing approval permits tree removal, bulk earthworks, and drainage works across the entirety of the site, with the construction of a data centre on approximately the front third as depicted in the figure below. The balance of the site is the location of the proposed SSDA, excluding bulk earthworks.

Figure 2 Site Plan for approved data centre on Site, under DA-21-01058 (Source: DEM architects)

1.4 Overview of proposed development

The SSDA seeks approval for the construction and use of a new data storage premises at the rear of the site. The particulars of the Proposal are as follows:

- Construction of a new two-storey 19.2MW data centre at the rear of the Site including ancillary office space
- A total floor area of 8,076sqm
- Provision of external plant in plant yards to the west, north and south of the proposed data hall, as well as rooftop plant, which will be screened
- Provision of 9 new generators, for a site total of 12 generators
- Capacity for up to 289,000L of diesel fuel storage
- Operation to take place 24 hours a day, 7 days a week
- New vehicular circulation to provide access to Station Road, connecting into new driveways already approved under DA-21-01058

- Parking for 31 vehicles
- Landscaping works.

Select images of the Proposal are provided below.

Figure 3 Render of the proposed development

Figure 4 Proposed SYD08 Site Plan

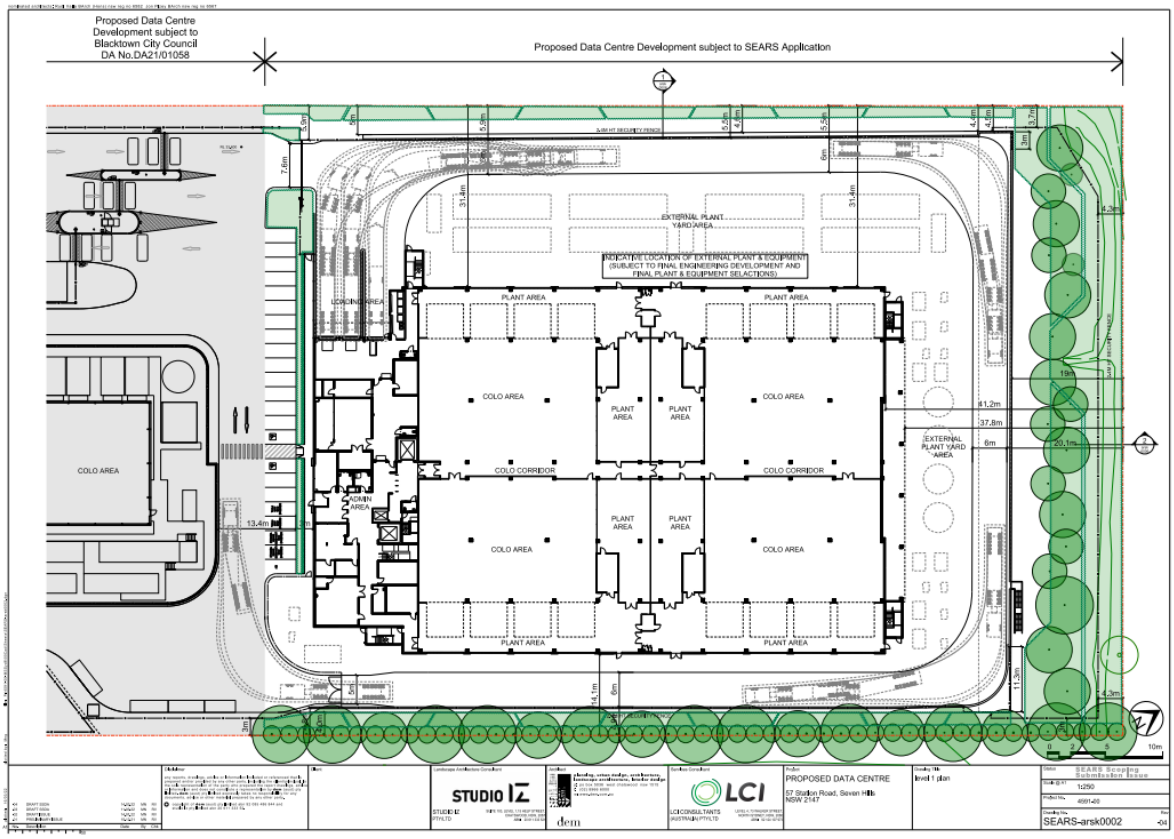
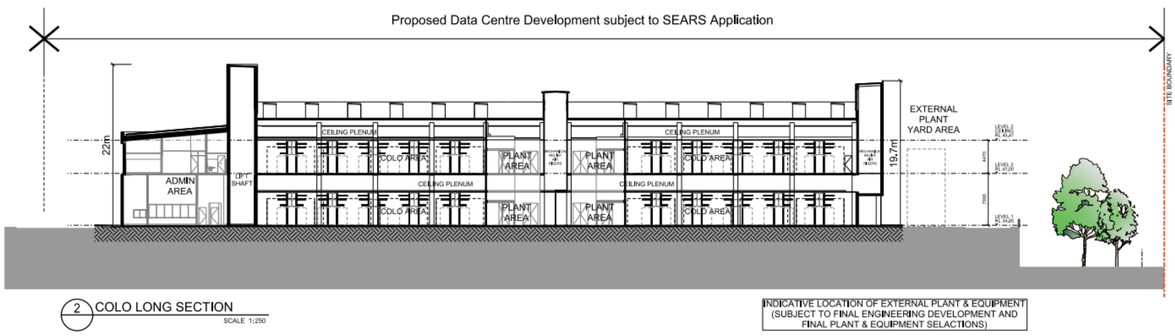


Figure 5 Section View of Proposed SYD08 Development



The orientation of the proposed datacentre with respect to the closest residential receiver is shown in Figure 6 below.

Figure 6 Proposed SYD08 datacentre location with respect to nearest residential receivers

1.5 Nearest Sensitive Receptors

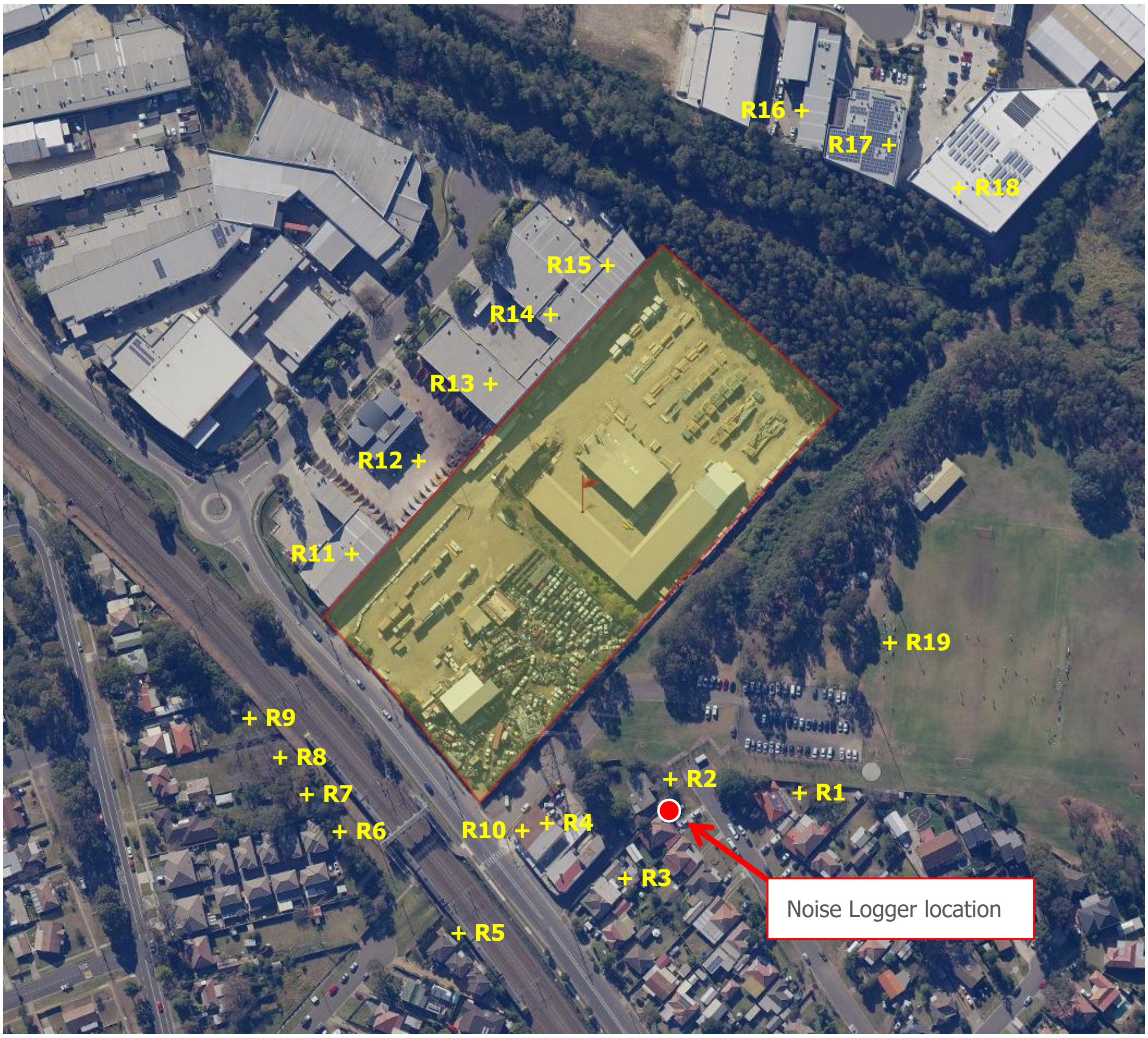
Several potentially impacted noise receivers are located in the vicinity of the subject site. The receptors in this report are considered representative of the closest off-site receivers for the proposed datacentre. The considered receivers are listed in Table 2 and presented in Figure 7 below.

Table 2 Nearest Potentially Affected Receivers

Receptor ID	Address	Lot and DP	Type of Receiver
R1	13 Edna Avenue, Toongabbie	Lot 53 in DP 29128	Residential
R2	20A Edna Avenue, Toongabbie	Lot 1 in DP 1265160	Residential
R3	43 Station Road, Toongabbie	Lot 12 in DP 28399	Residential
R4	51 Station Road, Toongabbie	Lot 2 in DP 215656	Residential
R5	1 McCoy Street, Toongabbie	SP 90150	Residential
R6	15 Carter Street, Seven Hills	SP 90359	Residential
R7	13 Carter Street, Seven Hills	Lot 6 in DP 657231	Residential
R8	11 Carter Street, Seven Hills	Lot 5 in DP 1004516	Residential
R9	9 Carter Street, Seven Hills	Lot 4 in DP 1049979	Residential
R10	43 Station Road, Toongabbie	Lot 1 in DP 215656	Commercial

Receptor ID	Address	Lot and DP	Type of Receiver
R11	2 Tollis Place, Seven Hills	Lot 11 in DP 1071476	Industrial
R12	4-6 Tollis Place, Seven Hills	Lots 9 and 10 in DP 1071476	Industrial
R13	8 Tollis Place, Seven Hills	SP 76250	Industrial
R14	10 Tollis Place, Seven Hills	SP 76275	Industrial
R15	12 Tollis Place, Seven Hills	SP 78424	Industrial
R16	16 Distribution Place, Seven Hills	Lot 9 in DP 1098735	Industrial
R17	18 Distribution Place, Seven Hills	Lot 8 in DP 1098735	Industrial
R18	20 Distribution Place, Seven Hills	Lot 7 in DP 1098735	Industrial
R19	26 Mimosa Avenue, Toongabbie	Lot A in DP 29128	Active Recreation

Figure 7 Location of Considered Receivers surrounding the project site



2 EXISTING ACOUSTIC ENVIRONMENT

2.1 Noise Descriptors and Terminology

Environmental noise constantly varies in level with time. Therefore, it is necessary to measure noise in terms of quantifiable time periods with statistical descriptors. Typically, environmental noise is measured over 15 minute periods and relevant statistical descriptors of the fluctuating noise are determined to quantify the measured level.

Noise (or sound) consists of minute fluctuations in atmospheric pressure capable of detection by human hearing. Noise levels are expressed in terms of decibels, abbreviated as dB or dBA, the "A" indicating that the noise levels have been frequency weighted to approximate the characteristics of normal human hearing. Because noise is measured using a logarithmic scale, 'normal' linear arithmetic does not apply, e.g., adding two sound sources of equal values result in an increase of 3dB (i.e., 60 dBA plus 60 dBA results in 63 dBA). A change of 1 dB or 2 dB in the sound level is difficult for most people to detect, whilst a 3 dB – 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB change roughly corresponds to a doubling or halving in loudness.

The most relevant environmental noise descriptors are the L_{Aeq}, L_{A1}, L_{A10} and L_{A90} noise levels. The L_{Aeq} noise level represents the "equivalent energy average noise level". This parameter is derived by integrating the noise level measured over the measurement period. It represents the level that the fluctuating noise with the same acoustic energy would be if it were constant over the measured time period.

The L_{A1}, L_{A10} and L_{A90} levels are the levels exceeded for 1%, 10% and 90% of the sample period. These levels can be considered as the maximum noise level, the average repeatable maximum and average repeatable minimum noise levels, respectively.

Specific acoustic terminology is used in this assessment report. An explanation of common acoustic terms is included in Appendix A.

2.2 Unattended Noise Measurements

2.2.1 Monitoring Details

To determine the background noise levels at nearby receivers, long term unattended noise monitoring was conducted at 18 Edna Avenue, Toongabbie.

The unattended noise logger at 18 Edna Avenue was chosen as it is one of the closest residential receivers to the subject site. The noise logger was positioned to the side of the house, in line with the residential façade. The location of the unattended noise logger is shown in Figure 7.

2.2.2 Monitoring Instrumentation

Instrumentation used for the noise survey comprised a Rion NL 42 sound level meter / analyser (serial number 00409024) fitted with a microphone windshield. Calibration of the logger was checked prior to and following the measurements. Drift in calibration did not exceed ±0.5 dBA. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates. A photograph of the noise logger on site is shown in Figure 8.

Charts presenting summaries of the measured daily noise data are attached in Appendix B. These charts, representing each 24 hour period, show the L_{A1}, L_{A10}, L_{Aeq} and L_{A90} noise levels measured over 15 minute time periods.

Logging was conducted from Wednesday 21 October 2020 to Tuesday 27 October 2020. The measurement results have been filtered to remove data affected by adverse weather conditions, such as excessively windy or rainy time periods, as recorded by the nearest Bureau of Meteorology weather station at Horsley Park (AWS 067119). Detailed noise logging results are shown in Appendix B.

The measured background noise data of the logger was processed in accordance with the recommendations contained in the NSW Environment Protection Authority's (EPA) Noise Policy for Industry (NPI).

The Rating Background Noise Level (RBL) is the background noise level used for assessment purposes at the nearest potentially affected receiver. It is the 90th percentile of the daily background noise levels during each assessment period, being day, evening and night. The RBL $L_{A90\ (15minute)}$ and L_{Aeq} noise levels are presented in Table 3.

The results of the measurement survey provide ambient noise levels that are considered to be representative of the levels to be expected at the nearest and most affected residences to the proposed development.

Table 3 Measured Ambient Noise Levels corresponding to the NPI's Assessment Time Periods

Measurement Location	Daytime¹ 7:00 am to 6:00 pm		Evening¹ 6:00 pm to 10:00 pm		Night-time¹ 10:00 pm to 7:00 am	
	RBL²	LAeq³	RBL²	LAeq³	RBL²	LAeq³
18 Edna Avenue, Toongabbie	41 dBA	55 dBA	39 dBA	50 dBA	31 dBA	46 dBA

Note 1: For Monday to Saturday, Daytime 7:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 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 – 8:00 am

Note 2: The RBL noise level is representative of the "average minimum background sound level" (in the absence of the source under consideration), or simply the background level.

Note 3: The LAeq is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

Figure 8 Photograph of noise monitor on site

3 OPERATIONAL NOISE EMISSION CRITERIA

3.1 Blacktown Development Control Plan 2015

Section 4.3 *Consideration of adjoining land* from the Blacktown Development Control Plan (DCP) 2015 states the following in relation to industrial developments:

> *Where development is proposed on major traffic routes or on land near to or adjoining a residential zone, a RE1 Public Recreation zone, or sensitive uses such as schools, Council will have particular regard to the following:*
>
> *(d) The likely level of noise to be emitted by the development, particularly its effect on the use of adjoining residential land. In general, noise generated by a development should not exceed the existing background sound pressure level by more than 5dB(A). A statement of compliance with this standard from an acoustic consultant may be required to be submitted with the DA.*

3.2 NSW Noise Policy for Industry

In NSW, the control of noise emissions is the responsibility of Local Governments and the NSW Environment Protection Authority (NSW EPA).

The NSW EPA has recently released a document titled *Noise Policy for Industry* (NSW NPI) which provides a framework and process for determining external noise criteria for the assessment of noise emission from industrial developments. The NSW NPI criteria for industrial noise sources have two components:

- Controlling the intrusive noise impacts for residents and other sensitive receivers in the short term; and
- Maintaining noise level amenity of particular land uses for residents and sensitive receivers in other land uses.

3.2.1 Intrusive Noise Impacts (Residential Receivers)

The NSW NPI states that the noise from any single source should not intrude greatly above the prevailing background noise level. Industrial noises are generally considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (L_{Aeq}), measured over a 15 minute period, does not exceed the background noise level measured in the absence of the source by more than 5 dB(A). This is often termed the Intrusiveness Criterion.

The 'Rating Background Level' (RBL) is the background noise level to be used for assessment purposes and is determined by the methods given in the NSW NPI. Using the rating background noise level approach results in the intrusiveness criterion being met for 90% of the time. Adjustments are to be applied to the level of noise produced by the source that is received at the assessment point where the noise source contains annoying characteristics such as tonality or impulsiveness.

3.2.2 Protecting Noise Amenity (All Receivers)

To limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in Table 2.2 of the NSW NPI. That is, the ambient L_{Aeq} noise level should not exceed the level appropriate for the particular locality and land use. This is often termed the 'Background Creep' or Amenity Criterion.

The amenity assessment is based on noise criteria specified for a particular land use and corresponding sensitivity to noise. The cumulative effect of noise from industrial sources needs to be considered in assessing the impact. These criteria relate only to other continuous industrial-type noise and do not include road, rail or community noise. If the existing (measured) industrial-type noise level approaches the criterion value, then the NSW NPI sets maximum noise emission levels from new sources with the objective of ensuring that the cumulative levels do not significantly exceed the criterion.

3.2.3 Area Classification

The NSW NPI characterises the "Suburban Residential" noise environment as an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This area often has the following characteristic: evening ambient noise levels defined by the natural environment and human activity.

In addition, the RBLs at 18 Edna Avenue are < 45 during the day, < 40 during the evening and < 35 during the night period, corresponding to the suburban receiver category.

Therefore, for residential receivers in the "suburban" areas as well as non-residential receivers, the recommended amenity criteria are shown in Table 4 below.

Table 4 NSW NPI – Recommended L_{Aeq} Noise Levels from Industrial Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day[1]	Recommended Amenity Noise Level ($L_{Aeq, period}$)[2]
Residential (R1-R9)	Suburban	Day	55
		Evening	45
		Night	40
Commercial Premises (R10)	All	When in use	65
Industrial Premises (R11-R18)	All	When in use	70
Active Recreation (R19)	All	When in use	55

Note 1: For Monday to Saturday, Daytime 7:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 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 – 8:00 am

Note 2: The L_{Aeq} is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

When the existing noise level from industrial noise sources is close to the recommended "Amenity Noise Level" (ANL) given above, noise from the new source must be controlled to preserve the amenity of the area in line with the requirements of the NSW NPI.

3.2.4 Project Trigger Noise Levels

Generally speaking, the noise criteria is determined by both the intrusiveness and amenity criteria. The intrusive and amenity criteria for industrial noise emissions, derived from the measured data, are presented in Table 5. The criteria are nominated for the purpose of determining the operational noise limits for mechanical plant associated with the development which can potentially affect noise sensitive receivers.

For each assessment period, the lower (i.e., the more stringent) of the amenity or intrusive criteria are adopted. These are shown in bold text in Table 5.

Table 5 External noise level criteria in accordance with the NSW NPI

Location	Time of Day	Project Amenity Noise Level, $L_{Aeq, period}$ [1] (dBA)	Measured $L_{A90, 15 min}$ (RBL) [2] (dBA)	Measured $L_{Aeq, period}$ Noise Level (dBA)	Intrusive $L_{Aeq, 15 min}$ Criterion [3] for New Sources (dBA)	Amenity $L_{Aeq, 15 min}$ Criterion for New Sources (dBA) [4]	Noise Criterion (lower of the intrusiveness and amenity criteria[5])
Residences (R1-R9)	Day	50	41	55	**46**	53	46
	Evening	40	39	50	44	**43**	43
	Night	35	31	46	**36**	38	36
Commercial (R10)	When in use	60	N/A	N/A	N/A	63	63
Industrial Premises (R11-R18)	When in use	65	N/A	N/A	N/A	68	68
Active Recreation (R19)	When in use	50	N/A	N/A	N/A	53	53

Note 1: Project Amenity Noise Levels corresponding to "Suburban" areas, equivalent to the Recommended Amenity Noise Levels (from the NPI) minus 5 dBA

Note 2: L_{A90} Background Noise or Rating Background Level (RBL)

Note 3: Intrusive criterion is equal to the RBL + 5 dB

Note 4: According to Section 2.2 of the NSW NPI, the L_{Aeq}, 15 minutes is equal to the L_{Aeq}, period + 3 dB

Note 5: The lower of the amenity and the intrusiveness level is typically used as the applicable overall noise criterion for the day, evening and nighttime periods.

3.2.5 Sleep Disturbance

An accurate representation of sleep disturbance impacts on a community from a noise source is particularly difficult to quantify mainly due to differing responses of individuals to sleep disturbance – this is found even within a single subject monitored at different stages of a single night's sleep or during different periods of sleep.

In addition, the differing grades of sleep state make a definitive definition difficult, and even where sleep disturbance is not noted by the subject, factors such as heart rate, mood and performance can still be negatively affected.

An assessment of sleep disturbance should consider the maximum noise level or L_{A1}(1 minute), and the extent to which the maximum noise level exceeds the background level and the number of times this may happen during the night-time period. Factors that may be important in assessing the extent of impacts on sleep include:

- How often high noise events will occur;
- Time of day (normally between 10.00pm and 7.00am); and
- Whether there are times of day when there is a clear change in the existing noise environment (such as during night periods).

Section 2.5 of the EPA NPI provides the following criteria:

- $L_{Aeq,15min}$ 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.

As outlined in Table 5 above, the measured rating background noise level during the night hours (10:00pm to 7:00am) is 31 dBA L_{A90}. Therefore, the resultant RBL + 15dB is 46dBA, which is below the minimum 52 dBA L_{AFmax}. As such, the 52dBA minimum recommended by the NSW EPA NPI will be adopted for this assessment at all surrounding receivers.

3.3 Road Traffic Noise Criteria

In March 2011, the Department of Environment Climate Change and Water NSW (now the EPA) released the NSW 'Road Noise Policy' (RNP) (DECCW, 2011). The NSW RNP aims to identify the strategies that address the issue of road traffic noise from:

- existing roads
- new road projects
- road redevelopment projects
- new traffic generating developments

The NSW RNP defines the criteria to be used in assessing the impact of such noise. Although it is not mandatory to achieve the noise assessment criteria in this NSW RNP, proponents will need to provide justification if it is not considered feasible or reasonable to achieve them.

3.3.1 Road classification

Station Road can be classified as a sub-arterial road while the proposed internal roads for the development can be classified as local roads. The proposed datacentre development is best described as a new traffic generating development.

3.3.2 Noise assessment criteria

Table 3 of the NSW RNP outlines the road traffic noise assessment criteria for residential land uses. The applicable section is reproduced in the below table.

Table 6 Road Traffic Noise Assessment Criteria for Residential Land Uses

Road category	Type of project/land use	Assessment Criteria – dB(A)	
		Day (7am to 10pm)	Night (10pm to 7am)
Sub-arterial roads – residential receivers	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)

3.4 Criteria for Emergency Generators

Section 1.4 of the Noise Policy for Industry is shown below:

Noise Policy for Industry

1.4 What noise sources does the policy apply to?

The policy applies to industrial noise sources from activities listed in **Schedule 1 of the POEO Act** and regulated by the EPA. All scheduled activities require an environment protection licence issued under the POEO Act. The policy is also an appropriate reference document for DP&E when assessing major development proposals under the EP&A Act.

Local government is an independent regulator for noise under the legislation, and has discretion in dealing with noise within its area of responsibility.

The policy is designed for large industrial and agricultural sources and specifies substantial monitoring and assessment procedures that may not always be applicable to the types of sources councils need to address. However, local government may find the policy helpful in assessing noise from premises it regulates and in the carrying-out of its land-use planning responsibilities as outlined in Section 1.1.1. Information on noise management for local government is also provided in the EPA's *Noise guide for local government 2013*.

In general, the types of premises dealt with in the policy include:

As can be seen above, the Noise Policy for Industry clearly states that "The policy applies to industrial noise sources from activities listed in Schedule 1 of the Protection of the Environment Operations (POEO) Act and regulated by the EPA". Schedule 1 of the POEO Act is highlighted in bold for emphasis. Schedule 1 of the POEO Act, Section 17 (1A) is shown below

17 Electricity generation

(1) This clause applies to the following activities—

electricity works (wind farms), meaning the generation of electricity by means of wind turbines.

general electricity works, meaning the generation of electricity by means of electricity plant that, wherever situated, is based on, or uses, any energy source other than wind power or solar power.

metropolitan electricity works (gas turbines), meaning the generation of electricity by means of electricity plant—

(a) that is based on, or uses, a gas turbine, and

(b) that is situated in the metropolitan area or in the local government area of Port Stephens, Maitland, Cessnock, Singleton, Wollondilly or Kiama.

metropolitan electricity works (internal combustion engines), meaning the generation of electricity by means of electricity plant—

(a) that is based on, or uses, an internal combustion engine, and

(b) that is situated in the metropolitan area or in the local government area of Port Stephens, Maitland, Cessnock, Singleton, Wollondilly or Kiama.

(1A) However, this clause does not apply to the generation of electricity by means of electricity plant that is emergency stand-by plant operating for less than 200 hours per year.

As seen above, Schedule 1, Section 17 (1A) of the POEO Act, states that

> *"this clause does not apply to the generation of electricity by means of electricity plant that is emergency stand-by plant operating for less than 200 hours per year".*

Therefore, under the POEO Act, the Noise Policy for Industry is only applicable to generator events that occur more than 200 hours a year. Note that the Noise Policy for Industry is applicable to the assessment of all other noise sources.

It is understood that, as part of this proposal, generators are proposed to be used in the event of a power blackout. Additionally, the generators are also proposed to be tested periodically, one at a time during the day period only.

Testing of generators one by one is expected to tally 38 hours per year as per the table below.

Table 7 Proposed generator testing plan

Month	% load	Test	Run duration (min)	Colo generator	Admin Generator	Mechanical Generator	Total min
1	no-load	Monthly	10	8	1	0	90
2	no-load	Monthly	10	8	1	0	90
3	70	Quarterly	35	8	1	0	315
4	no-load	Monthly	10	8	1	0	90
5	no-load	Monthly	10	8	1	0	90
6	70	Quarterly	35	8	1	0	315
7	no-load	Monthly	10	8	1	0	90
8	no-load	Monthly	10	8	1	0	90
9	70	Quarterly	35	8	1	0	315
10	no-load	Monthly	10	8	1	0	90
11	no-load	Monthly	10	8	1	0	90
12	100	Annual	65	8	1	0	585

The use of all generators in a power outage will also not exceed 200 hours per year. Therefore, use of all generators at once for power generation is outside the framework of the POEO Act and the Noise Policy for Industry. Despite this, an emergency scenario whereby all generators are running simultaneously (in the event of a critical power failure event) has been modelled for completeness – note that, in reality, this would be highly unlikely.

Testing of one generator at a time is within the framework of the Noise Policy for Industry and is analysed in this report as an operational scenario.

3.5 Development Near Rail Corridors and Busy Roads – Interim Guideline

The Development near Rail Corridors and Busy Roads – Interim Guideline sets out noise and vibration guidance for developments near rail corridors. Section 3.5 of the Development near Rail Corridors and Busy Roads – Interim Guideline contains the following acoustic criteria.

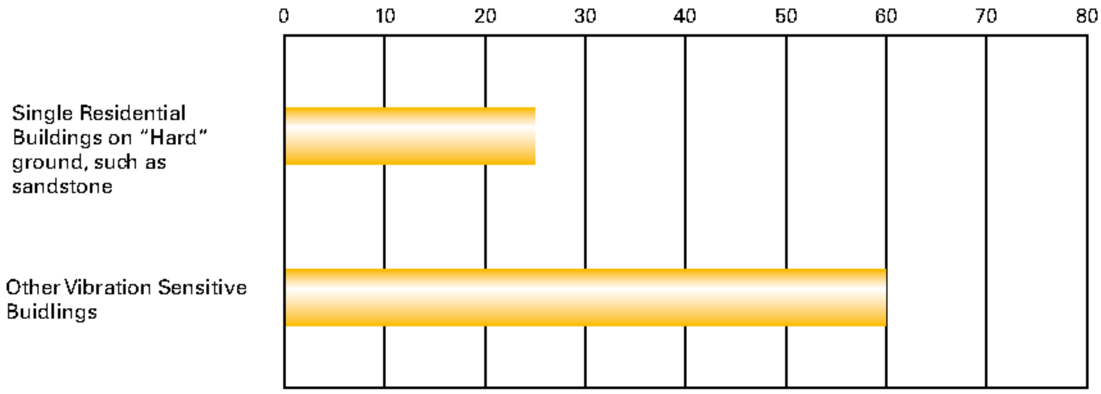
If the development is for the purpose of a building for residential use, the consent authority must be satisfied that appropriate measures will be taken to ensure that the following L_{Aeq} levels are not exceeded:

- in any bedroom in the building: 35dB(A) at any time 10pm–7am
- anywhere else in the building (other than a garage, kitchen, bathroom or hallway): 40dB(A) at any time

The proposed development is not for residential use, therefore the noise requirements within the Development near Rail Corridors and Busy Roads – Interim Guideline are satisfied.

In terms of railway vibration, the front façade of the proposed development is approximately 140m from the nearest railway line. As shown in Figure 9 , the development is outside the typical zone where an assessment of rail vibration would be required. Therefore, potential vibration from the corridor has also been satisfied as per section 3.5.1 of the Development near Rail Corridors and Busy Roads – Interim Guideline.

Figure 9 Rail Vibration Assessment Zones



3.6 Interim Construction Noise Guideline

The Interim Construction Noise Guideline (ICNG) sets out ways to deal with the potential impacts of construction noise on residences and other sensitive land uses. The ICNG presents assessment approaches that are tailored to the scale of construction projects.

A portion of the main objectives from Section 1.3 of the ICNG are presented below:

- Promote a clear understanding of ways to identify and minimise noise from construction works
- Focus on applying all "feasible" and "reasonable" work practices to minimise construction noise impacts
- Encourage construction to be undertaken only during the recommended standard hours unless approval is given for works that cannot be undertaken during these hours
- Streamline the assessment and approval stages and reduce time spent dealing with complaints at the project implementation stage
- Provide flexibility in selecting site-specific feasible and reasonable work practices in order to minimise noise impacts

The ICNG contains a quantitative assessment method which is applicable to this project. Guidance levels are given for airborne noise at residences and other sensitive land uses, including commercial and industrial premises.

The quantitative assessment method involves predicting noise levels at sensitive receivers and comparing them with the Noise Management Levels (NMLs). The NML affectation categories for residential receivers have been reproduced from the guideline and are listed in Table 8 below.

Specific non-residential receivers in the vicinity of the proposed construction site, and their recommended 'management levels', are presented in Table 9.

Based on the measured background noise levels summarised in Section 2.2, the NMLs to be used in this assessment are listed in Table 10.

Table 8 NMLs for quantitative assessment at residences

Time of Day	Noise Management Level $L_{Aeq(15minute)}$[1,2]	How to Apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq(15minute)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dBA	The highly noise affected 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: 1. Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences. 2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected 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 5 dB above the noise affected level, the proponent should negotiate with the community.

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

Note 2 The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours). The term RBL is described in detail in the NSW Industrial Noise Policy (EPA 2000).

Table 9 NMLs for quantitative assessment at non-residential receivers

Land Use	$L_{Aeq(15minute)}$ Construction NML
Commercial (R10)	70
Industrial (R11-R18)	75
Active Recreation (R19)	65

Table 10 NMLs as basis for the acoustic assessment

Receiver Types	NML, dB $L_{Aeq(15minute)}$ Standard Construction Hours: Monday to Friday: 7 am to 6 pm and Saturday: 8 am to 1 pm
Residence (R1-R9)	51
Commercial (R10)	70
Industrial (R11-R18)	75
Active Recreation (R19)	65

3.7 Vibration Criteria

The impacts of ground borne vibration on buildings may be segregated into the following three categories:

- Human comfort – vibration in which the occupants or users of the building are inconvenienced or possibly disturbed. Refer to further discussion in Section 3.7.1.
- Effects on building contents – where vibration can cause damage to fixtures, fittings and other non-building related objects. Please see Section 3.7.2.
- Effects on building structures – where vibration can compromise the structural integrity of the building itself. Refer to further discussion in Section 3.7.2.

3.7.1 Vibration Criteria – Human Comfort

Vibration effects relating specifically to the human comfort aspects of the project are taken from the guideline titled "Assessing Vibration – A Technical Guideline". (AVTG) This type of impact can be categorised and assessed using the intermittent vibration criterion. Intermittent vibration refers to activities such as drilling, compacting or tasks that would result in continuous vibration if operated continuously (refer to Table 11).

Table 11 Intermittent vibration impacts criteria ($m/s^{1.75}$) 1 Hz-80 Hz

Location	Daytime		Night-time	
	Preferred Values	Maximum Values	Preferred Values	Maximum Values
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

These criteria are "dose" based criteria which are determined by both vibration level and duration. They are therefore dependent on the level and usage of the equipment. The above VDV criteria are more applicable to complaint based compliance assessments and can be assessed by longer term vibration monitoring. The practical considerations of how to exclude vibration in the building caused by doors slamming, building occupant activity in their apartments, etc. would however need to be overcome before a VDV assessment could be carried out.

For feasible simplicity, vibration from typical activities will be assessed against criteria for impulsive vibration, which is assessed on the basis of acceleration levels. Such an assessment procedure is inherently conservative, since the criteria for impulsive vibration is more stringent than that for intermittent vibration and assumes essentially continuous exposure to the vibration level. The levels appropriate for this development are given in Table 12.

Table 12 Impulsive vibration in terms of weighted RMS acceleration criteria (m/s^2) 1-80Hz

Location	Assessment period	Preferred Values[1] (m/s^2)		Maximum Values[1] (m/s^2)	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Critical areas [2]	Day or night-time	0.0050	0.0036	0.010	0.0072
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and places of worship	Day or night-time	**0.64**	**0.46**	**1.28**	**0.92**

Note 1: From Assessing Vibration – A Technical Guideline DEC (2006)
Note 2: e.g. hospital operating theatres, precision laboratories

Note: Perception thresholds for continuous whole-body vibration vary widely among individuals. Approximately half the people in a typical population, when standing or seated, can perceive a vertical weighted peak acceleration of 0.015 m/s^2. The weighting used is Wb. A quarter of the people would perceive a vibration of 0.01 m/s^2 peak, but the least sensitive quarter would only be able to detect a vibration of 0.02 m/s^2 peak or more. Perception thresholds are slightly higher for vibration duration of less than about 1 s.

The assessment criteria for impulsive vibration, presented in different units, are shown below in Table 13 below.

Table 13 Criteria for exposure to impulsive vibration, presented in different units (Z axis only) [1]

Location	Assessment period	[2] RMS acceleration (m/s^2) & vib. accel. value (dB re 10^{-6} m/s^2)		[3]RMS velocity (mm/s) & vib. velocity value (dB re 10^{-9} mm/s)		[4] Peak velocity (mm/s)	
		Preferred	Maximum	Preferred	Maximum	Preferred	Maximum
Residences	Daytime[4]	0.30 (110 dB)	0.60 (113 dB)	6.0 (136 dB)	12 (142 dB)	8.6	17.0
	Night-time	0.10 (100 dB)	0.20 (106 dB)	2.0 (126 dB)	4.0 (132 dB)	2.8	5.6
Offices, schools, educational institutions and places of worship	Day or night-time	**0.64 (116 dB)**	**1.28 (122 dB)**	**13.0 (142 dB)**	**26.0 (148 dB)**	**18.0**	**36.0**

Note 1: From Assessing Vibration – A Technical Guideline DEC (2006)
Note 2: Values derived from z-axis critical frequency range 4–8 Hz. Where required, a more detailed analysis can be conducted as per BS 6472–1992.
Note 3: Values given for the most critical frequency range >8 Hz assuming sinusoidal motion. Where required, a more detailed analysis can be conducted as per AS 2670.2–1990.
*Note 4: Sufficient justification should accompany the use of a peak velocity approach if used in an assessment. Note that the crest factor of the source vibration **must** be considered – and for impulsive sources can be 10 or higher.*
Note 5: Specific values depend on social and cultural factors, psychological attitudes and expected degree of intrusion.

3.7.2 Vibration Criteria – Building Contents and Structure

The vibration effects on the building itself are assessed against international standards as follows:

- For transient vibration: British Standard BS 7385: Part 2-1993 *"Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration"* (BSI 1993); and

- For continuous or repetitive vibration: German DIN 4150: Part 3 – 1999 *"Effects of Vibration on Structure"* (DIN 1999).

3.7.3 Standard BS 7385 Part 2 - 1993

For transient vibration, as discussed in standard BS 7385 Part 2-1993, the criteria are based on peak particle velocity (mm/s) which is to be measured at the base of the building. These are summarised in Table 14 and illustrated in Figure 10.

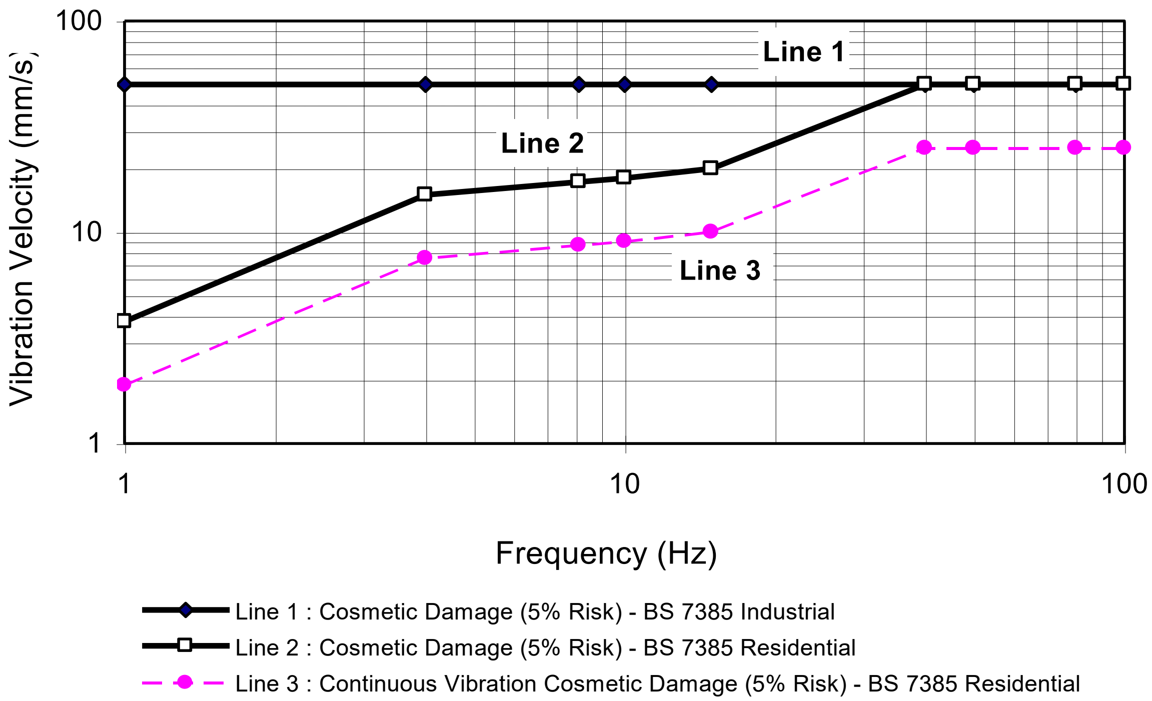
Table 14 Transient vibration criteria as per standard BS 7385 Part 2 - 1993

Line in below figure	Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
		4 Hz to 15 Hz	15 Hz and Above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Standard BS 7385 Part 2 – 1993 states that the values in Table 14 relate to transient vibration which does not cause resonant responses in buildings.

Where the dynamic loading caused by continuous vibration events is such as that results in dynamic magnification due to resonance (especially at the lower frequencies where lower guide values apply), then the values in Table 14 need to be reduced by up to 50% (refer to Line 3 in Figure 10).

Figure 10 BS 7385 Part 2 – 1993, graph of transient vibration values for cosmetic damage



In the lower frequency region where strains associated with a given vibration velocity magnitude are higher, the recommended values corresponding to Line 2 are reduced. Below a frequency of 4 Hz where a high displacement is associated with the relatively low peak component particle velocity value, a maximum displacement of 0.6 mm (zero to peak) is recommended. This displacement is equivalent to a vibration velocity of 3.7 mm/s at 1 Hz.

The standard also states that minor damage is possible at vibration magnitudes which are greater than twice those given in Table 14. Major damage to a building structure may occur at values greater than four times the tabulated values.

Fatigue considerations are also addressed in the standard and it is concluded that unless calculation indicates that the magnitude and number of load reversals is significant (in respect of the fatigue life of building materials) then the values in Table 14 should not be reduced for fatigue considerations.

3.7.4 Standard DIN 4150 Part 3 - 1999

For continuous or repetitive vibration, standard DIN 4150 Part 3-1999 provides criteria based on values for peak particle velocity (mm/s) measured at the foundation of the building; these are summarised in Table 15. The criteria are frequency dependent and specific to particular categories of structures.

Table 15 Structural damage criteria as per standard DIN 4150 Part 3 - 1999

Type of Structure	Peak Component Particle Velocity, mm/s			
	Vibration at the foundation at a frequency of			Vibration of horizontal plane of highest floor at all frequencies
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz[1]	
Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
Structures that, because of their sensitivity to vibration, do not correspond to those listed in lines 1 and 2 and are of great intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8

Note 1: For frequencies above 100Hz, at least the values specified in this column shall be applied.

4 POTENTIAL NOISE IMPACTS

4.1 Predictive Noise Modelling Equipment

Predictive noise modelling in this report was carried out using the ISO 9613 algorithm within iNoise V2022.01. The iNoise software package was specifically used, as the 3D computational model of the site and surrounding area allows the terrain undulations, building heights and locations and noise source positions to be specifically modelled. In addition to terrain, buildings and noise sources, the iNoise model also includes ground absorption and receiver locations.

All modelling algorithms have their advantages and disadvantages. Each software package also notably interprets the modelling algorithms differently. A clear advantage of ISO9613 is that it offers ISO17534-3 compliance. This standard ensures conformity between modelling software packages, improving the repeatability of noise predictions. ISO9613 is often considered the international industry standard noise modelling approach.

The approach taken in this assessment has been chosen to optimise the outcome for the most affected sensitive receivers. Noise modelling was completed using iNoise and incorporating the ISO9613 algorithm. A modification was included to use the CONCAWE approach for temperature effects at distances greater than 100m. Class F weather conditions with wind speeds of 2m/s were selected in accordance with the requirements of the NPfI. This approach has ensured that a consistently verifiable approach to ground absorption, air absorption and barrier attenuation has been chosen with the added advantage of the consideration of adverse weather conditions for sensitive receivers at distances greater than 100m.

A notable disadvantage of the CONCAWE noise model is that it applies from 100m to 2000m. The nearest sensitive receiver for this project is within 100 m from the site. Given the very small distance to sensitive receivers, weather effects, air absorption and ground absorption have very little influence on the noise mitigation recommendations.

4.2 Nominal Equipment Sound Power Levels

To predict potential noise levels at the considered receivers, the noise models considers major mechanical equipment including air handling units and generators. In this noise model, it is assumed that the generator units are packaged and feature intake and exhaust mufflers. Generators are assumed to be tested one at a time during the day period only for the operational scenarios. The air handling units are all direct evaporative cooling units, located indoors, drawing air in through openings in the façade.

SYD08 is proposed to comprise 64 Direct Evaporative Cooling Air Handling Units and 9 generators (including 1 admin generator). The Air Handling Units are modelled in two different ways; namely, with a bushfire filtration module considered, and with a standard filtration module. It is not decided at this stage which of the two filtration modules will be used for the Air Handing Units for the data centre development; as such, both have been modelled. The modelled scenarios are based directly on documentation provided by LCI regarding realistic worst-case operating scenarios for both filtration module options.

Specifically, our modelling assumes the following operational scenario for the Standard Mode Air Handling Units:

- 8 x data halls, each with 7 Air Handling Units, running at 100% load.

Alternatively, our modelling assumes the following operational scenario for the Bushfire Mode Air Handling Units:

- 7 x data halls, each with 8 Air Handling Units, running at partial load.
- 1 x data hall with 7 Air Handling Units running at 100% load.

The approved datacentre under the existing development approval (*DA-21-01058*) is to have 4 Direct Evaporative Cooling Air Handling Units and 3 generators (including 1 admin generator). For the purpose of our operational assessment, the noise impacts are assessed cumulatively with those from the existing development approval. That is, all Air Handling Units associated with both sites have been assessed simultaneously in Section 4.5. Note that it is assumed that the Air Handling Units at the approved datacentre are operating at partial load as per Table 16.

Sound Power Levels of the selected air handling units and generators are shown in Table 16 and Table 17 respectively. It is noted that each Air Handling Unit is comprised of six (6) centrifugal fans, and that the sound power levels for the Air Handling Units are based on 100% fan speed, as well as a specified partial load. The generator is modelled inside an acoustic enclosure rated at 85 dB(A) at 1m. The Generator enclosure features an exhaust silencer as well as intake and discharge attenuators.

Table 16 Sound power level (SWL) for Air Handling Units

AHU Type	Fans	Octave Band Centre Frequencies (Hz)								Overall
		63	125	250	500	1000	2000	4000	8000	
AHU with Bushfire filtration	100% Load	82	88	88	84	86	87	86	80	**93 dBA**
	Partial Load	79	85	85	81	83	84	83	77	**90 dBA**
Standard AHU	100% Load	70	82	90	81	77	76	73	64	**85 dBA**

Table 17 Sound Power Level (SWL) for the generators in acoustic enclosures

Equipment	Octave Band Centre Frequencies (Hz)								Overall
	63	125	250	500	1000	2000	4000	8000	
Generator in enclosure	109	103	95	88	85	81	78	74	**93 dBA**

Based on the proposed design of each Air Handling Unit, whereby an evaporative cooler and filters are positioned between the centrifugal fans and the openings in the building façade, we have conservatively assumed insertion losses resulting from this setup. These are tabulated below.

Table 18 Insertion Losses Assumed for Combination of Evaporative Cooler and Filters within Air Handling Units (Standard Mode)

Insertion Loss	Octave Band Centre Frequencies (Hz)							
	63	125	250	500	1000	2000	4000	8000
Filters/Evaporative cooler assumed insertion loss, Standard Mode (dB)	3	4	5	5	5	5	5	5

Table 19 Insertion Losses Assumed for Combination of Evaporative Cooler and Filters within Air Handling Units (Bushfire Mode)

Insertion Loss	Octave Band Centre Frequencies (Hz)							
	63	125	250	500	1000	2000	4000	8000
Filters/Evaporative cooler assumed insertion loss, Bushfire Mode (dB)	3	4	6	8	10	8	8	6

Standard Mode air handling units have additionally been modelled with 200mm deep acoustic louvres, while Bushfire Mode air handling units have been modelled with 300mm deep acoustic louvres. Details of the required insertion losses provided by the louvres are included in the tables below.

Table 20 Minimum Insertion Losses – 200mm Deep Intake Louvres for Air Handling Units (for Standard Mode)

Insertion Loss	Octave Band Centre Frequencies (Hz)							
	63	125	250	500	1000	2000	4000	8000
Required insertion loss (dB)	1	3	7	11	12	10	10	9

Table 21 Minimum Insertion Losses – 300mm Deep Intake Louvres for Air Handling Units (for Bushfire Mode)

Insertion Loss	Octave Band Centre Frequencies (Hz)							
	63	125	250	500	1000	2000	4000	8000
Required insertion loss (dB)	4	7	9	13	14	12	12	8

4.3 Noise from Trucks and Cars Travelling to or from the Site

The *Traffic Impact Assessment* by The Transport Planning Partnership (reference number 20407, Version V03, dated 01/04/22) specifies that the total peak hourly trip generation of the proposed development is estimated as follows:

- AM and PM peak periods:
    - 3 heavy vehicles (6 trips).
    - 10 light vehicles (20 trips).

As such, for a 15 minute period, we have assumed the following for car and truck movements to and from the site:

- Day/Evening Scenario
    - 2 Truck movements (1 entering the site and 1 leaving the site), 1 truck door close, and 1 truck engine start.
    - 6 light vehicle movements (3 entering the site and 3 leaving the site), 3 car door closes, and 3 car engine starts.
- Night Scenario
    - 2 Truck movements (1 entering the site and 1 leaving the site), 1 truck door close, and 1 truck engine start.
    - 6 light vehicle movements (3 entering the site and 3 leaving the site), 3 car door closes, and 3 car engine starts.

4.3.1 Assumed Vehicle Noise Levels and Time Durations

This noise assessment includes assessment of the potential uses within the development. The following noise levels include the expected source noise events from activities likely to occur on the site:

1. 10 Tonne truck start L_{Aeq} of 96 dB(A), for a duration of 2 seconds (source height of 3m).
2. 10 Tonne truck door close L_{Aeq} of 90 dB(A), for a duration of 1 second (source height of 3m).
3. 10 Tonne truck manoeuvring at <15 km/h L_{Aeq} = 92 dB(A), for a duration of 2 minutes (source height of 3m).

4. Car start L_{Aeq} of 89 dB(A), for a duration of 2 seconds (source height of 1m).
5. Car door close L_{Aeq} of 87 dB(A), for a duration of 1 second (source height of 1m).
6. Car manoeuvring at <15 km/h L_{Aeq} of 85 dB(A), for a duration of 2 minutes (source height of 1m).
7. Semi truck start L_{Aeq} of 101 dB(A), for a duration of 2 seconds (source height of 3m).
8. Semi truck door close L_{Aeq} of 93 dB(A), for a duration of 1 second (source height of 3m).
9. Semi truck manoeuvring at <15 km/h L_{Aeq} of 97 dB(A), for a duration of 2 minutes (source height of 3m).

Assumed noise levels have been based on detailed noise measurements of cars and various sized trucks and vans.

4.4 Modelling Assumptions

In this assessment, the following assumptions have been incorporated:

- Noise generating scenarios are modelled on a worst case 15 minute period;
- Terrain has been sourced from the NSW Land and Property Information database Six Maps;
- Ground Absorption has been included in the model with the entire model having an absorption factor of 0.25, indicative of the combination of surrounding grass areas and hard surfaces;
- Receptors are modelled 1.5m above the ground, except for Receivers 4 and 10, which are modelled 5.0m above the ground since they include a second storey.
- On site and surrounding buildings have been included in the model;
- The assessment for the proposed equipment is based on the sound levels listed for the air handling units in Table 16 and the generators in Table 17.
- Generators are to be tested during the day period only.
- Generator testing is assumed to take place using a single generator at a time.
- The evaporative cooler and filters within the Air Handling Units are assumed to give rise to insertion losses as per Table 18 and Table 19.
- Air handling units have been modelled with intake acoustic louvres. Details of the required insertion losses provided by the louvres are included in Table 20 and Table 21, for Standard Mode and Bushfire Mode, respectively.
- The primary noise sources modelled are continuous in nature. The air handling units will run continuously over the whole day (as is the nature of a datacentre, which runs continuously) and will not cycle on/off. Tonality and intermittent modifying corrections outlined under the NPfI are not required for this project.
- Noise-enhancing weather conditions have been accounted for in the modelling. In line with Fact Sheet D of the NPfI, Option 1 has been selected to consider meteorological effects (see below extract); this represents a conservative assessment methodology.

> *Adopt the **noise-enhancing meteorological conditions** for all assessment periods for noise impact assessment purposes without an assessment of how often these conditions occur – a conservative approach that considers source-to-receiver wind vectors for all receivers and F class temperature inversions with wind speeds up to 2 m/s at night.*

4.5 Modelled Scenarios

Four operational noise generating scenarios and two emergency scenarios are modelled in this report and assessed against the operational criteria, as follows:

- Standard Mode AHUs:

- Standard Mode Operational Scenario 1: Operational Day Scenario with 60 Direct Evaporative Cooling Air Handling Units (8 x data halls, each with 7 Air Handling Units, running at 100% load; 4 x Air Handing Units within approved development to the south, running at 100% load) and 1 x 3.0 MW Generator.

- Standard Mode Operational Scenario 2: Operational Evening/Night Scenario with 60 Direct Evaporative Cooling Air Handling Units (8 x data halls, each with 7 Air Handling Units, running at 100% load; 4 x Air Handing Units within approved development to the south, running at 100% load).

- Standard Mode Emergency Scenario 1: Emergency Scenario with 60 Direct Evaporative Cooling Air Handling Units (8 x data halls, each with 7 Air Handling Units, running at 100% load; 4 x Air Handing Units within approved development to the south, running at 100% load), and all 12 Emergency Generators running simultaneously.

- Bushfire Mode AHUs:

  - Bushfire Mode Operational Scenario 1: Operational Day Scenario with 67 Direct Evaporative Cooling Air Handling Units (7 x data halls, each with 8 Air Handling Units, running at partial load; 1 x data hall with 7 Air Handling Units running at 100% load; 4 x Air Handing Units within approved development to the south, running at partial load) and 1 x 3.0 MW Generator.

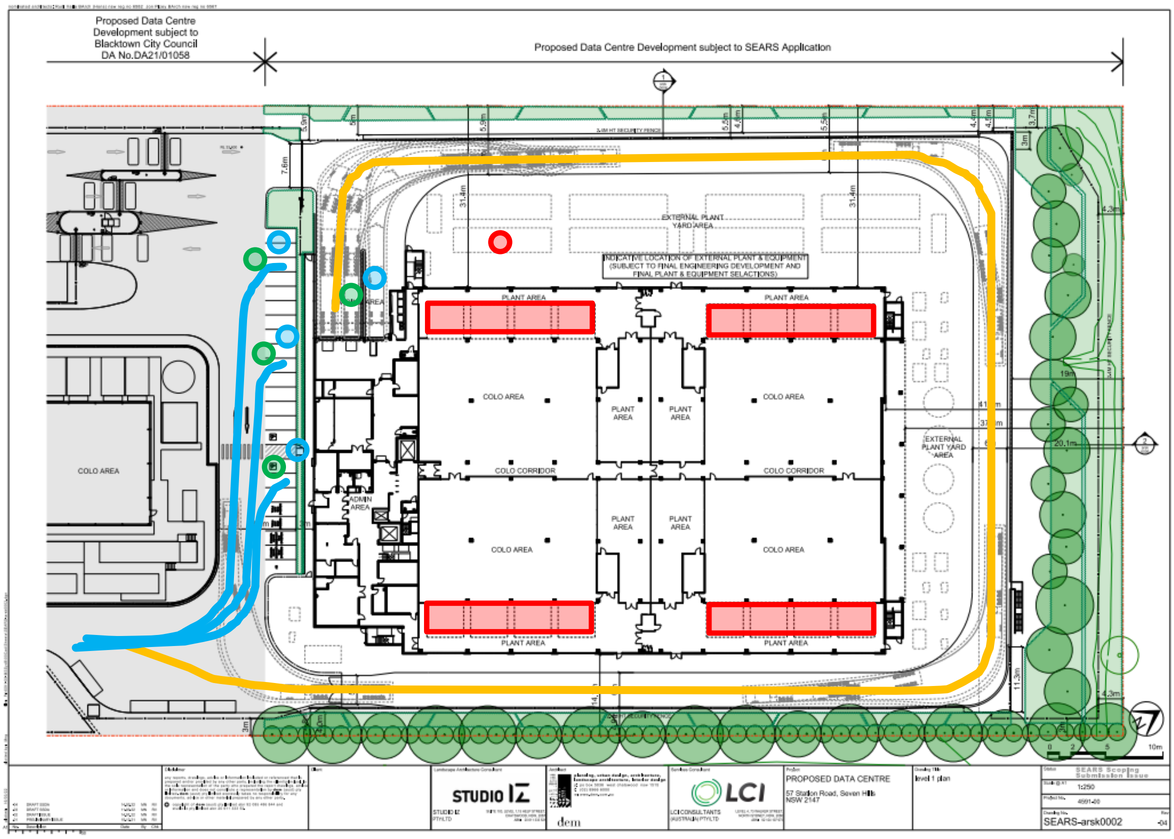
  - Bushfire Mode Operational Scenario 2: Operational Evening/Night Scenario with 67 Direct Evaporative Cooling Air Handling Units (7 x data halls, each with 8 Air Handling Units, running at partial load; 1 x data hall with 7 Air Handling Units running at 100% load; 4 x Air Handing Units within approved development to the south, running at partial load).

  - Bushfire Mode Emergency Scenario 1: Emergency Scenario with 67 Direct Evaporative Cooling Air Handling Units (7 x data halls, each with 8 Air Handling Units, running at partial load; 1 x data hall with 7 Air Handling Units running at 100% load; 4 x Air Handing Units within approved development to the south, running at partial load) and all 12 Emergency Generators running simultaneously.

Note that the above emergency scenarios whereby all standby generators are running simultaneously (in the event of a critical power failure event) has been modelled for completeness – in reality, this would be highly unlikely.

All modelled noise emission sources are visualised in the below figures.

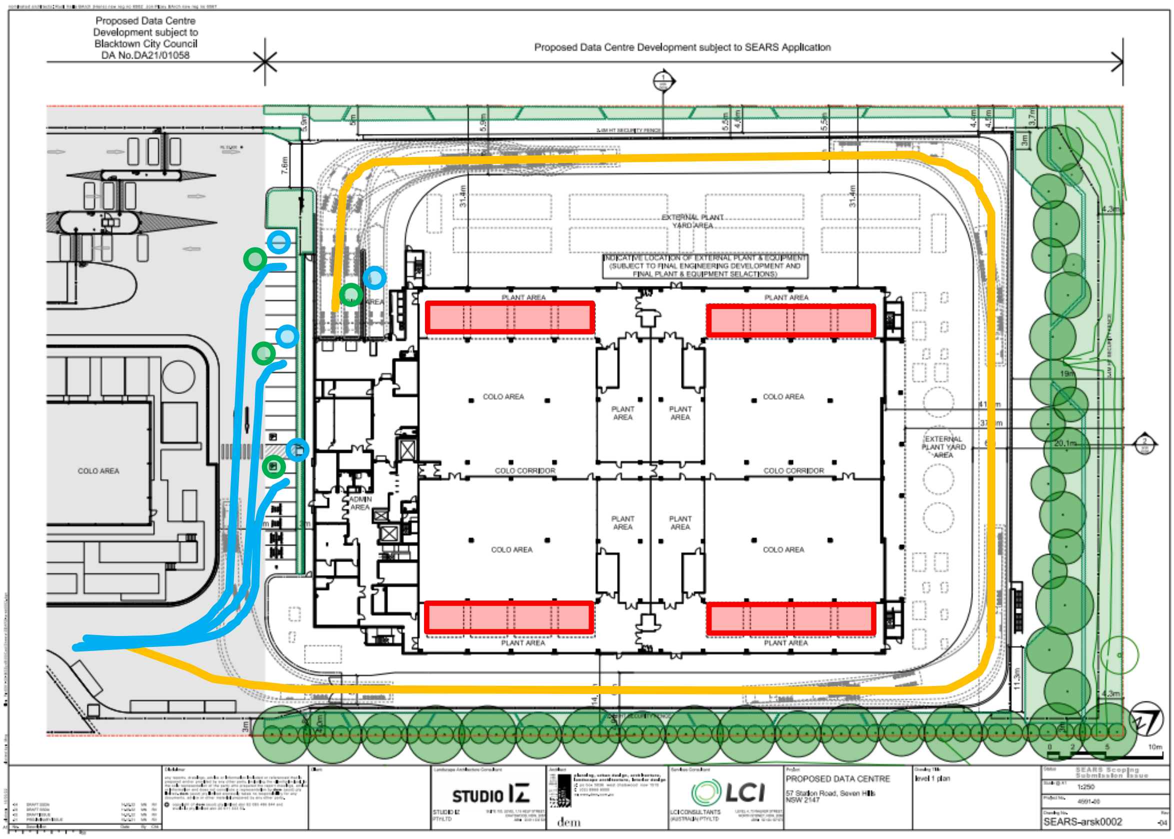
Figure 11 Modelled Noise Emission Sources visualized for the Day Period



Key:

- Generator
- Air Handling Units
- Door close
- Engine start
- Truck movement
- Car movement

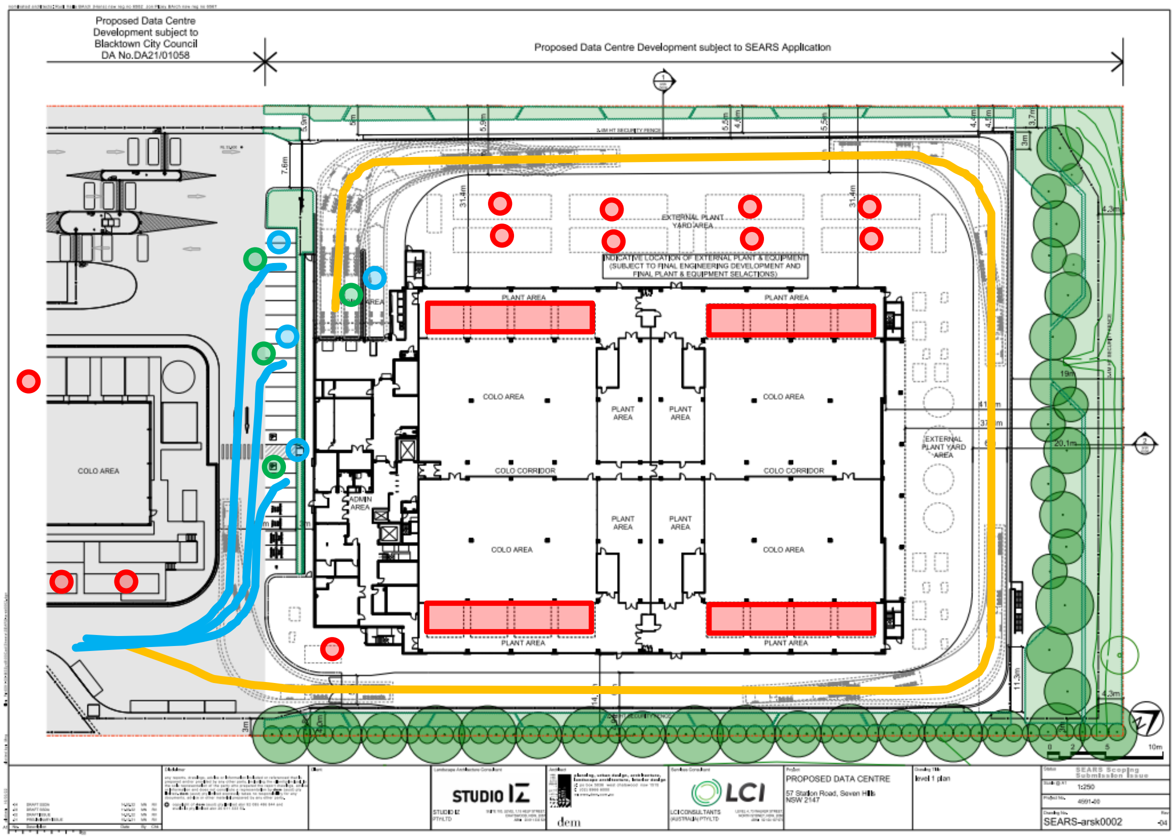
Figure 12 Modelled Noise Emission Sources visualized for the Evening/Night Period



Key:

- Air Handling Units
- Door close
- Engine start
- Truck movement
- Car movement

Figure 13 Modelled Noise Emission Sources visualized for the Emergency Scenario



Key:

- Generator
- Air Handling Units
- Door close
- Engine start
- Truck movement
- Car movement

4.6 Predicted Noise Levels

4.6.1 Standard Mode Operational Scenarios

The predicted L_{Aeq} results of the modelled operational scenarios for Standard Mode AHUs with up to one generator operating are presented below in Table 22. Noise contours of the modelled operational scenarios are shown in the figures below. Note that the contour maps are set to receiver level heights of 1.5m.

Compliance with the noise criteria set out in the Blacktown DCP 2015 and NSW NPI is predicted at all receivers during all operational scenarios, provided the modelling assumptions outlined above are implemented into the design of the datacentre.

Table 22 Predicted Noise Levels, Standard Mode Operational Scenarios, L_{Aeq} (15 minute)

Receiver (Height from ground)	Criteria (dBA)			Predicted Noise Levels (dBA)	
	Day	Evening	Night	Day Scenario with one Generator	Evening/Night Scenario with no Generators
R1 (1.5m)	46	43	36	32	31
R2 (1.5m)	46	43	36	34	33
R3 (1.5m)	46	43	36	27	26
R4 (5.0m)	46	43	36	37	36
R5 (1.5m)	46	43	36	29	27
R6 (1.5m)	46	43	36	33	23
R7 (1.5m)	46	43	36	35	28
R8 (1.5m)	46	43	36	38	36
R9 (1.5m)	46	43	36	38	36
R10 (5.0m)	63	63	63	33	32
R11 (1.5m)	68	68	68	31	27
R12 (1.5m)	68	68	68	44	41
R13 (1.5m)	68	68	68	38	34
R14 (1.5m)	68	68	68	38	35
R15 (1.5m)	68	68	68	30	28
R16 (1.5m)	68	68	68	41	40
R17 (1.5m)	68	68	68	27	24
R18 (1.5m)	68	68	68	28	23
R19 (1.5m)	53	53	53	36	35

Figure 14 Standard Mode Operational Scenario 1 – Operational Day Scenario with 60 Direct Evaporative Cooling Air Handling Units (with 200mm Deep Acoustic Louvres) and 1 x 3.0 MW Generator

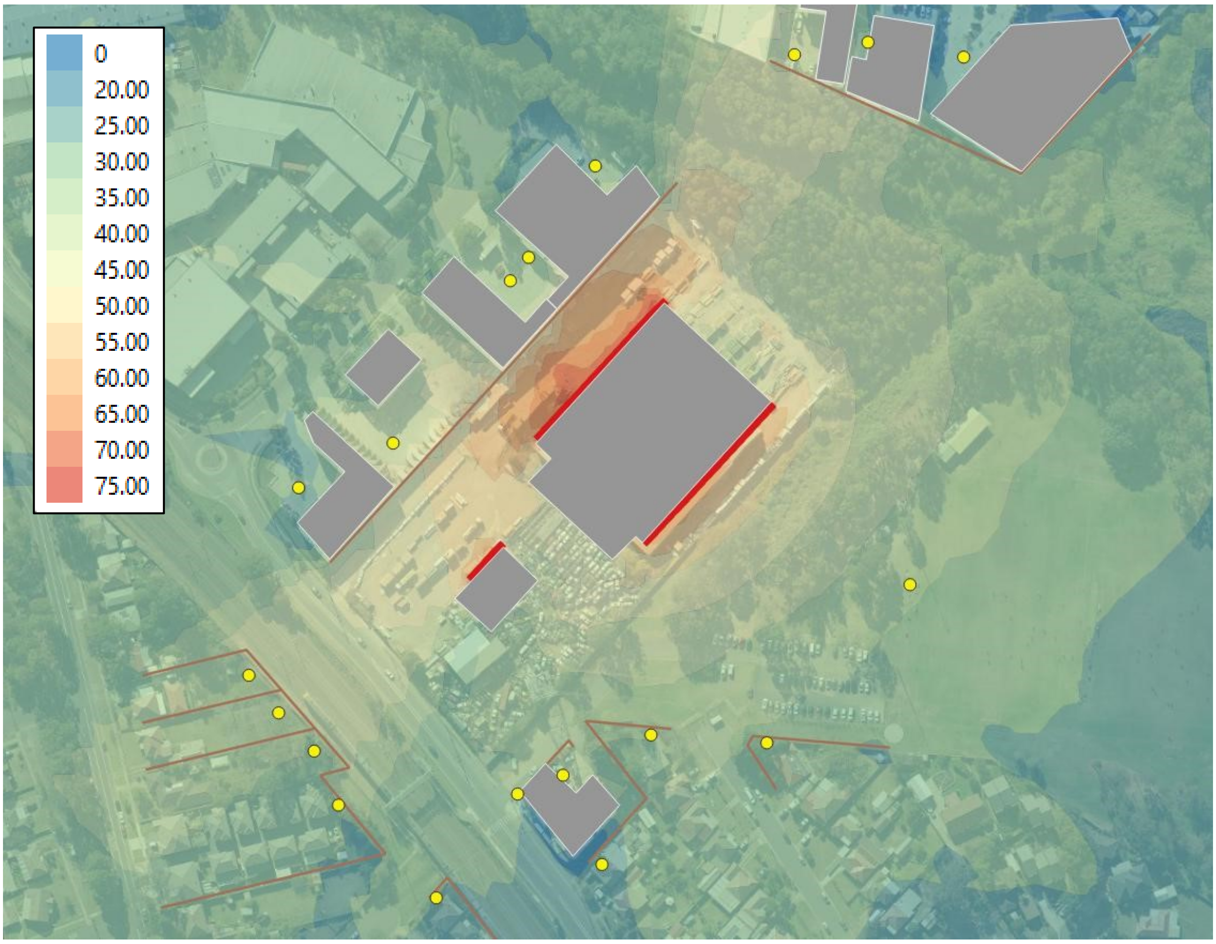
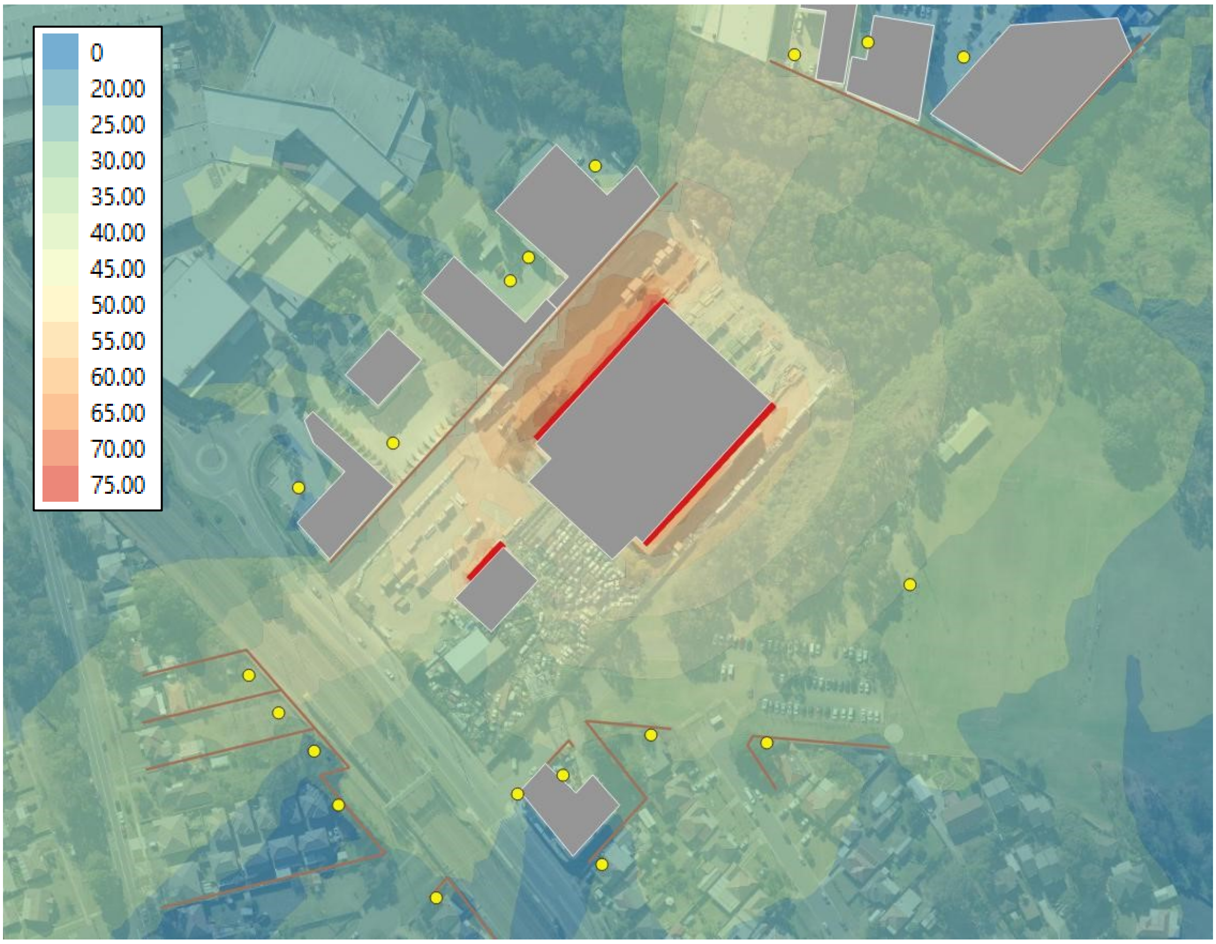


Figure 15 Standard Mode Operational Scenario 2 – Operational Evening/Night Scenario with 60 Direct Evaporative Cooling Air Handling Units (with 200mm Deep Acoustic Louvres)



4.6.2 Standard Mode Emergency Scenario

The predicted L_{Aeq} results of the modelled emergency scenario for Standard Mode AHUs with all generators operating are presented below in Table 22.

Since the use of all generators in a power outage will not exceed 200 hours per year, the use of all generators at once is outside the framework of the POEO Act and the Noise Policy for Industry. As such, there are no applicable criteria for the assessment of the emergency scenario under the Noise Policy for Industry.

Nonetheless, Blacktown Council has recommended that this assessment be completed. With this in mind, exceedances of the operational noise criteria set out in the Blacktown DCP 2015 and NSW NPI are predicted at several receivers during the emergency scenario.

Council has further recommended that nearby residents are informed of the potential for excessive noise generation during periods of total power failure in the area, despite the rarity of these events occurring.

Table 23 Predicted Noise Levels, Standard Mode Emergency Scenario, L_{Aeq} (15 minute)

Receiver (Height from ground)	Criteria (dBA)			Predicted Noise Levels (dBA)
	Day	Evening	Night	Emergency Scenario with all Generators
R1 (1.5m)	N/A	N/A	N/A	43
R2 (1.5m)	N/A	N/A	N/A	46
R3 (1.5m)	N/A	N/A	N/A	37
R4 (5.0m)	N/A	N/A	N/A	52
R5 (1.5m)	N/A	N/A	N/A	43
R6 (1.5m)	N/A	N/A	N/A	43
R7 (1.5m)	N/A	N/A	N/A	45
R8 (1.5m)	N/A	N/A	N/A	45
R9 (1.5m)	N/A	N/A	N/A	45
R10 (5.0m)	N/A	N/A	N/A	49
R11 (1.5m)	N/A	N/A	N/A	38
R12 (1.5m)	N/A	N/A	N/A	50
R13 (1.5m)	N/A	N/A	N/A	46
R14 (1.5m)	N/A	N/A	N/A	46
R15 (1.5m)	N/A	N/A	N/A	39
R16 (1.5m)	N/A	N/A	N/A	47
R17 (1.5m)	N/A	N/A	N/A	34
R18 (1.5m)	N/A	N/A	N/A	37
R19 (1.5m)	N/A	N/A	N/A	44

4.6.3 Bushfire Mode Operational Scenarios

The predicted L_{Aeq} results of the modelled operational scenarios for Bushfire Mode AHUs with up to one generator operating are presented below in Table 22. Noise contours of the modelled operational scenarios are shown in the figures below. Note that the contour maps are set to receiver level heights of 1.5m.

Compliance with the noise criteria set out in the Blacktown DCP 2015 and NSW NPI is predicted at all receivers during all operational scenarios, provided the modelling assumptions outlined above are implemented into the design of the datacentre.

Table 24 Predicted Noise Levels, Bushfire Mode Operational Scenarios, $L_{Aeq\ (15\ minute)}$

Receiver (Height from ground)	Criteria (dBA)			Predicted Noise Levels (dBA)	
	Day	Evening	Night	Day Scenario with one Generator	Evening/Night Scenario with no Generators
R1 (1.5m)	46	43	36	32	31
R2 (1.5m)	46	43	36	34	33
R3 (1.5m)	46	43	36	26	24
R4 (5.0m)	46	43	36	38	36
R5 (1.5m)	46	43	36	28	26
R6 (1.5m)	46	43	36	33	23
R7 (1.5m)	46	43	36	35	28
R8 (1.5m)	46	43	36	37	34
R9 (1.5m)	46	43	36	37	34
R10 (5.0m)	63	63	63	35	34
R11 (1.5m)	68	68	68	29	22
R12 (1.5m)	68	68	68	43	40
R13 (1.5m)	68	68	68	38	33
R14 (1.5m)	68	68	68	37	33
R15 (1.5m)	68	68	68	30	27
R16 (1.5m)	68	68	68	41	39
R17 (1.5m)	68	68	68	26	22
R18 (1.5m)	68	68	68	27	22
R19 (1.5m)	53	53	53	37	37

Figure 16 Bushfire Mode Operational Scenario 1 – Operational Day Scenario with 67 Direct Evaporative Cooling Air Handling Units (with 300mm Deep Acoustic Louvres) and 1 x 3.0 MW Generator

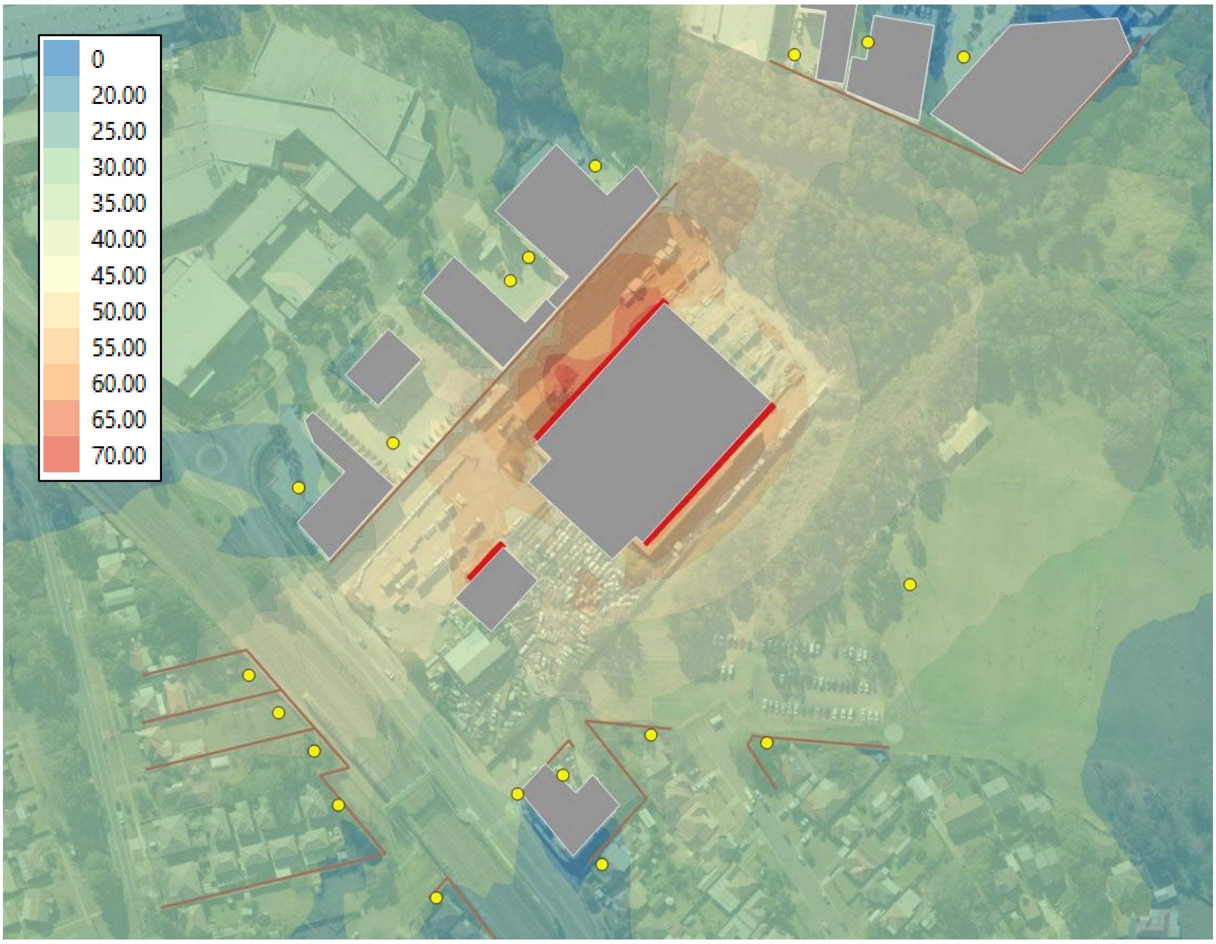
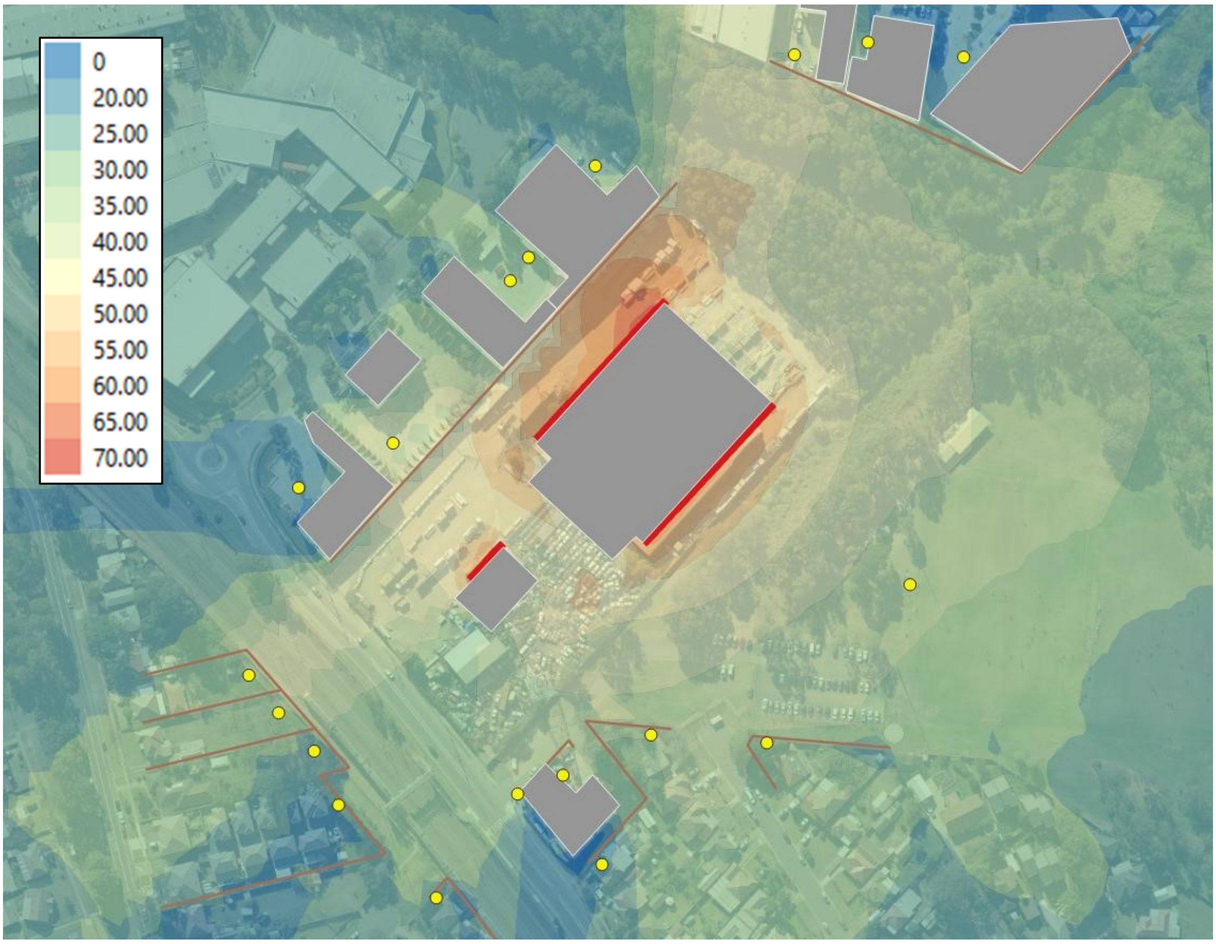


Figure 17 Bushfire Mode Operational Scenario 2 – Operational Evening/Night Scenario with 67 Direct Evaporative Cooling Air Handling Units (with 300mm Deep Acoustic Louvres)



4.6.4 Bushfire Mode Emergency Scenario

The predicted L_{Aeq} results of the modelled emergency scenario for Bushfire Mode AHUs with all generators operating are presented below in Table 22.

Since the use of all generators in a power outage will not exceed 200 hours per year, the use of all generators at once is outside the framework of the POEO Act and the Noise Policy for Industry. As such, there are no applicable criteria for the assessment of the emergency scenario under the Noise Policy for Industry.

Nonetheless, Blacktown Council has recommended that this assessment be completed. With this in mind, exceedances of the operational noise criteria set out in the Blacktown DCP 2015 and NSW NPI are predicted at several receivers during the emergency scenario.

Council has further recommended that nearby residents are informed of the potential for excessive noise generation during periods of total power failure in the area, despite the rarity of these events occurring.

Table 25 Predicted Noise Levels, Bushfire Mode Emergency Scenario, $L_{Aeq\ (15\ minute)}$

Receiver (Height from ground)	Operational Criteria (dBA)			Predicted Noise Levels (dBA)
	Day	Evening	Night	Emergency Scenario with all Generators
R1 (1.5m)	N/A	N/A	N/A	45
R2 (1.5m)	N/A	N/A	N/A	47
R3 (1.5m)	N/A	N/A	N/A	38
R4 (5.0m)	N/A	N/A	N/A	53
R5 (1.5m)	N/A	N/A	N/A	43
R6 (1.5m)	N/A	N/A	N/A	44
R7 (1.5m)	N/A	N/A	N/A	45
R8 (1.5m)	N/A	N/A	N/A	45
R9 (1.5m)	N/A	N/A	N/A	45
R10 (5.0m)	N/A	N/A	N/A	50
R11 (1.5m)	N/A	N/A	N/A	38
R12 (1.5m)	N/A	N/A	N/A	50
R13 (1.5m)	N/A	N/A	N/A	46
R14 (1.5m)	N/A	N/A	N/A	45
R15 (1.5m)	N/A	N/A	N/A	39
R16 (1.5m)	N/A	N/A	N/A	47
R17 (1.5m)	N/A	N/A	N/A	34
R18 (1.5m)	N/A	N/A	N/A	38
R19 (1.5m)	N/A	N/A	N/A	46

4.7 Feasibility And Noise Control Measures

The modelling conducted in Section 4.6 finds that, should certain noise control measures be adopted, as discussed further below, compliance with the noise criteria set out in the Blacktown DCP 2015 and NSW NPI is predicted at all sensitive receivers during both operating scenarios.

The following conceptual noise controls are recommended for the project:

- The generators are to be tested one at a time during the day scenario only.
- The generators are to be packaged units which feature attenuators on the air intakes and mufflers or attenuators on the exhaust ducts. The enclosed generators are to comply with a sound pressure level of 85 dB(A) at 1m. The recommendations are to be assessed at the detail design stage.
- Blacktown Council has recommended that nearby residential receivers are informed of the potential for excessive noise generation during periods of total power failure in the area, despite the rarity of these events occurring.
- The sound power levels of the air handling units are to be at or below the levels listed in Table 16 of this report for the day, evening and night periods. The suitability of the selected air handling units is to be assessed at the detailed design stage.
- The air handling units are to incorporate intake acoustic louvres:
  - If Standard Mode AHUs are to be implemented, then louvres with the below insertion losses are proposed (nominally 200mm deep). Details of the required insertion losses provided by the louvres are included in the table below. The locations of the proposed louvres are indicated in Figure 18 and Figure 19.

Table 26 Minimum Insertion Losses – 200mm Deep Intake Louvres for Air Handling Units (for Standard Mode)

Insertion Loss	Octave Band Centre Frequencies (Hz)							
	63	125	250	500	1000	2000	4000	8000
Required insertion loss (dB)	1	3	7	11	12	10	10	9

  - If Bushfire Mode AHUs are to be implemented, then louvres with the below insertion losses are proposed (nominally 300mm deep). Details of the required insertion losses provided by the louvres are included in the table below. The locations of the proposed louvres are indicated in Figure 20 and Figure 21.

Table 27 Minimum Insertion Losses – 300mm Deep Intake Louvres for Air Handling Units (for Bushfire Mode)

Insertion Loss	Octave Band Centre Frequencies (Hz)							
	63	125	250	500	1000	2000	4000	8000
Required insertion loss (dB)	4	7	9	13	14	12	12	8

- Once the final concept, mechanical equipment selection and equipment layout are finalised in later stages of the project, recommended noise control measures can be finalised. That is, the above conceptual noise measures are subject to final equipment selections and layouts.

Figure 18 Markup showing locations of proposed acoustic louvres should "Standard mode" AHUs be implemented – Level 1

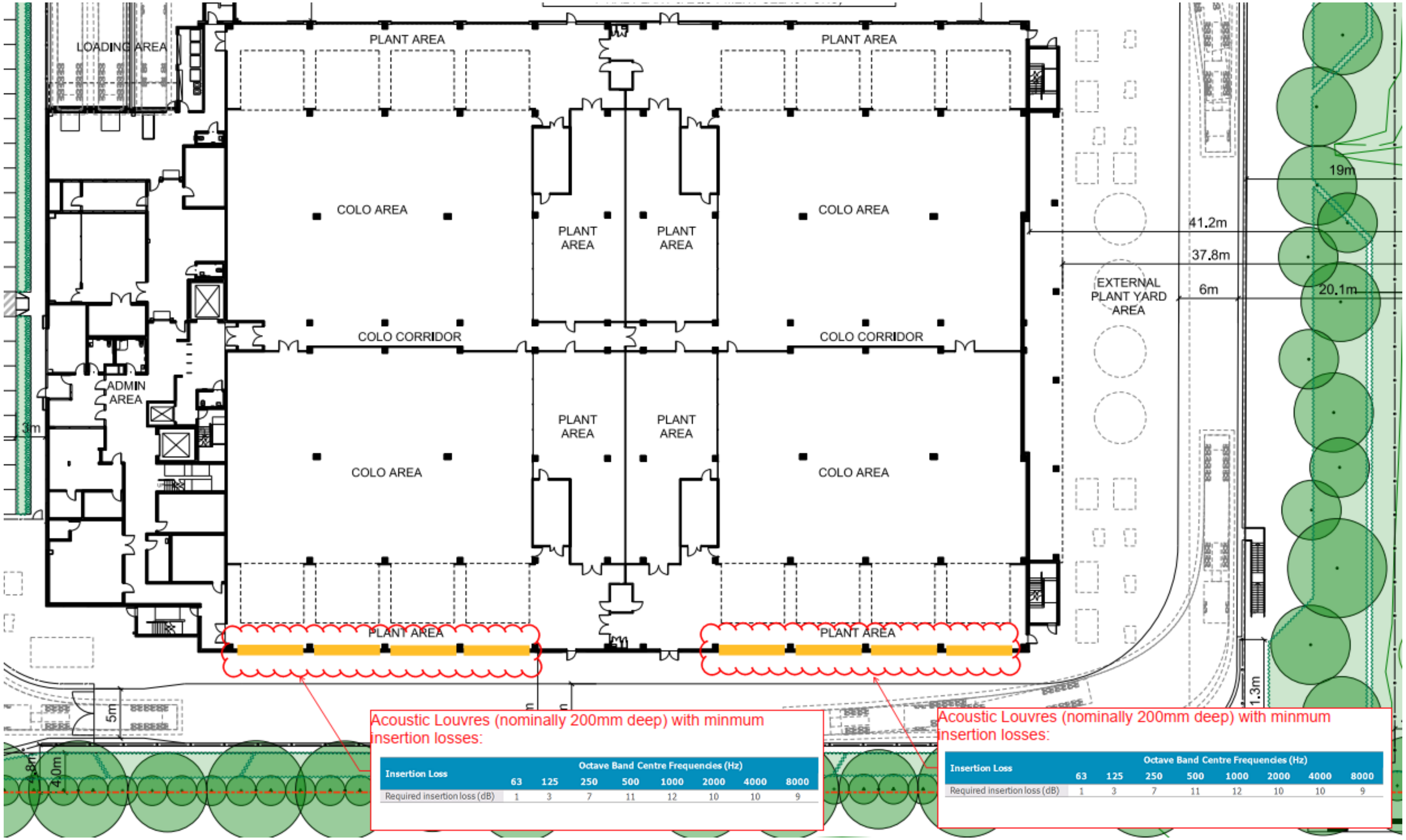
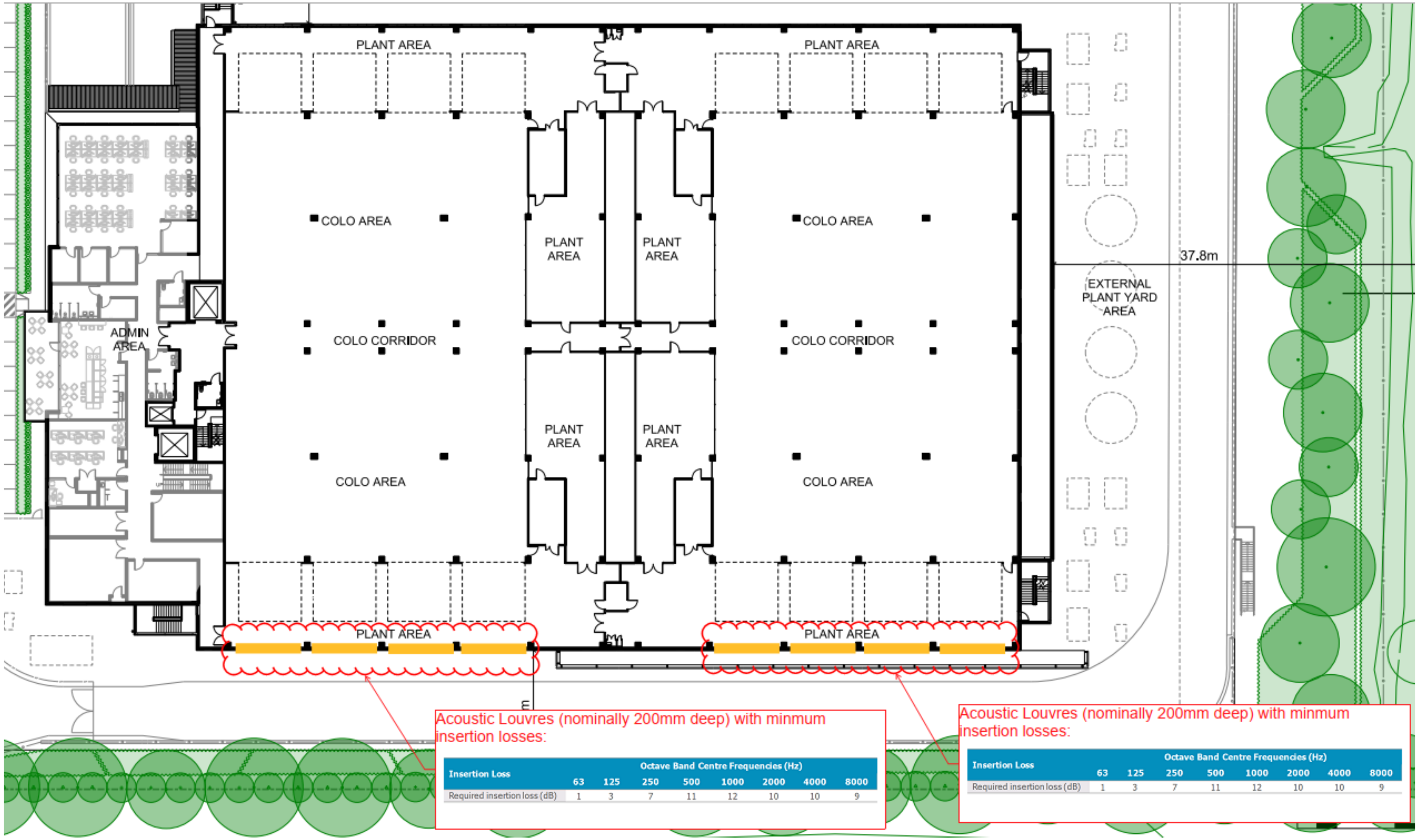


Figure 19 Markup showing locations of proposed acoustic louvres should "Standard mode" AHUs be implemented – Level 2



Insertion Loss	Octave Band Centre Frequencies (Hz)							
	63	125	250	500	1000	2000	4000	8000
Required insertion loss (dB)	1	3	7	11	12	10	10	9

Insertion Loss	Octave Band Centre Frequencies (Hz)							
	63	125	250	500	1000	2000	4000	8000
Required insertion loss (dB)	1	3	7	11	12	10	10	9

Figure 20 Markup showing locations of proposed acoustic louvres should "Bushfire mode" AHUs be implemented – Level 1

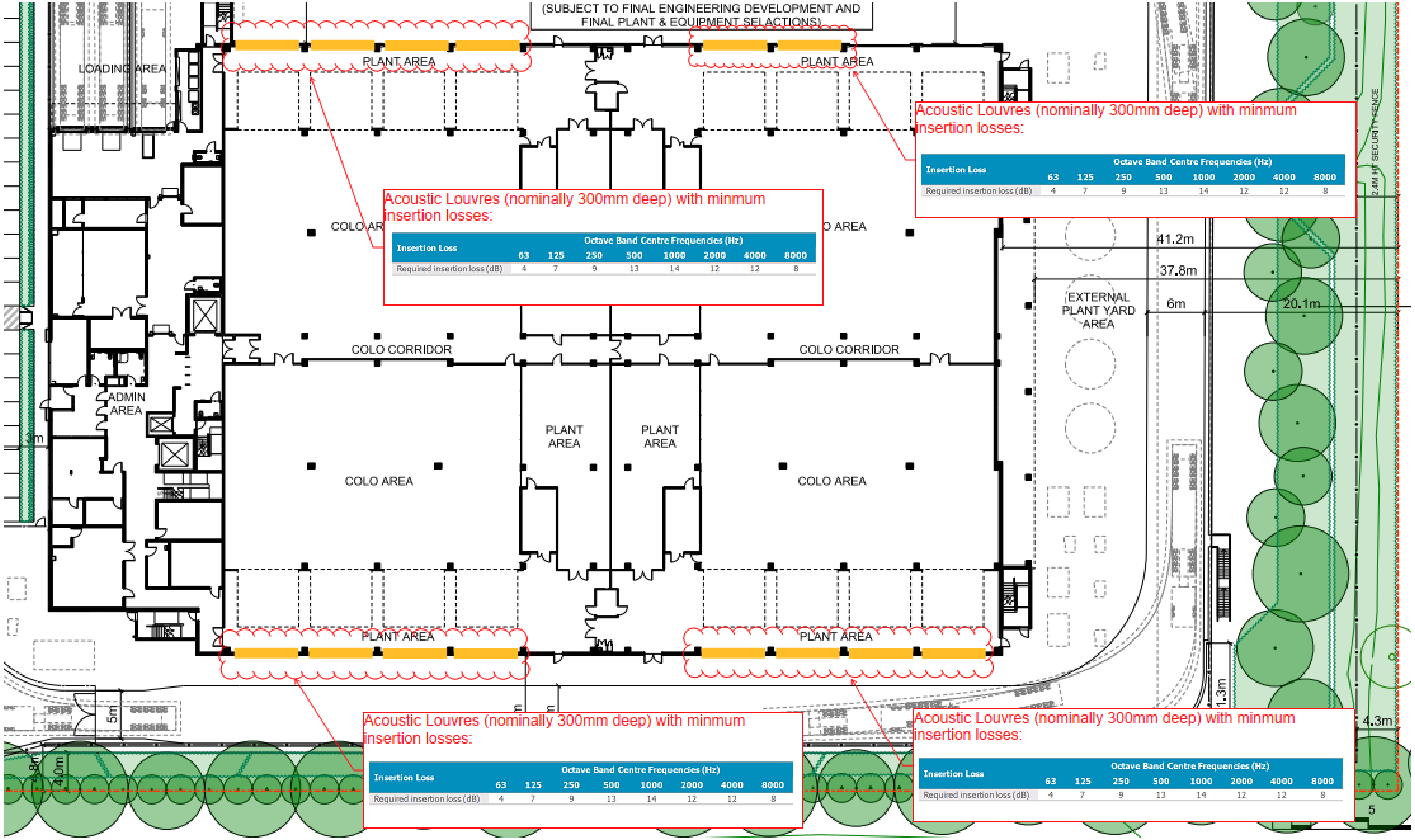
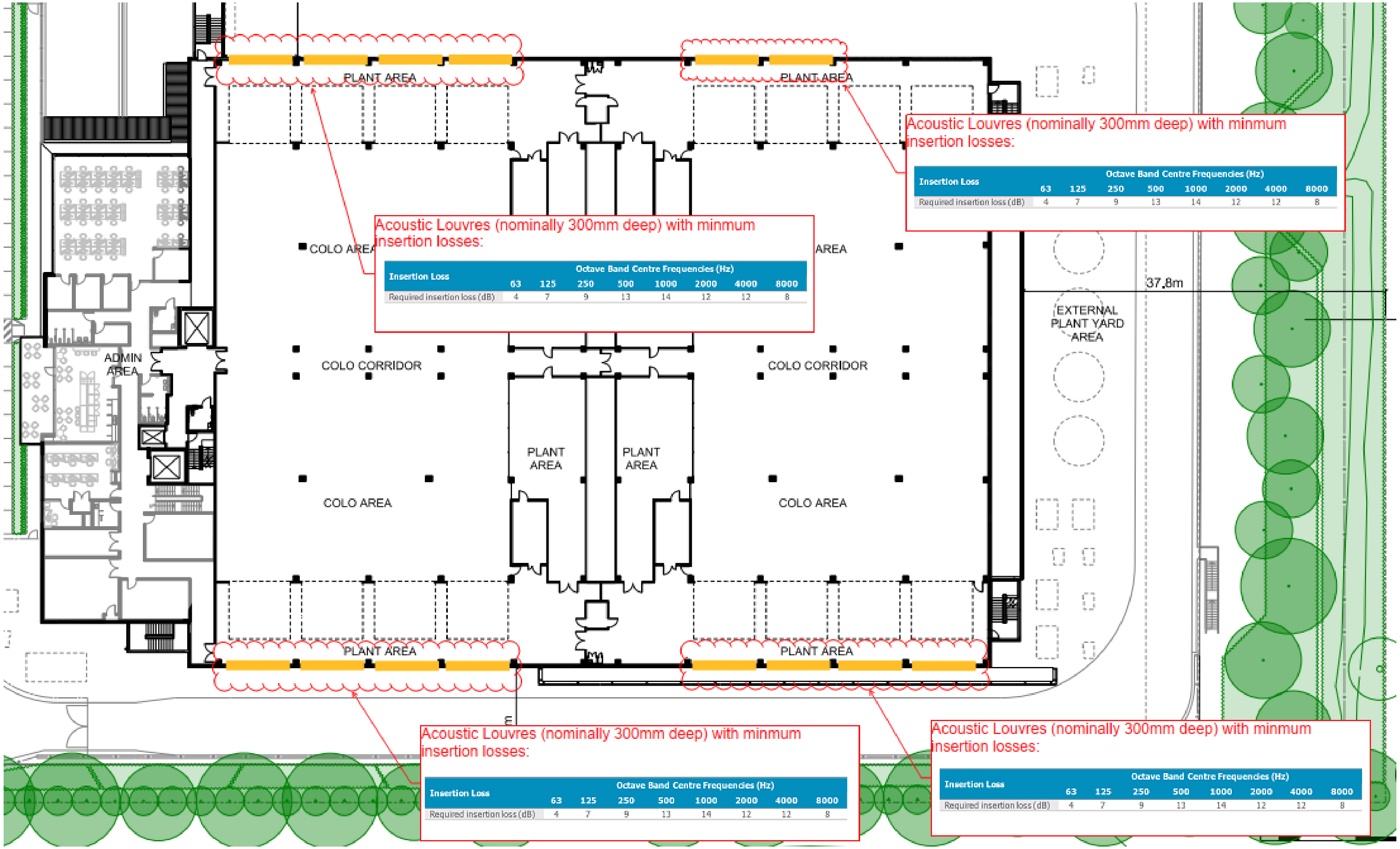


Figure 21 Markup showing locations of proposed acoustic louvres should "Bushfire mode" AHUs be implemented – Level 2



5 ROAD TRAFFIC NOISE ASSESSMENT

As part of the total industrial development at 57 Station Road, Seven Hills, additional vehicle movements are expected on Station Road. Station Road has been selected for this road noise assessment as it is the road that will have the highest proportion of site traffic travelling to/from the site. For other surrounding roadways, the proportion of traffic from the development will be lower, and, therefore, road traffic noise is not proposed to be assessed.

Under section 3.4.1 of the Road Noise Policy "for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'no build option'".

A 2 dB increase equates to approximately a 60% increase in total traffic along the subject road.

The *Traffic Impact Assessment* by The Transport Planning Partnership (reference number 20407, Version V03, dated 01/04/22) specifies that the existing average daily traffic volume along Station Road is 20,980. In the worst-case scenario, the total peak hourly trip generation of the proposed development is estimated as follows:

- AM and PM peak periods:
    - 3 heavy vehicles (6 trips).
    - 10 light vehicles (20 trips).

The proportional traffic increase along Station Road from the development is therefore predicted to be far smaller than a 60% increase. Therefore, it is predicted that road traffic noise levels will not increase by 2 dB or more. The proposed road movements are thus predicted to comply with the Road Noise Policy and no further noise mitigation measures are recommended.

6 CONSTRUCTION NOISE AND VIBRATION

Predictive noise modelling of the construction noise activities was carried out using the ISO 9613 algorithm within iNoise 2022.01. Construction activities are assumed to include the following:

- Bulk earthworks;
- Concreting works;
- Structure works.

6.1 Noise Generating Scenarios

Major plant equipment to be used in the construction works is likely to include excavators, dozers, trucks, hand tools and a franna. The sound power levels for the construction equipment likely to be used for each of the listed tasks are provided in the table below. Indicative locations of the noise sources are shown in Figure 22 to Figure 24.

Table 28 Summary of utilised construction sound power levels

Tasks	Equipment	Sound Power Levels (dBA re 1pW)	Operational Time per 15 minute period
1. General excavation works	Excavator 25T	109	15 minutes
	Dozer 25T	109	15 minutes
	Watercart	106	15 minutes
	Truck	106	5 minutes
2. Concreting works	Concrete truck	106	15 minutes
	Concrete pump	106	15 minutes
	Truck	106	5 minutes
3. Façade construction	Franna	106	15 minutes
	Truck	106	5 minutes
	Power hand tools	100	5 minutes

Figure 22 Construction Scenario 1 – General Excavation Works

Figure 23 Construction Scenario 2 – Concreting Works

Figure 24 Construction Scenario 3 – Façade Construction

6.2 Modelling Assumptions

The following modelling assumptions are utilised for the construction noise assessment:

- The noise generating scenario is modelled for a worst case 15 minute period;
- Terrain has been sourced from the NSW Land and Property Information database Six Maps;
- Ground Absorption has been included in the model with the surrounding grass areas having an absorption factor of 1.0 and the site itself and other hard surfaces having a ground absorption factor of 0;
- All receptors are modelled 1.5m above the ground;
- The noise sources and sound power levels have been modelled with respect to the information presented in Table 28 and
- Construction noise is assumed to take place during the following construction hours:
  - Monday to Friday 7 am to 6 pm
  - Saturday 8 am to 5 pm
  - No work on Sundays or public holidays

6.3 Predicted $L_{Aeq,\ 15\ min}$ Noise Levels

The predicted $L_{Aeq,\ 15\ min}$ results of the modelled construction scenarios are presented below in Table 29. Noise contours of the modelled $L_{Aeq,\ 15\ min}$ construction scenarios are shown in Figure 25 to Figure 27. It is shown that construction activities during each of the construction stages are predicted to exceed the standard hours criteria of 51 dBA at several residential receivers. Exceedances of the 'standard construction hours' criteria are identified by bold text in Table 29. Exceedances of the 'outside standard construction hours' criteria are identified by underlined text in Table 29.

Based on the expected construction noise levels, suitable management controls and community notifications are required; see Section 7.

Table 29 Predicted Noise Levels, Construction Scenarios, L_{Aeq} (15 minute)

Receiver	Criteria	Criteria	Predicted Noise Levels – Construction Scenario		
	Standard Hours	Outside Standard Hours	1	2	3
R1	51	46	**<u>53</u>**	<u>49</u>	<u>48</u>
R2	51	46	**<u>54</u>**	<u>50</u>	<u>49</u>
R3	51	46	40	37	35
R4	51	46	**<u>59</u>**	**<u>55</u>**	**<u>54</u>**
R5	51	46	<u>50</u>	44	43
R6	51	46	<u>49</u>	43	42
R7	51	46	<u>51</u>	<u>47</u>	45
R8	51	46	<u>51</u>	46	44
R9	51	46	<u>50</u>	46	44
R10	70	70	57	55	53
R11	75	75	36	33	30
R12	75	75	55	50	48
R13	75	75	41	38	35
R14	75	75	43	39	38
R15	75	75	38	34	31
R16	75	75	53	50	47

Receiver	Criteria Standard Hours	Criteria Outside Standard Hours	Predicted Noise Levels – Construction Scenario 1	2	3
R17	75	75	34	30	28
R18	75	75	47	39	41
R19	65	65	60	55	54

Figure 25 Predicted Noise Contours – Construction Scenario 1, L_{Aeq} (15 minute)

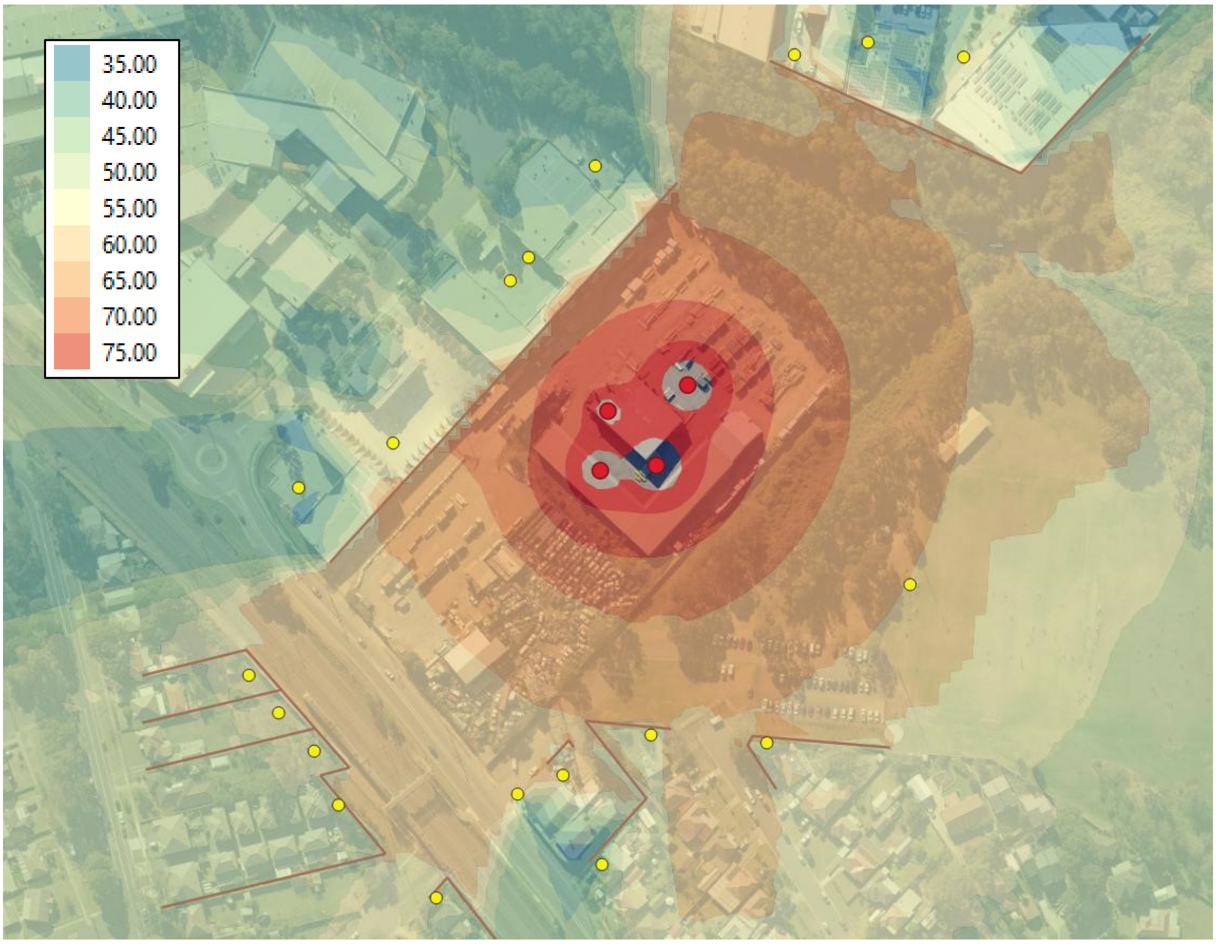


Figure 26 Predicted Noise Contours – Construction Scenario 2, $L_{Aeq\ (15\ minute)}$

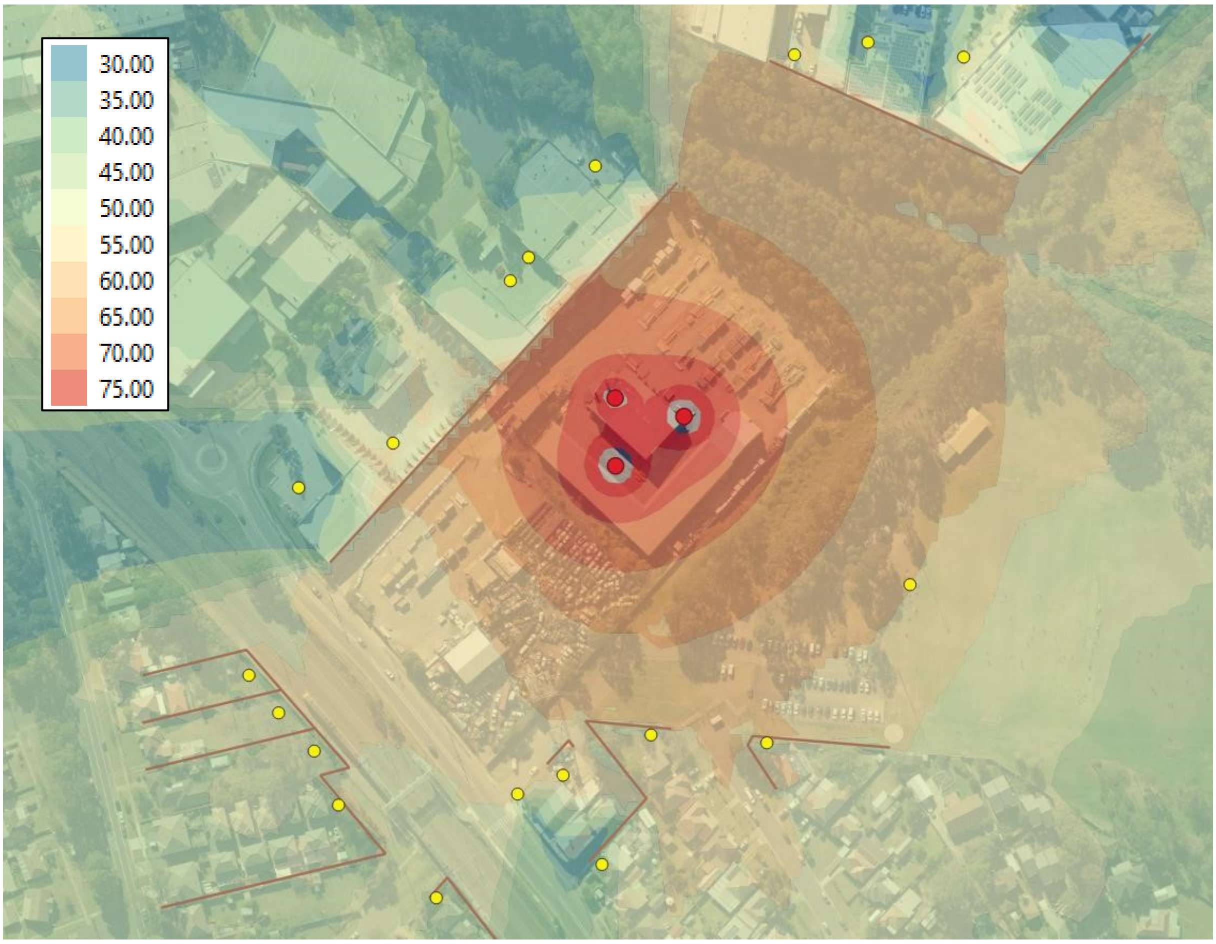
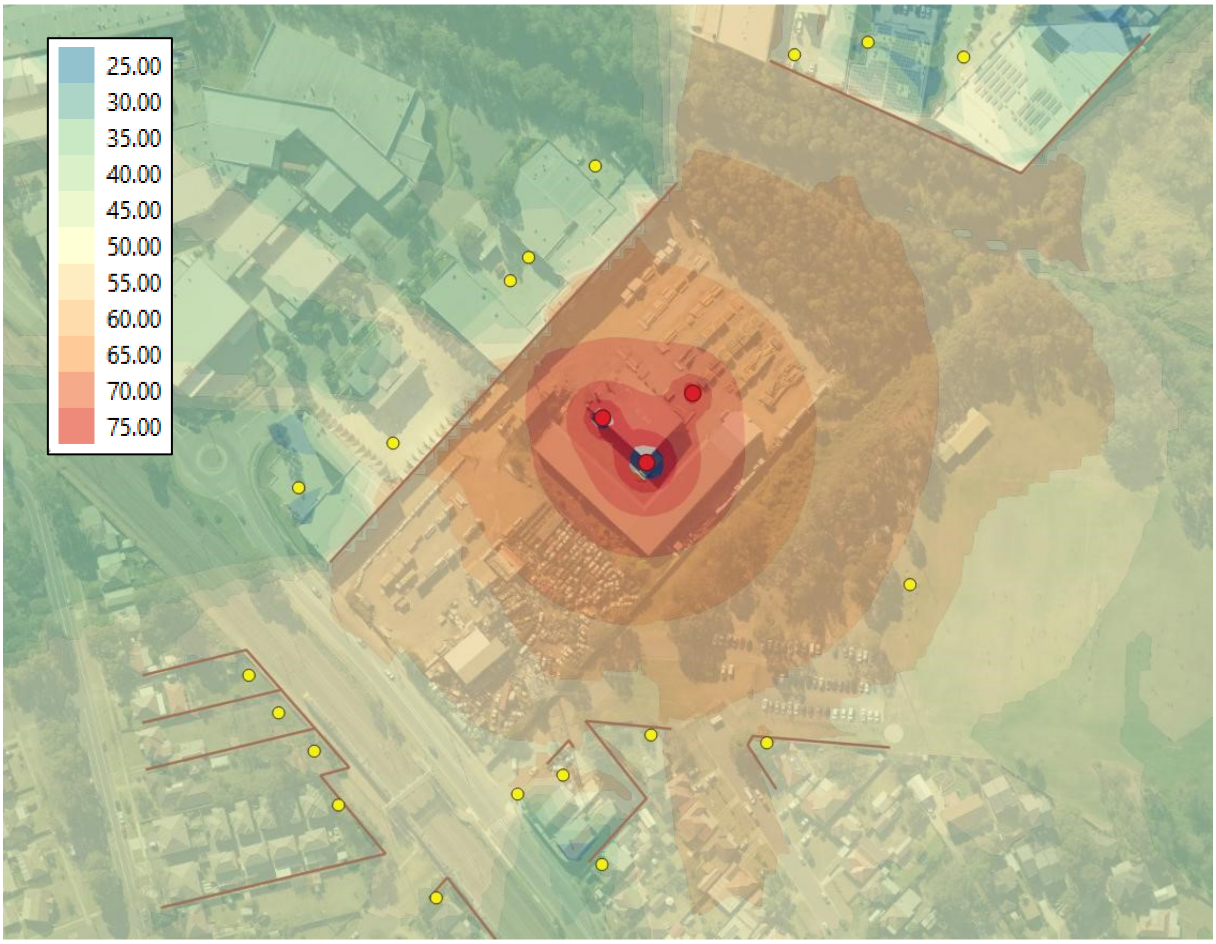


Figure 27 Predicted Noise Contours – Construction Scenario 3, $L_{Aeq\ (15\ minute)}$



6.4 Construction Vibration Assessment

In order to maintain compliance with the human comfort vibration criteria discussed in Section 3.7, it is recommended that the indicative safe distances listed in Table 30 should be maintained. These indicative safe distances should be validated at the start of construction works by undertaking measurements of vibration levels generated by construction and demolition equipment to be used on site.

If applicable, the criteria for scientific or medical equipment (should any of these exist close to the site) can be more stringent than those required for human comfort. Vibration validating measurements should be conducted at each site to determine the vibration level and potential impact to this sensitive equipment.

Additionally, any vibration levels should be assessed in accordance with the criteria discussed in Section 3.7. This information should also be included as part of the CNVMP.

Table 30 Recommended indicative safe working distances for vibration intensive plant

Plant	Rating / Description	Safe Working Distances (m)	
		Cosmetic Damage (BS 7385: Part 2 DIN 4150: Part 3)	Human Comfort (AVTG)
Vibratory roller	< 50 kN (Typically 1 – 2 tonnes)	5	15 – 20
	< 100 kN (Typically 2 – 4 tonnes)	6	20
	< 200 kN (Typically 4 – 6 tonnes)	12	40
	< 300 kN (Typically 7 – 13 tonnes)	15	100
	> 300 kN (Typically more than 13 tonnes)	20	100
Small hydraulic hammer	300 kg, typically 5 – 12 tonnes excavator	2	7
Medium hydraulic hammer	900 kg, typically 12 – 18 tonnes excavator	7	23
Large hydraulic hammer	1600 kg, typically 18 – 34 tonnes excavator	22	73
Vibratory pile driver	Sheet piles	2 – 20	20
Jackhammer	Hand held	1	Avoid contact with structure and steel reinforcements

7 CONSTRUCTION NOISE CONTROL MEASURES

Given the predicted noise levels in Section 6, the following noise control measures and noise management practices are recommended to be adopted as part of this proposed construction works.

7.1 Acoustic Management Procedures

7.1.1 Summary of Management Procedures

Table 31 below summarises the management procedures recommended for airborne noise impacts. These procedures are also further discussed in the report. Hence, where applicable, links to further references are provided in Table 31.

Table 31 Summary of mitigation procedures

Procedure	Abbreviation	Description	Further Reference
General Management Measures	GMM	Introduce best-practice general mitigation measures in the workplace which are aimed at reducing the acoustic impact onto the nearest affected receivers.	Refer to Section 7.6
Project Notification	PN	Issue project updates to stakeholders, discussing overviews of current and upcoming works. Advanced warning of potential disruptions can be included. Content and length to be determined on a project-by-project basis.	Refer to Section 7.3
Verification Monitoring	V	Monitoring to comprise attended or unattended acoustic surveys. The purpose of the monitoring is to confirm measured levels are consistent with the predictions in the acoustic assessment, and to verify that the mitigation procedures are appropriate for the affected receivers. If the measured levels are higher than those predicted, then the measures will need to be reviewed and the management plan will need to be amended.	For noise impact, refer to Section 7.2.2
Complaints Management System	CMS	Implement a management system which includes procedures for receiving and addressing complaints from affected stakeholders	Refer to Section 7.4
Specific Notification	SN	Individual letters or phone calls to notify stakeholders that noise levels are likely to exceed noise objectives. Alternatively, contractor could visit stakeholders individually in order to brief them in regards to the noise impact and the mitigation measures that will be implemented.	Refer to Section 7.3
Respite Offer	RO	Offer provided to stakeholders subjected to an ongoing impact.	-
Alternative Construction Methodology	AC	Contractor to consider alternative construction options that achieve compliance with relevant criteria. Alternative option to be determined on a case-by-case basis. It is recommended that the selection of the alternative option should also be determined by considering the assessment of on-site measurements (refer to Verification Monitoring above).	-

The application of these procedures is in relation to the exceedances over the relevant criteria. For airborne noise, the criteria are based on NMLs. The allocation of these procedures is discussed in Section 7.1.2.

7.1.2 Allocation of Noise Management Procedures

For residences, the management procedures have been allocated based on noise level exceedances at the affected properties, which occur over the designated NMLs. The allocation of these procedures is summarised in Table 32 below.

Table 32 Allocation of noise management procedures – residential receivers

Construction Hours	Exceedance over NML (dB)	Management Procedures (see definition above)
Mon – Fri: 7:00 am to 6:00 pm Sat: 8:00 am – 5:00 pm No work on Sunday or Public Holidays.	0 - 3	GMM
	4 - 10	GMM, PN, V [1], CMS, AC
	> 10	GMM, PN, V, CMS, SN, AC

Notes

1. Verification monitoring to be undertaken upon complaints received from affected receivers

Please note the following regarding the allocation of these procedures:

- The exceedances have been estimated as part of the acoustic assessment, and these are summarised in Section 6.3.
- The allocation of procedures is based on the assumptions used for noise level predictions (refer to Section 6.1). Consequently, these allocations can be further refined once additional details of the construction program become available.

7.2 Site Specific Noise Mitigation Measures

7.2.1 General Comments

The contractor will, where reasonable and feasible, apply best practice noise mitigation measures. These measures shall include the following:

- Maximising the offset distance between plant items and nearby noise sensitive receivers.
- Preventing noisy plant working simultaneously and adjacent to sensitive receivers.
- Minimising consecutive works in the same site area.
- Orienting equipment away from noise sensitive areas.
- Carrying out loading and unloading away from noise sensitive areas.

In order to minimise noise impacts during the works, the contractor will take all reasonable and feasible measures to mitigate noise effects.

The contractor will also take reasonable steps to control noise from all plant and equipment. Examples of appropriate noise control include efficient silencers and low noise mufflers.

The contractor should apply all feasible and reasonable work practices to meet the NMLs and inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels, duration of noise generating construction works, and the contact details for the proposal.

7.2.2 Noise Monitoring

Noise monitoring, if required, will be performed by an acoustical consultant directly engaged by the contractor.

Noise monitoring is recommended to be undertaken by attended noise measurements at the start of any new phase of works (i.e., demolition, excavation or remediation works etc.). The statistical parameters to be measured should include the following noise descriptors: L_{Amin}, L_{A90}, L_{A10}, L_{A1}, L_{Amax} and L_{Aeq}. Unattended noise measurements should be conducted over consecutive 15 minute periods.

This monitoring should also be complemented by undertaking attended noise measurements in order to:

- Differentiate between construction noise sources and other extraneous noise events (such as road traffic and aircraft noise)

- Note and identify any excessive noise emitting machinery or operation.

In addition to the above detailed measurements, should any complaints be received which have not been determined previously, it should be confirmed by conducting additional attended noise measurements.

The survey methodology and any equipment should comply with the requirements discussed in Standard AS 1055.1-1997.

It is our understanding that noise and vibration monitoring will be undertaken on the site for the entirety of the construction period. This is proposed to be conducted via SiteHive monitoring equipment.

7.2.3 Alternate Equipment or Process

Exceedance of the site's NMLs should result in an investigation as to whether alternate equipment could be used, or a difference process could be undertaken.

In some cases, the investigation may conclude that no possible other equipment can be used, however, a different process could be undertaken.

7.2.4 Acoustic Enclosures/Screening

Typically, on a construction site there are three different types of plant that will be used: mobile plant (i.e., excavators, skid steers, etc.), semi mobile plant (i.e., hand tools generally) or static plant (i.e., diesel generators).

For plant items which are static it is recommended that, in the event exceedances are being measured due to operation of the plant item, an acoustic enclosure/screen is constructed to reduce impacts. These systems can be constructed from Fibre Cement (FC) sheeting or, if airflow is required, acoustic attenuators or louvres.

For semi mobile plant, relocation of plant should be investigated to either be operated in an enclosed space or at locations away from a receiver.

With mobile plant it is generally not possible to treat these sources. However, investigations into the machine itself may result in a reduction of noise (i.e., mufflers/attenuators etc).

7.2.5 Site Cranes (Permanent)

Cranes to be installed are recommended to be electric. Should these cranes require ground-based diesel generators, acoustic enclosures/screens are to be provided. Refer to 7.2.4 above. Advice from a qualified Acoustic Consultant should be sought.

If diesel cranes are proposed, a detailed review of the proposed crane generator should be undertaken by a qualified Acoustic Consultant to determine if the following is required:

- Acoustic muffler on the exhaust.

- Acoustic enclosure around the plant.

7.2.6 Required Piling

Piling on the site will be limited and will not require vibration or percussion piling. All piling should be undertaken during the approved hours of works for the project and the proposed period when piling is to be undertaken is to be included in the community notifications provided to surrounding receivers.

7.3 Community Consultation

Active community consultation and the maintenance of positive relations with local residents and businesses would assist in alleviating concerns and thereby minimising complaint. It is common for construction projects to provide community consultation if an exceedance of noise goals has been predicted. This communication is commonly conducted in the form of a letter box drop or more active engagement with more highly impacted receivers.

This form of notification should provide specific notification of the duration and timing of the construction activities so that residents are informed about the proposed works ahead of time. The letter should also provide the community with details for a community liaison officer available to adequately respond to all project related enquiries.

In response to the operational parameters provided by each of the operators above the recommended mitigation measures outlined in this report are formulated with consideration of the information provided.

Prior to the works onsite being undertaken, it is recommended that further community consultation with the neighbouring affected parties be undertaken.

The communication, however, should not be limited to the beginning of the onsite works but throughout, providing the community with constant updates on the progress and upcoming works. In our experience these could include:

- Site noticeboard;
- Email notifications; and
- Letterbox drops.

7.4 Complaints Management System

Should complaints arise they must be dealt with in a responsible and uniform manner, therefore, a management system to deal with complaints is detailed below.

Community complaints will be managed by the Main Contract, which will be via email and phone during business hours. It is understood that details of this are currently being arranged.

All complaints should be investigated by the Contractor in accordance with the procedures outlined in Australia Standard 2436-2010. Consequently, a complaint response procedure should be implemented. Information to be gathered as part of this process should include:

- location of complainant
- time/s of occurrence of alleged noise or vibration impacts
- nature of impact particularly with respect to vibration
- Perceived source
- Prevailing weather conditions and similar details that could be utilised to assist in the investigation of the complaint.

All resident complaints will be responded to in the required timeframe and action taken recorded.

Post receiving a noise and or vibration complaint, the process outlined in the *Contingency Plans* below should be undertaken.

7.5 Contingency Plans

Contingency plans are required to address noise or vibration problems if excessive levels are measured at surrounding sensitive receivers and/or if justified complaints occur. Such plans include:

- Stop the onsite works.
- Identify the source of the main equipment within specific areas of the site which is producing the most construction noise and vibration at the sensitive receivers; and
- Review the identified equipment and determine if an alternate piece of equipment can be used or the process can be altered.
- In the event an alternate piece of equipment or process can be used, works can re-commence.
- In the event an alternate piece of equipment or process cannot be determined implement a construction assessment to be performed by a suitably qualified acoustic consultant.

The Superintendent shall have access to view the Contractor's noise measurement records on request. The Superintendent may undertake noise monitoring if and when required.

7.6 General Mitigation Measures (Australia Standard 2436-2010)

As well as the above project specific noise mitigation controls, AS 2436-2010 "*Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites*" sets out numerous practical recommendations to assist in mitigating construction noise emissions. Examples of strategies that could be implemented on the subject project are listed below, including the typical noise reduction achieved, where applicable.

7.6.1 Adoption of Universal Work Practices

- Regular reinforcement (such as at toolbox talks) of the need to minimise noise and vibration.
- Regular identification of noisy activities and adoption of improvement techniques.
- Avoiding the use of portable radios, public address systems or other methods of site communication that may unnecessarily impact upon nearby sensitive receivers.
- Where possible, avoiding the use of equipment that generates impulsive noise.
- Minimising the need for vehicle reversing for example (particularly at night), by arranging for one-way site traffic routes.
- Use of broadband audible alarms on vehicles and elevating work platforms used on site.
- Minimising the movement of materials and plant and unnecessary metal-on-metal contact.
- Minimising truck movements.

7.6.2 Plant and Equipment

- Choosing quieter plant and equipment based on the optimal power and size to most efficiently perform the required tasks.
- Selecting plant and equipment with low vibration generation characteristics.

- Operating plant and equipment in the quietest and most efficient manner.

7.6.3 On Site Noise Mitigation

- Maximising the distance between noise activities and noise sensitive land uses.
- Installing purpose-built noise barriers, acoustic sheds and enclosures.

7.6.4 Work Scheduling

- Providing respite periods which could include restricting very noisy activities to time periods that least affect the nearby noise sensitive locations, restricting the number of nights that after-hours work is conducted near residences or by determining any specific requirements.
- Scheduling work to coincide with non-sensitive periods.
- Planning deliveries and access to the site to occur quietly and efficiently and organising parking only within designated areas located away from the sensitive receivers.
- Optimising the number of deliveries to the site by amalgamating loads where possible and scheduling arrivals within designated hours.
- Including contract conditions that include penalties for non-compliance with reasonable instructions by the principal to minimise noise or arrange suitable scheduling.

7.6.5 Source Noise Control Strategies

Some ways of controlling noise at the source are:

- Where reasonably practical, noisy plant or processes should be replaced by less noisy alternatives.
- Modify existing equipment: Engines and exhausts are typically the dominant noise sources on mobile plant such as cranes, graders, excavators, trucks, etc. In order to minimise noise emissions, residential grade mufflers should be fitted on all mobile plant utilised on site.
- Siting of equipment: locating noisy equipment behind structures that act as barriers, or at the greatest distance from the noise-sensitive area; or orienting the equipment so that noise emissions are directed away from any sensitive areas, to achieve the maximum attenuation of noise.
- Regular and effective maintenance.

7.6.6 Miscellaneous Comments

Deliveries should be undertaken, where possible, during standard construction hours.

Maximise hammer penetration (and reduce blows) by using sharp hammer tips. Keep stocks of sharp profiles at site and monitor the profiles in use.

It is advised that mobile plant and trucks operating on site for a significant portion of the project are to have reversing alarm noise emissions minimised. This is to be implemented subject to recognising the need to maintain occupational safety standards.

No public address system should be used on site (except for emergency purposes).

8 CONCLUSION

This noise and vibration impact assessment report has been prepared by Pulse White Noise Acoustics (PWNA) on behalf of Lehr Consultants International (Australia) Pty Ltd (LCI) in support of a State Significant Development Application (SSDA) submitted to the Department of Planning and Environment (DPE) under Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act 1979).

LCI is seeking to secure approval for the construction of a new data storage centre development on the site known as 57 Station Road, Seven Hills, located within the Blacktown City Council local government area (LGA). The proposed development will comprise the erection of a new two-storey data centre at the rear of the site, associated plant and equipment, car parking areas, landscaping, and civil works.

This document assesses the potential operational noise impacts of the proposed development on the neighbouring receptors. In particular, operational impacts of the development and impacts associated with the construction of the development are assessed at the nearest receptors. The noise and vibration impacts are assessed cumulatively with those from the existing development approval, issued by Blacktown City Council under DA-21-01058.

Based on the findings from this Noise and Vibration Impact Assessment, should the noise control measures recommended in Section 4.6.4 be implemented, the proposed datacentre development is predicted to comply with the recommended noise criteria set out in the Blacktown DCP 2015 and NSW NPI at the surrounding receivers.

APPENDIX A: ACOUSTIC TERMINOLOGY

The following is a brief description of the acoustic terminology used in this report.

Sound power level	The total sound emitted by a source
Sound pressure level	The amount of sound at a specified point
Decibel [dB]	The measurement unit of sound
A Weighted decibels [dB(A])	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).
Decibel scale	The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows:

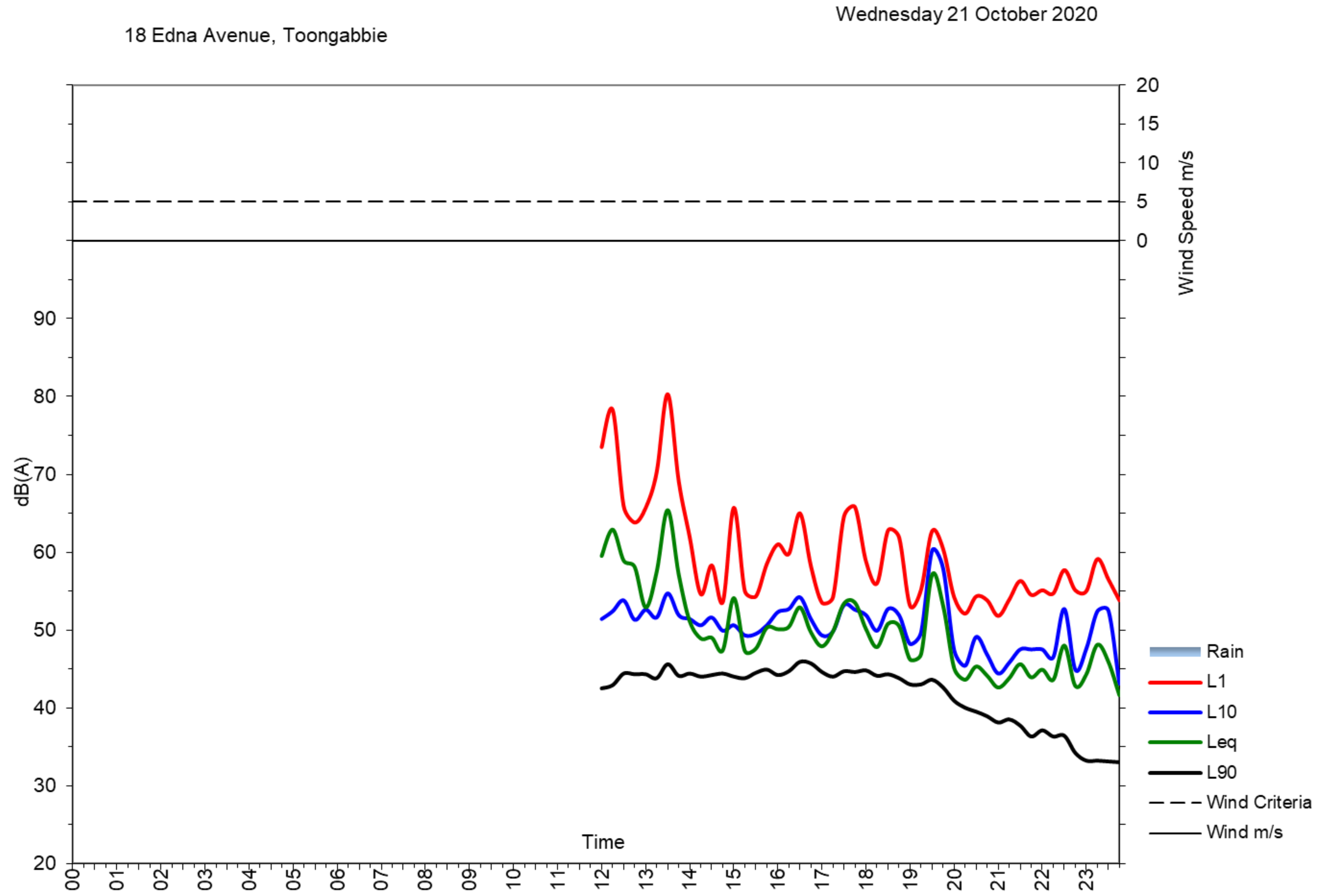
0dB(A)	Threshold of human hearing
30dB(A)	A quiet country park
40dB(A)	Whisper in a library
50dB(A)	Open office space
70dB(A)	Inside a car on a freeway
80dB(A)	Outboard motor
90dB(A)	Heavy truck pass-by
100dB(A)	Jackhammer/Subway train
110 dB(A)	Rock Concert
115dB(A)	Limit of sound permitted in industry
120dB(A)	747 take off at 250 metres

Frequency [f]	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound.
Ambient sound	The all-encompassing sound at a point composed of sound from all sources near and far.
Equivalent continuous sound level [L_{eq}]	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.
Reverberation	The persistence of sound in a space after the source of that sound has been stopped (the reverberation time is the time taken for a reverberant sound field to decrease by 60 dB)
Air-borne sound	The sound emitted directly from a source into the surrounding air, such as speech, television or music
Impact sound	The sound emitted from force of one object hitting another such as footfalls and slamming cupboards.
Air-borne sound isolation	The reduction of airborne sound between two rooms.
Sound Reduction Index [R] (Sound Transmission Loss)	The ratio the sound incident on a partition to the sound transmitted by the partition.
Weighted sound reduction index [R_w]	A single figure representation of the air-borne sound insulation of a partition based upon the R values for each frequency measured in a laboratory environment.
Level difference [D]	The difference in sound pressure level between two rooms.

Normalised level difference [D_n]	The difference in sound pressure level between two rooms normalised for the absorption area of the receiving room.
Standardised level difference [D_{nT}]	The difference in sound pressure level between two rooms normalised for the reverberation time of the receiving room.
Weighted standardised level difference [$D_{nT,w}$]	A single figure representation of the air-borne sound insulation of a partition based upon the level difference. Generally used to present the performance of a partition when measured in situ on site.
C_{tr}	A value added to an R_w or $D_{nT,w}$ value to account for variations in the spectrum.
Impact sound isolation	The resistance of a floor or wall to transmit impact sound.
Impact sound pressure level [L_i]	The sound pressure level in the receiving room produced by impacts subjected to the adjacent floor or wall by a tapping machine.
Normalised impact sound pressure level [L_n]	The impact sound pressure level normalised for the absorption area of the receiving room.
Weighted normalised impact sound pressure level [$L_{n,w}$]	A single figure representation of the impact sound insulation of a floor or wall based upon the impact sound pressure level measured in a laboratory.
Weighted standardised impact sound pressure level [$L'_{nT,w}$]	A single figure representation of the impact sound insulation of a floor or wall based upon the impact sound pressure level measured in situ on site.
C_I	A value added to an L_{nW} or $L'_{nT,w}$ value to account for variations in the spectrum.
Energy Equivalent Sound Pressure Level [$L_{A,eq,T}$]	'A' weighted, energy averaged sound pressure level over the measurement period T.
Percentile Sound Pressure Level [$L_{Ax,T}$]	'A' weighted, sound pressure that is exceeded for percentile x of the measurement period T.

*Definitions of a number of terms have been adapted from Australian Standard AS1633:1985 *"Acoustics – Glossary of terms and related symbols"*

APPENDIX B: NOISE MONITORING RESULTS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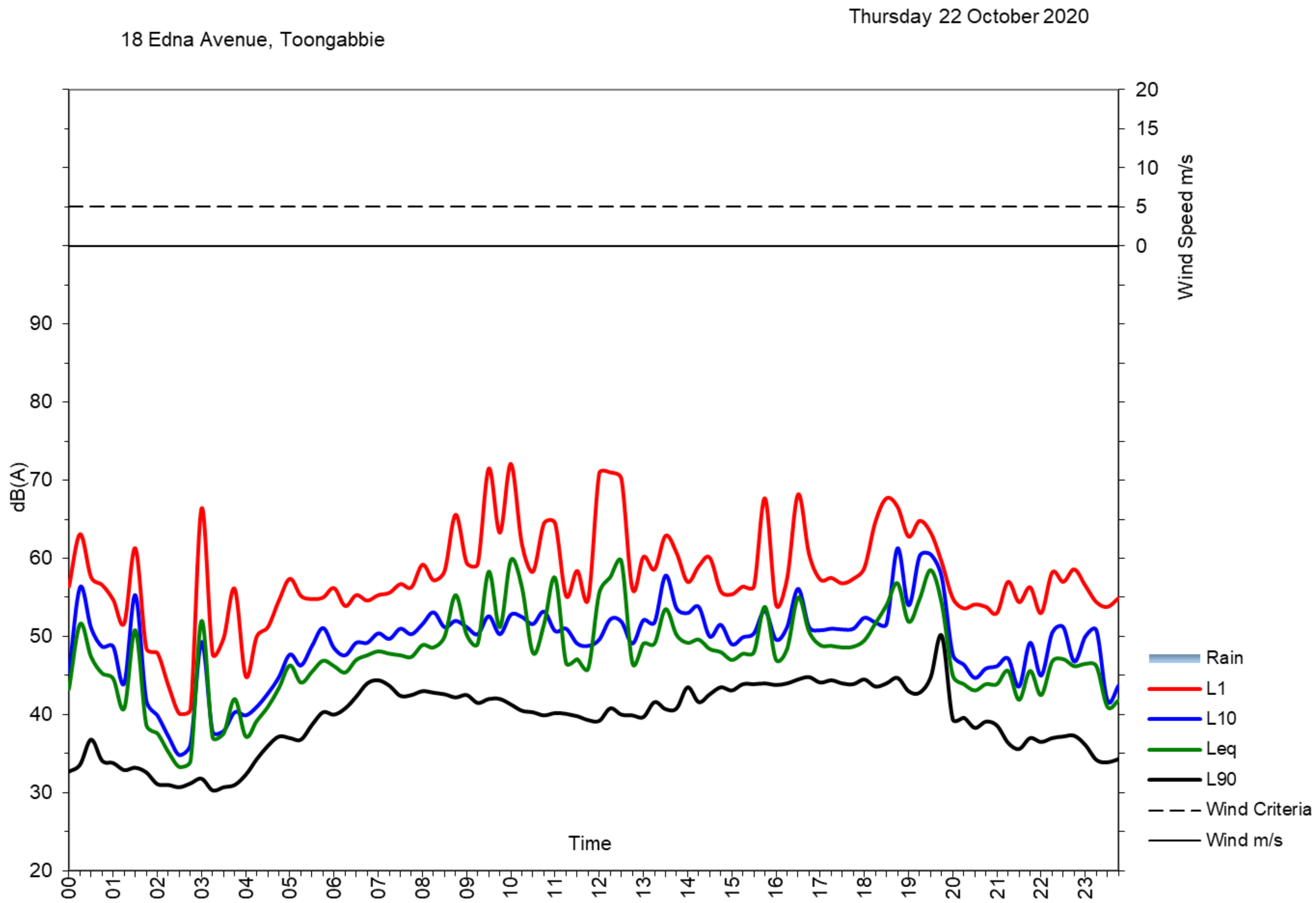
20
15
10
5
0
Wind Speed m/s
90
80
70
60
50
40
30
20
dB(A)
Time
00
01
02
03
04
05
06
07
08
09
10
11
12
13
14
15
16
17
18
19
20
21
22
23
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s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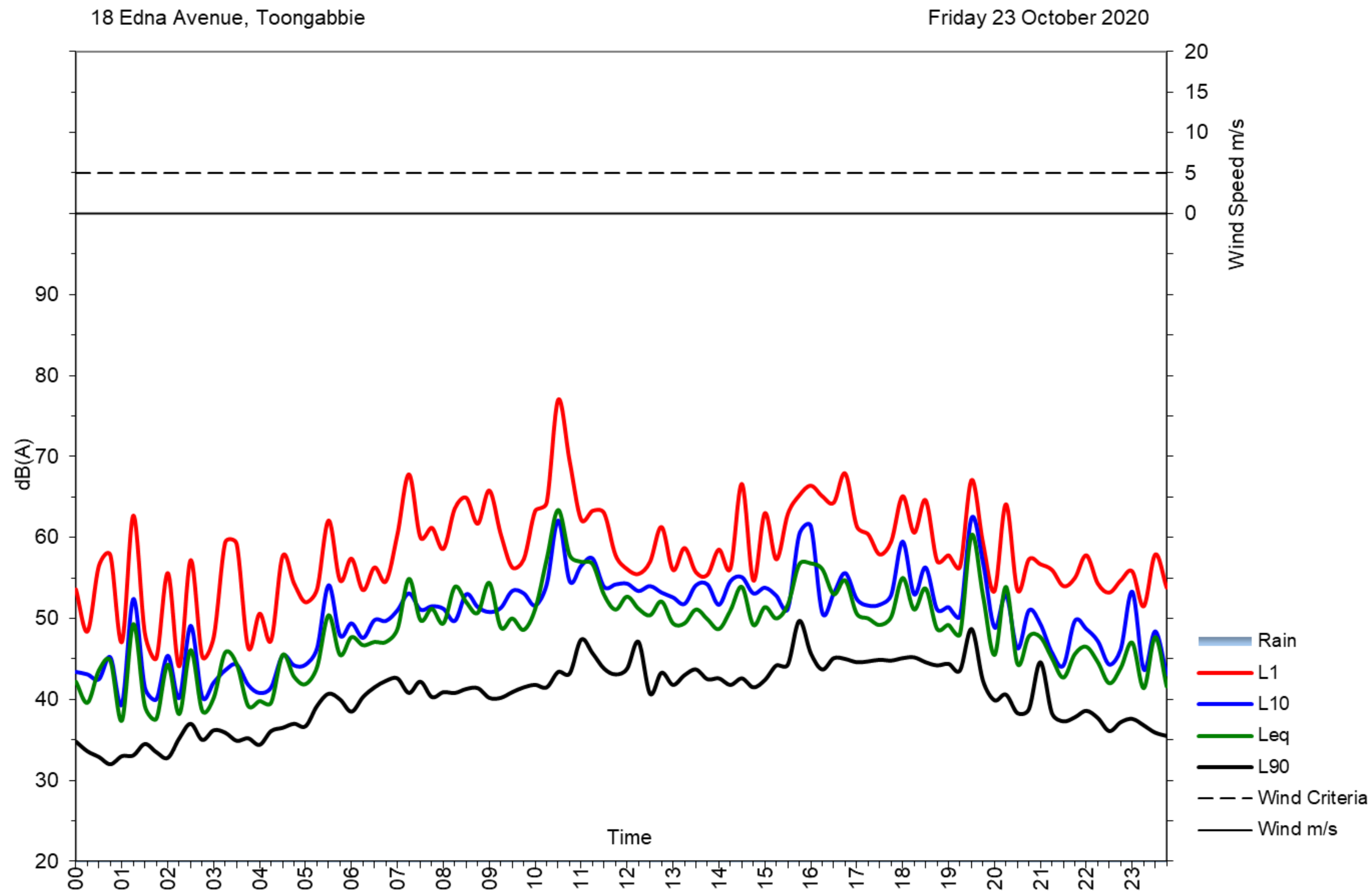
dB(A)
Wind Speed m/s
Time
90
80
70
60
50
40
30
20
20
15
10
5
0
00
01
02
03
04
05
06
07
08
09
10
11
12
13
14
15
16
17
18
19
20
21
22
23
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s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Friday 23 October 2020
dB(A)
Wind Speed m/s
Time
20
15
10
5
0
90
80
70
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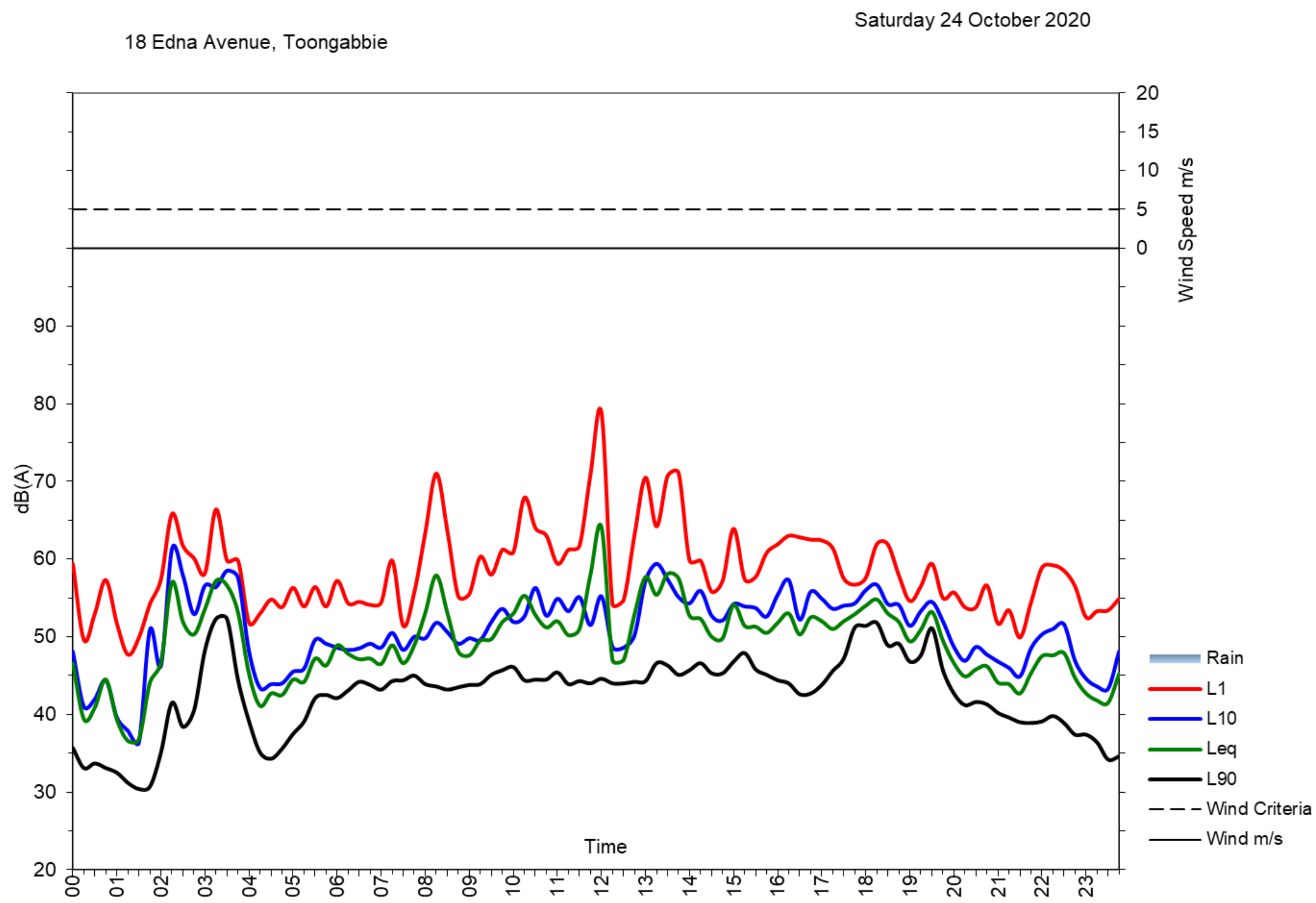
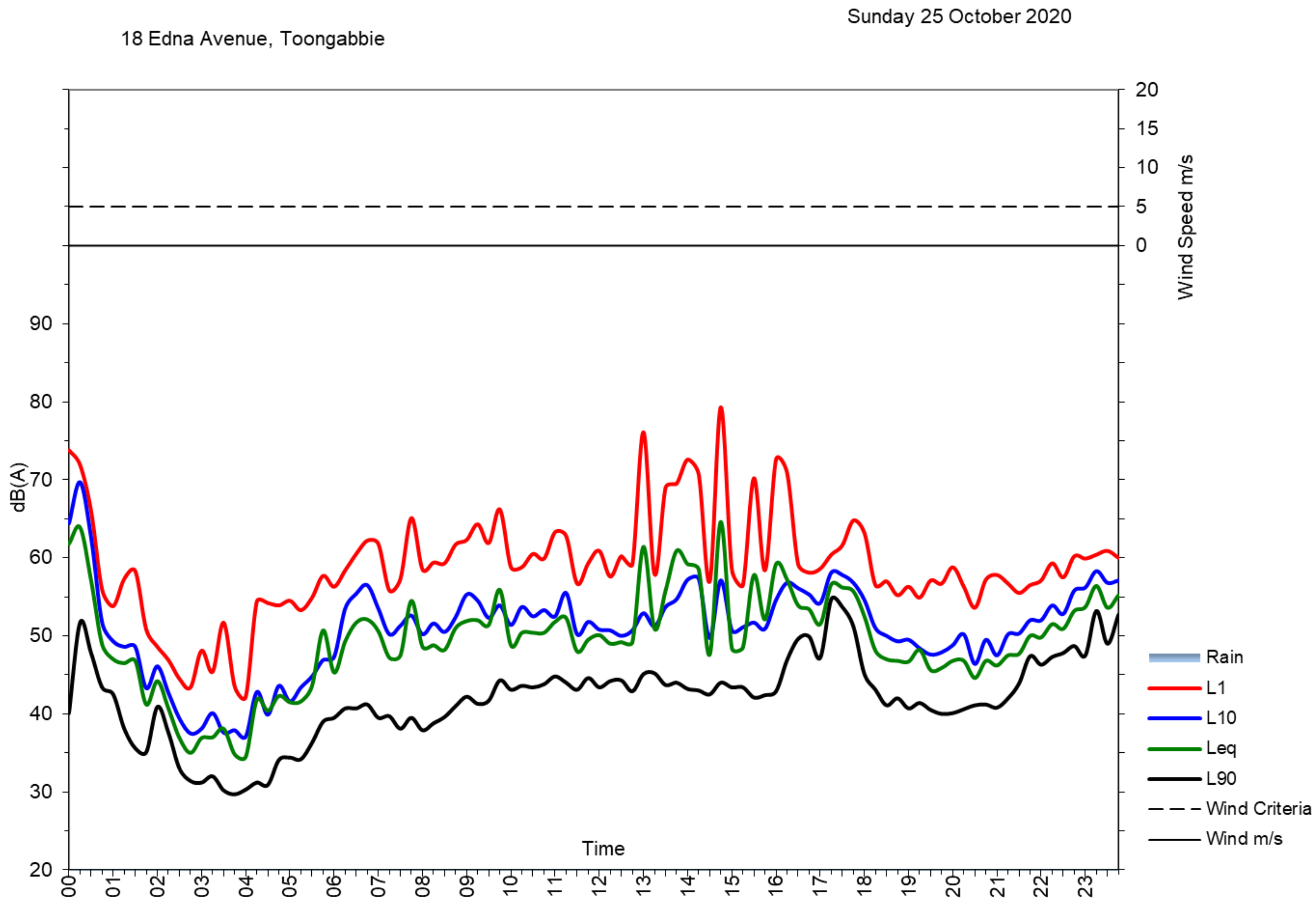
50
40
30
20
00
01
02
03
04
05
06
07
08
09
10
11
12
13
14
15
16
17
18
19
20
21
22
23
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s



18 Edna Avenue, Toongabbie
Saturday 24 October 2020
20
15
10
5
0
Wind Speed m/s
90
80
70
60
50
40
30
20
dB(A)
Time
00
01
02
03
04
05
06
07
08
09
10
11
12
13
14
15
16
17
18
19
20
21
22
23
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s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18 Edna Avenue, Toongabbie
20
15
10
5
0
Wind Speed m/s
90
80
70
60
50
40
30
20
dB(A)
Time
00
01
02
03
04
05
06
07
08
09
10
11
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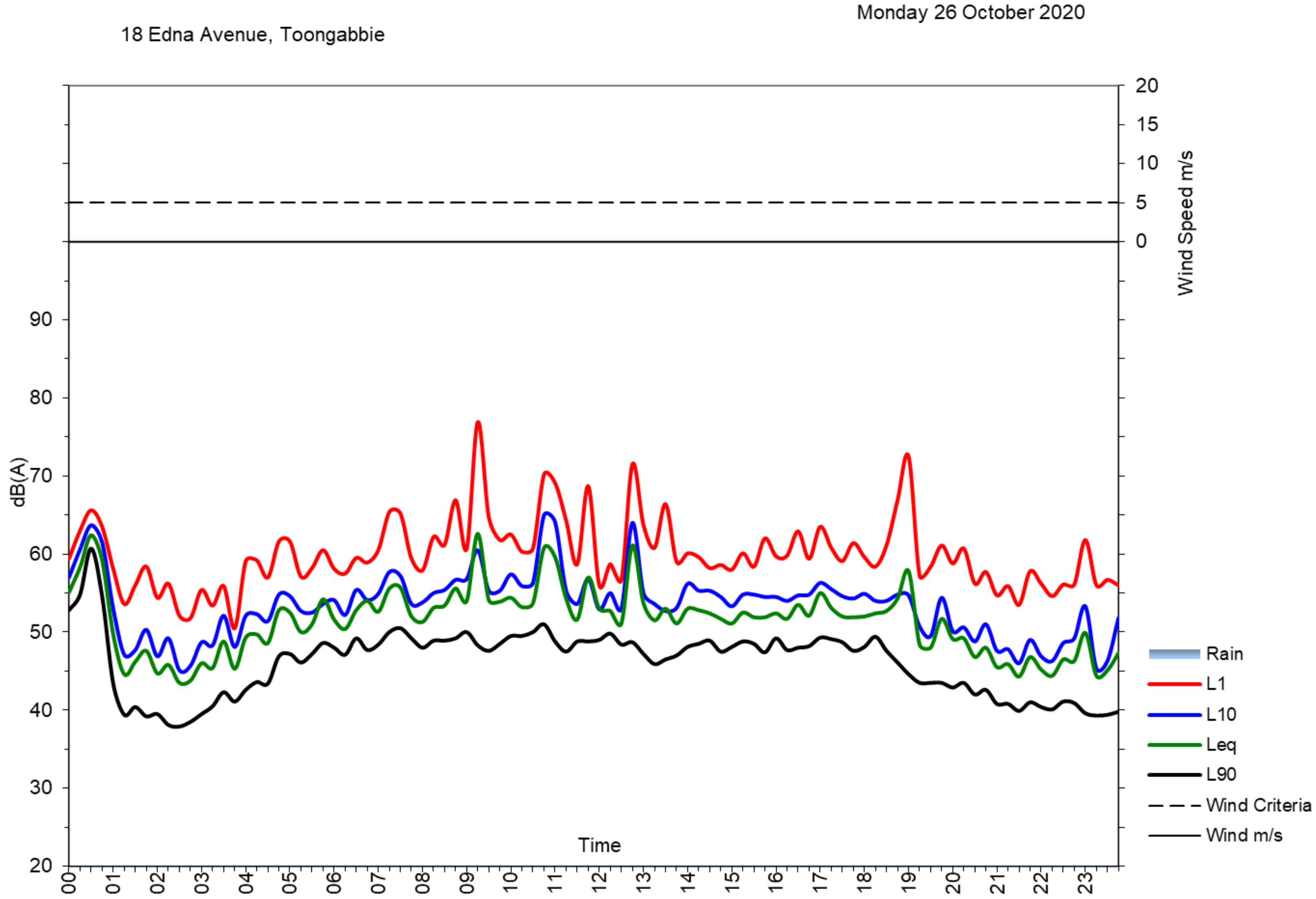
16
17
18
19
20
21
22
23
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s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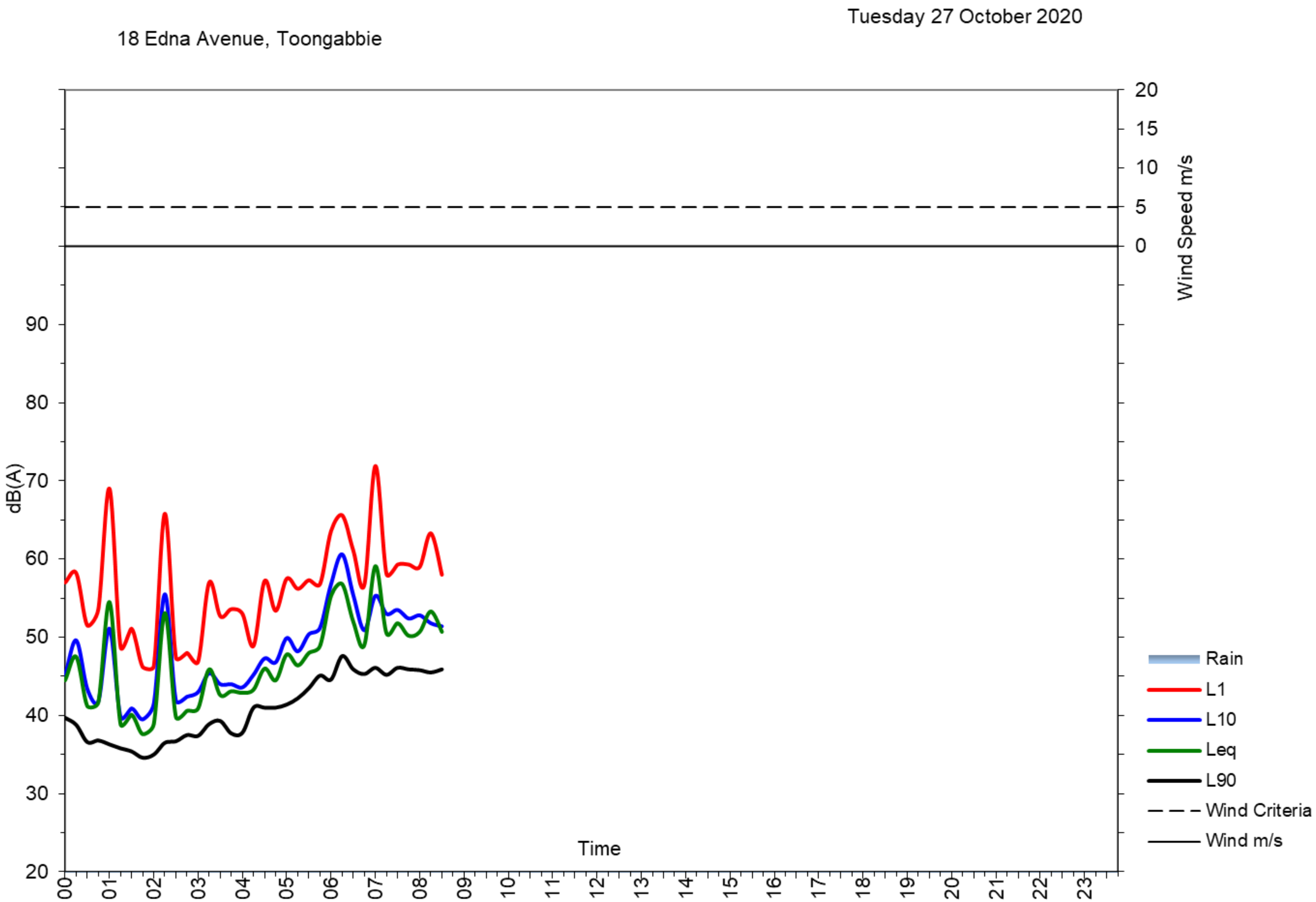
18 Edna Avenue, Toongabbie
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s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Tuesday 27 October 2020
20
15
10
5
0
Wind Speed m/s
90
80
70
60
50
40
30
20
dB(A)
Time
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01
02
03
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22
23
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s