Project Dune – Development Application Assessments

Environmental Noise Report

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Contents

Appendices

Figures

Tables

Executive Summary

Aurecon has been engaged to undertake the environmental noise assessment of the Stage 1 and future stages phase of a datacentre campus proposed to be located at 300-340 Barry Road, Campbellfield, VIC.

The site is located within an Industrial Zone, and the adjacent area consists of Industrial Zones to the north, east and west. The nearest sensitive receivers are located within the General Residential Zone directly to the south of the site.

The area surrounding the site includes several existing commercial warehouse facilities including Visy Industries located to the north of the site which operates 24 hours per day. Additionally, the Upfield railway line train stabling yard is located immediately adjacent to the project site and likely to involve night-time operations that contribute to the ambient noise environment.

EPA Victoria Publication 1826.5: *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* (Noise Protocol) and EPA Victoria Publication 1996 *Guidance for assessing low frequency noise* have been utilised for the assessment. Noise limits were derived for each noise sensitive area (NSA) based on existing measured background levels and the established zoning levels.

A 3D computational noise model has been developed of the site and surrounding buildings using SoundPLAN v9.1. The model includes the neighbouring buildings and the topography of the surrounding area. The model incorporates the key items of noise generating equipment that are proposed to be included in the design, including:

- Air cooled chillers
- Emergency back-up generators
- Load banks
- Transformers
- Outside air package units (OAPs)
- Condensers (CUs)
- Roof exhaust fans

Noise emissions from the overall site have been predicted at the surrounding receivers based on the current concept design for Stage 1 of the development, as well as preliminary assessment for Stage 1 and future stages.

Acoustic mitigation strategies have been provided in the report which are recommended to be included in the design of the future stages. These design interventions can reduce noise from external equipment to achieve the required noise limits for the entire project site (Stage 1 and future stages) assuming proper integration into the design.

Potential mitigation measures for the future stages will include but not be limited to:

- Optimisation of building and plant spatial layouts. Orientate and position high noise emitting outdoor equipment as far away from the nearest NSAs as is practical.
- Apply noise limits for selection of external mechanical and electrical equipment and associated infrastructure.
- Acoustic barriers to the roof plant as outlined in the report.
- Allow for high performing sound attenuating enclosures for containerised generator sets.

1 Introduction

This noise assessment report has been prepared to support a Planning Permit Application for the use and development of the proposed Stage 1 phase of a datacentre campus, associated infrastructure and earthworks at 300-340 Barry Road, Campbellfield, VIC. Although the current application covers Stage 1 only, the report also outlines potential noise mitigation strategies to inform the design of future stages, aiming to achieve compliance with applicable noise limits once both Stage 1 and future stages (Stage 2 – 6) are operational.

The site is located within the City of Hume local government area with the subject site and surrounds shown in Figure 1-1.

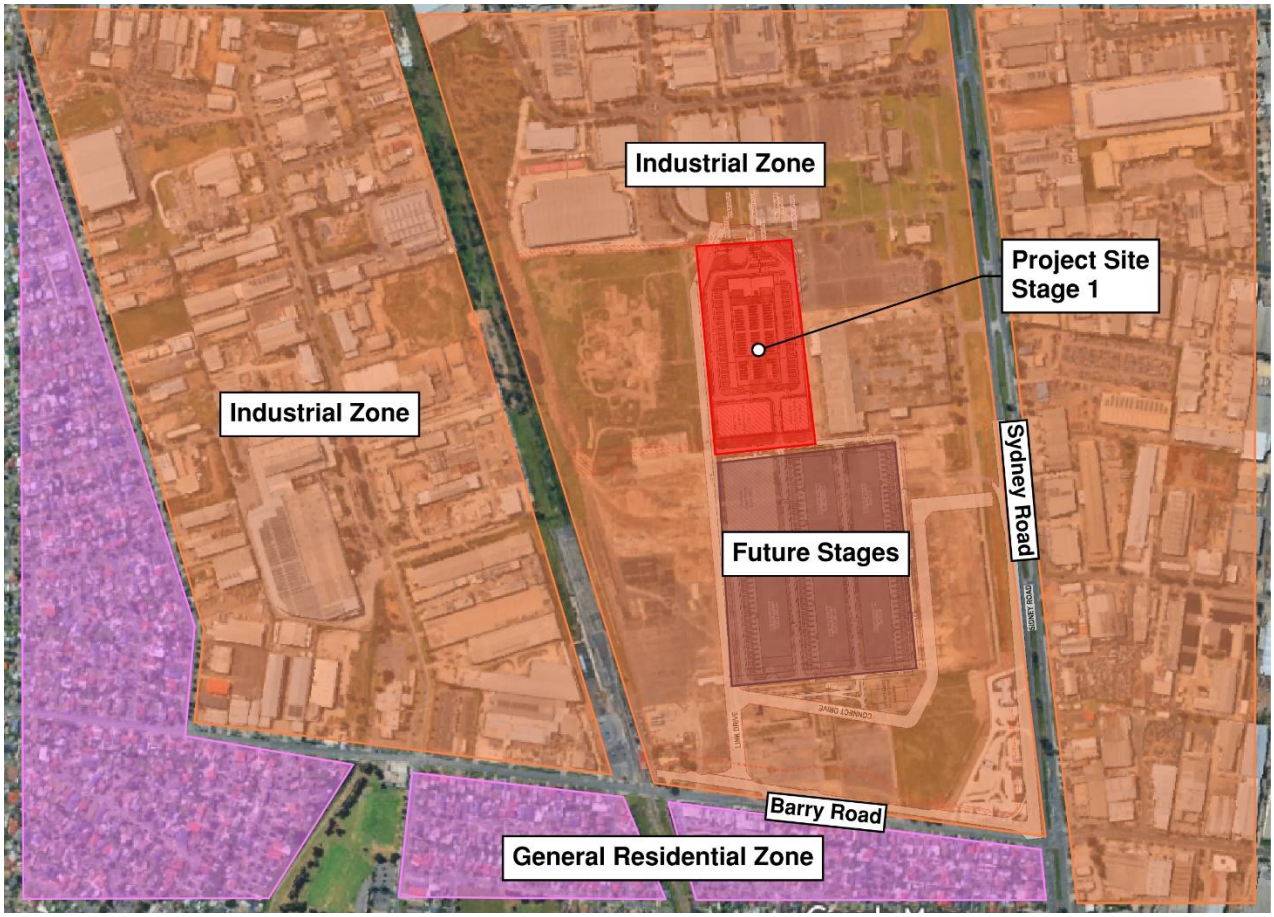


Figure 1-1 Overview of the Subject Site and surrounds (Project Stage 1 and preliminary location for future stages expansions).

2 Project Description

2.1 Project Site

Stage 1 of the project seeks approval to use and develop the subject site for the first datacentre building (Stage 1), a Jemena Substation and associated Battery Energy Storage System (BESS) in the external plant zone, see Figure 2-1.

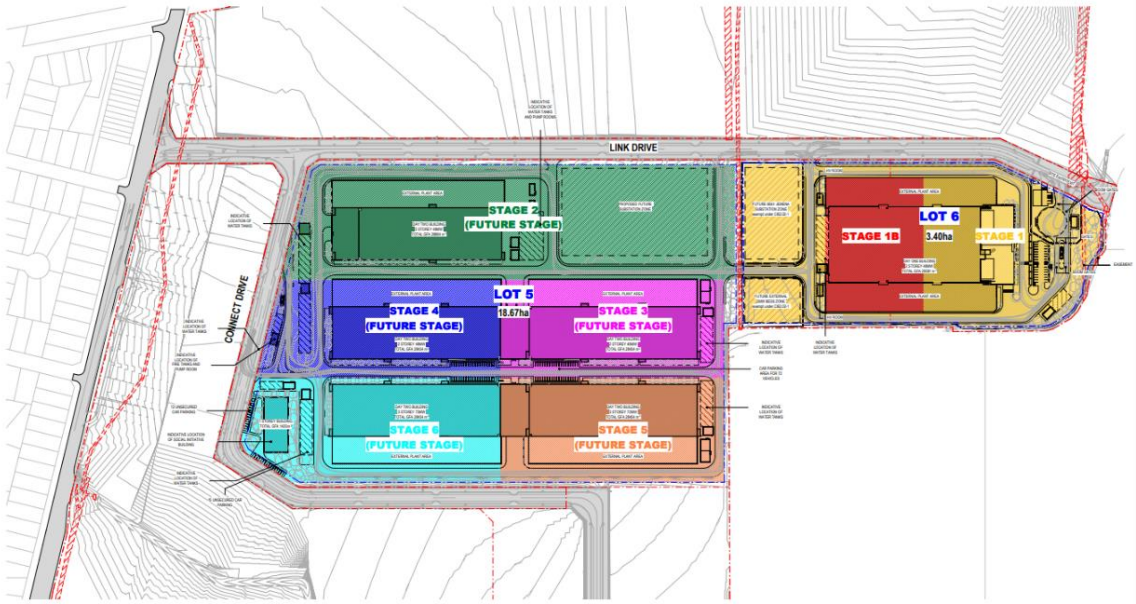


Figure 2-1 Subject Site and Application Area.

The Stage 1 phase of the project is proposed to comprise of the following components:

- A 2-storey datacentre building, with associated site infrastructure to support the building's function.
- Proposed Jemena substation zone consisting of 2 high voltage transformers (75MW each)
- An ancillary office and designated loading area.
- Car parking facilities.
- Internal (private) roads providing access to the datacentre buildings.
- Associated landscaping.
- Civil works to support a future substation and associated future stages works.

The preliminary design of the future stages of the project is proposed to comprise the following components. There is currently no detailed design of these facilities and the below is for information purposes only:

- Stage 2 – 48 MW (2 Storey building)
- Stage 3 – 48 MW (2 Storey building)
- Stage 4 – 48 MW (2 Storey building)
- Stage 5 – 72 MW (3 Storey building)
- Stage 6 – 72 MW (3 Storey building)
- Proposed future substation zone
- 5MW Battery Energy Storage System located in the proposed future external plant zone
- Internal (private) roads providing access to the datacentre buildings.

3 Surrounding Environment

3.1 Existing Noise Sensitive Areas

The proposed site is in the western and central areas of Campbellfield, Victoria. It lies west of the Hume Highway, north of Barry Road, and is bordered on its western side by the Upfield train line. The surrounding area consists primarily of commercial and industrial properties, with several warehouses identified nearby.

More broadly the surrounding area is also characterised by some existing industry including multiple Visy facilities approximately 1.5 km northwest of the site.

The following noise sensitive areas (NSAs) have been identified based on a review of aerial photos and confirmation while on site. The NSA addresses and the distance to site are shown in Table 3-1.

NSA1 represents all residential properties located directly south of the project site, across Barry Road, with only the road separating them from the site. NSA2 includes residential properties situated south of Barry Road and to the west of the Upfield train line. NSA3 comprises residential areas to the west of the project site and west of Kyabram Street, with an industrial zone located between these residences and the site.

The project site and the locations of the existing NSAs are illustrated in Figure 3-1.

Table 3-1 NSA addresses

Noise sensitive area	Representative Address (residential uses)	Approximate distance to Project Site	
		Stage 1	Future Stages
NSA1	287 Barry Rd, Campbellfield, VIC	650m	260m
NSA2	20 Doy St, Dallas, VIC	660m	290m
NSA3	37 Kyabram St, Coolaroo, VIC	1000m	1000m

Figure 3-1 Site and surrounding NSAs

3.2 Existing Industry

The area surrounding the site includes several existing commercial warehouse facilities. During site surveys, noise emissions from the Visy Industries facilities were audible at the neighbouring residences on Kyabram St, Coolaroo and Edmund St, Dallas in the early hours of the morning (1.00am to 3.00am) which indicates that they are operating 24 hours per day. Additionally, the Upfield railway line train stabling yard is located immediately adjacent to the project site and is likely to be operational during night-time periods, as such facilities commonly accommodate early-morning train dispatches, late-night arrivals, and routine overnight maintenance activities that contribute to the existing ambient noise environment.

Figure 3-2 shows the identified Visy Industries facilities and Upfield railway line train stabling yard area in the surrounding area in relation to the NSAs and the site.

Figure 3-2 Existing Industry areas near project site

There are numerous other businesses and industry in the surrounding area as is shown in Figure 3-2. There is limited information concerning the operating hours of the various businesses in the area; and we highlight that the night period is defined as 10 pm to 7am and it is possible that other operations may operate overnight or may begin prior to 7am. However, during the site surveys, only noise from Visy was noticeable at the NSA locations.

4 Noise Survey

4.1 Noise Monitoring Methodology

Aurecon has undertaken short-term attended noise measurement for the day and night periods at three locations within proximity of the proposed project.

Due to site access restrictions and the risk of extraneous noise from existing industry activity, unattended long-term noise logging was not considered feasible as part of the project. In lieu of noise logging, Aurecon undertook attended noise measurements at three locations representative of the nearest residential sensitive receptors in accordance with the short-term noise survey methodology set out in the Noise Protocol.

The background noise measurements were undertaken using a Bruel&Kjaer 2270 (Instrument Serial Number 3029475) sound level meter and a Pulsar Model 105 (Instrument serial number 99005) calibrator. All equipment used for the noise measurements are NATA certified and the calibration certificates haven provided in Appendix C.

4.2 Measurement Locations

Noise measurements were conducted during the daytime of 24 July 2025, and during the night-time period on 25 July 2025. Subjective observations were also made to better understand the existing acoustic environment. As the proposed facility is intended to operate 24/7, the night-time noise limit will be the most critical criterion for assessment.

Measurement locations 1, 2 and 3 were chosen to be representative of the NSA1, NSA2 and NSA3 respectively. All noise measurement locations with respect to the identified NSAs are shown in Figure 4-1.

Figure 4-1 Measurement Locations

4.3 Measurement Results

The summary of the noise measurements including the subjective observations are shown in Table 4-1.

Table 4-1 Noise Measurement Summary

Location	Measurement Period	Measurement Date	Measurement Start Time, Duration	Measured sound level (dBA)		Average (dBA)		Notes
				L_{eq}	L_{90}	L_{eq}	L_{90}	
Location 1 – Near Hughes Court Playground, Campbellfield	Day (7am – 6pm)	Thursday 24 July 2025	11:22 AM 15 minutes	59	50	57	49	Main noise sources observed during these measurements include: ▪ Traffic noise on Sydney Road and Barry Road audible ▪ Birds noise audible ▪ Aircraft noise audible
			12:59 PM 15 minutes	55	48			
	Night (10pm – 7am)	Friday 25 July 2025	01:00 AM 15 minutes	48	46	48	46	
			02:19 AM 15 minutes	48	45			
Location 2 - Near 41 Edmund St, Dallas	Day (7am – 6pm)	Thursday 24 July 2025	11:47 AM 15 minutes	58	45	61	45	Main noise sources observed during these measurements include: ▪ Traffic noise from Barry St and Sydney Road audible ▪ Traffic noise from Upfield train line audible ▪ Aircraft noise audible ▪ Visy Industries noise audible during night time measurements
			01:55 PM 15 minutes	63	45			
	Night (10pm – 7am)	Friday 25 July 2025	01:20 AM 15 minutes	50	45	53	45	
			02:38 AM 15 minutes	55	45			
Location 3 - Near Progress Reserve, Coolaroo	Day (7am – 6pm)	Thursday 24 July 2025	12:32 PM 15 minutes	54	44	54	44	Main noise sources observed during these measurements include: ▪ Traffic noise from Kyabram St ▪ Traffic noise from Upfield
			2:20 PM 15 minutes	53	44			
	Night (10pm – 7am)	Friday 25 July 2025	01:42 AM 15 minutes	45	43	48	45	

Location	Measurement Period	Measurement Date	Measurement Start Time, Duration	Measured sound level (dBA)		Average (dBA)		Notes
				L_{eq}	L_{90}	L_{eq}	L_{90}	
			02:59 AM 15 minutes	50	46			train line audible ▪ Aircraft noise audible ▪ Visy Industries noise audible during night time measurements

Although noise from Visy Industries was audible at NSA2 and NSA3, it was not possible to identify an appropriate background equivalent location in the vicinity. Reviewing the measured background levels at the three NSAs it is apparent that there is marginal difference in the background level at the three locations and therefore the noise contribution from Visy Industries is not considered to be intrusive to the background level.

5 Regulatory Framework

The amended Environment Protection Act 2017 (the EP Act) and the Victorian Environment Protection Regulations 2021 (the Regulations) came into effect on 1 July 2021.

Subordinate legislation under the Act includes EPA Publication 1826.5 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues,* September 2025 (Noise Protocol). The noise limits determined using the methodology in the Noise Protocol apply to the average industrial noise level (not including noise associated with other non-industrial noise sources) over a 30-minute period.

5.1 General Environmental Duty

The Act mandates that businesses have a general environmental duty (GED) to manage their activities to minimise the risk of environmental damage. Under the Act the GED requires that *'any person who is engaging in an activity that may give rise to risks of harm to human health or the environment from pollution or waste must minimise those risks, so far as reasonably practicable'*.

The requirement to demonstrate that the GED is being complied with is in addition to compliance with the noise limits set out in the Noise Protocol. Businesses must be able to demonstrate that they are both applying the GED and complying with the applicable noise limits.

Victorian EPA guideline 1856 'Reasonably Practicable' provides guidance concerning what must be considered when assessing the proportionate controls to mitigate or minimise the risk of harm. These measures include a hierarchy of controls, defined as follows:

- Eliminate risk: *Can you eliminate the risk?*
- Likelihood of the risk: *What's the chance that harm will occur?*
- Degree of harm (consequence): *How severe could the harm be on human health or the environment?*
- State of knowledge: *What do you know, or what can you find out, about the risks your activities pose?*
- Available suitable controls: *What technology, processes or equipment are available to control the risk and what controls are suitable for use in your circumstances?*

- Costs of suitable controls: *How much does the control cost to put in place compared to how effective it would be in reducing the risk?*

Guideline 1856 requires that these factors need to be considered together to determine what is reasonably practicable to control risks of environmental damage.

5.2 Noise Protocol

The EPA Publication 1826.5 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* (Noise Protocol) provides framework for environmental planning and decision making and a clear set of publicly agreed environmental objectives. The Noise Protocol specifies the following procedures to determine unreasonable and aggravated noise under the Regulations:

- Set noise limits.
- Assess noise emitted from existing commercial, industrial and trade premises, entertainment venues and outdoor entertainment events.
- Evaluate anticipated noise emissions from development proposals (new commerce or trade premises, or proposed extensions from existing premises new entertainment venues or proposed extensions of existing venues) and proposed outdoor entertainment events.

5.3 Victorian Environment Protection Regulations 2021

5.3.1 Time Periods

Airborne noise from fixed infrastructure must comply with the Environment Protection Regulations 2021 (the Regulations) and the GED under the Act and subordinate legislation including the Noise Protocol.

The time periods defined in the Regulations are summarised in Table 5-1.

Table 5-1 Time periods

Period	Day	Time
Day	Monday to Saturday	7 a.m. to 6 p.m.
Evening	Monday to Saturday	6 p.m. to 10 p.m.
	Sunday / Public Holidays	7 a.m. to 10 p.m.
Night	Monday to Sunday / Public Holidays	10 p.m. to 7 a.m.

5.3.2 Emergency Equipment

Part 117 of the 2021 Victorian Environment Protection Regulations define the noise sources which need to be considered when assessing noise from commercial, industrial and trade premises, and notes the following:

> *117 Noise sources that must not be taken into account in this Division*
>
> *(1) In this Division, when the level of noise emitted from commercial, industrial and trade premises is assessed, the following sources of noise must not be taken into account—*
>
> *…*
>
> *(xi) equipment used in relation to an emergency;*

(2) In this regulation—

emergency has the same meaning as in the Emergency Management Act 2013.

Note

For the purposes of section 166 of the Act, noise emitted by an item prescribed by this regulation may be unreasonable having regard to paragraphs (a)(i)–(v) of the definition of unreasonable noise in section 3(1) of the Act.

The noise protocol provides further guidance in Part 3

3. Noise limits – Emergency equipment

(37) Where the noise source under consideration is equipment used solely in relation to emergencies, the relevant noise limit applying to the testing or maintenance of such equipment, as determined in clauses 1 to 15 or clauses 16 to 36 above, is increased by 10 dB for a day period and by 5 dB for all other periods.

(38) For the purpose of clause 37, equipment used in relation to emergencies includes –

…

c. a standby generator means a generator of electrical power used as an alternative to the mains supply in emergencies, or for a maximum period of 4 hours per month for maintenance purposes;

On this basis, we interpret the regulations as follows:

- During an emergency (i.e. with all generators operating simultaneously), noise emissions from the emergency generators is not required to comply with the noise limits set out in the noise protocol. However, a General Environmental Duty exists to minimise the risk of harm from noise as far as is reasonably practicable as stated in Section 5.1.
- During testing (generally a single generator, and during the day period only), a relaxation of the noise limits is applied (10 dB during the day and 5 dB during the evening / night).

Noise emissions from emergency generator equipment must still be assessed against the General Environmental Duty, with the likelihood of risk of environmental harm considered based on likelihood of risk, degree of harm, and the cost / availability of suitable controls.

5.4 EPA Technical Guideline 1997

5.4.1 Urban and Rural Area Method

The EPA Victoria Publication 1997 *Technical guide: Measuring and analysing industry noise and music noise* (the Guideline) provides guidance in the assessment of noise including measurement, prediction, analysis and reporting conducted in accordance with Part 5.3 of the Regulations. Section 3 of the Guideline specifies that the Noise Protocol method depends on the location of the NSA, not the location of the noise-emitting premises (the project site). The Urban Area Method applies if the noise sensitive area is within a major urban area, as defined in the Environment Protection Regulations 2021 (Victoria). The Rural Area Method applies if the noise sensitive area is not within a major urban area.

As the project site is located within a major urban area as defined in the Environment Protection Regulations 2021 (Victoria) and within the Melbourne Urban Growth Boundary[1], the Urban Area Method of the Noise Protocol applies. This method establishes noise limits based on the characteristics of urban environments.

5.4.2 Managing Noise from Multiple Sites

Part 119 of the Environment Protection Regulations states that

[1] The Urban Growth Boundary is identified as the “Blue area” in the map of greater Melbourne as defined by the Victoria State Revenue Office https://www.sro.vic.gov.au/owning-property/land-tax/exemptions-and-concessions-land-tax/primary-production-land/greater-melbourne-and-urban-zones.

"If 2 or more commercial, industrial and trade premises (whether existing or proposed) emit, or are likely to emit, noise that contributes to the effective noise level, a person in management or control of one or more of those premises must take all reasonable steps to ensure that the contribution from each of the premises, when combined, does not exceed the noise limit for the noise sensitive area."

Therefore, where there is more than one premises contributing to the noise received at a noise sensitive area, each premises would need to contribute a level lower than the applicable noise limit to avoid the cumulative noise level exceeding the noise limit.

EPA Technical Guideline 1997 (the Guideline) provides a methodology for assessing industry noise for multiple premises. The Guideline notes:

- The contribution of the proposed development should be abated to meet, for each of the day, evening, or night period, a level set below the relevant noise limit by 10 x log10(N) decibels, where N is the total number of existing and likely contributing industry premises

The Guideline provides Table 5-2 demonstrating the reduction required based on the number of contributing premises.

Table 5-2 Example of values of 10xlog10(N) from The Guideline

Table 2: Example of values of 10 x log10(N), rounded to one decimal point.

N	10 x log10(N)
1	0.0 dB
2	3.0 dB
3	4.8 dB
4	6.0 dB
5	7.0 dB

N	10 x log10(N)
6	7.8 dB
7	8.5 dB
8	9 dB
9	9.5 dB
10	10.0 dB

5.5 Environment Reference Standard

The Victorian Environment Reference Standard (ERS) is part of the subordinate legislation under the Environment Protection Act. The ERS sets out the environmental values of the ambient air, ambient sound, land and water environments that are sought to be achieved or maintained in Victoria and provides standards to support those values. The ERS is not a compliance standard, however its primary function is to provide an environmental assessment and reporting benchmark.

The ERS sets out environmental values of the ambient sound environment as follows:

Table 5-3 ERS environmental values of ambient sound

Environmental Value	Description of the environmental value
Sleep during the night	An ambient sound environment that supports sleep at night
Domestic and recreational activities	An ambient sound environment that supports recreational and domestic activities in a residential setting
Normal conversation	An ambient sound environment that allows for a normal conversation indoors without the need to raise voices
Child learning and development	An ambient sound environment that supports cognitive development and learning in children
Human tranquillity and enjoyment outdoors in natural areas	An ambient sound environment that allows for the appreciation and enjoyment of the environment for its natural condition and the restorative benefits of tranquil soundscapes in natural areas

Environmental Value	Description of the environmental value
Musical entertainment	An ambient sound environment that recognises the community's demand for a wide range of musical entertainment

Land use categories are defined in the ERS which are established based on the planning zones. The site and adjacent properties to the north of Barry Rd are zoned as IN1Z, which is a Category I Zone. Residential properties to the south of Barry Road are at the interface to the IN1Z zone and are located in a GRZ1 zone which is a Category III zone.

The indicators and objectives for the identified land use categories are summarised below.

Table 5-4 ERS indicators and objectives

Land Use Category	Indicators and objectives	
Category I	Outdoor L_{Aeq8rh} from 10pm to 6am	55 dBA
	Outdoor $L_{Aeq16rh}$ from 6am to 10pm	60 dBA
Category III	Outdoor L_{Aeq8rh} from 10pm to 6am	40 dBA
	Outdoor $L_{Aeq16rh}$ from 6am to 10pm	50 dBA

5.6 EPA Publication 1996: Assessment of Low Frequency Noise

The EPA publication 1996, *Noise guidelines: Assessing low frequency noise* (EPA 1996) applies to low frequency noise generated by the proposed development. the guideline provides assessment criteria and procedures for assessing low frequency noise impacts, including the application of low frequency corrections to determine effective noise levels at Noise Sensitive Areas (NSAs).

This document outlines the low frequency noise assessment for the proposed development with respect to outdoor low frequency noise objectives outlined in EPA Publication 1996. The assessment has been undertaken to identify and manage the potential risk of low frequency noise annoyance, associated with testing operations involving generators and load banks within the proposed site.

6 Noise Limits

6.1 Noise Protocol Methodology

EPA Publication 1826.5 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues, September 2025 (Noise Protocol)* sets the overall methodology for the measurement and assessment of noise from commercial and industrial sites in Victoria. The noise limits are derived using the urban area methodology, as the Project Site is within the Urban Growth Boundary. The derivation includes an assessment of the background noise level in the environment together with the type of land use around the noise sensitive receivers.

The measured day and night period background noise level will be used to establish the noise limits. For the evening periods, in the absence of direct measurement data, background level will be assumed to be neutral relative to the zoning level. This assumption will be used to derive the corresponding evening noise limits accordance with the Noise Protocol.

The site zoning and derivation of the Zoning Levels for the NSAs can be seen in Appendix A.

The noise limits for NSA1 to NSA3 have been established and are provided in Table 6-1.

Table 6-1 Noise limit derivation for NSA1 to NSA3

Location	Time	Zoning Levels[1]	Existing Background noise levels dBL_{A90} [2]	Background Level Assessment	Noise Limits ($dBL_{Aeq,30mins}$) [3]	
					Building in services operating in normal mode	Testing of standby generators, standby boilers and fire pumps
NSA1: 287 Barry Rd, Campbellfield	Day (7am – 6pm)	58	49	Neutral	58	68
	Evening (6pm – 10pm)	51	-	Neutral[4]	51	56
	Night (10pm – 7am)	47	46	High	49	54
NSA2: 20 Doy St, Dallas	Day (7am – 6pm)	56	45	Neutral	56	66
	Evening (6pm – 10pm)	50	-	Neutral[4]	50	55
	Night (10pm – 7am)	45	45	High	48	53
NSA3 37 Kyabram St, Coolaroo	Day (7am – 6pm)	53	44	Neutral	53	63
	Evening (6pm – 10pm)	47	-	Neutral[4]	47	52
	Night (10pm – 7am)	42	44	High	47	52

1 The zoning levels were based on the proportion of land type use within the circles according to Noise Protocol.
2. Average background (L90) levels as measured and reported in Section 4.3
3. Established in accordance with the Noise Protocol approach. Noise Protocol notes that "the noise limit shall be increased by 10dB for day period and by 5 dB for other periods" for the testing of standby generators, standby boilers and fire pumps for a maximum period of 4 hours per month
4. Background noise levels assumed to be neutral relative to the zoning level

6.1.1 Cumulative Noise Impacts

The derived noise limits represent the cumulative noise level received at the NSA consisting of the contribution of all surrounding commercial and industrial properties. The Noise Protocol requires a 'equal sharing' principle, whereby the noise limit is 'shared' by all noise generating industry in the area.

During night-time monitoring, noise from the Visy Industries area was audible at NSA2 and NSA3, indicating continuous operations during this period. Although noise from the Upfield Stabling Yard was not detected during the measurements, it is considered a potential night-time source and included in the assessment under the equal sharing principle.

The evening period is assumed to have a similar industrial noise environment as the night-time, and thus the same number of contributing premises (N) is applied.

During the daytime, the industrial noise environment is more complex, with a larger number of potential contributors. To account for this, an additional generic industrial source is assumed in the calculation, this is to account for the contribution of various minor industrial activities in the surrounding area which are unlikely to be significant noise contributors at the NSAs.

The number of contributing industrial premises (N) considered for each NSA across different time periods is summarised in the Table 6-2 below.

It should be noted that the overall 'Project Site' referred to in Table 6-2 will include source contributions from Stage 1 and potential future expansion on the site. The details and design of future stages are not currently known. However, design of future expansion must be designed to control noise emissions such that overall noise limits from the 'Project Site' are not exceeded. This will need to be considered in the noise control design for any future stages.

Table 6-2 Summary of noise generating sites and adjustment to noise limit

NSA	Time period	Properties contributing	Number of contributing industries	Adjustment to noise limit
Southern (NSA1)	Day	Project Site Upfield Stabling Yard Other industry sources	3	-4.8 dBA
	Evening and Night	Project Site Upfield Stabling Yard	2	-3 dBA
South-Western (NSA2) and Western (NSA3)	Day	Project Site Upfield Stabling Yard Visy warehouse Other industry sources	4	-6 dBA
	Evening and Night	Project Site Upfield Stabling Yard Visy warehouse	3	-4.8 dBA

On this basis, the established project contribution noise limits for each of the noise sensitive areas will be reduced by the above values. The recommended maximum project contribution for the overall Project site (Stage 1 and Future Stage) is stated in Table 6-3.

Table 6-3 Recommended maximum noise limits from the overall 'Project Site'

Noise sensitive area	Address	Recommended maximum project contribution, L_{eq} dBA					
		Normal			Emergency equipment testing		
		Day	Evening	Night	Day	Evening	Night
NSA1[1]	287 Barry Rd, Campbellfield	53	48	46	63	53	51
NSA2[2]	20 Doy St, Dallas	50	45	43	60	50	48
NSA3[3]	37 Kyabram St, Coolaroo	47	42	42	57	47	47

1. Indicative of all residential properties to the south of the project site
2. Indicative of all residential properties to the southwest of the project site
3. Indicative of all residential properties to the west of the project site

6.2 General Environmental Duty Implementation

Environmental noise emissions from industrial activities, if not adequately managed, have the potential to cause harm. Table 6-4 shows the consideration of the measures outlined in Section 5.1 from Guideline 1856.

Table 6-4 Consideration of Measures to mitigate or minimise the Risk of Harm to Human Health.

Consideration	Implementation
1. Eliminate risk.	Datacentre activities will inherently generate noise during operation. However, mitigation measures will be considered as part of the design, including specification of low noise equipment (see Table 7-2).
2. Likelihood of risk; how often harm would occur.	The site will be designed to reduce noise impacts from the proposed development so as to not exceed derived noise limits from the Noise Protocol. Even though there are no specific noise limits for an emergency scenario, generator noise emission limit is provided to reduce the associated noise impacts as far as is reasonably practicable
3. Degree of harm (consequence).	There are varying degrees of harm associated with noise, ranging from: ▪ Hearing loss / permanent damage. ▪ Sleep disturbance. ▪ Audibility and annoyance. At noise levels exceeding 85 dB $L_{Aeq(8hr)}$ / 140 dB L_{Cmax} irreversible hearing damage may occur. Harm associated with hearing loss / permanent damage is covered by Worksafe Victoria compliance codes[2] and is not expected to be exceeded on site. The degree of audibility of noise depends on the level of noise emitted together with the ambient background noise levels. Where there is a low level of ambient noise at a receiver location, noise emissions are more likely be audible at times. This may occur where there is limited surrounding activity from roads and other noise sources. The audibility of noise can be classified as follows[4]: ▪ 0 to 3 dB above background noise levels: not typically audible. ▪ 3 to 5 dB above background noise levels: marginally audible. ▪ > 5 dB above background noise levels: generally audible. Other factors such as the frequency content, tonality, impulsiveness, and other characteristics may also impact the audibility of noise.
4. State of knowledge; awareness of risks the activities pose.	Undertaking detailed reviews and assessments of environmental noise emissions from the site (such as this report) is part of the general environmental duty to understand the likely noise emissions from the site and identify mitigation measures to reduce noise impacts so far reasonably practicable.
5. Availability and suitability of controls.	It is considered that best practice to review available suitable controls to minimise risk associated with noise, would be in the development and maintenance of a site noise management plan: ▪ Include sound power level limit as part of the equipment specification, see sound power level summarised in Table 7-2. ▪ Appropriate acoustic barrier to enclose major plant, refer acoustic barrier extent in Section 7.4.2. ▪ Strategic placement of major noise equipment as far as practical as shown in Figure 7-2.

	Although noise emission from Stage 1 is considered within the noise limits with the current equipment selection, the future stages site noise management plans would include but not be limited to: ■ Regular review of available technology assessing whether low-noise alternatives exist ■ Regular equipment maintenance to reduce noise. ■ General plans for community consultation and procedures to address noise complaints. ■ Noise monitoring plans.
6. Cost and effectiveness of controls.	Costs associated with low noise equipment will be reviewed as the design progresses. It is considered that with appropriate management measures, risks of environmental harm can be appropriately managed. Low-cost noise mitigation measures have been considered in the mitigation process and has been recommended where possible.

7 Noise Emission Predictions

7.1 Assumptions and Limitations

The following assumptions and limitations apply to the assessment based on the stage development:

Stage 1:

- In all scenarios, all typical equipment (excluding generators) operates at 100% capacity continuously, with the chillers operating at 47.1 °C ambient dry bulb condition to assess for worst case scenario.
- For the generator testing scenario, a single generator and load bank will be operated independently. As a worst-case scenario, this has been assumed to be the generator located closest to the receiver on the southwest side.

At the time of the assessment, noise data for all equipment has not been confirmed and therefore a preliminary schedule of equipment has been developed in Table 7-1.

- This noise and vibration assessment is based on this assumed noise data. Upon appointment of the successful supplier, confirmation should be provided that the selected equipment is able to perform within the predictions of this assessment. If not, further review and additional mitigation will be required.

Future Stage:

- Equipment noise in Table 7-2 of the future development is based on preliminary major plant selections and proposed building operational capacity. This noise and vibration assessment is based on this assumed noise data. During the design and upon appointment of the successful supplier, confirmation should be provided that the selected equipment is able to perform within the predictions of this assessment. If not, further review and additional mitigation will be required.
- For the generator testing scenario, 3 sets of generators and load banks have been assumed to be operated simultaneously for Stage 2, 4 and 6. As a worst-case scenario, this has been assumed to be the generator located closest to the NSAs (along Barry Road).
- The future stages building capacity is assumed to be:
  - Stage 2 – 4: 48MW datacentre
  - Stage 5 – 6: 72MW datacentre

Others:

- The future BESS is proposed to have approximately 5MW capacity with the following:
  - 8x 6,250kWH Energy Storage System (Battery)
  - 2x 4,980kVA Power Conversion System (PCS)
- The UPS system is assumed to be cooled by the rooftop chiller system. Accordingly, noise emissions from the UPS system have been considered negligible.
- Transformer required for the projects:

  - 2x 75MW for Stage 1
  - 6x 75MW for Future Stage
- Transformers will be equipped with 6m high blast wall to three sides, with the northern side open for maintenance and access.
- Preliminary acoustic assessment of acoustic characteristics has been conducted against EPA Publication 1996 and EPA 1826.5, based on interpolated one-third octave sound power level (50 Hz – 10k Hz), predicted noise level at the NSAs are evaluated against the EPA 1826.5.

Further review of equipment manufacturer data will be required during subsequent design stages to determine whether tonal penalties are required to be added to the predicted noise levels as per the procedures in the Noise Protocol.

The following acoustic considerations are beyond the scope of this study and have not been addressed:

- Environmental noise impact during construction phase.
- Noise emission from other small plant equipment or fans associated with the building which have not been specified at this stage. It is expected that noise treatment to minor equipment would be readily available via unit selection or acoustic mitigation such as
  - Selection of appropriate attenuators.
  - Install acoustic louvres
  - Install internally lined duct to intake or discharge path of ventilation units

7.2 Equipment Schedule for Stage 1

The current design of the datacentre includes major plant equipment such as air-cooled chillers, outside air package units, generators and transformers.

Typically, all equipment other than the generators are expected to be operational 24/7 and would need to meet the most stringent night period limit. Testing of generator equipment is expected to occur one unit at a time with a load bank and occur during the day period only.

Table 7-1 details the acoustic data utilised for the predictions based on the current mechanical and electrical design.

At this stage of the project, the following operational scenarios have been assessed:

- Normal operation: Operational equipment includes 44 chillers, 6 OAP units, 8 condensers and 44 kiosk transformers.
- Generator testing operation: Operational equipment includes 44 chillers, 6 OAP units, , 8 condensers, 44 kiosk transformers, 1 backup generator, and 1 mobile load bank.

Table 7-1 Stage 1: Major equipment sound power level – Interpolated one-third octave

Equipment	Qty	Octave Band Centre Frequency, Hz Sound Power Level (SWL) in dB																							Total dBA	Source and assumptions
		50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k	
Chillers	44	92	90	88	86	84	84	85	85	85	85	86	86	86	86	85	83	81	80	80	79	78	77	76	75	95	Chiller selection is a Smardt AD150.4R.F1AEUA.A020DA.E2D. The chiller's sound power level (SWL) has been calculated to be 95 dB(A) based on the sound pressure level (SPL) spectrum at 10m, as provided in the manufacturer's data sheet.
Generator container	44	117	117	116	114	113	110	106	104	103	103	102	102	102	102	101	100	98	97	94	93	92	92	91	90	111	Generator selection is a Cummins C2750D5BE-PB. The SWL spectrum is provided in the manufacturer's data sheet for an unattenuated unit. The generator design will include a weatherproof, sound attenuated enclosure which will provide additional attenuation.It is recommended that the generator to achieve 85dBA @1m.
Generator exhaust flute	44	114	114	111	107	104	101	99	97	95	92	90	90	91	91	91	90	90	91	92	93	94	95	97	98	105	
OAP unit	6	74	74	74	73	73	76	81	84	83	81	80	80	82	83	82	81	80	79	77	76	75	73	72	71	91	OAP unit selection is an Air Change PCU-N-LD 40. The SWL spectrum is provided in the manufacturer's data sheet and adjusted to account for all 4 fans of the OAP operating simultaneously.
Load bank	1	107	106	108	115	119	113	117	115	108	108	114	107	107	107	106	104	102	99	97	95	92	90	87	84	117	Load bank is used for Generator Testing only, noise data derived based on an indicative selection.
Kiosk transformer	44	73	74	74	76	77	75	72	70	70	71	71	69	66	64	63	61	60	58	56	55	52	50	47	45	76	Kiosk transformer selection is provided by supplier Schneider Electric with a specified load of 2.5MVA. The sound power level (SWL) is derived from IEC60076-10 and adjusted to the manufacturer sound pressure level of 68dBA at 1m.
HV Transformer	2	89	90	91	92	93	91	88	86	86	88	88	86	83	81	79	78	76	74	73	71	69	66	64	61	92	The HV transformers are located within the Jemena substation. The sound power level (SWL) is derived from IEC60076-10 based on 75MW high voltage transformer.
Condensers	8	79	79	80	81	82	81	81	80	80	80	79	77	75	74	72	70	68	67	66	65	63	62	61	59	84	Condenser noise is based on Daikin REYQ22

At this stage, one-third octave band noise data for the above sources has not been received from the suppliers. Therefore, interpolated data has been used to enable low-frequency assessment. On this basis, effective noise levels will be revised as the design progresses to review the need for any noise character adjustments in accordance with the Noise Protocol methodologies.

7.3 Equipment Schedule for Future Stages

Based on the assumed future development building capacity, Table 7-2 details the additional major equipment's acoustic data utilised for the predictions based on the assumed mechanical and electrical design.

Typically, all equipment other than the generators are expected to be operational 24/7 and would need to meet the most stringent night period limit. Testing of generator equipment is expected to occur three unit at a time with three load bank and occur during the Day period only.

At this stage of the project, the following operational scenarios have been assessed:

- Normal operation: Operational equipment includes 250 chillers, 30 OAP units, 40 condensers and 264 kiosk transformers.
- Generator testing operation: Operational equipment includes 250 chillers, 30 OAP units, 40 condensers, 264 kiosk transformers, 3 backup generators, and 3 mobile load banks.

At this stage, one-third octave band noise data for the sources have not been received from the suppliers. Therefore, interpolated data has been used and are outlined in Table 7-2. On this basis, effective noise levels will be revised as the design progresses to review the need for any noise character adjustments in accordance with the Noise Protocol methodologies.

Table 7-2: Future Stage: Major equipment sound power level – Interpolated one-third octave

Equipment	Qty	Octave Band Centre Frequency, Hz Sound Power Level (SWL) in dB																								Total dBA	Source and assumptions
		50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k		
Future Chillers	250	78	76	74	71	70	70	71	71	71	71	71	71	72	72	70	68	67	66	65	64	63	63	62	61	80	The chiller's sound power level (SWL) has been calculated to be 80 dB(A) based on future quiet mode chillers
Future Generator intake	264	104	102	101	100	98	96	92	89	89	89	88	88	88	88	87	85	84	82	80	78	78	77	76	76	93	Generator selection is derived based on indicative selection recommended to achieve 85dBA @1m. The generator design will include acoustic enclosure and exhaust muffler which will provide additional attenuation.
Future Generator discharge	264	102	100	99	98	96	94	90	87	87	87	86	86	86	86	85	83	82	80	78	76	75	75	74	74	97	
Future Generator exhaust flute	264	99	98	97	96	94	92	88	85	84	85	84	84	84	84	83	81	80	78	76	74	73	73	72	72	95	
OAP unit	30	74	74	74	73	73	76	81	84	83	81	80	80	82	83	82	81	80	79	77	76	75	73	72	71	91	OAP unit selection is Air Change PCU-N-LD 40. The SWL spectrum is provided in the manufacturer's data sheet and adjusted to account for all 4 fans of the OAP operating simultaneously.
Future Load bank	3	102	101	103	110	114	108	112	110	103	103	109	102	102	101	101	99	97	94	92	90	87	85	82	79	112	Load bank is used for generator Testing only, noise data derived based on indicative selection.
Kiosk transformer	264	73	74	74	76	77	75	72	70	70	71	71	69	66	64	63	61	60	58	56	55	52	50	47	45	76	Kiosk transformer selection is provided by supplier Schneider Electric with a specified load of 2.5MVA. The sound power level (SWL) is derived from IEC60076-10 and adjusted to the manufacturer sound pressure level of 68dBA at 1m.
HV Transformer	6	89	90	91	92	93	91	88	86	86	88	88	86	83	81	79	78	76	74	73	71	69	66	64	61	92	The HV transformers are located within the Jemena substation. The sound power level (SWL) is derived from IEC60076-10 based on 75MW high voltage transformer.
Condensers	40	79	79	80	81	82	81	81	80	80	80	79	77	75	74	72	70	68	67	66	65	63	62	61	59	84	Condenser noise is based on Daikin REYQ22
Future BESS	8	-	-	-	69	68	65	65	71	75	82	77	75	74	76	76	74	73	73	70	68	66	63	61	57	85	The Battery Energy Storage selection is a Hithium 6250 kWh unit. The detailed sound power level (SWL) has not been provided and is assumed from indicative equipment that has similar capacity (6250 kWh).
Future PCS (Power conversion system)	2	73	74	74	76	76	75	72	70	70	71	71	69	66	64	63	61	59	58	56	55	52	50	47	45	76	The PCS are located within BESS zone. The sound power level (SWL) is derived from IEC60076-10 based on 4980kVA transformer.

7.4 Noise Modelling

Calculations of noise emissions during the normal and generator testing operations have been undertaken using SoundPLAN v9.1. A 3D image of the modelled datacentre building and surrounds are shown in Figure 7-1 to Figure 7-3.

7.4.1 Stage 1

Figure 7-1 outlines the modelling methodology of the proposed development of Stage 1, including the Stage 1 building, substation zone on the ground south to Stage 1 and other existing industrial buildings within the surrounding vicinity. The substation zone is also modelled with the assumed 6m high blast wall which acts as a noise barrier within the model.

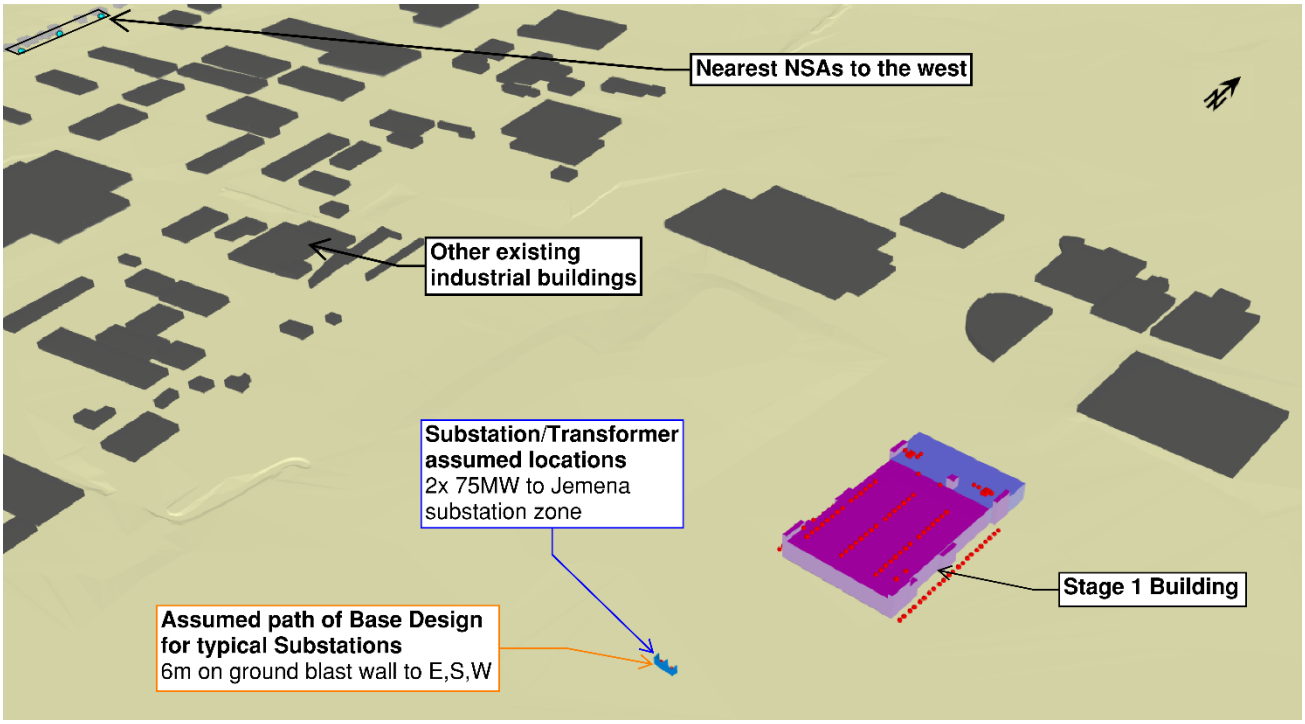


Figure 7-1 3D model of Stage 1 and surrounds.

7.4.2 Future stages

Figure 7-2 outlines the modelling methodology of the proposed future stages, including the Data Centres, additional substation zone on the ground south to Stage 1, Future BESS and other existing industrial buildings within the surrounding vicinity.

The future substation zone is also modelled with the assumed 6m high blast wall which acts as a noise barrier within the model. Rooftop chillers are modelled with an acoustic barrier surrounding them on the future stages buildings.

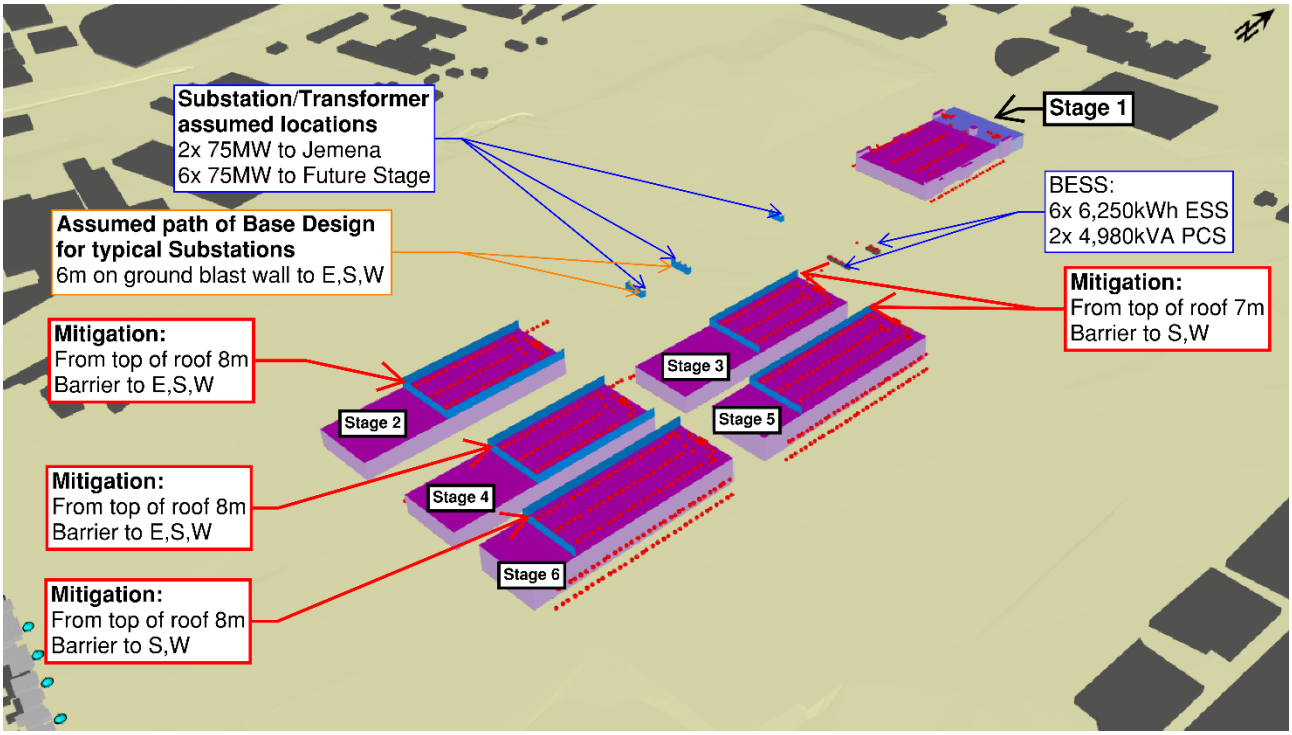


Figure 7-2 3D model of future stages and surrounds

Figure 7-3 provides an overview of all the proposed equipment for Stage 1 and future stages, including normal operation and testing operation equipment.

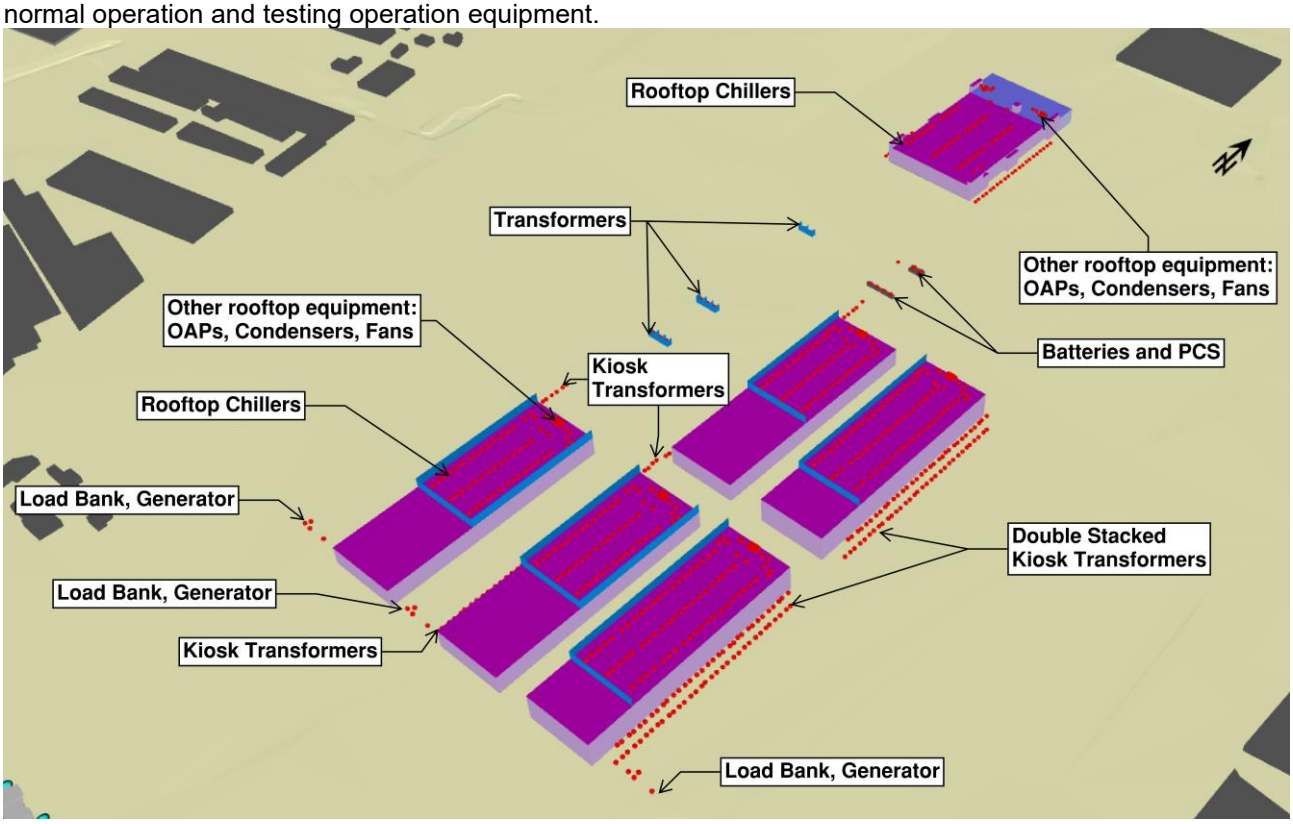


Figure 7-3 3D model of Stage 1 and future stages major equipment noise sources

7.5 Results

Noise emissions from the site have been predicted based on the proposed building layout and current plant selections at the nearest receivers to the datacentre building.

7.5.1 Effective noise levels

Publication 1826.5 defines the effective noise level as a 30–minute equivalent sound pressure level adjusted, where relevant for

a) Duration (A_{dur})

b) Noise character

   i) Tonality (A_{tone})

   ii) Impulse (A_{imp})

   iii) Intermittency (A_{int})

c) Measurement position

   i) Reflection (A_{refl})

   ii) Indoor (A_{ind})

The effective noise level is calculated using the following equation.

$$ENL = L_{Aeq} + A_{dur} + A_{tone} + A_{imp} + A_{int} + A_{refl} + A_{ind}$$

A review of the predicted noise levels and operational characteristics has been undertaken considering the requirements for the applicable adjustments described in Publication 1826.5 and based on the assumed sound power level and the predicted noise level at the NSAs, tonal characteristics has been identified at 50 Hz and 125 Hz during generator testing, primarily due to the operation of the generators and load banks. In accordance with EPA Publication 1826.5, a +2 dB penalty has been applied to the predicted testing noise levels presented in Table 7-4 and Table 7-6. Notwithstanding the tonal adjustment, the resulting effective noise levels are predicted to comply with the noise limits outlined in Section 6.1.1.

Further review of equipment sections would be required as the design progresses to confirm noise characteristics of the equipment does not require any further adjustment.

7.5.2 Normal Operation (Stage 1)

A review of the relative contributions from the various sources on site indicates that the chillers are the dominant noise source at all locations. Preliminary tonal noise assessment has been conducted based on interpolated one-third octave noise data; tonality is not detected from the predicted one-third octave noise level at the NSAs as per the methodology outlined in EPA 1826.5 and no adjustment is required for the predicted noise level at the NSAs.

The predicted noise emissions to the various identified NSAs during normal operation are summarised in Table 7-3.

Table 7-3 Stage 1 Noise Emission Predictions for Normal Operation, Night Period.

NSA Name[1]	Address	Period Project Contribution Limit dB(A)	Predicted Noise Level, LAeq dB(A)	Effective Noise Level	Compliance
NSA1	309 Barry Road, Campbellfield	Night– 46	40	40	Yes
NSA2	17 Doy St, Dallas	Night– 43	42	42	Yes

NSA3	55 Kyabram St, Coolaroo	Night– 42	39	39	Yes
Note:	1. Based on the modelling results, the above receivers within the NSAs are the closest to the site and predicted to experience the greatest noise exposure. Therefore, the corresponding street addresses differ from the reference NSAs defined in Table 6-2. Based on the modelling, noise emissions to other receivers in each area would be lower than those presented above.				

7.5.3 Generator Testing Operation (Stage 1)

An assessment of the noise emissions from a single generator being tested at the datacentre building site has been undertaken. Generator testing operation would be scheduled to be only undertaken during the day period. Preliminary tonal noise assessment has been conducted based on interpolated one-third octave noise data; it is noted that the tonality is detected at 125Hz and 500Hz due to the operation of the load bank and generator, a +2dBA penalty has been added to the predicted noise level to determine the Effective Noise Level.

The predicted noise emissions to the various identified NSAs during generator testing operation are summarised in Table 7-4.

Table 7-4 Stage 1 Noise Emission Predictions for Generator Testing Operation, Day Period.

NSA[1] Name	Address	Period Project Contribution Limit dB(A)	Predicted Noise Level, LAeq dB(A)	Effective Noise Level[2]	Compliance
NSA1	309 Barry Road, Campbellfield	Day– 63	50	52	Yes
NSA2	17 Doy St, Dallas	Day– 60	51	53	Yes
NSA3	55 Kyabram St, Coolaroo	Day– 57	49	51	Yes
Note:	1. Based on the modelling results, the above receivers within the NSAs are the closest to the site and predicted to experience the greatest noise exposure. Therefore, the corresponding street addresses differ from the reference NSAs defined in Table 6-2. Based on the modelling, noise emissions to other receivers in each area would be lower than those presented above. 2. Plus 2dBA corrections were made across all NSA as the predicted noise levels indicate tonal characteristics as defined by EPA 1826.5.				

7.5.4 Normal Operation (Stage 1 and future stages)

A review of the relative contributions from the various sources on site indicates that the chillers are the dominant noise source at all locations. A preliminary tonal noise assessment has been conducted based on interpolated one-third octave noise data, tonality is not detected from the predicted one-third octave noise level at the NSAs as per the methodology outlined in EPA 1826.5 and no adjustment is required for the predicted noise level at the NSAs.

The predicted noise emissions to the various identified NSAs during normal operation are summarised in Table 7-3.

Table 7-5 Future Stages Noise Emission Predictions for Normal Operation, Night Period.

NSA[1] Name	Address	Period Project Contribution Limit dB(A)	Predicted Noise Level, LAeq dB(A)	Effective Noise Level	Compliance
NSA1	309 Barry Road, Campbellfield	Night– 46	43	43	Yes
NSA2	17 Doy St, Dallas	Night– 43	43	43	Yes
NSA3	55 Kyabram St, Coolaroo	Night– 42	40	40	Yes

Note:	1. Based on the modelling results, the above receivers within the NSAs are the closest to the site and predicted to experience the greatest noise exposure. Therefore, the corresponding street addresses differ from the reference NSAs defined in Table 6-2. Based on the modelling, noise emissions to other receivers in each area would be lower than those presented above

7.5.5 Generator Testing Operation (Stage 1 and Future Stages)

An assessment of the noise emissions from three generators being tested at the datacentre building site has been undertaken. Generator testing operation would be scheduled to be only undertaken during the day period. Preliminary tonal noise assessment has been conducted based on interpolated one-third octave noise data; it is noted that tonality is detected at 125Hz and 500Hz due to the operation of the load bank and generator, a +2dBA penalty has been added to the predicted noise levels to determine the Effective Noise Level.

The predicted noise emissions to the various identified NSAs during generator testing operation are summarised in Table 7-6.

Table 7-6 Future Stage Noise Emission Predictions for Generator Testing Operation, Day Period.

NSA[1] Name	Address	Period Project Contribution Limit dB(A)	Predicted Noise Level, LAeq dB(A)	Effective Noise Level[2]	Compliance
NSA1	309 Barry Road, Campbellfield	Day– 63	59	61	Yes
NSA2	17 Doy St, Dallas	Day– 60	55	57	Yes
NSA3	55 Kyabram St, Coolaroo	Day– 57	45	47	Yes
Note:	1. Based on the modelling results, the above receivers within the NSAs are the closest to the site and predicted to experience the greatest noise exposure. Therefore, the corresponding street addresses differ from the reference NSAs defined in Table 6-2. Based on the modelling, noise emissions to other receivers in each area would be lower than those presented above 2. Plus 2dBA corrections were made across all NSA as the predicted noise levels indicate tonal characteristics as defined by EPA 1826.5.				

7.5.6 Discussion

Stage 1

With the current equipment selection, noise emissions from Stage 1 of the development are predicted to comply with the derived noise limits at all existing NSAs for both the normal and generator testing operations.

Future stages

The future stages of the development remain at the concept design stage, with the final building layouts, capacities and plant selections still under development. As part of the due diligence process and in response to GED, a preliminary noise assessment of Stage 1 and Future Stage has been undertaken. The assessment indicated that based on the current assumptions and the assumed sound power level outlined in Section 7.3, the development can potentially comply with the derived noise limits at all existing NSAs for both the normal and generator testing operations with the assumed mitigation measures.

As part of the General Environmental Duty as per the EPA VIC, noise mitigation shall be provided to the generators to reduce the associated noise impacts as far as is reasonable and practical. The current design has allowed for generators with a weatherproof sound attenuating enclosure and exhaust flue muffler, which can achieve an overall noise level of 85dBA at 1m. Based on the above, the generator testing assessment indicates that the generator noise can achieve the noise limits without further mitigation.

8 Discussion

8.1 Sleep disturbance

The existing noise environment in the area surrounding the project site consists of a number of non-natural sources including road traffic noise, train noise and commercial / industrial noise sources. The noise survey indicates that the background noise levels in the area are already elevated during the night period, between 10pm and 6am. The background noise survey undertaken on site demonstrates that between 10pm and 6am the ERS objective of 40dBA for Category III areas (residences to the south) are already exceeded.

EPA Publication 1997 highlights that the noise limits established in accordance with Publication 1826.5 are intentionally more stringent for the night period to protect sleep. Noise protocol limits are established based on the surrounding land use zoning, together with the existing background noise level. During the night period where the existing background noise level is categorised as high relative to the zoning level, the noise limit is established based on the background level plus 3dB.

On this basis, it is considered that compliance with the noise limits established in accordance with EPA Publication 1826.5 demonstrates adequate consideration of sleep disturbance impacts.

8.2 Low frequency noise

EPA Publication 1996 *Assessing Low Frequency Noise, June 2021* provides a framework to understand the risk of harm from the emissions of low frequency noise.

Publication 1996 provides an outdoor low frequency threshold criterion. The criterion is not a set limit, however, provides a level that indicates a potential risk of problematic low frequency noise.

At this stage of the design, detailed low frequency noise data for equipment may not be available, with suppliers typically providing noise data, for frequencies as low as 63Hz only. Where data is available it has been incorporated into the model.

A comparison of the measured existing equivalent ($L_{eq15min}$) day period noise levels, predicted normal operation noise levels, and predicted testing operation noise levels against the Publication 1996 threshold are provided in Table 8-1 and Table 8-2. The baseline noise survey indicates that that there are already sources of low frequency noise in the area from existing sources that exceed the Publication 1996 threshold at times. The measurement undertaken at Location 1 at 11:24am included two plane flybys including one distant jet and a nearby propeller plane.

Table 8-1 EPA Publication 1996 low frequency noise threshold – Stage 1

Location	Item	1 /3 Octave Band Centre Frequency, Hz Sound Pressure Level												
		10	**12.5**	**16**	**20**	**25**	**31.5**	**40**	**50**	**63**	**80**	**100**	**125**	**160**
Outdoor	EPA Publication 1996 Outdoor low frequency threshold criterion	**92**	**89**	**86**	**77**	**69**	**61**	**54**	**50**	**50**	**48**	**48**	**46**	**44**
NSA 1	Measured Background LAeq	61	60	58	56	59	56	55	56	58	56	59	57	54
	Normal Operation	N/A							43	41	39	34	33	32
	Testing Operation								56	56	54	49	51	46
NSA 2	Measured Background LAeq	59	58	56	55	56	56	57	57	56	54	53	55	56
	Normal Operation	N/A							42	41	39	34	32	32
	Testing Operation								56	56	54	49	51	46
NSA 3	Measured Background LAeq	64	62	58	56	56	56	57	60	60	62	56	56	53
	Normal Operation	N/A							41	39	38	32	31	31
	Testing Operation								55	55	54	49	51	46
Note: N/A – 1/3 Octave band at lower frequencies (10Hz – 40Hz) are not available at this stage and the predicted low frequency noise will be further review once available.														

Table 8-2 EPA Publication 1996 low frequency noise threshold – Stage 1 and future stages

Location	Item	1 /3 Octave Band Centre Frequency, Hz Sound Pressure Level												
		10	**12.5**	**16**	**20**	**25**	**31.5**	**40**	**50**	**63**	**80**	**100**	**125**	**160**
Outdoor	EPA Publication 1996 Outdoor low frequency threshold criterion	**92**	**89**	**86**	**77**	**69**	**61**	**54**	**50**	**50**	**48**	**48**	**46**	**44**
NSA 1	Measured Background LAeq	61	60	58	56	59	56	55	56	58	56	59	57	54
	Normal Operation	N/A							45	44	44	40	40	39
	Testing Operation								58	57	56	57	60	54
NSA 2	Measured Background LAeq	59	58	56	55	56	56	57	57	56	54	53	55	56
	Normal Operation	N/A							44	43	42	38	38	37
	Testing Operation								55	54	53	53	57	51
NSA 3	Measured Background LAeq	64	62	58	56	56	56	57	60	60	62	56	56	53
	Normal Operation	N/A							42	41	40	35	35	34
	Testing Operation								46	44	44	41	47	41
Note: N/A – 1/3 Octave band at lower frequencies (10Hz – 40Hz) are not available at this stage and the predicted low frequency noise will be further review once available.														

Typical operational noise levels are predicted to be below the Publication 1996 thresholds. During generator testing the noise levels in the 50Hz to 160Hz range are predicted to be higher when compared to the typical operation, however predicted levels are mostly above the threshold but below the measured existing background level.

Further review of equipment sections would be required as the design progresses to confirm low frequency noise emissions are appropriately mitigated.

8.3 Mitigation Strategy for Future Stages

The proposed data centre development may be expanded (Future Stage) following completion of Stage 1. Based on the current masterplan, the future expansion may include:

- Three (3) two-storey data centres (each approximately 48MW);
- Two (2) three-storey data centres (each approximately 72MW);
- Battery Energy Storage Systems (BESS) (approximately 5MW total); and
- Associated substations for Future Stage.

The future stages remain at a concept design level and are subject to change as the project develops, as such, the final development may differ from the indicative layout assessed in this report.

Given these uncertainties, a preliminary assessment has been undertaken based on assumptions of indicative equipment quantities and corresponding sound power levels, as outlined in Table 7-2. Conservative assumptions have been adopted to demonstrate the acoustic feasibility of Stage 1 and future stages.

Subject to the implementation of the acoustic mitigation measures outlined below, including equipment-specific noise limits and acoustic screening of major plant, the indicative future stages are predicted to comply with the applicable noise criteria during both normal operation and generator testing conditions.

The assessment should be reviewed as the design develops to confirm compliance with the applicable operational noise limits.

- Chillers (future stages):
  - Sound power levels shall be limited to 80dBA per unit.
  - Chillers should be screened by continuous acoustic barriers with the extend and height shown in Figure 7-2
- Emergency Generators (future stages)
  - Generator sound pressure levels shall be limited to 85dBA at 1m per unit, inclusive of the generator package, air intake and discharge systems, and exhaust flues
  - Up to three (3) generators may be tested simultaneously, one per building.
- Future BESS and energy infrastructure
  - Transformer sound power level shall be limited to 92dBA per unit
  - Transformers are assumed surrounded by 6 m high blast walls on three sides, with the northern side remaining open. This is required for safety, however provides benefit in terms of noise mitigation.
  - Battery system sound power levels shall be limited to 85dBA per unit.
- Other Major Plant
  - Noise limits for other major equipment are provided in Table 7-2

- All major roof plant outlined in Table 7-2 should be located within the acoustic barrier shown on the concept layout shown in Figure 8-1.

- Acoustic barrier
  - Constructed with minimum surface mass of 15kg/m^2
  - Continuous with no airgap
  - Height and extend of the barrier are shown in Figure 8-1.
- Roof equipment should be placed towards the north, furthest away as practical from Barry Road

As the future stages remain at an early design stage, the assessment should be considered preliminary in nature. The noise impacts and mitigation requirements should be reviewed and refined as the design progresses and equipment selections become available.

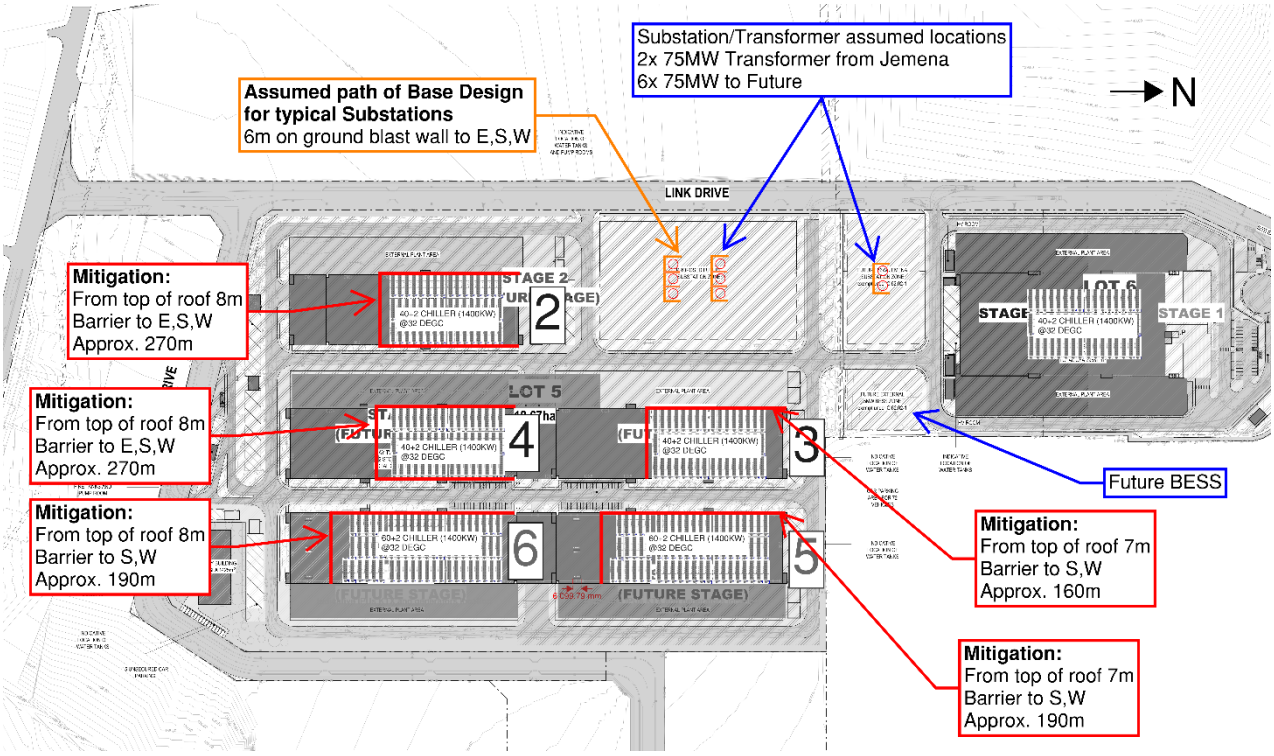


Figure 8-1 Future stages acoustic barrier markup

9 Conclusion

A review of the environmental noise emissions from the proposed datacentre site (Stage 1) has been undertaken. Based on the current equipment schedule and selections, noise emissions to the existing noise sensitive areas in the area surrounding the Project Site (Stage 1) are predicted to comply with the limits established in accordance with EPA Publication 1826.5.

A preliminary acoustic assessment of Stage 1 and the future stages have been undertaken to assess the acoustic feasibility of the full site. Based on the indicative future plant schedule and the implementation of the recommended noise mitigation measures, noise emissions at existing noise sensitive areas are predicted to comply with the EPA Publication 1826.5 noise limits. The recommendations for noise mitigation are provided Table 7-2 and Figure 7-2.

Appendix A – Site Zoning and Influencing Factors

A summary of the zoning within 200m radius from the centre of the Noise Sensitive Areas is presented across Figure 9-1 to Figure 9-3.

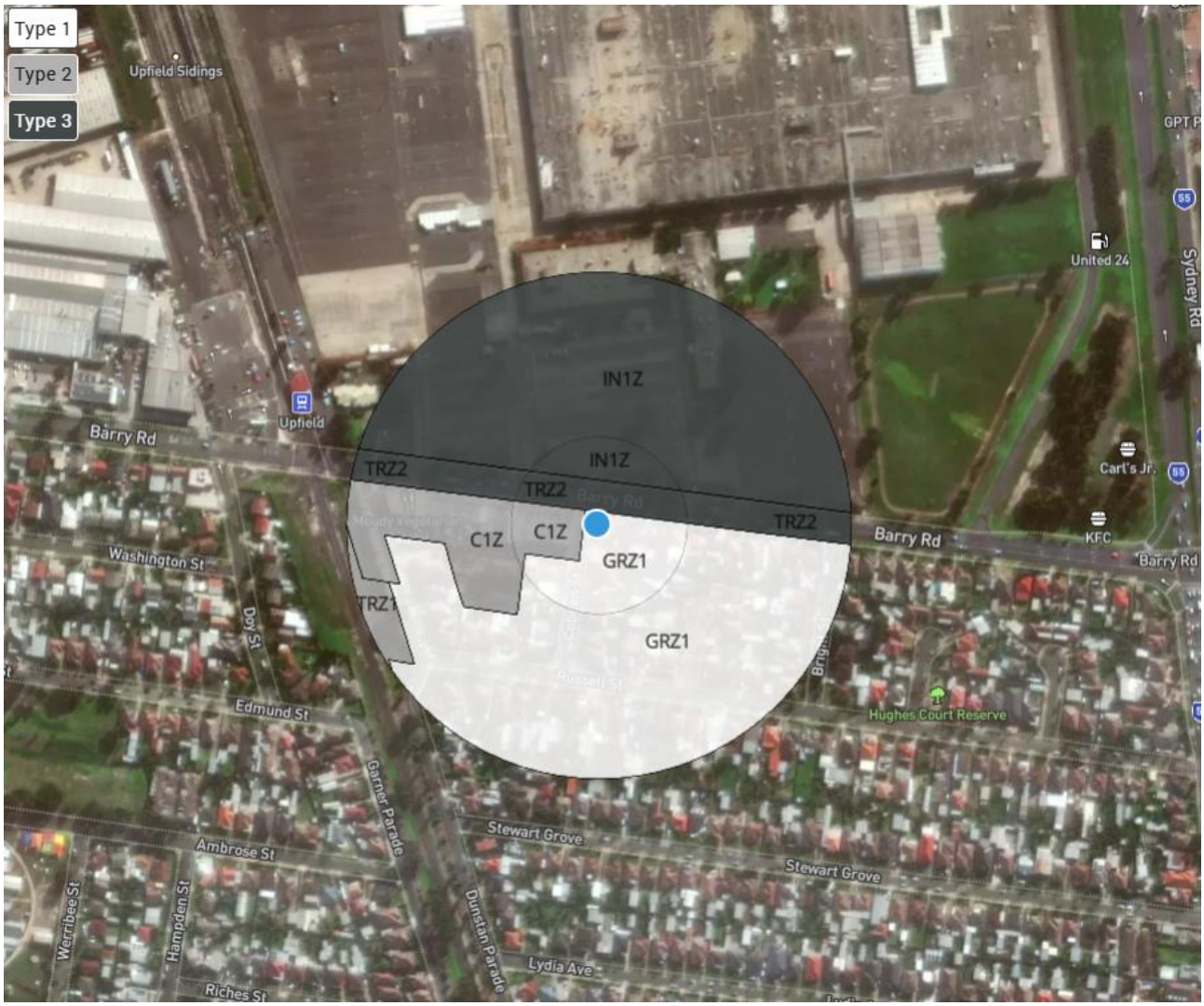


Figure 9-1 Zoning surrounding NSA1.

Figure 9-2 Zoning surrounding NSA2.

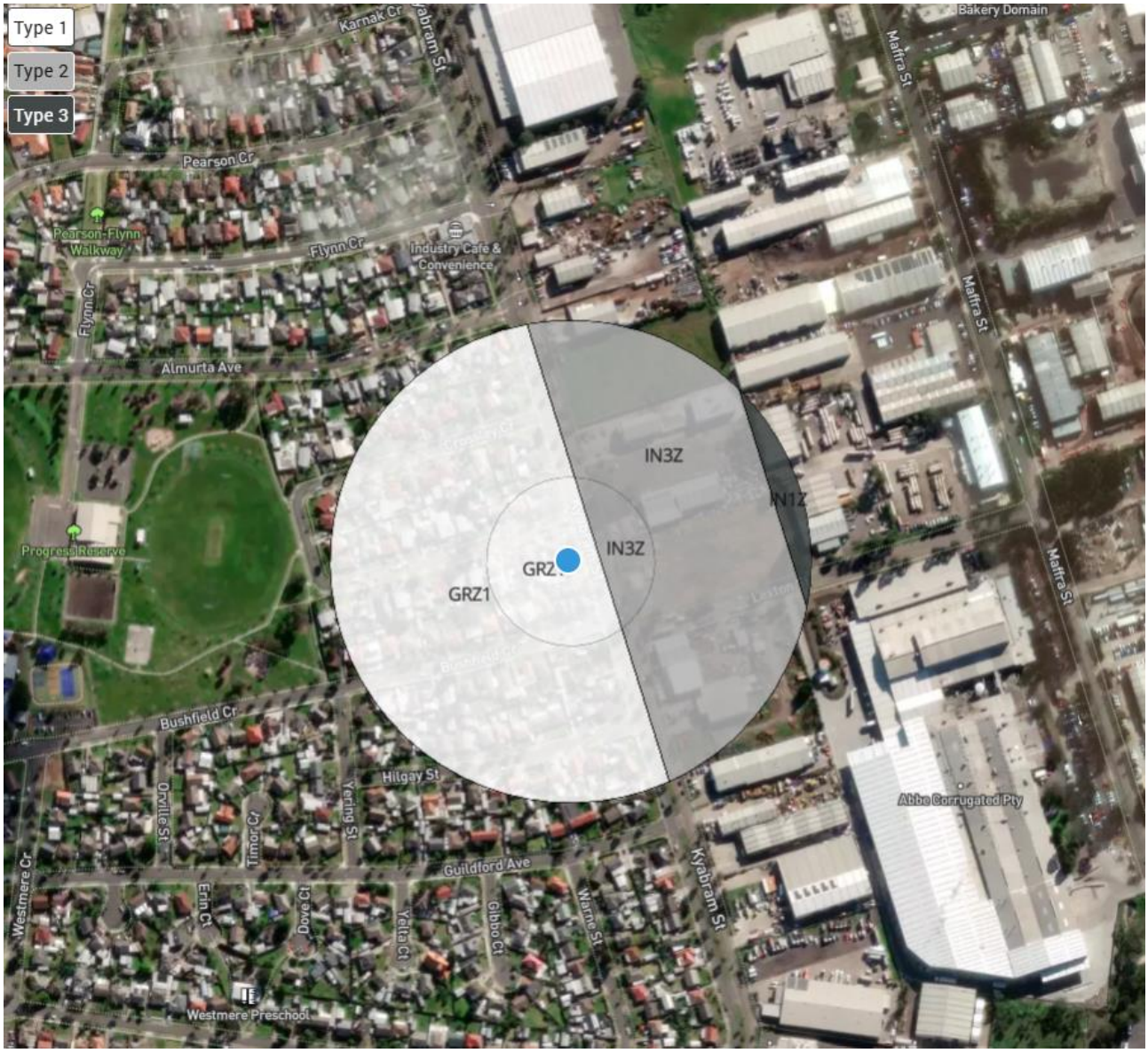
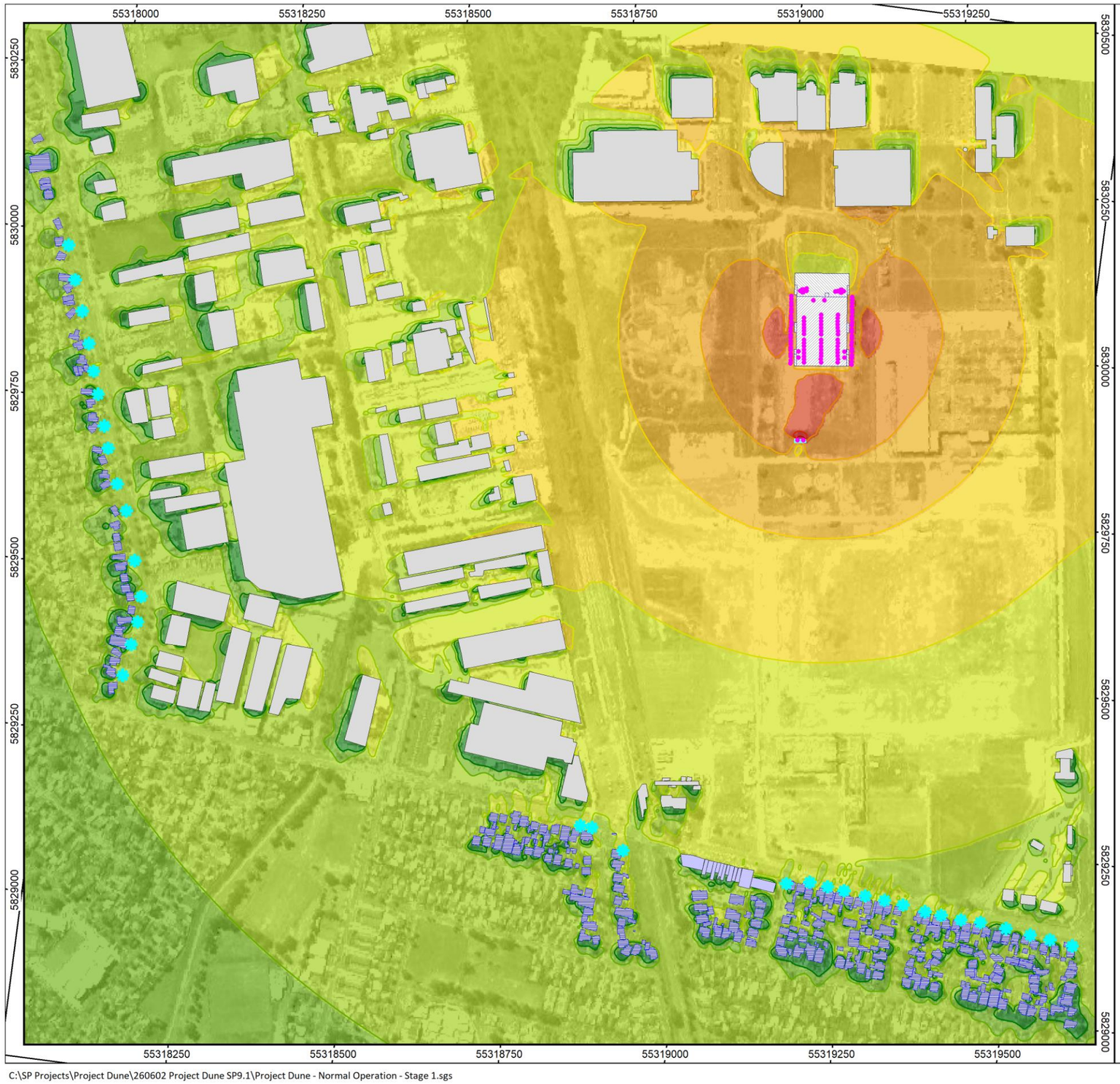


Figure 9-3 Zoning surrounding NSA3.

Appendix B – Noise Contours



C:\SP Projects\Project Dune\260602 Project Dune SP9.1\Project Dune - Normal Operation - Stage 1.sgs

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Project Dune

Predicted Noise Contours

Normal Operation - Stage 1

NOTES:

(1) PROPOGATION 1.5M ABOVE GROUND LEVEL.
(2) NOISE CONTOURS EXCLUDE TONALITY CORRECTIONS APPLICABLE FOR THE SCENARIO.
(3) ALL AREA WITHOUT SHADING WERE NOT CALCULATED IN THE MODEL.
(4) GRID MAP CONTOURS CALCULATED AT 5M. NOISE CONTOURS MAY VARY TO THE REPORT VALUES.

LEGEND

- Point Noise Source
- Noise Sensitive Receiver
- Residential building
- Main building
- Industrial
- Noise Wall
- Commercial

	<=	30.0
30.0 <	<=	35.0
35.0 <	<=	40.0
40.0 <	<=	45.0
45.0 <	<=	50.0
50.0 <	<=	55.0
55.0 <	<=	60.0
60.0 <	<=	65.0
65.0 <	<=	70.0
70.0 <	<=	75.0
75.0 <		

N

0 60 120 180 240 m

C:\SP Projects\Project Dune\260602 Project Dune SP9.1\Project Dune - Normal Operation - Future Stage.sgs

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Project Dune

Predicted Noise Contours

Normal Operation - Future Stage

NOTES:

(1) PROPOGATION 1.5M ABOVE GROUND LEVEL.
(2) NOISE CONTOURS EXCLUDE TONALITY CORRECTIONS APPLICABLE FOR THE SCENARIO.
(3) ALL AREA WITHOUT SHADING WERE NOT CALCULATED IN THE MODEL.
(4) GRID MAP CONTOURS CALCULATED AT 5M. NOISE CONTOURS MAY VARY TO THE REPORT VALUES.

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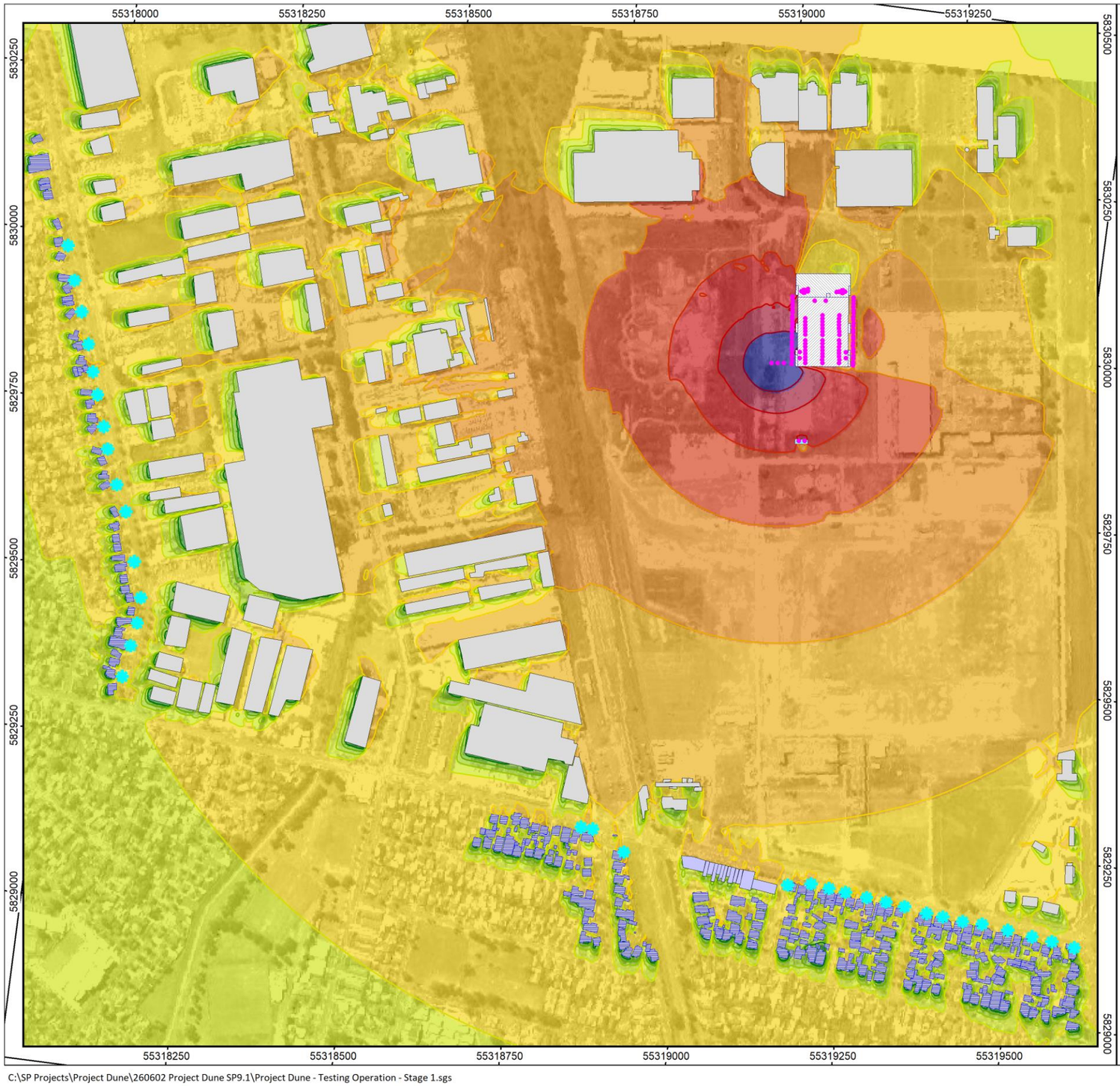
- Point Noise Source
- Noise Sensitive Receiver
- Residential building
- Main building
- Industrial
- Noise Wall
- Commercial

	<=	30.0
30.0 <	<=	35.0
35.0 <	<=	40.0
40.0 <	<=	45.0
45.0 <	<=	50.0
50.0 <	<=	55.0
55.0 <	<=	60.0
60.0 <	<=	65.0
65.0 <	<=	70.0
70.0 <	<=	75.0
75.0 <		

N

0 60 120 180 240 m



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Project Dune

Predicted Noise Contours

Testing Operation - Stage 1

NOTES:

(1) PROPOGATION 1.5M ABOVE GROUND LEVEL.
(2) NOISE CONTOURS EXCLUDE TONALITY CORRECTIONS APPLICABLE FOR THE SCENARIO.
(3) ALL AREA WITHOUT SHADING WERE NOT CALCULATED IN THE MODEL.
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- Noise Sensitive Receiver
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- Main building
- Industrial
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- Commercial

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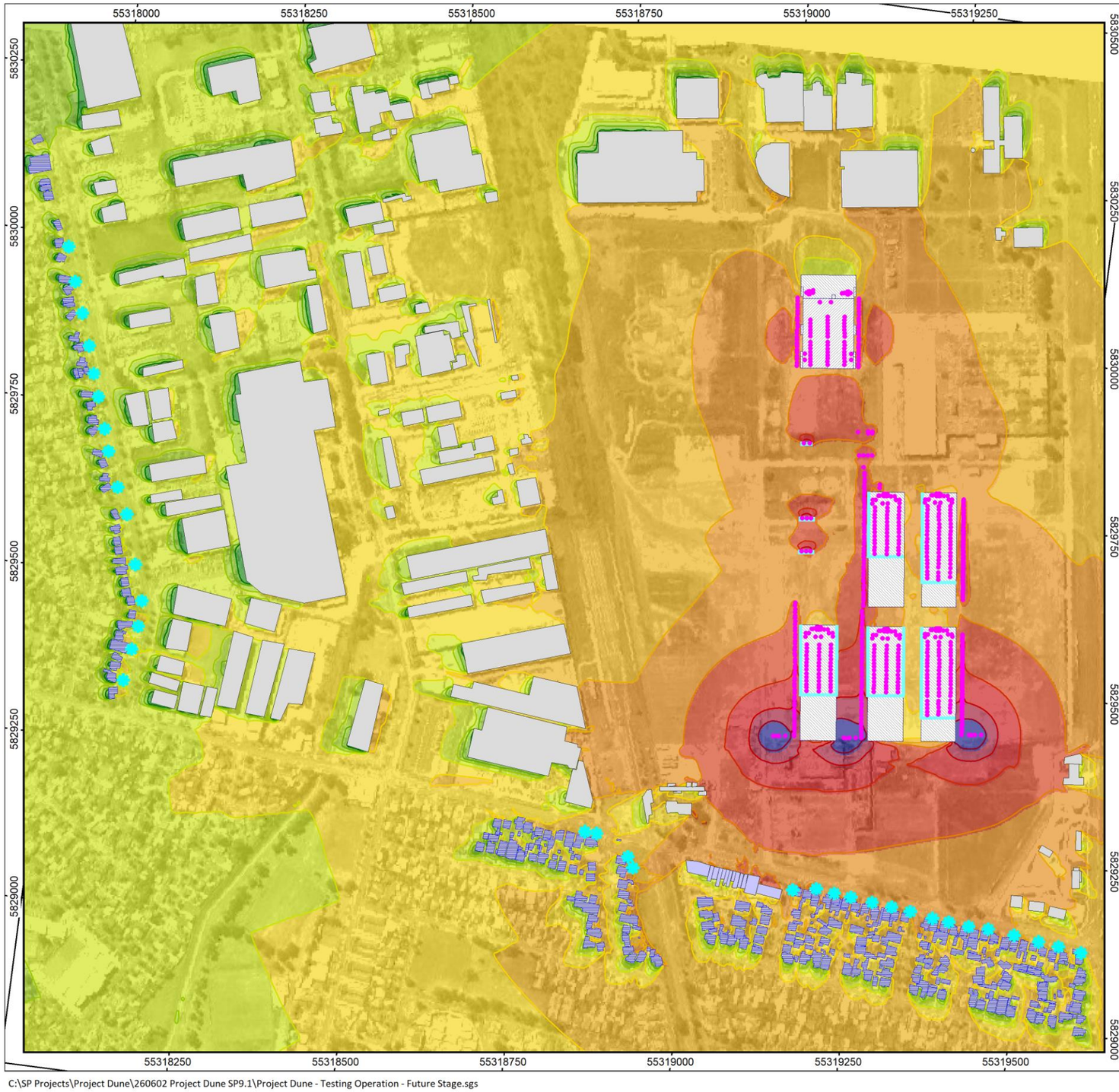
35.0 <	<=	40.0
40.0 <	<=	45.0
45.0 <	<=	50.0
50.0 <	<=	55.0
55.0 <	<=	60.0
60.0 <	<=	65.0
65.0 <	<=	70.0
70.0 <	<=	75.0
75.0 <		

N

0 60 120 180 240 m



C:\SP Projects\Project Dune\260602 Project Dune SP9.1\Project Dune - Testing Operation - Future Stage.sgs

AGP Sustainable Real Assets

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Project Dune

Predicted Noise Contours

Testing Operation - Future Stage

NOTES:

(1) PROPOGATION 1.5M ABOVE GROUND LEVEL.
(2) NOISE CONTOURS EXCLUDE TONALITY CORRECTIONS APPLICABLE FOR THE SCENARIO.
(3) ALL AREA WITHOUT SHADING WERE NOT CALCULATED IN THE MODEL.
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- Residential building
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	<=	30.0
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40.0 <	<=	45.0
45.0 <	<=	50.0
50.0 <	<=	55.0
55.0 <	<=	60.0
60.0 <	<=	65.0
65.0 <	<=	70.0
70.0 <	<=	75.0
75.0 <		

N

0 60 120 180 240 m

Appendix C – Calibration Certificates

Acoustic Research Labs Pty Ltd
Unit 36/14 Loyalty Rd
North Rocks NSW AUSTRALIA 2151
Ph: +61 2 9484 0800 A.B.N. 65 160 399 119
www.acousticresearch.com.au

Octave Band Filter
IEC 61260-3:2016
Calibration Certificate

Calibration Number C24652

Client Details	Aurecon Level 8, 850 Collins Street Docklands VIC, 3008
Filter Model Number :	Type 2270
Filter Serial Number :	4.7.6
Instrument Serial Number :	3029475
Microphone Serial Number :	3260624
Pre-amplifier Serial Number :	30129
Firmware Version :	4.7.6.244

Atmospheric Conditions

Ambient Temperature :	24.3 °C
Relative Humidity :	41 %
Barometric Pressure :	99.75 kPa

Calibration Technician : Emanuel Eid
Secondary Check: Cooper Sallway
Calibration Date : 28 Aug 2024
Report Issue Date : 29 Aug 2024
Approved Signatory : Juan Aguero

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
Midband Relative Attenuation (Clause 10)	**Pass**	Operating Range Lower Limit (Clause 12)	**Pass**
Linearity, Range and Overload (Clause 11)	**Pass**	Relative Attenuation (Clause 13)	**Pass**

The filter submitted for testing successfully completed the periodic tests of IEC 61260-3, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61260-2, to demonstrate that the model of filter fully conformed to the class 1 specifications in IEC 61260-1:2014 the filter submitted for testing conforms to the class 1 specifications of IEC 61260-1:2014.

Uncertainties of Measurement -

Electrical Tests		Environmental Conditions	
-5 dB < ΔA(Ω) ≤ 40 dB	*±0.12 dB*	*Temperature*	*±0.1 °C*
40 dB < ΔA(Ω) ≤ 120 dB	*±0.2 dB*	*Relative Humidity*	*±1.9 %*
		Barometric Pressure	*±0.11 kPa*

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025 - Calibration.

The results of the tests, calibrations and/or measurements included in this document are traceable to SI units.

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

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www.acousticresearch.com.au

Sound Calibrator

IEC 60942:2017

Calibration Certificate

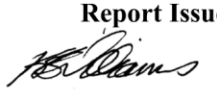
Calibration Number C24696

Client Details	Aurecon Level 8, 850 Collins Street Docklands VIC, 3008
Equipment Tested/ Model Number :	Pulsar Model 105
Instrument Serial Number :	99005

Atmospheric Conditions

Ambient Temperature :	23.2 °C
Relative Humidity :	45.1 %
Barometric Pressure :	101.37 kPa

Calibration Technician :	Jeff Yu	**Secondary Check:**	Cooper Sallway
Calibration Date :	13 Sep 2024	**Report Issue Date :**	16 Sep 2024

Approved Signatory :  Ken Williams

Characteristic Tested	Result
Generated Sound Pressure Level	*Pass*
Frequency Generated	*Pass*
Total Distortion	*Pass*

Nominal Level	Nominal Frequency	Measured Level	Measured Frequency
94	1000	94.01	1000.30

The sound calibrator has been shown to conform to the class 1 requirements for periodic testing, described in Annex B of IEC 60942:2017 for the sound pressure level(s) and frequency(ies) stated, for the environmental conditions under which the tests were performed..

Uncertainties of Measurement -

Specific Tests		Environmental Conditions	
Generated SPL	*±0.10 dB*	*Temperature*	*±0.1 °C*
Frequency	*±0.07 %*	*Relative Humidity*	*±1.9 %*
Distortion	*±0.20 %*	*Barometric Pressure*	*±0.11 kPa*

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

NATA WORLD RECOGNISED ACCREDITATION

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Document prepared by

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