DCI SYD02 Data Centre, Eastern Creek – Noise & Vibration Impact Assessment (NVIA)

LCI (Australia) Pty Ltd

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1 INTRODUCTION

1.1 Background

DCI Data Centres is proposing to expand its existing data centre located at 90 Peter Brock Drive, Eastern Creek. The existing data centre is known as SYD01. The proposed new data centre is known as SYD02.

On 1 September 2023, the then Department of Planning and Environment (the Department), as delegate of the then Minister for Planning and Public Spaces (the Minister), approved a State significant development application from NineZero DC Sub TC I Pty Limited (trading as DCI Data Centres, or DCI) for the expansion of DCI's Eastern Creek Data Centre located at 90 Peter Brock Drive, Eastern Creek in the Blacktown local government area (LGA).

The project was determined to be State Significant Development (SSD-21342738) and Development Consent was granted on 01/09/2023.

During detailed design for the project, DCI has identified the need for revision to the approved design. As such, DCI is proposing to modify the development consent to accommodate revised design.

To support the original application for development consent, an Environmental Impact Statement (EIS) was prepared in August 2022 (Eastern Creek Data Centre Expansion, Environmental Impact Statement, PJEP, Aug, 2022). This EIS included information on the potential noise and vibration impacts of the proposed data centre development.

This report provides an update to the noise and vibration impact considerations of the project.

1.2 Project Location

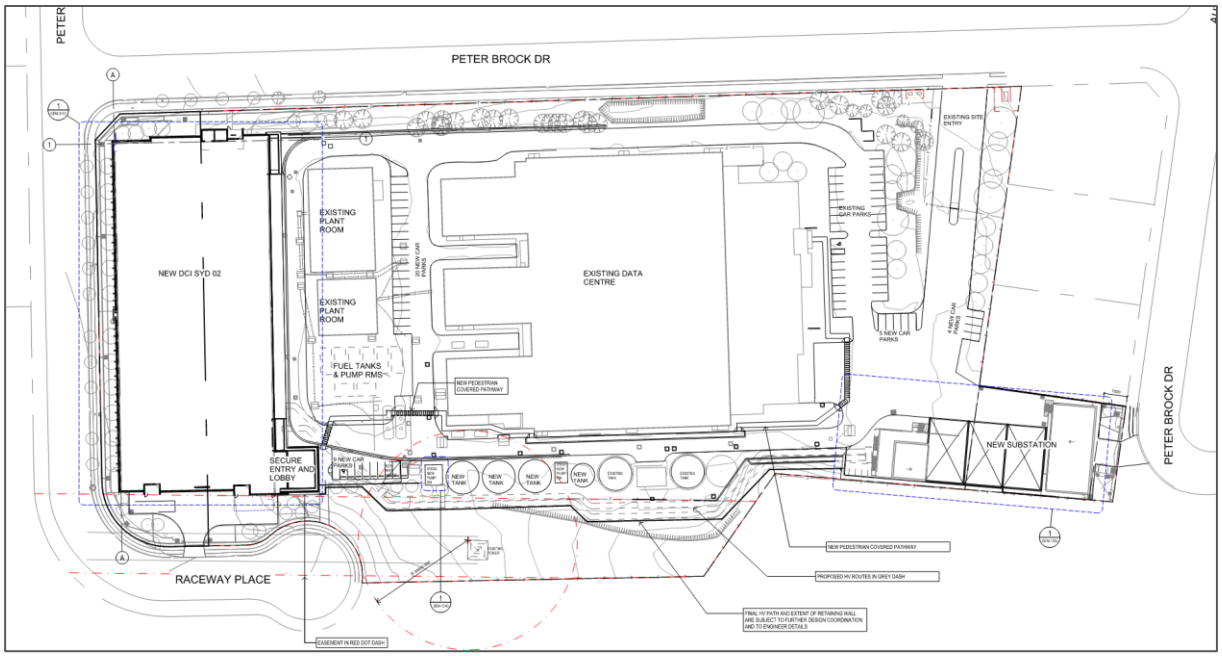
The project site is located at 90 Peter Brock Drive, Eastern Creek within Blacktown City Council.

Lot references are:

- Lot 34 DP 1131779
- Lots 32 & 33 PD 1140168
- Lot 25 DP 1122038

The existing data centre site has a total area of approximately 3.5 hectares. The expanded site has a total area of 4.1 hectares. The project site and majority of adjacent land is zoned IN1 General Industrial. To the southeast of the project is Prospect Nature Reserve. An overview map is shown in Figure 1.

Figure 1 Proposed DCI SYD02, Eastern Creek Data Centre – Site Plan



1.3 Project Overview

The Project involves the construction, fit out and operation of a multi-story, 63MW Data Centre building (SYD02) comprising:

- 2 low levels of plant, office, storage areas and 3 levels of Data Halls.
    - Lvl 1 – 4 off 4.5 MW Air Cooled
    - Lvl 2 – 4 off 9 MW Liquid Cooled
    - Lvl 3 – 2 off 4.5 MW Air Cooled + plant
- Ancillary office spaces and amenities.
- Carparking, loading docks, access roadways and landscaping.
- Zone Substation Support Works

It is proposed that the data centre would operate for 24 hours, 7 days a week.

The Proposal is shown in Figure 1 above. The Zone Substation to the south-east of the site is also shown in this figure. Drawings of the other areas relevant to the noise and vibration impact assessment are shown in the below figures.

Figure 2 Proposed DCI SYD02, Eastern Creek Data Centre – Roof

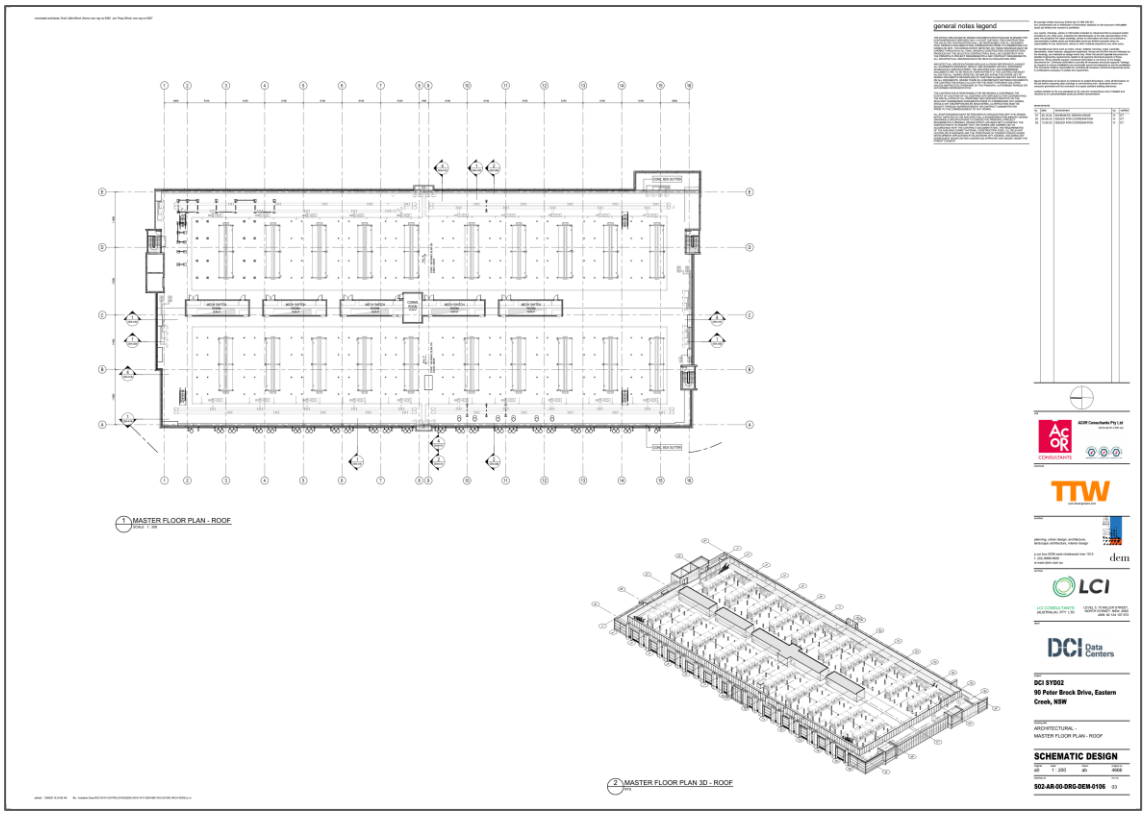


Figure 3 Proposed DCI SYD02, Eastern Creek Data Centre – Upper Roof

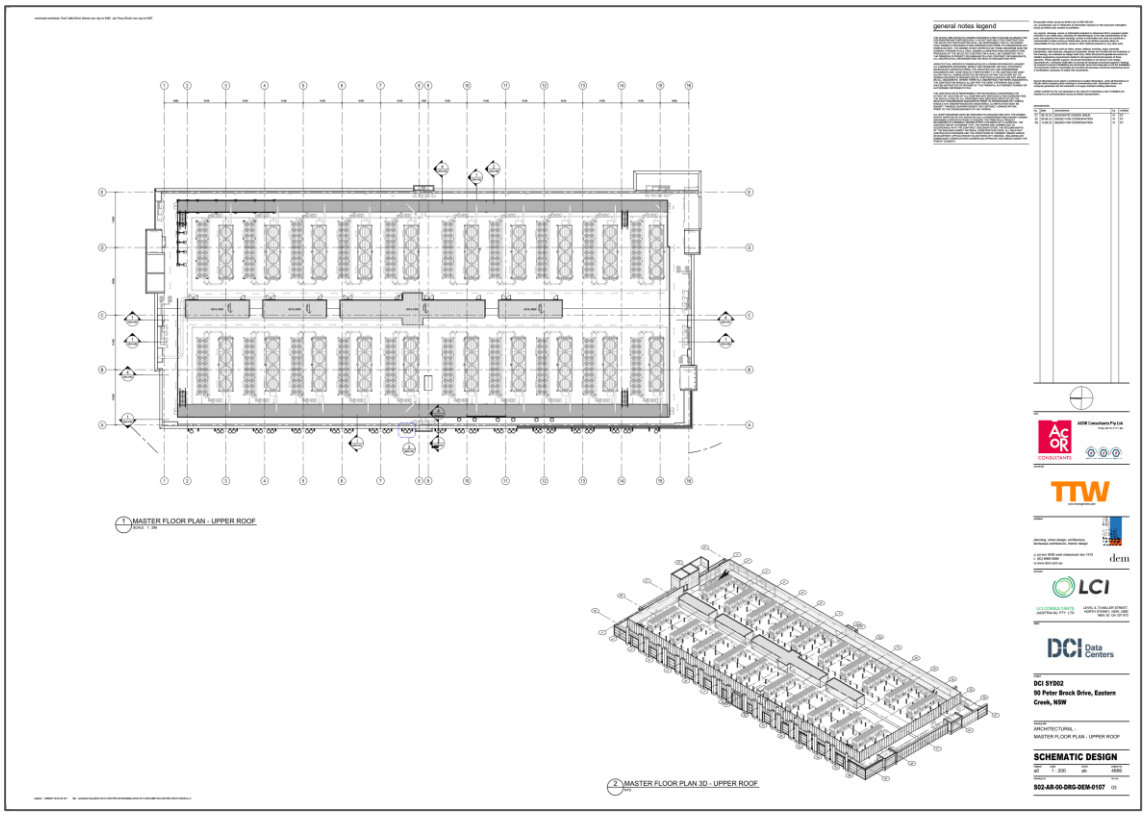
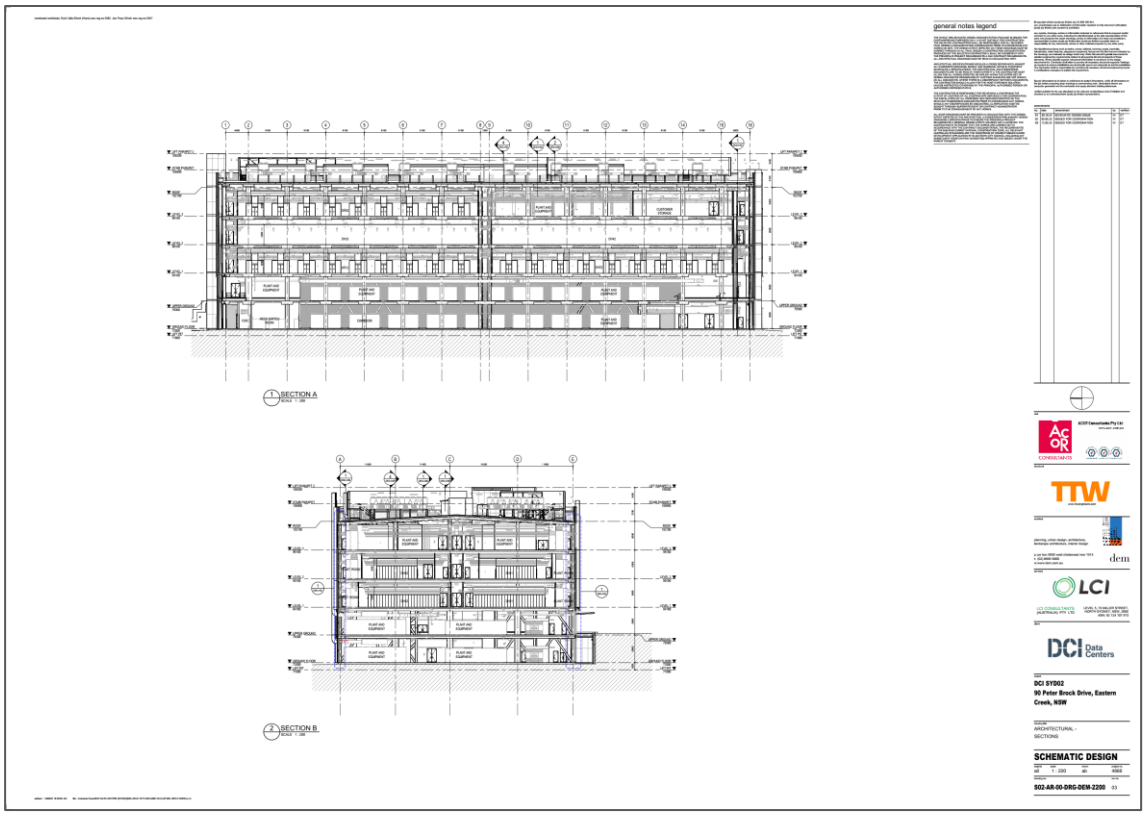


Figure 4 Proposed DCI SYD02, Eastern Creek Data Centre – Sections



1.4 Nearest Sensitive Receivers

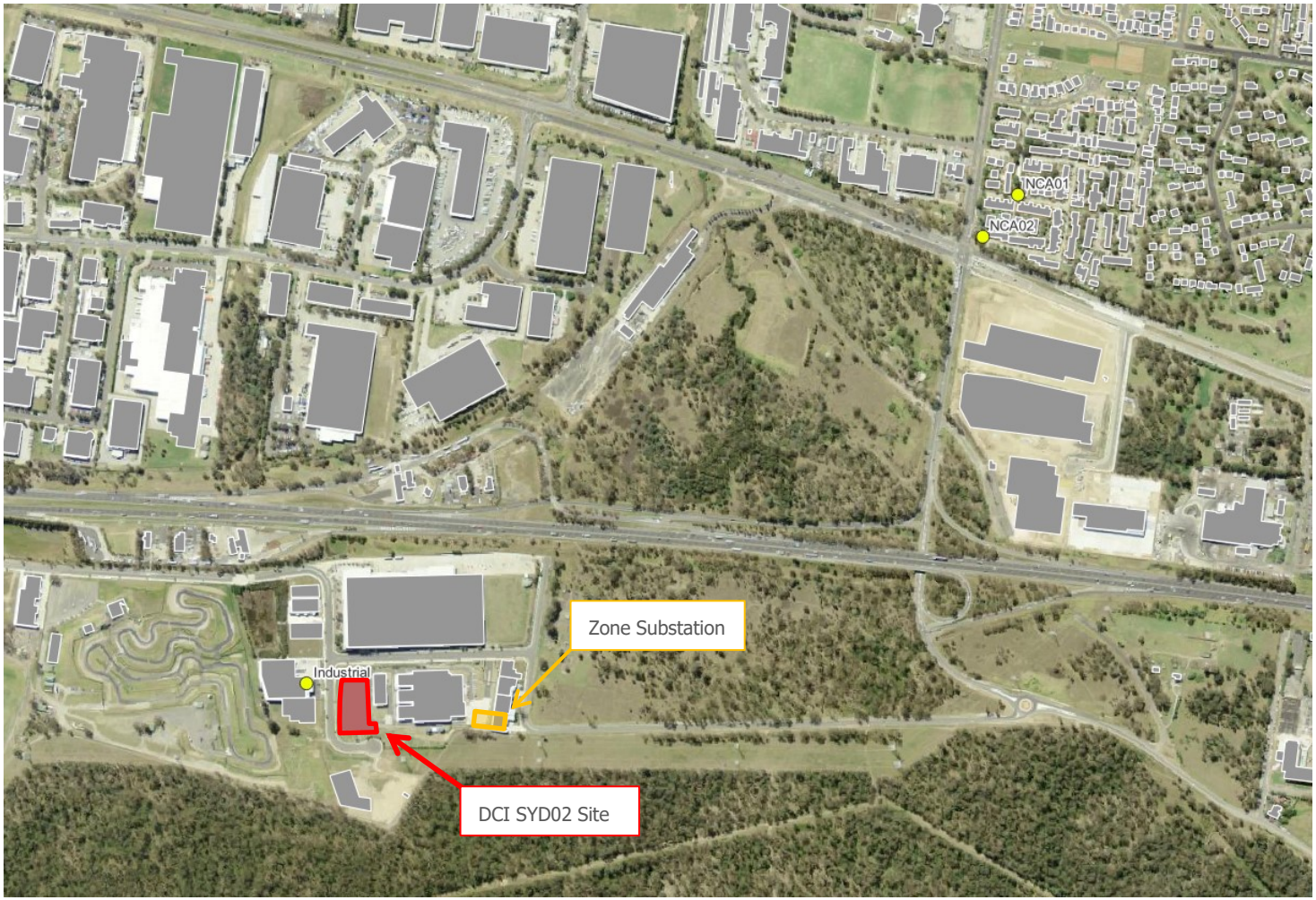
The site is bounded by other industrial premises including the existing data centre to the east. The site is located approximately 250 m south of the Western Motorway. To the south of the site is the Prospect Reservoir and surrounding lands which extends for approximately 3 km.

Several potentially impacted noise receivers are located in the vicinity of the subject site. The receivers in this report are considered representative of the closest off-site receivers for the proposed data centre. The considered receivers are listed in Table 1 and presented in Figure 5. The Noise Catchment Areas (NCAs) have been defined by RWDI Australia Pty Ltd as part of their *Noise & Vibration Impact Assessment* Report, reference number RWDI # 2104000, dated 13th April 2022, submitted as part of the approved SSDA (SSD-21342738).

Table 1 Nearest Potentially Affected Receivers

Receptor ID	Address	Type of Receiver	Receiver Height
NCA01	177 Reservoir Road, Blacktown NSW 2148	Residential	1.5 m, 4.5 m
NCA02	179 Reservoir Road, Blacktown NSW 2148	Residential	1.5 m, 4.5 m
Industrial	2 Raceway Place, Eastern Creek NSW 2766	Industrial	10 m

Figure 5 Site Location and Surrounding Receivers



2 NOISE EMISSION CRITERIA

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 Operational Noise Criteria Derived by RWDI Australia Pty Ltd

Noise monitoring at the project site has previously been undertaken by RWDI Australia Pty Ltd as part of their *Noise & Vibration Impact Assessment* Report, reference number RWDI # 2104000, dated 13th April 2022, submitted as part of the approved SSDA (SSD-21342738).

Based on the noise monitoring conducted, RWDI have developed operational noise criteria for the proposed development. The relevant section from this report is reproduced below.

Figure 6 RWDI Australia Pty Ltd Operational Noise Criteria (sourced from Doc. No.: RWDI # 2104000, dated 13th April 2022)

4 OPERATIONAL NOISE CRITERIA

4.1 NSW Noise Policy for Industry

The *Noise Policy for Industry* (NPfI) guideline is considered an appropriate basis for the development of criteria to assess the potential impact of noise emissions associated with the proposal on surrounding receivers.

Noise emissions and potential noise impact from the operation of the proposed development is assessed with respect to the site-specific noise trigger levels based on the *NPfI*. The assessment procedure has two components: intrusiveness and amenity.

4.1.1 Intrusiveness Noise Level

For assessing intrusiveness, the background noise level (L_{A90}) is measured and the RBL is determined. The intrusiveness of an industrial noise source may generally be considered acceptable if the equivalent continuous noise level (L_{Aeq}) of the source (measured over a 15-minute period) does not exceed the background noise level (RBL) by more than 5dBA.

The intrusiveness noise levels for the surrounding residential receivers are presented in **Table 4-1**.

Table 4-1: Project Intrusiveness Noise Level

Receiver	Time of day	Intrusiveness noise level $L_{Aeq,15min}$ dBA
NCA01	Day	44
	Evening	43
	Night	38
NCA02	Day	62
	Evening	58
	Night	54

4.1.2 Amenity Noise Level

The project amenity noise level limits the total noise from all industrial noise sources affecting a receiver. Different amenity noise levels apply for different types of receivers (e.g. residential, commercial, industrial – or for areas specifically reserved for passive recreation) and different areas (e.g. urban, suburban, rural). The amenity noise level applies to the $L_{Aeq,period}$ during the full day (or evening or night). To ensure that noise from cumulative industrial developments remains within the recommended amenity noise levels for an area, a project amenity noise level applies for each new source of industrial noise. This is calculated as the recommended amenity noise level for the receiver type minus 5 dBA. Where noise sources are not continuous for the whole period, 3 dB is added to convert $L_{Aeq(period)}$ to $L_{Aeq(15minute)}$.

Table 4-2 below presents the relevant project amenity noise levels, determined in accordance with the *NPfI*. NCA01 has been designated as suburban.

Figure 7 RWDI Australia Pty Ltd Operational Noise Criteria (sourced from Doc. No.: RWDI # 2104000, dated 13th April 2022) (continued)

The *NPfI* classifies urban residential as being "dominated by 'urban hum' or industrial noise source, where urban hum means the aggregate sound of many unidentifiable, mostly traffic and/or industrial related sound sources" as well as having background levels greater than 45 ,40, and 35 dBA during the day, evening, and night periods, respectively. As such, NCA02 has been designated as urban given the high existing background noise and short distance to the Great Western Highway.

Table 4-2: Project Amenity Noise Level

Noise Amenity Area	Time of Day	Recommended Amenity Noise Level $L_{Aeq,period}$ dBA	Project Amenity Trigger Level $L_{Aeq,15min}$ dBA
NCA01 (Suburban)	Day	55	53
	Evening	45	43
	Night	40	38
NCA02 (Urban)	Day	60	58
	Evening	50	48
	Night	45	43
Industrial	All times in use	70	68

4.1.3 Sleep Disturbance

Noise sources of short duration and high level that may cause disturbance to sleep if occurring during the night-time need to be considered.

The approach recommended by the *NPfI* is to apply the following initial screening noise levels:

- $L_{Aeq,15min}$ 40dBA or the prevailing RBL + 5dB, whichever is the greater; and/or
- L_{AFmax} 52dBA or the prevailing RBL + 15dB, whichever is the greater.

The sleep disturbance screening noise levels apply outside bedroom windows during the night period.

Where the screening noise levels cannot be met, a detailed maximum noise level event assessment should be undertaken. It may also be appropriate to consider other guidelines including the NSW *Road Noise Policy* (RNP) which contains additional guidance relating to potential sleep disturbance impacts.

Table 4-3 presents the screening level for maximum noise level events. The value in **BOLD** is the greater of the $L_{Aeq,15min}$ and L_{AFmax} descriptors.

Table 4-3: Maximum Noise Level Event Screening Levels, L_{AFmax}

Receiver	RBL	Screening Level $L_{Aeq,15min}$	Screening Level L_{AFmax}
NCA01	33	38/**40**	48/**52**
NCA02	49	**54**/40	**64**/52

Figure 8 RWDI Australia Pty Ltd Operational Noise Criteria (sourced from Doc. No.: RWDI # 2104000, dated 13th April 2022) (continued)

4.1.4 Modifying Factors

The *NPfI* includes correction factors such as tonal noise, low-frequency noise, intermittent noise, and duration. Where two or more modifying factors are present, the maximum adjustment to a noise source level is 10 dBA (excluding duration correction).

Noise emissions from a data centre typically would not require modifying factors. Of the applicable factors, only tonal or low frequency could be applied. However, these impacts are usually the result of faulty equipment and not inherent in the operation of the site.

4.1.5 Project Noise Trigger Levels

The amenity and intrusiveness noise levels and resulting project noise trigger levels (PNTL) are shown in **Table 4-4** and include the sleep disturbance (screening) levels.

Table 4-4: Project Noise Trigger Level

Noise Amenity Area	Time of Day	PNTL	Noise Descriptor
NCA01	Day	44	$L_{Aeq,15min}$
	Evening	43	$L_{Aeq,15min}$
	Night	38	$L_{Aeq,15min}$
	Night	52	L_{AFmax}
NCA02	Day	58	$L_{Aeq,15min}$
	Evening	48	$L_{Aeq,15min}$
	Night	43	$L_{Aeq,15min}$
	Night	64	L_{AFmax}
Industrial	When in use	68	$L_{Aeq,15min}$

2.3 Operational Noise Criteria from Approved SSDA (SSD-21342738)

Operational noise criteria detailed in the Development Consent Conditions (SSD-21342738) are reproduced below.

Figure 9 Development Consent Conditions (SSD-21342738) Related to Noise Impacts

PART B SPECIFIC ENVIRONMENTAL CONDITIONS

NOISE

Hours of Work

B1. The Applicant must comply with the hours detailed in Table 1 below.

Table 1 *Hours of Work*

Activity	Day	Time
Construction	Monday – Friday Saturday	7 am to 6 pm 8 am to 1 pm
Operation (excluding back-up generator testing)	Monday – Sunday	24 hours
Back-up generator testing	Monday – Saturday	7 am to 6 pm

B2. Works outside of the hours identified in condition B1 may be undertaken in the following circumstances:

(a) works that are inaudible at the nearest sensitive receivers;

(b) works agreed to in writing by the Planning Secretary;

(c) for the delivery of materials required outside these hours by the NSW Police Force or other authorities for safety reasons; or

(d) where it is required in an emergency to avoid the loss of lives, property or to prevent environmental harm.

Construction Noise Limits

B3. The development must be constructed to achieve the construction noise management levels detailed in the ICNG (as may be updated or replaced from time to time). All feasible and reasonable noise mitigation measures must be implemented and any activities that could exceed the construction noise management levels must be identified and managed in accordance with the management and mitigation measures in the Appendix 2 of this consent.

Construction Noise and Vibration Management Plan

B4. Prior to the commencement of construction, the Applicant must prepare a Construction Noise and Vibration Management Plan (CNVMP) for the development to the satisfaction of the Planning Secretary. A copy of the CNVMP must be included in the development's CEMP (see condition C2), and must:

(a) be prepared by a suitably qualified and experienced noise expert(s);

(b) describe procedures for achieving the noise management levels in the ICNG (as may be updated or replaced from time to time);

(c) describe the measures that would be implemented to manage:

(i) high noise-generating works (such as piling); and

(ii) potential vibration impacts to nearby properties; and

(d) include a complaints management system that would be implemented for the duration of construction.

B5. The Applicant must:

(a) not commence construction until the CNVMP (see by condition B4) has been approved by the Planning Secretary; and

(b) implement the most recent version of the CNVMP approved by the Planning Secretary for the duration of construction.

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Figure 10 Development Consent Conditions (SSD-21342738) Related to Noise Impacts (continued)

Operational Noise Limits

B6. The Applicant must ensure that noise generated by the operation of the development does not exceed the noise limits in Table 2 at the receiver locations shown in Appendix 3 of this consent.

Table 2 *Noise Limits (dB(A))*

Location	Time period	Noise limit $L_{Aeq(15\ minute)}$
Residential receivers in NCA01	Night	35
Residential receivers in NCA02	Night	41

The noise limits in Table 2 do not apply during emergency operations.

Note: *Noise generated by the development is to be measured in accordance with the relevant monitoring performance procedures and exemptions (including certain meteorological conditions) of the NSW Noise Policy for Industry (EPA, 2017) (as may be updated or replaced from time to time).*

Operational Noise Verification Report

B7. Within three months of the commencement of full operation of the development (described in the EIS as being when all data storage equipment and associated infrastructure is in place and operating), or as otherwise directed by the Planning Secretary, the Applicant must prepare and submit a noise verification report for the development. The Noise Verification Report must:

(a) be prepared to the satisfaction of the Planning Secretary by a suitably qualified acoustic consultant;

(b) demonstrate that noise verification has been carried out by a suitably qualified and experienced acoustic consultant in accordance with the latest version of:

(i) *AS 1055:2018 Acoustics – Description and measurement of environmental noise* (Standards Australia, 2018); and

(ii) *Approved Methods for the Measurement and Analysis of Environmental Noise in NSW* (EPA, 2022); and

(c) include:

(i) details of the measurement location/s, including justification for the use of any alternative or intermediate location/s in accordance with Section 7 of the *Noise Policy for Industry* (EPA, 2017);

(ii) an analysis of the development's compliance with the noise limits specified in condition B6;

(iii) an outline of management actions to be taken to address circumstances where the noise limits specified in condition B6 are exceeded; and

(iv) a description of contingency measures in the event management actions are not effective in reducing noise levels to an acceptable level.

VIBRATION

Vibration Criteria

B8. Vibration caused by construction at any residence or structure outside the site must be limited to:

(a) for structural damage, the latest version of *DIN 4150-3 (1992-02) Structural vibration - Effects of vibration on structures* (German Institute for Standardisation, 1999); and

(b) for human exposure, the acceptable vibration values set out in the *Environmental Noise Management Assessing Vibration: a technical guideline* (DEC, 2006) (as may be updated or replaced from time to time).

B9. The limits in condition B8 apply unless otherwise outlined in the development's CNVMP (see condition B4).

AIR QUALITY

Dust Minimisation

B10. The Applicant must take all reasonable steps to minimise dust generated during all works authorised by this consent.

B11. During construction, the Applicant must ensure that:

(a) exposed surfaces and stockpiles are suppressed by regular watering or other alternative suppression method;

(b) all trucks entering or leaving the site with loads have their loads covered;

(c) trucks associated with the development do not track dirt onto the public road network;

(d) public roads used by these trucks are kept clean; and

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2.4 Construction Noise and Vibration Criteria

Construction noise and vibration impacts have previously been assessed as part of the *Noise & Vibration Impact Assessment* Report undertaken by RWDI Australia Pty Ltd as part of their, reference number RWDI # 2104000, dated 13th April 2022, submitted as part of the approved SSDA (SSD-21342738).

In addition, a *Construction Noise and Vibration Management Plan* has been prepared for the site by Pulse White Noise Acoustics (PWNA), reference *240442-2 – DCI Datacentre – Construction Noise and Vibration Management Plan – R1,* dated 9th May 2025.

These documents identify construction noise limits and provide construction noise and vibration control and mitigation measures to satisfy the requirements of the Development Consent Conditions (SSD-21342738).

This report provides an update to the noise and vibration impact considerations of the project, which includes accommodating a revised design. Since the construction methodology is not proposed to change from that identified previously by RWDI and PWNA, no further assessment of construction noise and vibration impacts is included as part of this report.

2.5 Operational Road Traffic Noise Criteria

Individual developments have the potential to generate additional road traffic and associated noise impacts from vehicles accessing the site. The EPAs Road Noise Policy provides guidance on appropriate noise criteria which should be considered.

Presented below are the applicable noise criteria for road traffic on arterial and sub-arterial roads. Access routes for vehicles accessing the site are limited to arterial and sub-arterial roads only (assumed to be the Western Motorway, Reservoir Road and Peter Brock Drive). Hence, the noise criteria for local roads have not been provided.

Table 2 Road Traffic Noise Assessment Criteria for Residential Land Uses

Road category	Type of project/land use	Assessment Criteria – dB(A)	
		Day (7:00 am to 10:00 pm)	Night (10:00 pm to 7:00 am)
Freeway/arterial/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)

Where the predicted noise levels for the project indicate likelihood to exceed the noise criteria presented in Table 2, it is considered not reasonable and feasible to provide noise mitigation measures if the project does not increase noise by greater than 2.0 dB. A change of 2 dB to 3 dB in road traffic noise is often considered to be indiscernible.

In line with the assumptions made in the *Noise & Vibration Impact Assessment* Report undertaken by RWDI, all road traffic is assumed to be via Peter Brock Drive towards Reservoir Road before linking up with the Western Motorway. No residential receivers are located along this route. On this basis, there is no noise impact on residences due to additional traffic from construction and operational phases.

As such, no further assessment of road traffic noise impacts is included as part of this report.

2.6 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, six (6) at a time during the day period only.

The generator testing approach for SYD02 is understood to include the following:

- Monthly Testing – 5-6 generators at a time for 15 mins.
- Annual (Load Test) – 5-6 generators at a time for 1 hour.

The above generator testing regime will keep the total generator use under 200 hours (operational) per year, such that an EPL licence will not be required.

Based on the probability of power outages at the Proposal site, 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.

3 OPERATIONAL NOISE IMPACTS

3.1 Predictive Noise Modelling Methodology

Predictive noise modelling in this report was carried out using the ISO 9613 algorithm within iNoise v2024.2.1. 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.

The meteorological assessment has assessed a worst-case situation, which entails the calculation of the worst-case weather in all directions for all receivers. The following weather conditions have been included in the assessment, in accordance with the requirements of Fact Sheet D of the NPfI.

Standard meteorological conditions:

- 0.5 m/s wind speeds; and
- Stability category D.

Daytime and evening noise enhancing properties:

- 3 m/s wind speeds; and
- Stability category D.

Night-time noise enhancing properties:

- 2 m/s wind speeds; and
- Stability category F.

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 noise sensitive receivers at distances greater than 100 m.

3.2 Nominal Equipment Sound Power Levels

To predict potential noise levels at the considered receivers, the noise models considers major mechanical equipment including air-cooled chillers, hybrid dry coolers and diesel generators. In this noise model, it is assumed that the generator units are containerised and feature intake and exhaust mufflers. Generators are assumed to be tested six (6) at a time during the day period only for the operational scenarios.

DCI SYD02 is proposed to comprise twenty (20) air-cooled chillers, twenty (20) hybrid dry coolers, located on the rooftop of the data centre, as well as fifty-two (52) emergency diesel generators (42 for IT load, and 10 for Mechanical), located internally on ground floor, upper ground floor, and Level 3. The modelled scenarios are based directly on documentation provided by LCI Consultants regarding realistic worst-case operating scenarios, and proposed generator testing regimes.

The generator testing approach for SYD02 is understood to include the following:

- Monthly Testing – 5-6 generators at a time for 15 mins.
- Annual (Load Test) – 5-6 generators at a time for 1 hour.

The above generator testing regime will keep the total generator use under 200 hours (operational) per year, such that an EPL licence will not be required.

Assumed Sound Power Levels of the preliminary selected air-cooled chillers and hybrid dry coolers, for all operational time periods, are shown in Table 3 and Table 4 respectively. It is noted that the sound power levels are based on the specified fan speeds and operational capacities listed in the tables, as instructed by LCI Consultants at this stage of the project.

Table 3 Sound power level (SWL) for Air-Cooled Chillers

Unit	Ambient Temp. (Fan Speed)	Octave Band Centre Frequencies, dB (Hz)								Overall (dBA)
		63	125	250	500	1000	2000	4000	8000	
Air-Cooled Chillers	25DB/20WB (46% fans)	90	94	82	82	82	80	74	71	**86 dBA**

Table 4 Sound Power Level (SWL) for Hybrid Dry Coolers

Unit	Fans	Octave Band Centre Frequencies, dB (Hz)								Overall (dBA)
		63	125	250	500	1000	2000	4000	8000	
Hybrid Dry Coolers	Jaeggie (4 fans)	90	90	87	85	82	77	70	61	**87 dBA**

The diesel generators are modelled inside an acoustic enclosure, which features treatment where necessary (including acoustic treatment to the exhaust discharge in the form of a muffler or similar, treatment to the radiator discharge / discharge stack where necessary, air intake face where necessary (in the form of acoustic louvres or similar), and enclosure treatment) to reach a maximum combined sound power level of 100 dBA. The maximum overall sound power level (logarithmic summation of all noise emitting components / faces of the generator) of the diesel generators have been provided in Table 5 below.

Table 5 Nominated Sound Power Level (SWL) for the generators in acoustic enclosures

Generator Model	Octave Band Centre Frequencies, dB (Hz)								Overall (dBA)
	63	125	250	500	1000	2000	4000	8000	
Overall Sound Power	93	102	95	95	94	94	89	83	**100 dBA**

In addition to the above sound power level data, major noise generating mechanical plant within the data halls, for both air-cooled halls and water-cooled halls, is proposed to include Fan Wall Units (FWUs) within plant rooms along the eastern and western building façades. The façade louvres are assumed to be for ornamental/weather purposes; that is, not acoustically rated. Modelled sound pressure levels for this plant includes the following:

- In each air-cooled data hall, for 100% flow, FWUs at a sound pressure level of **66 dBA at 3m** (free field).
- In each water-cooled data hall, for 100% flow, FWUs at a sound pressure level of **63 dBA at 3m** (free field).
- The Coolant Distribution Units (CDUs) located within the plant rooms are understood to be acoustically inconsequential, in terms of their noise emissions, compared to the FWUs.

The noise model also considers noise from the Zone Substation to the south-east of the site; in particular, the transformers servicing the Zone Substation.

The following transformer Sound Power Levels have been assumed in our assessment, based on similar data centre projects:

1. No-Load Sound Levels: 84 dBA Sound Power Level.
2. Cooler Bank Sound Levels: 54 dBA maximum Sound Pressure Level (measured 2m from surface), equivalent to a Sound Power Level of 68 dBA.
3. Load Sound Levels: 67 dBA Sound Power Level.

It is further understood that the above sound power levels are slightly higher compared to what is achieved in practice. Nonetheless, as a worst-case noise generating scenario, the above levels have been used in our modelling.

Note that the no-load and load sound power levels have been summated to obtain the total sound power level at full load. Therefore, a full load transformer Sound Power Level of **84 dBA** is used in our assessment.

3.3 Modelling Assumptions

In this assessment, the following assumptions have been incorporated:

- Noise generating scenarios are modelled on a worst case 15-minute period.
- Terrain on site has been sourced from the site survey.
- Terrain off site has been taken from the NSW Land and Property Information database SixMaps.
- Receivers are modelled at a height of 1.5m for single storey dwellings and 4.5m above the ground for double storey dwellings. The noise contour results are only given for a receiver height of 1.5m.
- Ground Absorption has been included in the model with the industrial areas having an absorption factor of 0 (hard), suburban areas having an absorption of 0.25 and bushland having an absorption factor of 0.7 (soft).
- On site structures and surrounding buildings have been included in the noise model.
- The height of noise sources, including the air-cooled chillers, hybrid dry coolers, and generators has been based on architectural drawings of the proposed development.
- Contour maps include the impact of façade reflections close to modelled building façades.
- The assessment for the proposed equipment is based on the sound power levels listed in Table 3, Table 4 and Table 5.
- Generators are to be tested during the day period only.
- Generator testing is assumed to take place using six (6) generators at a time.
- The primary noise sources modelled are continuous in nature. The air-cooled chillers and hybrid dry coolers will run continuously over the whole day (as is the nature of a data centre, 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.*

- Note also that the ISO9613 algorithm also includes moderate source to receiver winds by default resulting in slightly adverse conditions and higher noise levels than standard weather conditions would predict.

3.4 Modelled Scenarios

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

- Operational Scenario 1: Operational Day Scenario with twenty (20) air-cooled chillers, twenty (20) hybrid dry coolers, located on the rooftop of the data centre, and six (6) emergency diesel generators, located internally on ground floor, upper ground floor, and Level 3, running simultaneously as part of a generator testing scenario.

- Operational Scenario 2: Operational Evening/Night Scenario with twenty (20) air-cooled chillers, and twenty (20) hybrid dry coolers, located on the rooftop of the data centre.

Additionally, a hypothetical emergency noise generating scenario has been modelled, as follows:

- Hypothetical Emergency Scenario 1: Hypothetical Emergency Scenario with twenty (20) air-cooled chillers, twenty (20) hybrid dry coolers, located on the rooftop of the data centre, and fifty-two (52) emergency diesel generators, located internally on ground floor, upper ground floor, and Level 3, all running simultaneously as part of a generator testing scenario.

3.5 Predicted Noise Levels

3.5.1 Operational Scenarios (up to six Generators operating at a time)

The predicted L_{Aeq} results of the modelled operational scenarios with up to six (6) generators operating simultaneously are presented below in Table 6. 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. Also note that all contour maps show the results for noise-enhancing weather conditions, as a worst-case scenario.

Compliance with the noise criteria set out in the Development Consent Conditions (SSD-21342738) is predicted at all receivers during all operational scenarios, provided the modelling assumptions outlined above are implemented into the design of the data centre.

Table 6 Predicted Noise Levels, Operational Scenarios, L_{Aeq} (15 minute)

Receiver (Height from Ground)	Criteria (dBA)			Predicted Noise Levels (dBA)	
	Day	Evening	Night	Day Scenario with Six (6) Generators	Evening/Night Scenario with no Generators
NCA01 (4.5m)	44	43	35	27	27
NCA02 (1.5m)	58	48	41	30	30
Industrial (10m)	68	68	68	63	62

Figure 11 Operational Scenario 1 – Operational Day Scenario – Contour Map

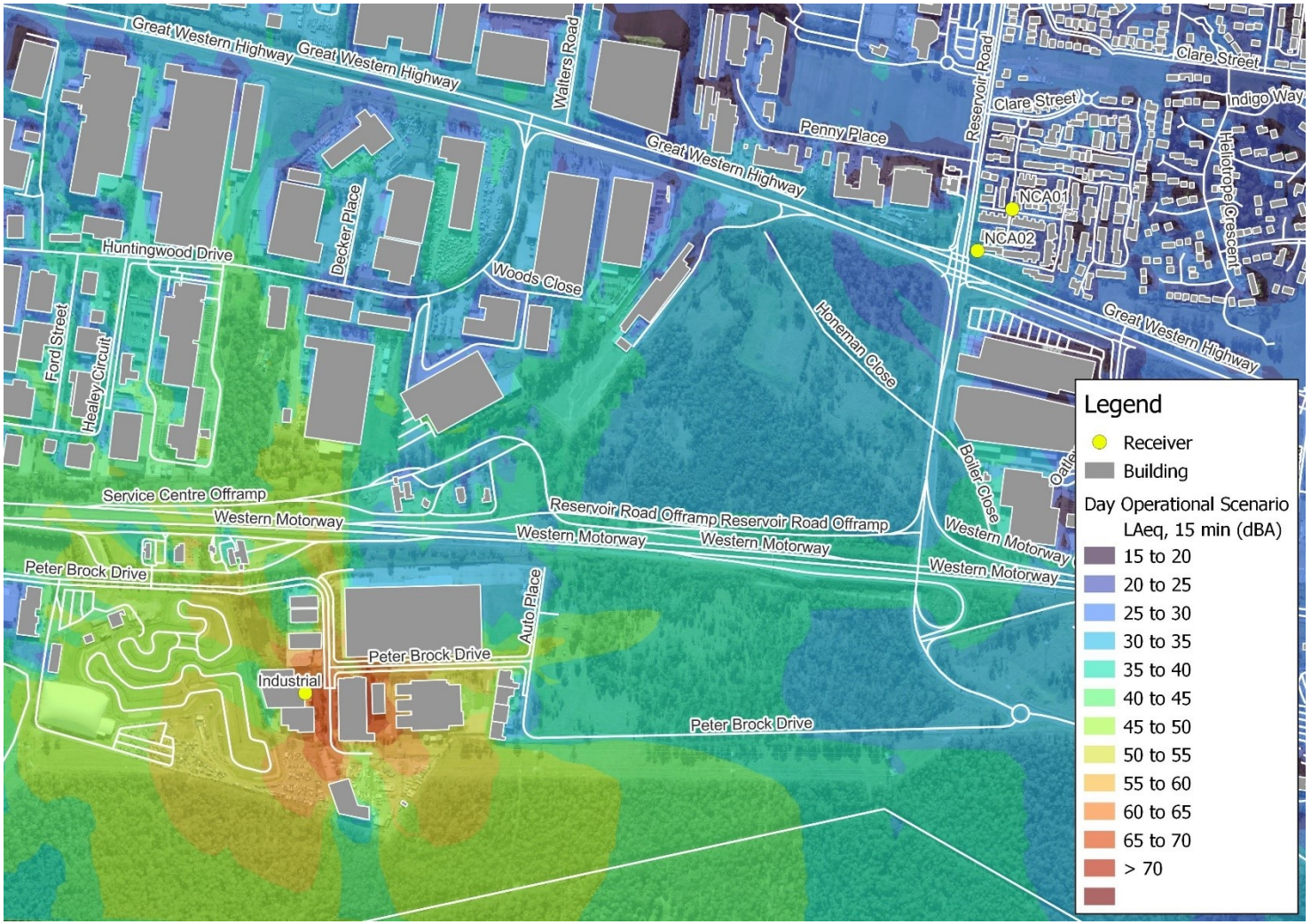
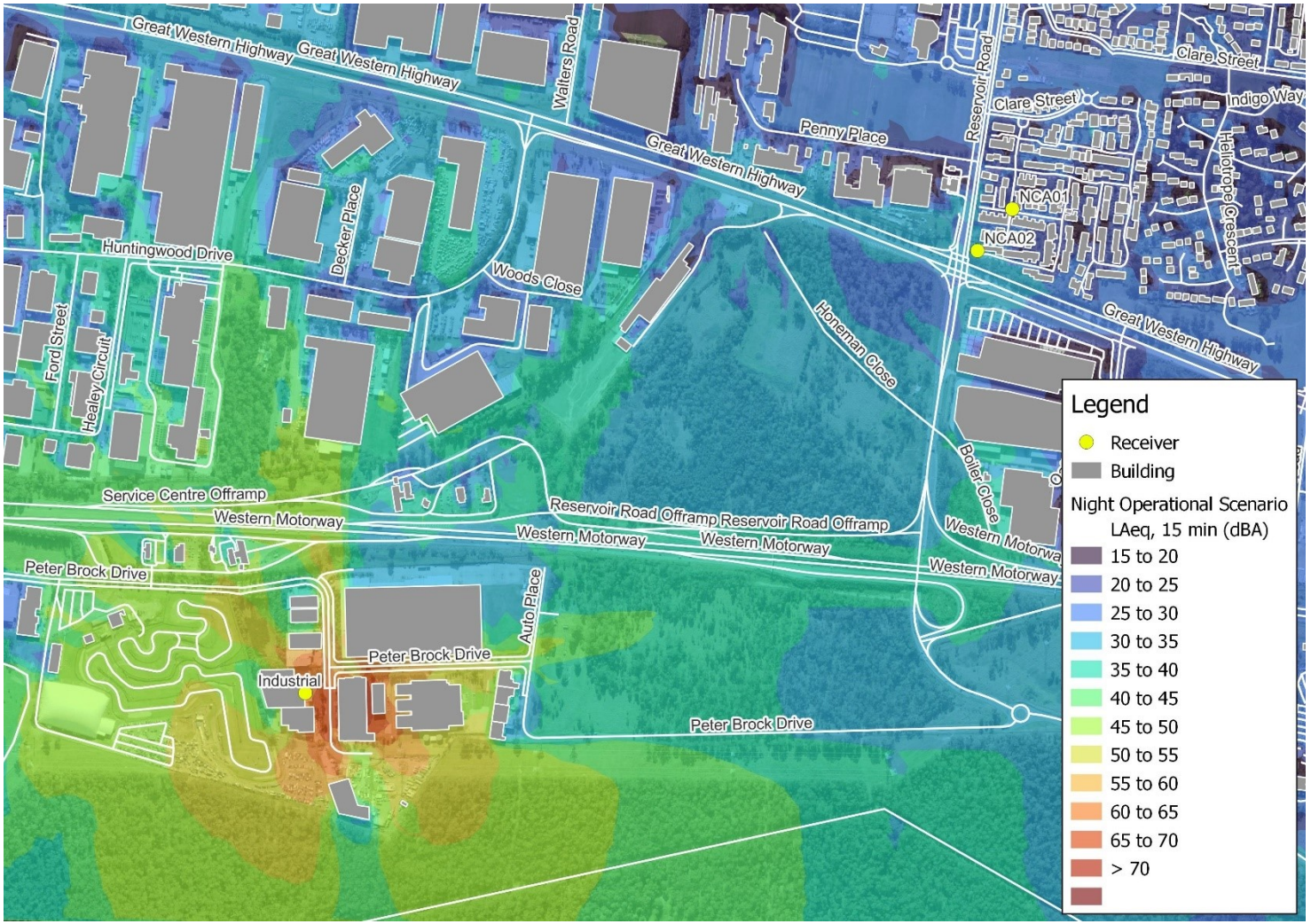


Figure 12 Operational Scenario 2 – Operational Evening/Night Scenario – Contour Map



3.5.2 Emergency Scenario

The predicted L_{Aeq} results of the modelled hypothetical emergency scenario with fifty-two (52) emergency diesel generators are presented in the below table. A noise contour map of the modelled emergency scenario is shown in the figure below. Note that the contour map is set to a receiver level height of 1.5m.

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.

Note that the above hypothetical emergency scenario whereby all standby generators are running simultaneously (in the event of a critical power failure event) has been modelled for completeness – in reality, the likelihood of failure is extremely low based on inferred outages in the area estimated from the System average interruption index.

Outside of a full systems power failure, the emergency generators would not operate for any other purpose than occasional testing. It is not considered reasonable to assess the emergency generator scenario against the project noise trigger levels presented in Section 2. This is due to the fact that a full systems power failure is an extremely unlikely event, and if it was to occur, the estimated duration of the emergency generators operating is expected to be hours rather than days, minimising the overall impact to the nearby community.

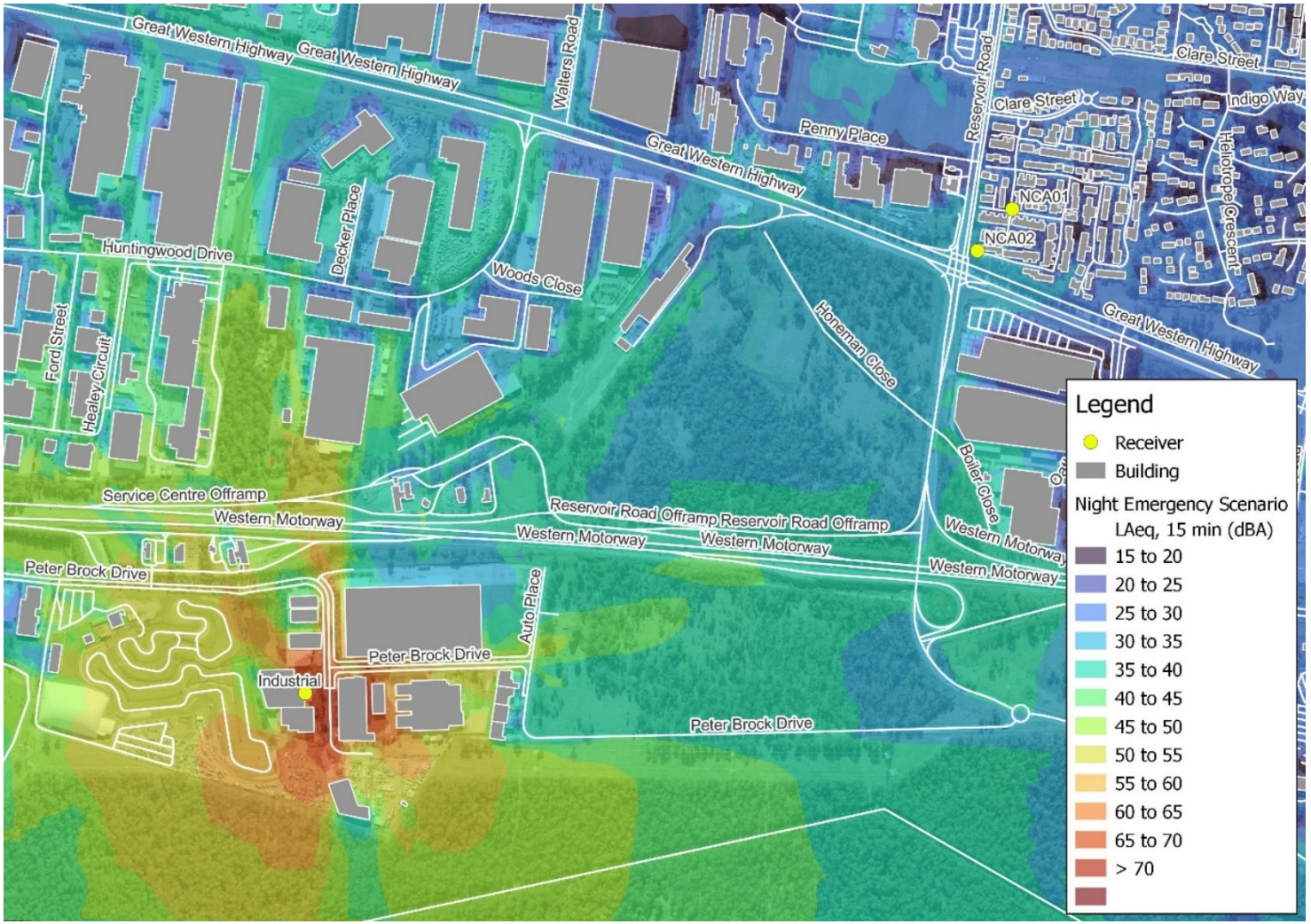
The purpose of this emergency scenario is to quantify the numerical noise predictions to the nearest noise sensitive receivers in the unlikely event of a full systems power outage at the data centre during the most sensitive time period (i.e., the night-time). Further discussion has been provided on the design considerations to the emergency generators within Section 3.6.

The predicted L_{Aeq} results of the modelled hypothetical emergency scenario are presented in the below table.

Table 7 Predicted Noise Levels, Emergency Scenario, L_{Aeq} (15 minute)

Receiver (Height from Ground)	Criteria (dBA)			Predicted Noise Levels (dBA)
	Day	Evening	Night	Emergency Night-time Scenario with all Generators Running
NCA01 (4.5m)	N/A	N/A	N/A	29
NCA02 (1.5m)	N/A	N/A	N/A	32
Industrial (10m)	N/A	N/A	N/A	67

Figure 13 Emergency Scenario 1 – Emergency Night Scenario – Contour Map



3.6 Comparison between PWNA and RWDI Noise Emission Predictions

PWNA note that the noise emission predictions detailed in Section 3.5 for both operational and emergency scenarios differ from those published by RWDI Australia Pty Ltd as part of their *Noise & Vibration Impact Assessment* Report, reference number RWDI # 2104000, dated 13th April 2022, submitted as part of the approved SSDA (SSD-21342738).

These numerical differences can be attributed to the following:

- The modelled equipment sound power levels have been updated since the submission of the RWDI report. The sound power levels modelled by PWNA are lower than those modelled by RWDI. Note that all equipment noise data is based on coordination with LCI Consultants Mechanical team, as detailed in Section 3.2.

- In addition, the modelling methodology employed (ISO 9613) is different to that employed by RWDI (CONCAWE). Note that ISO 9613 is often considered the international industry standard noise modelling approach and has been used extensively by PWNA on data centre projects across NSW and Australia.

- Other modelling assumptions and parameters used by PWNA may slightly differ from those employed by RWDI, leading to slight differences in noise emission predictions. PWNA have considerable experience in verifying, via on-site and at-receiver physical measurements, that the modelling assumptions and parameters outlined in Section 3.3 are appropriate and suitable for implementation on data centre projects. The modelling parameters which may slightly differ between the PWNA and RWDI modelling methodology include the following:
    - On-site and off-site terrain
    - Ground absorption properties
    - On-site structures and surrounding buildings
    - The height of noise sources, including the air-cooled chillers, hybrid dry coolers and generators, which is based off the latest architectural drawings

3.7 Annoying Characteristics of Noise

In accordance with the application of modifying factor corrections in Fact Sheet C of the Noise Policy for Industry, the following is noted regarding the relevant modifying factors.

3.7.1 Tonal Noise

The 1/3 octave band analysis shows that a 5dB modifying factor correction for tonal noise is not required. That is, the level of one-third octave band does not exceed the level of the adjacent bands on both sides by:

a) 5 dB or more if the centre frequency of the band containing the tone is in the range 500–10,000 Hz

b) 8 dB or more if the centre frequency of the band containing the tone is in the range 160–400 Hz

c) 15 dB or more if the centre frequency of the band containing the tone is in the range 25–125 Hz

3.7.2 Intermittent Noise

The fact that the units run continuously, a subjective assessment as well as noise measurements conducted at the surrounding receivers at a similar site, proves that the air-cooled chiller and hybrid dry cooler noise sources are not intermittent in nature. Therefore, this modifying factor is not required.

3.7.3 Low-Frequency Noise

The operations of the air-cooled chillers, hybrid dry coolers and diesel generators have the potential to generate low-frequency noise issues. The NPfI considers a low frequency noise issue to exist where:

a) The C minus A weighted noise level is 15 dB or greater; and

b) The spectrum is considered to be unbalanced.

The standard noise modelling algorithm, ISO9613, is unable to calculate low frequency and tonal noise impacts. Below 63 Hz, iNoise uses the 63Hz correction – an approach which has never been validated. For one-third octave bands, iNoise uses the octave band correction. Again, this approach has not been validated.

To resolve the limitations in modelling, the EPA have written an article in the AAS Journal, an example approach to consider low frequency noise in the context of the NSW Noise Policy for Industry. This provides an example approach on how a low frequency assessment can be completed. The approach is summarised below:

- Undertake one-third octave noise measurements between 10 Hz to 20 kHz at a similar site and comparable location,
- Identify the 10 Hz to 63 Hz spectrum components level by taking the logarithmic average of the measured noise levels,
- Predict one-third octave band noise levels, and apply the tail below 63 Hz; and
- Undertake a screening analysis of the one-third octave noise levels to assess the C-weighted minus A-weighted noise levels. Where the difference is greater than or equal to 15 dB, determine if the spectrum is considered to be unbalanced, in accordance with the Noise Policy for Industry.

PWNA has previously undertaken detailed low frequency noise measurements of operational data centres and generators at representative measurement locations. These noise measurements have been used to calculate the A and C weighted noise levels presented in Table 8 below, following the method presented above.

The scenario which has the greatest potential for a low-frequency issue is Operational Scenario 1, which includes the constant data centre mechanical noise (air-cooled chillers and hybrid dry coolers) as well as 6 x simultaneous generators operating for the purpose of maintenance testing.

The results of the low-frequency screening test for this scenario at each of the identified sensitive receivers are presented in Table 8 below.

Table 8 Low-Frequency Operational Noise Screening Test

Receiver (Height from ground)	Predicted Noise Levels Operational Scenario 1 – Day Scenario		
	dBA	dBC	Difference
NCA01 (4.5m)	27	36	9
NCA02 (1.5m)	30	40	10
Industrial (10m)	63	75	12

The results in Table 8 indicate that compliance with the low frequency screening test is achieved at all locations. This analysis has confirmed that the low frequency correction is not required, and further consideration of the unbalanced spectrum is not required as part of this assessment.

4 NOISE MANAGEMENT AND MITIGATION MEASURES

The modelling conducted in Section 3.5 finds that, should certain noise control measures be adopted, as discussed further below, compliance with the noise criteria outlined in the Development Consent Conditions (SSD-21342738) is predicted at all sensitive receivers during all operating scenarios.

Despite this, noise management measures are recommended to minimise the potential impact on the surrounding noise sensitive receivers.

4.1 Recommended Operational Management Measures

Majority of the noise emissions from the proposed data centre campus consists of constant, continuous mechanical plant operations. As such, minimal operational management measures are available / relevant. However, operational management measures for light / heavy vehicles and delivery of goods via trucks, whilst not required, are recommended to minimise the impact on nearby receivers outside the daytime period.

Noise management measures can be effective to control noise impacts associated with behaviours. The cornerstone to noise management measures is making employees and people accessing the site aware of their site requirements and obligations.

Clear signage should be provided for drivers to limit noise, and all conversations should be encouraged to be completed inside where the building fabric can reduce the transmission of noise.

4.2 Recommended Operational Mitigation Measures

The following conceptual noise controls are recommended for the project:

- The generators are to be tested six (6) at a time during the daytime only.
- The diesel generators are to be containerised within an acoustic enclosure, which features treatment where necessary (including acoustic treatment to the exhaust discharge in the form of a muffler or similar, treatment to the radiator discharge / discharge stack where necessary, air intake face where necessary (in the form of acoustic louvres or similar), and enclosure treatment) to reach a maximum combined sound power level of 100 dBA.
- The sound power levels of the air-cooled chillers, hybrid dry coolers, fan wall units, transformers, and all other mechanical plant and equipment referenced in this report, are to be at or below the levels listed in Section 3.2 of this report for all periods.
- 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.

4.2.1 Emergency Generator Scenario

Outside of a full systems power failure, the emergency generators would not operate for any other purpose than occasional testing (operating with a maximum of 6 generators simultaneously during the daytime period). It is not considered reasonable to assess the emergency generator scenario against the project noise trigger levels presented in Section 2. This is due to the fact that a full systems power failure is an extremely unlikely event, and if it was to occur, the estimated duration of the emergency generators operating is expected to be limited to hours of operation, rather than days, reducing the overall impact to the nearby community.

A detailed list of the mitigation and management measures that have been incorporated to the selection and design of the emergency generators to minimise the overall noise impacts to the noise sensitive receivers in the event of a full systems power failure are presented in Table 9 below.

Table 9 Generator Design Considerations

Considered Mitigation	Effect of noise emissions / benefit
Selection of closed generator set	The selection of a closed generator set was selected compared to an open generator set, this was due to the inherent reduction of noise emissions due to the substantial screening / transmission losses from the solid enclosure fitted to each generator.
Selection of mufflers to generator exhaust	The selected closed generator set features an optional exhaust muffler which provides significant noise reduction to the exhaust component of the generators.
Selection of generators on the basis of quiet operation	All of the selected generators will be selected on the basis of quiet operation to have a sound power level of not greater than 100 dB(A). This level has been nominated to reduce the overall noise impact to the nearest noise sensitive receivers during operational testing and in the unlikely event of a full systems power failure.
Inclusion of multiple 90° bends to the exhaust discharge of the generators	The decision to include multiple 90° bends to the generator exhaust provides a quantifiable reduction to the overall noise emissions from the emergency generators.
Inclusion of louvres to the façade of the plant rooms which house the generators	Louvres have been included to the façade of the plant rooms which house the emergency generators. These louvres provide a quantifiable insertion loss to the overall noise emissions from the emergency generators.
Optimisation of the positioning of the emergency generators at the data centre campus	The emergency generators have been positioned to the western façade of the data centre building. This design decision provides the acoustic benefit of positioning the generators as far away as possible from the noise-sensitive residential receiver locations to the north-east of the site.

It is therefore not considered reasonable or feasible to provide additional mitigation measures to the emergency generators when considering the noise impacts from the full systems power outage scenario.

5 CONCLUSION

DCI Data Centres is proposing to expand its existing data centre located at 90 Peter Brock Drive, Eastern Creek. The existing data centre is known as SYD01. The proposed new data centre is known as SYD02.

During detailed design for the project, DCI has identified the need for revision to the approved design. As such, DCI is proposing to modify the development consent to accommodate revised design.

Pulse White Noise Acoustics (PWNA) has been engaged to undertake a Noise and Vibration Impact Assessment of the proposed SYD02 data centre development located at 90 Peter Brock Drive, Eastern Creek, NSW. This document provides high level acoustic advice for the proposed data centre, including an assessment of noise emissions to external receivers.

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

Based on the findings from this assessment, should the noise control measures recommended in Section 4 be implemented, the proposed data centre development is predicted to comply with the recommended noise criteria set out in the Development Consent Conditions (SSD-21342738) 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"*