

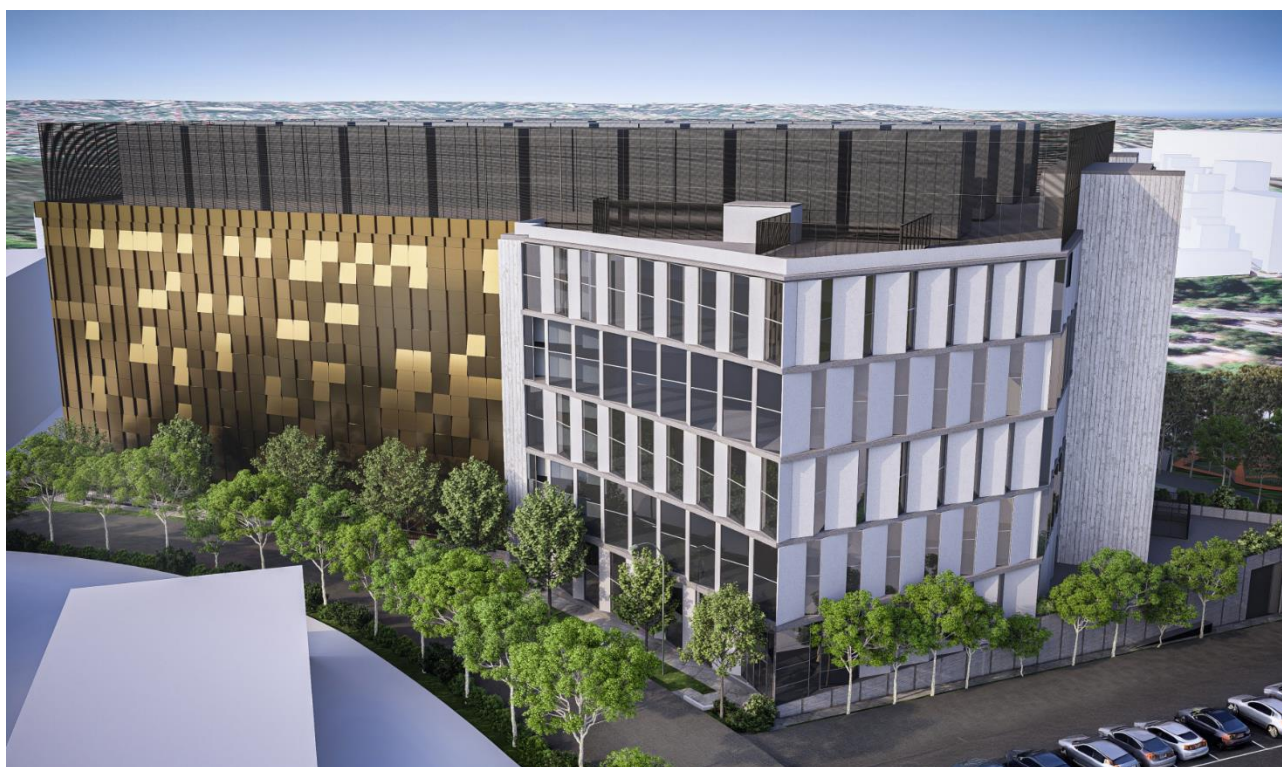
ISPT

## Julius Avenue Data Centre

### Noise and Vibration Impact Assessment

Reference: AC03

V2 | 18 June 2025



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Job number 306239

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## Contents

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|                                                |    |
|------------------------------------------------|----|
| Executive Summary                              | 1  |
| 1. Introduction                                | 2  |
| 1.1 The Site                                   | 2  |
| 1.2 Proposed development                       | 3  |
| 1.3 Planning framework                         | 4  |
| 1.4 Qualification                              | 4  |
| 2. Assessment requirements                     | 5  |
| 2.1 Response to SEARs                          | 5  |
| 2.2 Policy and planning context                | 5  |
| 3. Existing environment                        | 7  |
| 3.1 Assessment locations                       | 7  |
| 3.2 Existing acoustic environment              | 10 |
| 4. Operational noise assessment                | 12 |
| 4.1 Operational scenarios                      | 12 |
| 4.2 Noise criteria                             | 12 |
| 4.3 Modelling methodology                      | 13 |
| 4.4 Noise predictions                          | 15 |
| 5. Road traffic noise                          | 26 |
| 6. Construction noise and vibration assessment | 28 |
| 6.1 Construction noise criteria                | 28 |
| 6.2 Construction noise assessment              | 29 |
| 6.3 Construction traffic assessment            | 33 |
| 6.4 Construction vibration criteria            | 34 |
| 6.5 Vibration assessment                       | 34 |
| 6.6 Construction noise and vibration measures  | 34 |
| 7. Conclusion                                  | 39 |
| 8. References                                  | 40 |

## Tables

|                                                                                                    |   |
|----------------------------------------------------------------------------------------------------|---|
| Table 1: Development particulars                                                                   | 4 |
| Table 2: Industry Specific Secretary's Environmental Assessment Requirements – Noise and Vibration | 5 |
| Table 3: Residential assessment locations                                                          | 7 |

|                                                                                                         |     |
|---------------------------------------------------------------------------------------------------------|-----|
| Table 4: Noise monitoring locations                                                                     | 10  |
| Table 5 Long term noise monitoring results, dB(A)                                                       | 10  |
| Table 6: Short-term noise monitoring equipment                                                          | 11  |
| Table 7 Short-term noise monitoring results                                                             | 11  |
| Table 8: NPfI Project Noise Trigger Levels (normal operations)                                          | 12  |
| Table 9: Noise emission modelling methodology                                                           | 13  |
| Table 10: Architectural drawings                                                                        | 14  |
| Table 11: Meteorological conditions used in the noise assessment                                        | 15  |
| Table 12: Project equipment, quantities and noise levels (per unit)                                     | 17  |
| Table 13: MPark Talavera Road Data Centre assessment mitigation measures                                | 20  |
| Table 14: Modelling scenarios and corresponding plant and equipment quantities                          | 20  |
| Table 15: Predicted noise levels: Day - normal operation with generator testing                         | 21  |
| Table 16: Predicted noise levels: Evening - normal operation                                            | 22  |
| Table 17: Predicted noise levels: Night – normal operation                                              | 23  |
| Table 18: Noise source contribution at worst affected receiver locations during night period            | 24  |
| Table 19: Predicted noise levels: Emergency operation                                                   | 25  |
| Table 20: Existing peak traffic volumes on Delhi Road and Julius Avenue                                 | 26  |
| Table 21: Predicted traffic noise increase on Julius Avenue due to the operation of the development     | 26  |
| Table 22: Construction noise management levels (NMLs) at residential receivers                          | 28  |
| Table 23: Construction noise management levels (NMLs) at other noise sensitive land uses                | 29  |
| Table 24: Construction Noise Management Levels – recommended Standard hours                             | 29  |
| Table 25: ICNG recommended standard hours of construction                                               | 30  |
| Table 26: Equipment and plant sound power levels                                                        | 31  |
| Table 27: Predicted construction noise levels - Residential and non-residential receivers               | 32  |
| Table 28: Traffic anticipated to be generated by construction works <sup>1</sup>                        | 33  |
| Table 29: Construction noise and vibration mitigation and management measures                           | 35  |
| Table 30: Recommended minimum working distances for vibration intensive plant                           | 37  |
| Table 31: Unattended Noise Monitoring Equipment information                                             | B-2 |
| Table 32: Generator testing regime                                                                      | C-1 |
| Table 33: NPfI RANLs and PANLs                                                                          | D-2 |
| Table 34: Site Intrusive and amenity noise levels – external noise levels, $dB LA_{eq}(15 \text{ min})$ | D-4 |
| Table 35: Cooling tower sound pressure level data at 15 m – BAC XES3E-1424-12P ENDURA/H                 | E-4 |
| Table 36: Cooling tower calculated overall sound power level – BAC XES3E-1424-12P ENDURA/H              | E-4 |
| Table 37: Cooling tower sound power levels (for SoundPlan modelling) – BAC XES3E-1424-12P ENDURA/H      | E-5 |
| Table 38: Types of vibration - Definition                                                               | H-2 |
| Table 39: Preferred and maximum vibration acceleration levels for human comfort, $m/s^2$                | H-2 |
| Table 40: Acceptable vibration dose values (VDV) for intermittent vibration ( $m/s^{1.75}$ )            | H-3 |
| Table 41: BS 7385-2 structural damage criteria                                                          | H-3 |
| Table 42: DIN 4150-3 structural damage guideline values                                                 | H-4 |
| Table 43: Guideline values for short-term vibration impacts on buried pipework                          | H-4 |

## Figures

|                                                                                                                                |     |
|--------------------------------------------------------------------------------------------------------------------------------|-----|
| Figure 1: Aerial view of the Site (Source: Nearmap, 2024)                                                                      | 3   |
| Figure 2: Site context, surrounding land uses, noise catchment areas, noise sensitive receivers and noise monitoring locations | 9   |
| Figure 3: Noise modelling inputs and noise source locations                                                                    | 19  |
| Figure 4: Average third-octave band sound pressure levels of cooling tower noise based on measured noise data                  | E-6 |
| Figure 5: Third-octave band sound pressure levels of generator noise based on manufacturer's and measured noise data           | E-7 |
| Figure 6: Nearest residential apartments façade noise map (normal operation with generator testing, day)                       | G-6 |
| Figure 7: Nearest residential apartments façade noise map (normal operation, night)                                            | G-7 |

## Appendices

|                                                                      |     |
|----------------------------------------------------------------------|-----|
| Appendix A                                                           | A-1 |
| Glossary A-1                                                         |     |
| Appendix B                                                           | B-1 |
| Background and ambient noise survey                                  | B-1 |
| B.1 Unattended long-term noise monitoring                            | B-2 |
| Appendix C                                                           | C-1 |
| Generator testing regime                                             | C-1 |
| Appendix D                                                           | D-1 |
| Operational noise criteria                                           | D-1 |
| D.1 Noise Policy for Industry (NPfI)                                 | D-2 |
| Appendix E                                                           | E-1 |
| Cooling tower and generator noise data                               | E-1 |
| E.1 Cooling tower manufacturer's noise data                          | E-2 |
| E.2 Cooling tower noise modelling methodology                        | E-4 |
| Appendix F                                                           | F-1 |
| Low frequency noise analysis                                         | F-1 |
| Appendix G                                                           | G-1 |
| Noise contours                                                       | G-1 |
| G.1 Noise contours (horizontal) at 2 metres relative to ground level | G-2 |
| G.2 Vertical noise grids                                             | G-6 |
| Appendix H                                                           | H-1 |
| Vibration criteria                                                   | H-1 |
| H.1 Disturbance to building occupant                                 | H-2 |

|                                                    |                   |     |
|----------------------------------------------------|-------------------|-----|
| H.2                                                | Structural damage | H-3 |
| Appendix I                                         |                   | I-1 |
| Noise and vibration complaint management procedure |                   | I-1 |

# Executive Summary

A Noise and Vibration Impact Assessment has been conducted to accompany a State Significant Development Application (SSDA) for the proposed development at 6-8 Julius Avenue, North Ryde NSW in accordance with the requirements of the Planning Secretary's Environmental Assessment Requirements (SSD-80018208).

The SSDA seeks approval for the earthworks and construction of a new 115.2 MW data centre (the project). The project site is shown in Figure 1.

This study assessed the emission of both construction and operation noise and vibration from the project on the community and surrounding development, specifically addressing the following:

## Operation

Noise criteria for the site for the operation of the proposed data centre were determined according to the NSW *Noise Policy for Industry* [1]. The assessment considered both normal operations and maintenance activities, including generator testing. With the implementation of mitigation measures, the project can comply with the criteria for normal operation during all operating times. Maintenance operations involving the testing of two generators under load at a time was also compliant for the day period.

The traffic generated by the operation of the project is low and thus is predicted to comply with the NSW *Road Noise Policy* [2].

## Construction

Criteria for construction noise were established according to the NSW *Interim Construction Noise Guideline* [3]. The study identified likely construction activities and assessed noise emissions to nearby receivers. It was found that exceedances were predicted at the closest receivers during some activities. Although the assessment is conservative, mitigation and management measures have been recommended. Further noise mitigation measures should be reviewed during the development of the Construction Noise and Vibration Management Plan (CNVMP) prior to start of construction works.

The increase in traffic due to the construction of the project is predicted to comply with the NSW *Road Noise Policy*.

Criteria for construction vibration were based on the NSW *Assessing Vibration: a technical guideline* [4], AS 2187:Part 2 [5], BS 7385 Part 2 [6] and DIN 4150-3 [7]. Preliminary minimum working distances are established for potential vibration intensive construction activities. The nearest sensitive receivers and structures have been identified. Further site investigations may be warranted for underground services. Given the proximity of some receiver locations, mitigation and management measures to minimise vibration risk have been documented in this report. Sensitive receivers, structures and services should be confirmed and formalised in the CNVMP.

# 1. Introduction

This Noise and Vibration Impact Assessment (NVIA) report has been prepared by Arup Australia Pty Ltd on behalf of ISPT to accompany a State Significant Development Application (SSDA) for a data centre development.

## 1.1 The Site

The Site is identified as 6-8 Julius Avenue, North Ryde, legally described as Lot 89 in Deposited Plan 1082131 (the Site). The Site is irregular in shape and is located on the south-eastern side of Julius Avenue, North Ryde.

The Site has a primary frontage of approximately 100m to Julius Avenue and has a partial rear frontage to Richardson Place (cul-de-sac) at the north-eastern corner. The Site has an area of approximately 2.863ha.

The Site is currently vacant. The north-western part of the Site was excavated and cleared of vegetation in 2009 as part of Modified Determination No. 1395/1999 previously approved on the Site.

The Site is zoned E3 Productivity Support pursuant to Ryde Local Environmental Plan 2014 (RLEP 2014) and is located within the City of Ryde Local Government Area (LGA) which is approximately 15km north-west of the Sydney CBD.

Existing attributes of the Site and surrounding context are noted as follows:

- The Site is generally surrounded to the north-east, north-west, and south-west by commercial uses and E3 Productivity Support zoned land.
- Approximately 150m to the west of the Site is MU1 mixed Use zoned land which contemplates residential development to a height of 95m.
- The Site directly adjoins the Lane Cove National Park to the east and south-east which contains a walking track known as The Great North Walk and a fire trail.
- The Lane Cove River is located approximately 100m to the east of the Site.
- The Site directly adjoins the Ryde City Council Administrative Centre to the east.
- Approximately 500m to the west of the Site is the North Ryde Metro Station.
- The nearest residential development is located approximately 300m to the south-east of the Site on the eastern side of Lane Cove River in Lane Cove North, and 300m to the south-west of the Site on the southern side of Epping Road in North Ryde.

An aerial view of the Site is provided in Figure 1 below

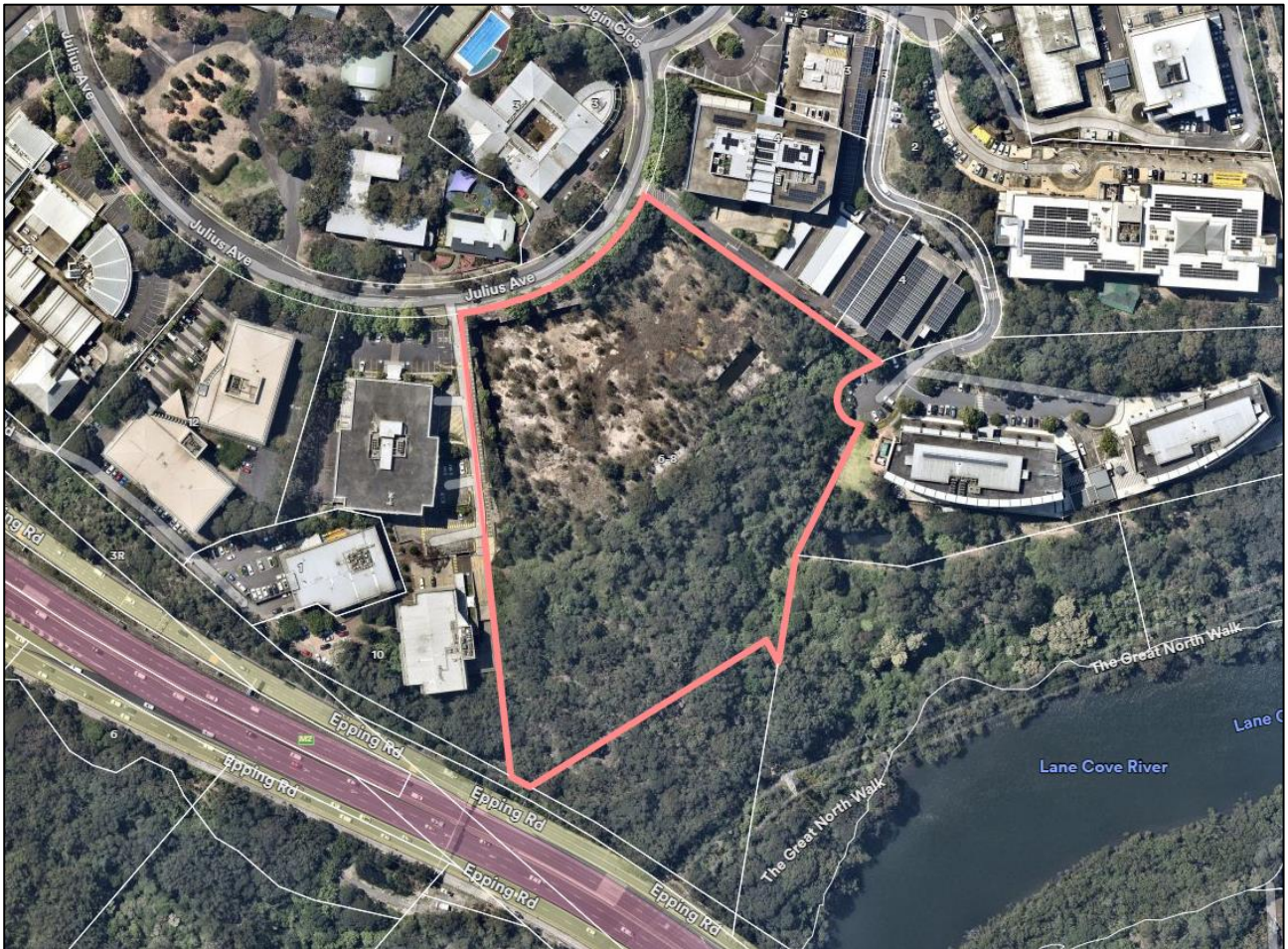


Figure 1: Aerial view of the Site (Source: Nearmap, 2024)

## 1.2 Proposed development

The Proposal involves the construction and operation of a data centre and associated infrastructure and amenities, identified as the Julius Avenue Data Centre, comprising the following scope of works:

- Site preparation works, including tree removal;
- Earthworks and additional site retaining;
- Infrastructure comprising civil works and utilities servicing;
- Construction a data centre, with the following:
  - Basement car parking for 54 cars, including 2 accessible;
  - 12 data halls across six (6) storeys with an IT load of 115.2 MW and a maximum power consumption of 169 MW, with upper-level mechanical equipment and rooftop plant;
  - Five (5) storey office/front of house building;
  - Six (6) storey enclosed generator building to rear of data centre.
- New Ausgrid precinct-wide 132 kilovolt (KV) Subtransmission Switching Station (STSS);
- One (1) new public street along the southern part of the Site;
- Two (2) new pedestrian through-site link from Julius Avenue to Richardson Place; and
- Complimentary landscaping and offset planting.

The Proposal includes works as identified in Table 1 below.

Table 1: Development particulars

| Component                 | Documentation                                                                                                               |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Site Area                 | 28,630sqm                                                                                                                   |
| Primary Land Use          | Data Centre (25,512sqm GFA)                                                                                                 |
| Ancillary Land Uses       | Office premises (1,393sqm GFA)                                                                                              |
| Gross Floor Area          | 26,905sqm                                                                                                                   |
| Floor Space Ratio         | 0.92:1                                                                                                                      |
| IT Load                   | 115.2 MW                                                                                                                    |
| Maximum Power Consumption | 169 MW                                                                                                                      |
| Building Height           | Approximately 48m                                                                                                           |
| New Streets               | One (1) new public street                                                                                                   |
| Car Parking               | 54 car parking spaces (including 2 accessible)                                                                              |
| Landscaping/trees         | Refer to EIS                                                                                                                |
| Back-Up Generators        | 72 x 3MW back-up generators & 1 x 1MW office back-up generator                                                              |
| Dangerous Goods           | 1,279kL diesel storage capacity (12 x 100kL tanks + 72 x 1kL day tanks + 1 x 6kL office blk tank + 1 x 1kL office day tank) |
| Estimated Jobs            | Refer to EIS                                                                                                                |

### 1.3 Planning framework

**Zoning and Permissibility:** The Site is zoned E3 Productivity Support under the provisions of RLEP 2014. The proposed use as a data centre is permitted with consent in the E3 Productivity Support zone pursuant to RLEP 2014. The Proposal is also permitted with consent by virtue of being in a prescribed zone pursuant to Chapter 2, Part 2.3, Division 3 of *State Environmental Planning Policy (Transport and Infrastructure)* 2021 (the Transport and Infrastructure SEPP).

**Approval Pathway:** The Proposal is classified as State Significant Development (SSD) on the basis that it falls within the requirements of Section 25 of Schedule 1 of the *State Environmental Planning Policy (Planning Systems)* 2021 (the Planning Systems SEPP), being:

#### 25 Data centres

- (1) Development for the purpose of data centres that has a total power consumption of more than the relevant amount.
- (2) In this section—  
**relevant amount** means—  
 (a) for any other development—15 megawatts.

The proposed data centre has a maximum power consumption of 170 megawatts and therefore the consent authority is NSW Department of Planning, Housing and Infrastructure (DPHI).

### 1.4 Qualification

This report was prepared by Arup who is a member of the Association of Australasian Acoustical Consultants (AAAC) in NSW. The consultants who prepared the assessment are members of the Australian Acoustical Society (AAS).

## 2. Assessment requirements

### 2.1 Response to SEARs

This report has been prepared in response to the requirements contained within the Secretary's Environmental Assessment Requirements (SEARs) dated 20 February 2025 issued for the SSDA (SSD-80018208). Specifically, this report has been prepared to respond to the industry-specific SEARs and additional assessment requirements as summarised in Table 2.

Table 2: Industry Specific Secretary's Environmental Assessment Requirements – Noise and Vibration

| Requirement                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Scope item to address requirement                                                                                                                                                                                                                                             | Section reference (this Report) |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| <b>12. Noise and Vibration</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                               |                                 |
| <b>Noise and Vibration Impact Assessment</b><br>Provide a noise and vibration assessment prepared in accordance with the relevant EPA guidelines and Australian / International Standards. The assessment must detail construction and operational noise and vibration impacts (including testing of any back-up power system) on nearby sensitive receivers and structure, and outline the proposed mitigation, management and monitoring measures that would be implemented. | This noise and vibration impact assessment has been prepared for the project addressing the industry-specific SEARs and includes:                                                                                                                                             |                                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | • Identification of nearby sensitive receivers                                                                                                                                                                                                                                | Section 3.1                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | • Construction noise and vibration impacts                                                                                                                                                                                                                                    | Section 6                       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | • Proposed construction noise and vibration mitigation, management and monitoring measures                                                                                                                                                                                    | Section 6.6                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | • Operational noise and vibration impacts                                                                                                                                                                                                                                     | Section 4                       |
| <b>Additional Assessment Matter</b><br>Prepare an operational noise assessment which:                                                                                                                                                                                                                                                                                                                                                                                          | • Proposed operational noise and vibration mitigation, management and monitoring measures                                                                                                                                                                                     | Section 4.4                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | • Provide details of noise monitoring survey, background noise levels at the potentially most-affected residential receptors (i.e. not necessarily the nearest residential receptor).                                                                                         | Section 3.2                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | • Include details of manufacturer specifications for plant and equipment and noise source inventory (demonstrating worst-case modelling of plant and equipment for each assessment period, including testing of any back-up power system and critical power failure scenario) | Section 4.4 and Appendix E      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | • Assess the effect of the development on neighbouring sites within the Macquarie Park Corridor Precinct, particularly at the nearby key sites along Julius Avenue                                                                                                            | Section 4                       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | • Evaluate data centre and substation operational noise for any potential annoying noise characteristics such as tonality and dominant low-frequency content.                                                                                                                 | Section 4.4 and Appendix E      |

### 2.2 Policy and planning context

The following policies, guidelines and standards have been considered in this assessment in accordance with the SEARs:

- NSW Environment Protection Authority (EPA) *Noise Policy for Industry* (NPfI), 2017 [1]
- NSW Department of Environment and Climate Change (DECC) *Interim Construction Noise Guideline* (ICNG), 2009 [3]
- NSW Department of Environment, Climate Change and Water (DECCW) *Road Noise Policy* (RNP), 2011 [2]
- NSW Department of Environment and Conservation (DEC) *Assessing Vibration: a technical guideline* (AVATG), 2006 [4]

- Transport for NSW (TfNSW) Construction Noise and Vibration Guideline (CNVG) Public Transport Infrastructure, 2023 [8]
- Australian Standard AS 1055-2018 – Acoustics—Description and measurement of environmental noise, 2018 [9]
- Australia Standard AS 2187.2-2006 – Explosives – Storage and use Part 2: Use of explosives [5]
- Australian Standard AS 2436-2010 – Guide to noise and vibration control on construction, demolition and maintenance sites, 2010 [10]
- Australian Standard AS IEC 61672.1-2019 – Electroacoustics – Sound Level Meters Specifications, 2019 [11]
- British Standard BS 5228: Part 1 2009 Code of Practice for Noise and Vibration Control on Construction and Open Sites Part 1: Noise, 2009 including Amendment 1, 2014 [12]
- British Standard BS 6472: Evaluation of human exposure to vibration in buildings (1-80 Hz), 1992 [13]
- British Standard BS 7385: Part 2 1993 Evaluation and Measurement of Vibration in Buildings, 1993 [6]
- German Institute for Standardisation DIN 4150: Part 3 2016 Vibration in Buildings – Effects of Structures, 2016 [7]

Acoustic terminologies used in this assessment are presented in Appendix A.

## 3. Existing environment

### 3.1 Assessment locations

Existing noise and vibration sensitive receivers have been identified in Table 3, and Figure 2 in accordance with requirements in Section 2.1 and the *Noise Policy for Industry* (NPfI) [1]. Additionally, future planned residential receivers as part of the Macquarie Park Transport Oriented Development (TOD) Rezoning [14] and planned nearby multi-use developments have been included as assessment locations as presented in Figure 2.

In accordance with the NPfI, the reasonably most-affected residences have been grouped into Noise Catchment Areas (NCAs) based on their acoustic environment as observed on site. NCAs are presented in Figure 2. For clarity, the assessment of residential receivers presented in this report is isolated to the reasonably most-affected receivers listed in Table 3.

The nearest noise sensitive receivers surrounding the site are described in Table 3, and graphically represented in Figure 2.

Table 3: Residential assessment locations

| Receiver ID                      | NCA  | Address                           | Description                                                                                                                             | No. of floors | Separation distance <sup>1</sup> (m) |
|----------------------------------|------|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------------------------|
| <b>Residential receivers</b>     |      |                                   |                                                                                                                                         |               |                                      |
| RES1                             | NCA1 | 5-11 Julius Avenue, North Ryde    | Future proposed residential apartments planned as part of the Macquarie Park Transport Oriented Development Urban Design Framework [15] | 18            | 200                                  |
| RES2                             | NCA1 |                                   |                                                                                                                                         | 18            | 195                                  |
| RES3                             | NCA1 | 39 Delhi Road, North Ryde         | Future proposed residential apartments. Development currently under assessment. [16]                                                    | 20            | 425                                  |
| RES4                             | NCA1 |                                   |                                                                                                                                         | 20            | 490                                  |
| RES5                             | NCA3 | 35 Walkers Drive, Lane Cove North | Existing multi-level residential townhouses                                                                                             | 3             | 440                                  |
| RES6                             | NCA3 | 25 Walkers Drive, Lane Cove North | Existing multi-level residential townhouses                                                                                             | 3             | 440                                  |
| RES7                             | NCA2 | 15 Gilda Street, North Ryde       | Existing split level residential single dwelling                                                                                        | 2             | 430                                  |
| RES8                             | NCA2 | 35 Gilda Street, North Ryde       | Existing split level residential townhouses                                                                                             | 2             | 400                                  |
| RES9                             | NCA2 | 18 Magdala Road, North Ryde       | Existing double level residential single dwelling                                                                                       | 2             | 480                                  |
| RES10                            | NCA2 | 30 Gilda Street, North Ryde       | Existing split level residential townhouses                                                                                             | 2             | 480                                  |
| RES11                            | NCA2 | 6A Magdala Rd, North Ryde         | Existing double level residential single dwelling                                                                                       | 2             | 570                                  |
| <b>Non-residential receivers</b> |      |                                   |                                                                                                                                         |               |                                      |
| COM1                             | -    | 10 Julius Avenue, North Ryde      | Existing commercial building                                                                                                            | 9             | 70                                   |
| COM2                             | -    | 12 Julius Avenue, North Ryde      | Existing commercial building                                                                                                            | 5             | 130                                  |
| COM3                             | -    | 14 Julius Avenue, North Ryde      | Existing commercial building                                                                                                            | 3             | 210                                  |
| COM4                             | -    | 1 Rivette Road, North Ryde        | Existing commercial building                                                                                                            | 12            | 320                                  |
| COM5                             | -    | 1B Rivette Road, North Ryde       | Existing commercial building                                                                                                            | 5             | 320                                  |
| COM6                             | -    | 1 Epping Road, North Ryde         | Existing commercial building                                                                                                            | 8             | 430                                  |
| COM7                             | -    | 39 Delhi Road, North Ryde         | Existing commercial building                                                                                                            | 9             | 380                                  |
| COM8                             | -    | 11 Julius Avenue, North Ryde      | Existing commercial building                                                                                                            | 8             | 315                                  |
| COM9                             | -    | 3 Julius Avenue, North Ryde       | Existing commercial building                                                                                                            | 4             | 80                                   |

| Receiver ID | NCA | Address                                               | Description                                                                                                                                                   | No. of floors | Separation distance <sup>1</sup> (m) |
|-------------|-----|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------------------------|
| COM10       | -   | 1 Julius Avenue, North Ryde                           | Existing commercial building                                                                                                                                  | 8             | 160                                  |
| COM11       | -   | 2 Julius Avenue, North Ryde                           | Existing commercial building                                                                                                                                  | 8             | 190                                  |
| COM12       | -   | 4 Julius Avenue, North Ryde                           | Existing commercial building                                                                                                                                  | 10            | 70                                   |
| COM13       | -   | 3 Richardson Pl, North Ryde                           | Existing commercial building                                                                                                                                  | 7             | 100                                  |
| COM14       | -   | 2 Richardson Pl, North Ryde                           | Existing commercial building                                                                                                                                  | 8             | 150                                  |
| COM15       | -   | 1 Richardson Pl, North Ryde                           | Existing commercial building                                                                                                                                  | 5             | 190                                  |
| CC1         | -   | 5A Julius Avenue, North Ryde                          | Existing child care centre<br>It is noted that this child care centre has closed and is currently vacated however has been included as an assessment location | 1             | 70                                   |
| CC2         | -   | 39 Delhi Road, North Ryde                             | Existing child care centre located on the ground level and externally of the commercial building facing Julius Avenue                                         | 1             | 370                                  |
| REC1        | -   | 'Great North Walk' located south of 6-8 Julius Avenue | Existing bush walk trail (Fairylane Track) within Lane Cove National Park                                                                                     | 1             | 120                                  |
| HOT1        | -   | 62 Delhi Road, North Ryde                             | Existing hotel / short-term accommodation                                                                                                                     | 5             | 320                                  |

Notes:

1\_ Separation distance approximately measured horizontally from receiver location to approx. mid-point of subject site.

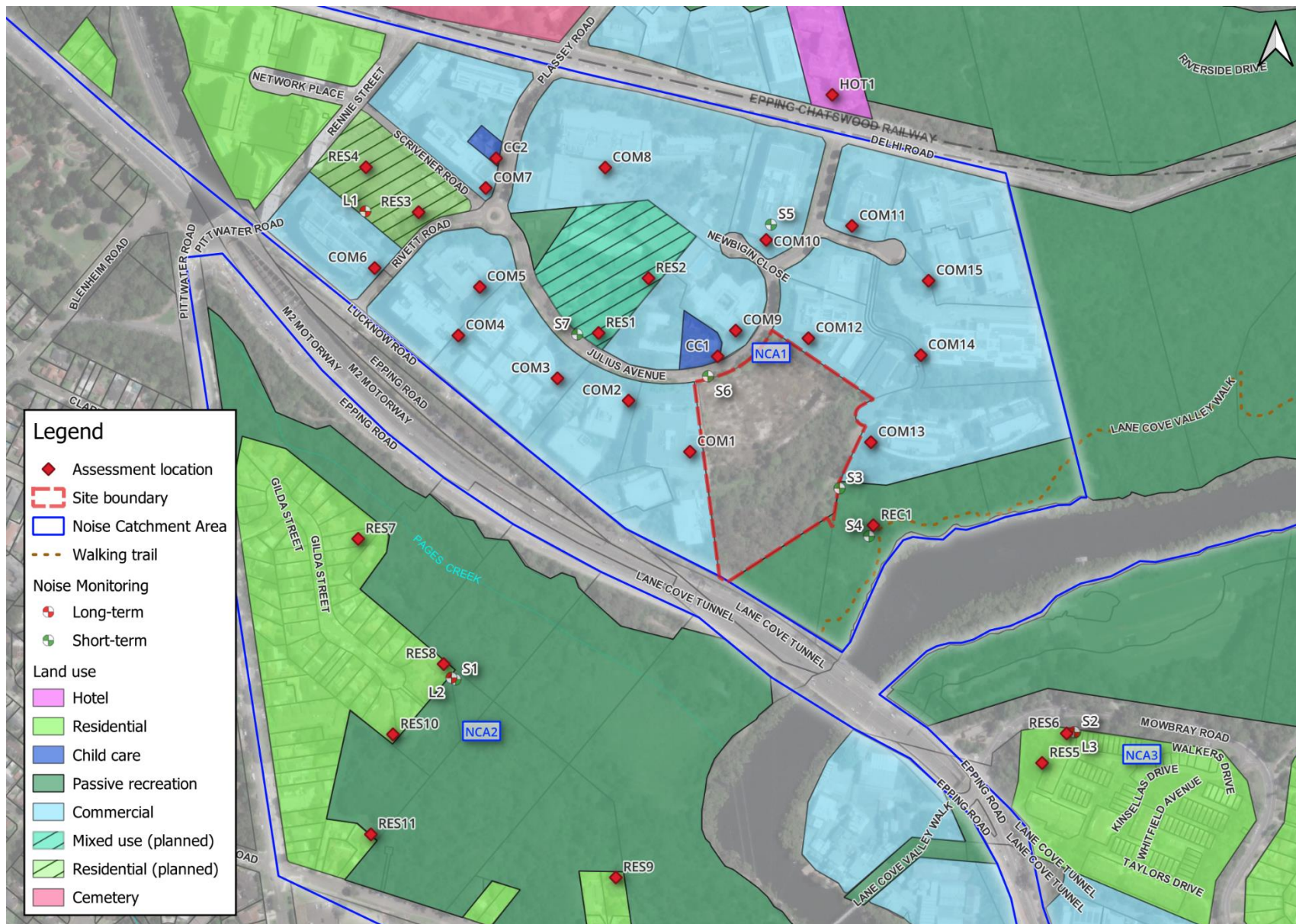


Figure 2: Site context, surrounding land uses, noise catchment areas, noise sensitive receivers and noise monitoring locations

## 3.2 Existing acoustic environment

Existing background noise levels are required for the establishment of the intrusive noise criteria, applying only to residential locations. All other receivers have fixed criteria applied.

### 3.2.1 Long-term noise monitoring

The noise monitoring locations are shown in Figure 2 and described in Table 4.

Table 4: Noise monitoring locations

| ID              | Location                                                            | Measurement period                               | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------|---------------------------------------------------------------------|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| L1 <sup>1</sup> | 39 Delhi Road, North Ryde (south of Scrivener Road / New Link Road) | Friday, 5 May to Tuesday, 16 May 2023            | Noise monitor located on ground level near the southern boundary of the site. Noise environment consists of general urban noise and traffic noise from M2 Motorway, Epping Road and Delhi Road.<br><br>This monitoring location is set back from the M2 Motorway, Epping Road and Delhi Road and shielded by multi-storey buildings. This monitoring location is considered to be a conservative representative of existing background and ambient noise levels for the reasonably most-affected residences within NCA1 nearest to the proposal site.                                 |
| L2              | 35 Gilda Street, North Ryde                                         | Thursday, 5 December to Monday, 16 December 2024 | Noise monitor positioned on ground level in the rear yard of the property. Noise environment consists of traffic noise from M2 Motorway and natural noise (e.g. birds and insects).<br><br>This monitoring location is set back from the M2 Motorway and Epping Road at an existing residential receiver location. The noise environment is characterised by natural noises and road traffic noise. Existing noise levels at this location are considered representative of the reasonably most-affected residences in NCA2.                                                          |
| L3              | 25 Walkers Drive, Lane Cove North                                   | Thursday, 5 December to Monday, 16 December 2024 | Noise monitor positioned on the ground level in the rear yard of the property. Noise environment consists of traffic noise from Mowbray Road and natural noise (e.g. birds and insects).<br><br>This monitoring location is shielded from Epping Road due to multi-storey apartments/townhouses and shielded from Mowbray Road due to road cuttings and the boundary fence. The noise environment is characterised by natural noises and road traffic noise. Existing noise levels at this location are considered representative of the reasonably most-affected residences in NCA3. |

Notes:

1\_ Long term noise monitoring conducted by Acoustic Logic as part of the EIS prepared for the Stockland Trinité Stage 2 Build-to-Rent development located at 39 Delhi Road, North Ryde (ref. *RTS Noise & Vibration Assessment* 20230459.1/2106A/R5/RF, dated 21/06/2024) [16]

Results of the long-term noise monitoring are summarised in Table 5. Further details regarding the noise monitoring and noise monitoring graphs are presented in Appendix B.

Table 5 Long term noise monitoring results, dB(A)

| Location                                                                              | Noise Catchment Area (NCA) | Time period <sup>1</sup> | Rating background noise levels, dBL <sub>A90</sub> | Ambient noise levels, dBL <sub>Aeq</sub> |
|---------------------------------------------------------------------------------------|----------------------------|--------------------------|----------------------------------------------------|------------------------------------------|
| L1 – 39 Delhi Road, North Ryde (south of Scrivener Road / New Link Road) <sup>2</sup> | NCA1                       | Day                      | 49                                                 | 55                                       |
|                                                                                       |                            | Evening                  | 46                                                 | 53                                       |
|                                                                                       |                            | Night                    | 38                                                 | 51                                       |
| L2 - 35 Gilda Street, North Ryde                                                      | NCA2                       | Day                      | 52                                                 | 61                                       |
|                                                                                       |                            | Evening                  | 48                                                 | 56                                       |
|                                                                                       |                            | Night                    | 39                                                 | 52                                       |

| Location                               | Noise Catchment Area (NCA) | Time period <sup>1</sup> | Rating background noise levels, dBL <sub>A90</sub> | Ambient noise levels, dBL <sub>Aeq</sub> |
|----------------------------------------|----------------------------|--------------------------|----------------------------------------------------|------------------------------------------|
| L3 – 25 Walkers Drive, Lane Cove North | NCA3                       | Day                      | 52                                                 | 68                                       |
|                                        |                            | Evening                  | 49                                                 | 60                                       |
|                                        |                            | Night                    | 36                                                 | 51                                       |

Notes:

1\_ Day: 07:00-18:00 Monday to Saturday and 08:00-18:00 Sundays & Public Holidays

Evening: 18:00-22:00 Monday to Sunday & Public Holidays

Night: 22:00-07:00 Monday to Saturday and 22:00-08:00 Sundays & Public Holidays

2\_ Conducted by Acoustic Logic as part of the EIS prepared for the Stockland Trinitri Stage 2 Build-to-Rent development located at 39 Delhi Road, North Ryde (ref. *RTS Noise & Vibration Assessment* 20230459.1/2106A/R5/RF, dated 21/06/2024)

### 3.2.2 Short-term noise monitoring

Table 6 presents the equipment used to conduct the noise measurements. Equipment carried current certificates of calibration at time of measurement.

Table 6: Short-term noise monitoring equipment

| Equipment         | Model                          | Serial no.   |
|-------------------|--------------------------------|--------------|
| Sound level meter | Brüel and Kjær 2250 Type 1     | 3029878      |
|                   | NTi XL2                        | A2A-11441-E0 |
| Calibrator        | Brüel and Kjær 2431 calibrator | 2445716      |

Short-term noise monitoring locations, results and notes are detailed in Table 7 and graphically presented in Figure 2.

Table 7 Short-term noise monitoring results

| Measurement Location                                                         | Date / Start Time period         | Measured noise level |                    | Notes                                                                                                                                                                   |
|------------------------------------------------------------------------------|----------------------------------|----------------------|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                              |                                  | dBL <sub>A90</sub>   | dBL <sub>Aeq</sub> |                                                                                                                                                                         |
| S1 - 35 Gilda Street, North Ryde                                             | 5 Dec 2024<br>11:25am – 11:40am  | 57                   | 62                 | Environmental noise consisting of traffic noise from M2 Motorway and natural noise (e.g. birds and insects).                                                            |
| S2 - 25 Walkers Drive, Lane Cove North                                       | 17 Dec 2024<br>10:51am – 11:06am | 67                   | 70                 | Environmental noise consisting of traffic noise from Mowbray Road and natural noise (e.g. birds and insects).                                                           |
| S3 – Richardson Place, North Ryde                                            | 17 Dec 2024<br>10:01am – 10:06am | 71                   | 73                 | Environmental noise consisting of insect noise, intermittent leaf blower noise in the distance to the north, and LV and HV traffic noise from Epping Road.              |
| S4 -Great North Walk track, near junction of Lane Cove River and Epping Road | 17 Dec 2024<br>10:15am – 10:30am | 71                   | 74                 | Environmental noise consisting of LV and HV traffic noise from Epping Road, insect noise prevalent throughout measurement.                                              |
| S5 – 1 Julius Avenue, North Ryde                                             | 12 Dec 2024<br>10:32pm – 10:42pm | 42                   | 44                 | On roof top of 1 Julius Avenue, dominant pump noise from the rooftop plant. Audible traffic noise from M2 Motorway consisting of mainly motorbikes and trucks.          |
| S6 – 6 – 8 Julius Avenue, North Ryde                                         | 12 Dec 2024<br>10:55pm – 11:10pm | 45                   | 52                 | LV and HV traffic noise from M2 Motorway, insect and frog noises prevalent, minimal local traffic on Julius Avenue during measurement.                                  |
| S7 - 5-11 Julius Avenue, North Ryde                                          | 12 Dec 2024<br>11:20pm – 11:35pm | 41                   | 46                 | Distant traffic from M2 Motorway and insect noises prevalent, barely audible plant noise from the north – north-east direction, minimal local traffic on Julius Avenue. |

## 4. Operational noise assessment

### 4.1 Operational scenarios

The following operational scenarios have been adopted for the assessment, which represent typical worst-case conditions for each assessment period.

**Normal** operation is defined as:

- Day: all equipment operating including one truck movement, two generators and two load banks, which will operate periodically under a scheduled testing regime. The scheduled testing regime is presented in Appendix C.
- Evening and night: all equipment operating except the truck, generators and load banks.

Criteria for normal operation is defined in Section 4.2.1.

**Emergency** operation is defined as:

- A utility failure when all equipment is operating including all generators.

Criteria for emergency operation is discussed in Section 4.2.2.

### 4.2 Noise criteria

#### 4.2.1 Normal operations

Normal and maintenance operation noise emissions from the site have been assessed in accordance with the NSW *Noise Policy for Industry* (NPfI) [1], which is primarily concerned with controlling intrusive noise impacts in the short-term for residences, and maintaining long-term noise level amenity for residences and other land uses.

The NPfI sets out the procedure to determine the Project Noise Trigger Levels (PNTLs) relevant to an industrial development. The PNTL is a level that, if exceeded would indicate a potential noise impact on the community and so ‘trigger’ a management response. The PNTLs for the site are summarised in Table 8. More detailed regarding the derivation of criteria is provided in Appendix D.

Future planned multi-use developments have been included as residential receivers within NCA1 for the purposes of this assessment. Typically, future receivers are assessed against amenity noise criteria. Given that PNTLs in NCA1 are based on or are more conservative than the amenity noise criteria, future planned residential receivers have been grouped into NCA1.

Table 8: NPfI Project Noise Trigger Levels (normal operations)

| Receiver type    | Receiver ID                    | Time period <sup>1</sup> | Project Specific Noise Trigger Levels (PNTL) dBL <sub>Aeq,15min</sub> | Sleep disturbance L <sub>Amax</sub> |
|------------------|--------------------------------|--------------------------|-----------------------------------------------------------------------|-------------------------------------|
| Residential NCA1 | RES1, RES2, RES3, RES4         | Day                      | 54                                                                    | -                                   |
|                  |                                | Evening                  | 48                                                                    | -                                   |
|                  |                                | Night                    | 43                                                                    | 53                                  |
| Residential NCA2 | RES7, RES8, RES9, RES10, RES11 | Day                      | 53                                                                    | -                                   |
|                  |                                | Evening                  | 43                                                                    | -                                   |
|                  |                                | Night                    | 38                                                                    | 54                                  |
| Residential NCA3 | RES5, RES6                     | Day                      | 53                                                                    | -                                   |
|                  |                                | Evening                  | 43                                                                    | -                                   |
|                  |                                | Night                    | 38                                                                    | 52                                  |

| Receiver type      | Receiver ID   | Time period <sup>1</sup> | Project Specific Noise Trigger Levels (PNTL) dBL <sub>Aeq,15min</sub> | Sleep disturbance L <sub>Amax</sub> |
|--------------------|---------------|--------------------------|-----------------------------------------------------------------------|-------------------------------------|
| Hotel / motel      | HOT1          | Day                      | 63                                                                    | -                                   |
|                    |               | Evening                  | 53                                                                    | -                                   |
|                    |               | Night                    | 48                                                                    | -                                   |
| Childcare centre   | CC1, CC2      | When in use              | 48                                                                    | -                                   |
| Passive recreation | REC1          | When in use              | 48                                                                    | -                                   |
| Commercial         | COM1 to COM15 | When in use              | 63                                                                    | -                                   |

Notes:

1\_ The NPfI defines day, evening and night periods as:

Day: the period from 7 am to 6 pm Monday to Saturday; or 8 am to 6 pm on Sundays and Public Holidays.

Evening: the period from 6 pm to 10 pm

Night: the remaining period

Table C1 of the NPfI [1] sets modifying factor corrections for annoying noise characteristics such as tonality, dominant low frequency, intermittency or irregularity. Modifying factors have been applied where appropriate for noise predictions in Section 4.4.

#### 4.2.2 Emergency operations noise criteria

The NPfI [1] sets criteria for normal operations. These criteria do not strictly apply to emergency operations, and typically less stringent criteria are adopted, based on the low likelihood of operation under such conditions.

Generator testing is included in the normal operation of the site which is assessed against the NPfI criteria. For emergency operations, the NPfI criteria are typically not adopted as emergency scenarios are considered atypical.

Designing all generators to comply with the NPfI criteria would be considered unreasonable due to the low likelihood of power failure. Furthermore, if power failure were to occur, the duration of an outage is expected to be hours rather than days.

Therefore, no acoustic criteria are proposed for emergency operations.

### 4.3 Modelling methodology

Noise levels have been predicted at the nearest sensitive receivers based on the noise levels and quantities of external plant equipment.

Table 9 outlines the noise modelling methodology, including inputs and basis of predictions.

Table 9: Noise emission modelling methodology

| Item                      | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Noise modelling software  | SoundPLAN Version 9.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Noise propagation model   | ISO 9613-2:2024 [17]<br>CONCAWE [18]<br>Operational noise levels during normal and maintenance operations with standard meteorological conditions were predicted using both the ISO 9613-2:2024 [17] and CONCAWE [18] algorithm. Noise predictions using the CONCAWE algorithm were generally found to be higher than noise predictions using the ISO 9613-2:2024 algorithm. Noise predictions for standard meteorological conditions have been presented for both algorithms in Section 4.4.4 to provide comparison. |
| Meteorological conditions | Standard and noise enhancing meteorological conditions were considered as detailed in Section 4.3.2                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Site buildings            | Based on the Macquarie Park TOD Rezoning [15] and architectural drawings in Section 4.3.1                                                                                                                                                                                                                                                                                                                                                                                                                             |

| Item                             | Details                                                                                                                                                                                                                                                                                                                            |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Receiver buildings               | Existing buildings based on aerial imagery, site truthing and building footprints obtained from Geoscape Buildings.<br>Future buildings based on available information from architectural drawings obtained online through NSW DPHI Major Projects Planning Portal and available information from the Macquarie Park TOD Rezoning. |
| Ground topography and absorption | Ground topography based on latest available digital elevation models obtained from NSW Government – Spatial Services<br>Ground absorption set to 0.4 to represent mixed ground conditions including hard surfaces (asphalt) and soft ground (vegetation and grass).                                                                |
| Noise sources                    | Noise sources detailed in Section 4.4.1 and preliminary noise mitigation measures detailed in 4.4.2                                                                                                                                                                                                                                |
| Assessment scenarios             | Assessment scenarios detailed in Section 4.4.3                                                                                                                                                                                                                                                                                     |

### 4.3.1 Architectural drawings

The NVIA is based on architectural drawings prepared by Greenbox Architecture as outlined in Table 10.

Table 10: Architectural drawings

| Drawing Number | Revision | Revision Date | Sheet Name                        |
|----------------|----------|---------------|-----------------------------------|
| 240089-010001  | 2        | 2025.05.09    | Locality & Context Plan           |
| 240089-010002  | 2        | 2025.05.09    | Site Analysis                     |
| 240089-010003  | 11       | 2025.05.09    | Site Plan                         |
| 240089-040001  | 2        | 2025.05.09    | GFA Calculation Diagrams          |
| 240089-040002  | 2        | 2025.05.09    | GFA Calculation Diagrams          |
| 240089-060001  | 2        | 2025.05.09    | Shadow Diagrams – Summer Solstice |
| 240089-060002  | 2        | 2025.05.09    | Shadow Diagrams – Winter Solstice |
| 240089-100101  | 8        | 2025.05.09    | Basement Plan                     |
| 240089-101001  | 8        | 2025.05.09    | Ground Floor Plan                 |
| 240089-101101  | 8        | 2025.05.09    | Level 01 Plan                     |
| 240089-101201  | 8        | 2025.05.09    | Level 02 Plan                     |
| 240089-101301  | 8        | 2025.05.09    | Level 03 Plan                     |
| 240089-101401  | 8        | 2025.05.09    | Level 04 Plan                     |
| 240089-101501  | 8        | 2025.05.09    | Level 05 Plan                     |
| 240089-101601  | 10       | 2025.05.09    | Level 06 Plan                     |
| 240089-101701  | 10       | 2025.05.09    | Roof Plan                         |
| 240089-150001  | 6        | 2025.05.09    | Building Elevations 01            |
| 240089-150002  | 6        | 2025.05.09    | Building Elevations 02            |
| 240089-200001  | 8        | 2025.05.09    | Building Section – Sheet 01       |
| 240089-200002  | 7        | 2025.05.09    | Building Section – Sheet 02       |
| 240089-200003  | 2        | 2025.05.09    | Building Section – Sheet 03       |
| 240089-300001  | 7        | 2025.05.09    | 3D ISO                            |

### 4.3.2 Meteorological conditions

Noise levels have been predicted for both the standard and the noise-enhancing weather conditions as specified in Table D1 of the NPfI.

Fact sheet D of the NPfI provides two options to consider meteorological effects:

- Option 1: adopt the noise enhancing meteorological conditions for all assessment periods for noise impact assessment purposes without an assessment of how often these conditions occur.

- Option 2: Determine the significance of noise-enhancing conditions by assessing the significance of temperature inversions during the night and wind during all periods.

The assessment has been conducted in accordance with Option 1 which does not require an assessment of the meteorological conditions in the area but instead use 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.

Meteorological conditions used in the assessment are summarised in Table 11.

Table 11: Meteorological conditions used in the noise assessment

| Modelling scenario | Period                | Modelling algorithm   | Meteorological conditions                                                                                                                                                |
|--------------------|-----------------------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Standard           | Day / evening / night | CONCAWE<br>ISO 9613-2 | CONCAWE: Stability categories A-D with wind speed up to 0.5 m/s at 10 m.<br>ISO 9614-2 predicts noise levels under moderate temperature inversion or downwind conditions |
| Noise-enhancing    | Day / evening         | CONCAWE               | Stability category A-D with light winds (up to 3 m/s at 10 m)                                                                                                            |
|                    | Night                 | CONCAWE               | Stability category A-D with light winds (up to 3 m/s at 10 m) and stability category F with winds up to 2 m/s at 10 m.                                                   |

Note, noise levels for stability category A-D with light winds (up to 3 m/s at 10 m) and noise levels for stability category F with winds up to 2 m/s at 10 m were predicted to be similar (<1 dB difference). The worst-case noise enhancing scenario has been presented in Section 4.4.4.

## 4.4 Noise predictions

### 4.4.1 Noise sources

Equipment noise levels for the project are summarised in Table 12. Quantities of each operating equipment are detailed in Table 14.

The sound power levels and octave band spectra have been provided by manufacturers or estimated based on expected equipment power ratings and past project experience. The primary noise sources assessed for this planning stage relate to external equipment, as the building envelope will primarily be concrete construction which will readily control noise breakout from the internal data halls, plant rooms and other spaces.

Cooling tower noise data provided by the manufacturer has been included in Appendix E. An outline of how the cooling tower noise level were modelled is also provided in Appendix E. Additionally, low frequency and third octave noise data has been sourced and analysed for low frequency or tonal characteristics in Appendix E.2.4 and Appendix E.2.5 for the primary noise emission sources, being the generators and cooling towers.

The noise assessment assumes equipment operation to meet the facility when at 100% IT load. The basis of design for the operating conditions of cooling towers and chillers are detailed in Appendix E.2.2.

Normal operations during the daytime period include maintenance testing of generators. This corresponds to a worst-case scenario of two generators being tested at any time with two load banks.

Regarding truck movements, it is anticipated that up to one truck would be travelling to and from the loading dock during a 15-minute period during the day period only. The truck would enter and exit via the new road off Julius Avenue to the loading dock located internally within the building. A truck would be on site for a maximum of 1 hour while being unloaded.

Noise emissions from all plant and equipment are characterised as steady-state sound in accordance with AS1055:2018 [9] i.e., constant noise emissions.

Site wide noise emissions are assumed to not exhibit tonal characteristics. Isolated plant items which could generate tonal noise, such as transformers, are not predicted to contribute to overall site noise emissions.

Tonal noise characteristics depend on specific design and operational factors, and the design is generally optimised to minimise tonal issues. Based on experience, the cumulative noise emissions from the site, which include multiple sources, are likely to mask any potential risk of tonal characteristics from individual plant. As a result, no penalty for tonality has been included.

Modelled noise sources are detailed in Table 12 and presented in Figure 3.

Table 12: Project equipment, quantities and noise levels (per unit)

| Equipment                                                      | Details                                                                                                                                                                                                                                       | Location                                                               | Lw, dB(A)<br>per item | Octave Band Centre Frequency, Hz, dB(Z) per item |     |     |     |     |     |     |     | Modelling approach                                                                                  |
|----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|-----------------------|--------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----------------------------------------------------------------------------------------------------|
|                                                                |                                                                                                                                                                                                                                               |                                                                        |                       | 63                                               | 125 | 250 | 500 | 1 k | 2 k | 4 k | 8 k |                                                                                                     |
| Cooling tower                                                  | BAC XES3E-1424-12P<br>ENDURA/H                                                                                                                                                                                                                | Rooftop                                                                | 73                    | 77                                               | 76  | 70  | 65  | 67  | 68  | 59  | 55  | Modelled as area sources according to the CTI ATC-128 test code.<br>Details provided in Appendix E. |
| Pressurisation<br>air handling<br>unit (PAHU)                  | Airchange PCU-N-D-10                                                                                                                                                                                                                          | Condenser on<br>rooftop                                                | 66                    | 44                                               | 46  | 53  | 60  | 63  | 60  | 53  | 48  | Modelled as point source                                                                            |
|                                                                |                                                                                                                                                                                                                                               | Intakes ducted to<br>rooftop level east<br>facade                      | 76                    | 40                                               | 53  | 64  | 68  | 70  | 71  | 70  | 61  | Modelled as point source                                                                            |
| VRF<br>condenser                                               | Daikin VRV IV Q Series                                                                                                                                                                                                                        | Level 7 rooftop<br>Level 2 rooftop                                     | 80                    | 90                                               | 89  | 83  | 78  | 73  | 65  | 65  | 55  | Modelled as point source                                                                            |
| Data Hall<br>3MW Diesel<br>generator<br>(backup<br>power only) | MTU 20V 4000 G94LF<br>Exhaust flue: RR/IAC<br>silencer<br>Intake: IAC 5S / Flexsheld<br>Sonic (6m x 4.5m x 2.4m)<br>attenuator<br>Discharge: IAC 7S /<br>Flexshield Sonic (6m x<br>4.5m x 3.0m) attenuator<br>Canopy: min. 150 mm<br>concrete | Generator gantry<br>building (6 floors,<br>12 generators per<br>floor) | Exhaust<br>flue: 91   | 91                                               | 90  | 92  | 85  | 84  | 86  | 81  | 66  | Modelled as point source                                                                            |
|                                                                |                                                                                                                                                                                                                                               |                                                                        | Intake: 95            | 95                                               | 90  | 69  | 65  | 64  | 65  | 73  | 96  | Modelled as area source                                                                             |
|                                                                |                                                                                                                                                                                                                                               |                                                                        | Discharge:<br>91      | 91                                               | 87  | 63  | 58  | 56  | 59  | 69  | 92  | Modelled as area source                                                                             |
| Admin/FOH<br>1MW Diesel<br>generator<br>(backup<br>power only) | Containerised within<br>acoustic enclosure<br>(Parratech)<br>$L_p @ 1m 75 dB(A)$                                                                                                                                                              | Rooftop                                                                | Exhaust<br>flue: 86   | 86                                               | 85  | 87  | 80  | 79  | 81  | 76  | 61  | Modelled as point source                                                                            |
|                                                                |                                                                                                                                                                                                                                               |                                                                        | Intake: 88            | 88                                               | 83  | 62  | 58  | 57  | 58  | 66  | 89  | Modelled as area source                                                                             |
|                                                                |                                                                                                                                                                                                                                               |                                                                        | Discharge:<br>89      | 89                                               | 85  | 61  | 56  | 54  | 57  | 67  | 90  | Modelled as area source                                                                             |
| Load bank                                                      | 3000 kW load bank in<br>acoustic enclosure<br>$L_p @ 1m 80 dB(A)$                                                                                                                                                                             | Rooftop                                                                | 99                    | 104                                              | 106 | 100 | 94  | 93  | 89  | 84  | 78  | Modelled as point source                                                                            |

| Equipment                        | Details                                                                         | Location                             | Lw, dB(A)<br>per item | Octave Band Centre Frequency, Hz, dB(Z) per item |     |     |     |     |     |     |     | Modelling approach       |
|----------------------------------|---------------------------------------------------------------------------------|--------------------------------------|-----------------------|--------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|--------------------------|
|                                  |                                                                                 |                                      |                       | 63                                               | 125 | 250 | 500 | 1 k | 2 k | 4 k | 8 k |                          |
| STSS transformers                | 60 MVA, maximum rated L <sub>w</sub> as per IEC60076-10                         | STSS zone at southern extent of site | 91                    | 94                                               | 96  | 91  | 91  | 85  | 80  | 75  | 68  | Modelled as point source |
| Service vehicle (heavy vehicles) | Vehicle accelerating/moving (assume 5 km/h) travelling to/from the loading dock | On ground                            | 70 Lw/metre           | 73                                               | 69  | 66  | 65  | 67  | 62  | 58  | 52  | Modelled as line source  |
|                                  | Vehicle reversing (assume 5 km/h) to the loading dock, includes reversing alarm |                                      | 64 Lw/metre           | 70                                               | 69  | 60  | 58  | 57  | 59  | 48  | 39  | Modelled as line source  |
|                                  | Airbrake                                                                        |                                      | 106                   | 115                                              | 109 | 105 | 103 | 101 | 97  | 93  | 87  | Modelled as point source |



Figure 3: Noise modelling inputs and noise source locations

#### 4.4.2 Mitigation measures

The mitigation measures in Table 13 (to be revised during detailed design) have been included in this assessment.

Table 13: MPark Talavera Road Data Centre assessment mitigation measures

| Item                              | Mitigation measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| All                               | Select equipment with sound power no more than listed in Table 12.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Cooling tower                     | Selection of low noise cooling tower fans (See Table 12 for noise levels)<br>See note in Appendix E.2.3 regarding the Variable Drive Frequency (VDF)                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Generators                        | Data hall generators contained within generator plant room.<br>Admin / FOH generator contained in acoustic enclosure<br>Attenuators to discharge and intake.<br>Muffler/silencer to exhaust.<br>(See Table 12 for noise levels)                                                                                                                                                                                                                                                                                                                                               |
| Load bank                         | Contained within an acoustic enclosure (see Table 12 for maximum noise levels)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Transformers                      | Selection of transformer plant with sound power no more than listed in Table 12<br>Noise wall along the south-east boundary of the STSS zone and partially along the north-east boundary of the STSS zone, as shown in Figure 3. Noise wall is to be: <ul style="list-style-type: none"> <li>Minimum 4 metres in height relative to ground level or 1 metre above the height of the transformer, whichever is higher</li> <li>Solid gap-free wall (i.e. no gaps at base of wall and between panels)</li> <li>Minimum density of 15kg/m<sup>2</sup> (e.g. 1x9mm FC)</li> </ul> |
| VRF condensers                    | Selection of condenser plant with sound power no more than listed in Table 12<br>Solid plant screen / noise wall around the Level 7 rooftop Admin VRF condensers and around the Level 2 western VRF condensers as shown in Figure 3. Noise wall is to be: <ul style="list-style-type: none"> <li>Minimum 3 metres in height above roof level</li> <li>Solid gap-free wall (i.e. no gaps at base of wall and between panels)</li> <li>Minimum density of 15kg/m<sup>2</sup> (e.g. 1x9mm FC)</li> </ul>                                                                         |
| PAHU                              | Selection of AHU plant with sound power no more than listed in Table 12<br>Ducted return air<br>Ducted air intake including two mitred bends to east facade                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Service vehicles (heavy vehicles) | Service vehicles and trucks to be operated on site during day hours<br>Service vehicles and trucks to be turned off while being unloaded                                                                                                                                                                                                                                                                                                                                                                                                                                      |

#### 4.4.3 Operating scenarios

To assess potential noise impacts during operation, three scenarios comprising typical equipment have been developed based on our understanding of the project. These scenarios are considered representative of the noisiest operational activities likely to occur and are described below.

Modelling scenarios are described in Section 4.1 and in modelled equipment quantities are presented in Table 14.

Table 14: Modelling scenarios and corresponding plant and equipment quantities

| Equipment                          | No. of equipment |         |       |                     |
|------------------------------------|------------------|---------|-------|---------------------|
|                                    | Normal operation |         |       | Emergency operation |
|                                    | Day              | Evening | Night |                     |
| Cooling tower                      | 72               | 72      | 72    | 72                  |
| Level 2 rooftop VRF condenser unit | 18               | 18      | 18    | 18                  |
| Level 7 rooftop VRF condenser unit | 17               | 17      | 17    | 17                  |

| Equipment        | No. of equipment |         |       |                                                      |
|------------------|------------------|---------|-------|------------------------------------------------------|
|                  | Normal operation |         |       | Emergency operation                                  |
|                  | Day              | Evening | Night |                                                      |
| PAHU             | 24               | 24      | 24    | 24                                                   |
| Generator        | 2                | -       | -     | 73 (72 data hall generators + 1 admin/FOH generator) |
| Load bank        | 2                | -       | -     | -                                                    |
| STSS transformer | 3                | 3       | 3     | 3                                                    |
| Service vehicle  | 1                | -       | -     | -                                                    |

Notes

1\_ Maintenance testing of the generators and load bank is proposed for the day period. While it will not occur at all time, it is included in the standard day operations.

#### 4.4.4 Predicted noise emissions levels

Noise predictions for under standard and noise-enhancing meteorological conditions are presented as follows:

- Table 15: Day period, including testing of two generators under full load. It is noted that predictions include noise contributions from the two loudest generators relative to each receiver location.
- Table 16: Evening period for normal operations
- Table 17: Night period for normal operation
- Table 19: Emergency operations.

The result tables include modifying factor adjustments as follows:

- Noise data for primary noise equipment has been analysed for low frequency and tonal noise characteristics in Appendix E.2.4 and Appendix E.2.5.
- Site noise emissions are not expected to exhibit tonal characteristics.
- Low frequency noise has been assessed in accordance with the Tables C1 and C2 of the NPfI and the best practice approach for applying the low frequency noise analysis as detailed in the journal paper prepared by the NSW Environment Protection Authority published by Acoustics Australia [19]. This analysis is presented in Appendix F. Modifying factor corrections for low frequency were not required to be applied for assessed receivers.
- Intermittent noise is not expected from the proposal as the noise sources are steady-state in nature.

Predicted noise levels at all sensitive receivers have been assessed against criteria in Section 4.2.1 during standard and noise-enhancing weather conditions.

Noise contours at a height of 2 metres relative to ground level are presented in Appendix G for each of the normal operating scenarios. Vertical façade noise maps of the nearest future apartment buildings are also presented in Appendix G.

Table 15: Predicted noise levels: Day - normal operation with generator testing

| Receiver | Overall site criteria<br>dBL <sub>Aeq,15min</sub> <sup>1</sup> | Standard weather conditions                 |     |            |                 | Noise-enhancing weather conditions <sup>2</sup> |            |                 |
|----------|----------------------------------------------------------------|---------------------------------------------|-----|------------|-----------------|-------------------------------------------------|------------|-----------------|
|          |                                                                | Predicted level<br>dBL <sub>Aeq,15min</sub> |     | Exceedance | Meets criteria? | Predicted level<br>dBL <sub>Aeq,15min</sub>     | Exceedance | Meets criteria? |
|          |                                                                | CONCAWE                                     | ISO |            |                 |                                                 |            |                 |
| CC1      | 48                                                             | 47                                          | 46  | -          | Yes             | 48                                              | -          | Yes             |
| CC2      | 48                                                             | 34                                          | 33  | -          | Yes             | 36                                              | -          | Yes             |
| COM1     | 63                                                             | 57                                          | 56  | -          | Yes             | 58                                              | -          | Yes             |
| COM2     | 63                                                             | 46                                          | 45  | -          | Yes             | 47                                              | -          | Yes             |

| Receiver | Overall site criteria<br>dBL <sub>Aeq,15min</sub> <sup>1</sup> | Standard weather conditions                 |     |            |                    | Noise-enhancing weather conditions <sup>2</sup> |            |                    |
|----------|----------------------------------------------------------------|---------------------------------------------|-----|------------|--------------------|-------------------------------------------------|------------|--------------------|
|          |                                                                | Predicted level<br>dBL <sub>Aeq,15min</sub> |     | Exceedance | Meets<br>criteria? | Predicted level<br>dBL <sub>Aeq,15min</sub>     | Exceedance | Meets<br>criteria? |
|          |                                                                | CONCAWE                                     | ISO |            |                    |                                                 |            |                    |
| COM3     | 63                                                             | 39                                          | 38  | -          | Yes                | 41                                              | -          | Yes                |
| COM4     | 63                                                             | 39                                          | 37  | -          | Yes                | 40                                              | -          | Yes                |
| COM5     | 63                                                             | 37                                          | 35  | -          | Yes                | 39                                              | -          | Yes                |
| COM6     | 63                                                             | 33                                          | 31  | -          | Yes                | 34                                              | -          | Yes                |
| COM7     | 63                                                             | 37                                          | 35  | -          | Yes                | 38                                              | -          | Yes                |
| COM8     | 63                                                             | 36                                          | 34  | -          | Yes                | 38                                              | -          | Yes                |
| COM9     | 63                                                             | 44                                          | 42  | -          | Yes                | 45                                              | -          | Yes                |
| COM10    | 63                                                             | 46                                          | 43  | -          | Yes                | 47                                              | -          | Yes                |
| COM11    | 63                                                             | 40                                          | 39  | -          | Yes                | 41                                              | -          | Yes                |
| COM12    | 63                                                             | 58                                          | 56  | -          | Yes                | 58                                              | -          | Yes                |
| COM13    | 63                                                             | 58                                          | 55  | -          | Yes                | 58                                              | -          | Yes                |
| COM14    | 63                                                             | 53                                          | 50  | -          | Yes                | 54                                              | -          | Yes                |
| COM15    | 63                                                             | 48                                          | 46  | -          | Yes                | 49                                              | -          | Yes                |
| HOT1     | 63                                                             | 35                                          | 30  | -          | Yes                | 36                                              | -          | Yes                |
| REC1     | 48                                                             | 47                                          | 45  | -          | Yes                | 48                                              | -          | Yes                |
| RES1     | 54                                                             | 48                                          | 46  | -          | Yes                | 49                                              | -          | Yes                |
| RES2     | 54                                                             | 49                                          | 46  | -          | Yes                | 50                                              | -          | Yes                |
| RES3     | 54                                                             | 32                                          | 32  | -          | Yes                | 34                                              | -          | Yes                |
| RES4     | 54                                                             | 25                                          | 27  | -          | Yes                | 27                                              | -          | Yes                |
| RES5     | 53                                                             | 39                                          | 38  | -          | Yes                | 41                                              | -          | Yes                |
| RES6     | 53                                                             | 39                                          | 38  | -          | Yes                | 41                                              | -          | Yes                |
| RES7     | 53                                                             | 32                                          | 30  | -          | Yes                | 33                                              | -          | Yes                |
| RES8     | 53                                                             | 39                                          | 37  | -          | Yes                | 40                                              | -          | Yes                |
| RES9     | 53                                                             | 39                                          | 36  | -          | Yes                | 41                                              | -          | Yes                |
| RES10    | 53                                                             | 41                                          | 37  | -          | Yes                | 43                                              | -          | Yes                |
| RES11    | 53                                                             | 40                                          | 35  | -          | Yes                | 41                                              | -          | Yes                |

Note:

1\_ Overall site criteria for normal operation with generator testing assessed against day criteria

2\_ The higher of the predicted noise level with noise enhancing wind conditions or temperature inversion conditions presented

Table 16: Predicted noise levels: Evening - normal operation

| Receiver | Overall Site criteria<br>dBL <sub>Aeq,15min</sub> <sup>1</sup> | Standard weather conditions                 |     |            |                    | Noise-enhancing weather conditions <sup>2</sup> |            |                    |
|----------|----------------------------------------------------------------|---------------------------------------------|-----|------------|--------------------|-------------------------------------------------|------------|--------------------|
|          |                                                                | Predicted level<br>dBL <sub>Aeq,15min</sub> |     | Exceedance | Meets<br>criteria? | Predicted level<br>dBL <sub>Aeq,15min</sub>     | Exceedance | Meets<br>criteria? |
|          |                                                                | CONCAWE                                     | ISO |            |                    |                                                 |            |                    |
| CC1      | 48                                                             | 39                                          | 37  | -          | Yes                | 39                                              | -          | Yes                |
| CC2      | 48                                                             | 29                                          | 28  | -          | Yes                | 31                                              | -          | Yes                |
| COM1     | 63                                                             | 53                                          | 51  | -          | Yes                | 53                                              | -          | Yes                |
| COM2     | 63                                                             | 36                                          | 36  | -          | Yes                | 37                                              | -          | Yes                |
| COM3     | 63                                                             | 33                                          | 33  | -          | Yes                | 35                                              | -          | Yes                |
| COM4     | 63                                                             | 35                                          | 32  | -          | Yes                | 37                                              | -          | Yes                |

| Receiver | Overall Site criteria<br>dBL <sub>Aeq,15min</sub> <sup>1</sup> | Standard weather conditions                 |     |            |                    | Noise-enhancing weather conditions <sup>2</sup> |            |                    |
|----------|----------------------------------------------------------------|---------------------------------------------|-----|------------|--------------------|-------------------------------------------------|------------|--------------------|
|          |                                                                | Predicted level<br>dBL <sub>Aeq,15min</sub> |     | Exceedance | Meets<br>criteria? | Predicted level<br>dBL <sub>Aeq,15min</sub>     | Exceedance | Meets<br>criteria? |
|          |                                                                | CONCAWE                                     | ISO |            |                    |                                                 |            |                    |
| COM5     | 63                                                             | 34                                          | 31  | -          | Yes                | 36                                              | -          | Yes                |
| COM6     | 63                                                             | 32                                          | 29  | -          | Yes                | 33                                              | -          | Yes                |
| COM7     | 63                                                             | 29                                          | 28  | -          | Yes                | 31                                              | -          | Yes                |
| COM8     | 63                                                             | 35                                          | 33  | -          | Yes                | 37                                              | -          | Yes                |
| COM9     | 63                                                             | 40                                          | 39  | -          | Yes                | 40                                              | -          | Yes                |
| COM10    | 63                                                             | 43                                          | 41  | -          | Yes                | 44                                              | -          | Yes                |
| COM11    | 63                                                             | 37                                          | 36  | -          | Yes                | 38                                              | -          | Yes                |
| COM12    | 63                                                             | 57                                          | 55  | -          | Yes                | 57                                              | -          | Yes                |
| COM13    | 63                                                             | 53                                          | 52  | -          | Yes                | 54                                              | -          | Yes                |
| COM14    | 63                                                             | 50                                          | 48  | -          | Yes                | 50                                              | -          | Yes                |
| COM15    | 63                                                             | 46                                          | 44  | -          | Yes                | 47                                              | -          | Yes                |
| HOT1     | 53                                                             | 30                                          | 28  | -          | Yes                | 31                                              | -          | Yes                |
| REC1     | 48                                                             | 34                                          | 34  | -          | Yes                | 35                                              | -          | Yes                |
| RES1     | 48                                                             | 43                                          | 42  | -          | Yes                | 44                                              | -          | Yes                |
| RES2     | 48                                                             | 42                                          | 41  | -          | Yes                | 44                                              | -          | Yes                |
| RES3     | 48                                                             | 29                                          | 29  | -          | Yes                | 30                                              | -          | Yes                |
| RES4     | 48                                                             | 22                                          | 22  | -          | Yes                | 24                                              | -          | Yes                |
| RES5     | 43                                                             | 35                                          | 34  | -          | Yes                | 37                                              | -          | Yes                |
| RES6     | 43                                                             | 35                                          | 34  | -          | Yes                | 37                                              | -          | Yes                |
| RES7     | 43                                                             | 24                                          | 22  | -          | Yes                | 25                                              | -          | Yes                |
| RES8     | 43                                                             | 31                                          | 28  | -          | Yes                | 32                                              | -          | Yes                |
| RES9     | 43                                                             | 36                                          | 32  | -          | Yes                | 37                                              | -          | Yes                |
| RES10    | 43                                                             | 34                                          | 32  | -          | Yes                | 36                                              | -          | Yes                |
| RES11    | 43                                                             | 33                                          | 31  | -          | Yes                | 35                                              | -          | Yes                |

Note:

1\_ Overall site criteria for normal operation assessed against evening criteria

2\_ The higher of the predicted noise level with noise enhancing wind conditions or temperature inversion conditions presented

Table 17: Predicted noise levels: Night – normal operation

| Receiver <sup>1</sup> | Overall Site criteria<br>dBL <sub>Aeq,15min</sub> <sup>2</sup> | Standard weather conditions                 |     |            |                    | Noise enhancing weather conditions <sup>3</sup> |            |                        |
|-----------------------|----------------------------------------------------------------|---------------------------------------------|-----|------------|--------------------|-------------------------------------------------|------------|------------------------|
|                       |                                                                | Predicted level<br>dBL <sub>Aeq,15min</sub> |     | Exceedance | Meets<br>criteria? | Predicted level<br>dBL <sub>Aeq,15min</sub>     | Exceedance | Meets<br>criteria?     |
|                       |                                                                | CONCAWE                                     | ISO |            |                    |                                                 |            |                        |
| HOT1                  | 48                                                             | 30                                          | 28  | -          | Yes                | 31                                              | -          | Yes                    |
| REC1                  | 48                                                             | 34                                          | 34  | -          | Yes                | 35                                              | -          | Yes                    |
| RES1                  | 43                                                             | 43                                          | 42  | -          | Yes                | 44                                              | 1          | Marginal<br>exceedance |
| RES2                  | 43                                                             | 42                                          | 41  | -          | Yes                | 44                                              | 1          | Marginal<br>exceedance |
| RES3                  | 43                                                             | 29                                          | 29  | -          | Yes                | 30                                              | -          | Yes                    |
| RES4                  | 43                                                             | 22                                          | 22  | -          | Yes                | 24                                              | -          | Yes                    |
| RES5                  | 38                                                             | 35                                          | 34  | -          | Yes                | 37                                              | -          | Yes                    |

| Receiver <sup>1</sup> | Overall Site criteria<br>dBL <sub>Aeq,15min</sub> <sup>2</sup> | Standard weather conditions                 |     |            |                    | Noise enhancing weather conditions <sup>3</sup> |            |                    |
|-----------------------|----------------------------------------------------------------|---------------------------------------------|-----|------------|--------------------|-------------------------------------------------|------------|--------------------|
|                       |                                                                | Predicted level<br>dBL <sub>Aeq,15min</sub> |     | Exceedance | Meets<br>criteria? | Predicted<br>level<br>dBL <sub>Aeq,15min</sub>  | Exceedance | Meets<br>criteria? |
|                       |                                                                | CONCAWE                                     | ISO |            |                    |                                                 |            |                    |
| RES6                  | 38                                                             | 35                                          | 34  | -          | Yes                | 37                                              | -          | Yes                |
| RES7                  | 38                                                             | 24                                          | 22  | -          | Yes                | 25                                              | -          | Yes                |
| RES8                  | 38                                                             | 31                                          | 28  | -          | Yes                | 32                                              | -          | Yes                |
| RES9                  | 38                                                             | 36                                          | 32  | -          | Yes                | 37                                              | -          | Yes                |
| RES10                 | 38                                                             | 34                                          | 32  | -          | Yes                | 36                                              | -          | Yes                |
| RES11                 | 38                                                             | 33                                          | 31  | -          | Yes                | 35                                              | -          | Yes                |

Note:

1\_ Receivers not operating at night have not been included

2\_ Overall site criteria for normal operation assessed against night criteria

3\_ The higher of the predicted noise level with noise enhancing wind conditions or temperature inversion conditions presented

Predicted noise levels at all sensitive receivers comply with criteria during the day and evening periods for standard and noise-enhancing weather conditions.

With the inclusion of reasonable and feasible noise mitigation measures as presented in Table 13, a negligible 1 dBA exceedance has been predicted for future planned residential apartments at receiver locations RES1 and RES2 during the night time period under noise-enhancing weather conditions.

The noise contribution from each noise source type during the night period under noise-enhancing weather conditions has been presented in Table 18.

Table 18: Noise source contribution at worst affected receiver locations during night period

| Noise source item      | Noise contribution, L <sub>Aeq,15min</sub> (night – normal operation; enhanced weather conditions) |                                        |
|------------------------|----------------------------------------------------------------------------------------------------|----------------------------------------|
|                        | Receiver RES1 (18 <sup>th</sup> floor)                                                             | Receiver RES2 (18 <sup>th</sup> floor) |
| Cooling towers         | 41 (36 <sup>1</sup> )                                                                              | 41 (36 <sup>1</sup> )                  |
| Level 7 VRF condensers | 40                                                                                                 | 39                                     |
| Level 2 VRF condensers | 31                                                                                                 | 27                                     |
| Transformers           | 28                                                                                                 | 21                                     |
| PAHU condenser         | 23                                                                                                 | 27                                     |
| PAHU inlet             | 22                                                                                                 | 28                                     |
| <b>Total</b>           | <b>44 (42<sup>1</sup>)</b>                                                                         | <b>44 (42<sup>1</sup>)</b>             |

Note:

1\_ Number in brackets indicates noise level with cooling towers operating under night-time conditions based on similar data centre projects demonstrating compliant with night-time noise criterion

The largest noise source contribution is from cooling towers at these residential receiver locations. The cooling tower noise levels have been based on a worst case daytime operating condition representative of a heat wave as described in Appendix E.2.2. The operating conditions of the cooling towers during the night-time period would be significantly lower resulting in significantly reduced noise emissions. Nominally, a greater than 5 dB(A) reduction in cooling tower noise levels would be expected based on recent similar data centre projects. Thus, noise emissions would be expected to reduce by more than 1 dB(A) at these receiver locations and comply with the night-time criterion.

Predicted noise levels for emergency operation are presented in Table 19.

Table 19: Predicted noise levels: Emergency operation

| Receiver | Predicted level, dBL <sub>Aeq,15min</sub> |     |                                                 |
|----------|-------------------------------------------|-----|-------------------------------------------------|
|          | Standard weather conditions               |     | Noise-enhancing weather conditions <sup>1</sup> |
|          | CONCAWE                                   | ISO |                                                 |
| CC1      | 49                                        | 47  | 49                                              |
| CC2      | 37                                        | 36  | 38                                              |
| COM1     | 58                                        | 57  | 59                                              |
| COM2     | 47                                        | 45  | 48                                              |
| COM3     | 40                                        | 39  | 42                                              |
| COM4     | 41                                        | 40  | 42                                              |
| COM5     | 39                                        | 36  | 41                                              |
| COM6     | 35                                        | 33  | 37                                              |
| COM7     | 38                                        | 37  | 39                                              |
| COM8     | 37                                        | 36  | 39                                              |
| COM9     | 46                                        | 44  | 47                                              |
| COM10    | 48                                        | 45  | 50                                              |
| COM11    | 47                                        | 46  | 49                                              |
| COM12    | 58                                        | 57  | 59                                              |
| COM13    | 68                                        | 64  | 69                                              |
| COM14    | 62                                        | 58  | 64                                              |
| COM15    | 55                                        | 53  | 56                                              |
| HOT1     | 37                                        | 33  | 39                                              |
| REC1     | 58                                        | 52  | 59                                              |
| RES1     | 49                                        | 48  | 51                                              |
| RES2     | 50                                        | 48  | 51                                              |
| RES3     | 34                                        | 35  | 35                                              |
| RES4     | 28                                        | 30  | 30                                              |
| RES5     | 48                                        | 46  | 50                                              |
| RES6     | 49                                        | 46  | 50                                              |
| RES7     | 40                                        | 37  | 42                                              |
| RES8     | 46                                        | 43  | 47                                              |
| RES9     | 47                                        | 44  | 49                                              |
| RES10    | 48                                        | 43  | 50                                              |
| RES11    | 46                                        | 41  | 47                                              |

Note:

1\_ The higher of the predicted noise level with noise enhancing wind conditions or temperature inversion conditions presented

## 5. Road traffic noise

Increased traffic generated on the public road network is assessed in accordance with the NSW *Road Noise Policy* (RNP) [2].

When assessing noise impact using the existing road network, an initial screening test is applied to evaluate whether noise levels are expected to increase by more than 2 dBA due to the additional traffic generated by the Proposal.

Where noise levels are predicted to increase by more than 2 dBA (i.e. 2.1 dBA or greater) further assessment is required against the criteria in Table 3 and Table 4 of the RNP for residential and non-residential land uses, respectively.

Access to and from the site will be via Julius Avenue and Richardson Place which are local roads with traffic generally coming from Delhi Road. It is noted land uses along Julius Avenue generally consist of commercial premises, a currently vacated child care centre and future residential apartments.

Existing peak hourly traffic volumes for weekday morning and afternoon periods are presented in Table 20.

Table 20: Existing peak traffic volumes on Delhi Road and Julius Avenue

| Location                                  | Weekday morning (8:15 – 9:15) |      | Weekday afternoon (15:15 – 16:15) |      |
|-------------------------------------------|-------------------------------|------|-----------------------------------|------|
|                                           | Total vehicles                | HV % | Total vehicles                    | HV % |
| Delhi Road – west of Julius Avenue        | 2501                          | 6.2  | 2714                              | 3.3  |
| Delhi Road – east of Julius Avenue        | 2370                          | 6.2  | 2416                              | 3.7  |
| Julius Avenue – north of Rivett Road      | 354                           | 1.1  | 416                               | 0.7  |
| Julius Avenue – south of Richardson Place | 286                           | 0.3  | 160                               | 1.3  |
| Richardson Place                          | 439                           | 0.2  | 260                               | 0.4  |

Note:

1\_ Traffic volumes as presented in the *Julius Avenue Data Centre Traffic Impact Assessment Report* prepared by PTC Consultants (ref. 24-1146 Issue 3, dated 12/05/2025) [20]

As per the Julius Avenue Data Centre Traffic Impact Assessment Report prepared by PTC Consultants (ref. 24-1146 Issue 3, dated 12/05/2024) [20], the development site is expected to generate 54 peak-hour vehicle trips (27 inbound and 27 outbound) with the assumed distribution of 50% of vehicles approaching from the west and 50% from the east. It is assumed that up to 2 heavy vehicle movements would be generated by the development site.

An assessment of the traffic noise increase based on the assumed traffic generated by the development and the worst-case peak hourly location (PM peak at Julius Avenue – south of Richardson Place) has been presented in Table 21.

Table 21: Predicted traffic noise increase on Julius Avenue due to the operation of the development

| Location                                                                      | Existing PM peak hour |      |                        | Future (with development) PM peak hour |      |                        | Increase in traffic noise (dBA) |
|-------------------------------------------------------------------------------|-----------------------|------|------------------------|----------------------------------------|------|------------------------|---------------------------------|
|                                                                               | Total vehicles        | HV % | L <sub>Aeq,1hour</sub> | Total vehicles                         | HV % | L <sub>Aeq,1hour</sub> |                                 |
| Sensitive receivers on Julius Avenue – south of Richardson Place <sup>1</sup> | 160                   | 1.3  | 59.2                   | 216                                    | 1.8  | 60.7                   | 1.5                             |

Note:

1\_ Based on receiver façade location 10 metres away from road carriageway (includes +2.5 dB façade correction)

Traffic noise generated by the development is predicted increase by less than 2 dBA and thus comply with the requirements of the RNP. Given other roads and sections of Julius Avenue have higher existing traffic volumes, generated traffic noise is anticipated to also comply with the RNP.

## 6. Construction noise and vibration assessment

Construction works will be assessed in accordance with the NSW *Interim Construction Noise Guideline* [3] (ICNG or Guideline).

### 6.1 Construction noise criteria

The ICNG [3] provides recommended noise levels for airborne construction noise at sensitive land uses. The guideline provides construction noise management levels above which all feasible and reasonable work practices should be applied to minimise the construction noise impact. The ICNG works on the principle of a ‘screening’ criterion – if predicted or measured construction noise exceeds the ICNG levels then the construction activity must implement all ‘feasible and reasonable’ work practices to reduce noise levels.

The ICNG provides two methods for assessing construction noise, varying typically on the basis of the project duration, being either a quantitative or a qualitative assessment. A quantitative assessment is recommended for major construction projects of significant duration, and involves the measurement of background noise levels for determination of noise management levels and prediction of construction noise levels. A qualitative assessment is recommended for small projects with a duration of less than three weeks and focuses on minimising noise disturbance through the implementation of reasonable and feasible work practices, and community notification.

The ICNG sets out management levels for noise at noise sensitive receivers, and how they are to be applied. These noise management levels (NMLs) for residential receivers and other sensitive receivers are reproduced in Table 22 and in Table 23 respectively.

Table 22: Construction noise management levels (NMLs) at residential receivers

| Time of day                                                                                                                       | NML <sup>1</sup><br>L <sub>Aeq</sub> (15 min) | How to apply                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Recommended standard hours:<br>Monday to Friday<br>7 am to 6 pm<br>Saturday 8 am to 1 pm<br>No work on Sundays or public holidays | Noise affected<br>RBL + 10 dB                 | The noise affected level represents the point above which there may be some community reaction to noise.<br><br>Where the predicted or measured L <sub>Aeq</sub> 15 min is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level.<br><br>The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.                                                                                                                                                                                                          |
|                                                                                                                                   | Highly noise affected<br>75 dB(A)             | The highly noise affected level represents the point above which there may be strong community reaction to noise.<br><br>Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: <ul style="list-style-type: none"> <li>times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences)</li> <li>if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.</li> </ul> |
| Outside recommended standard hours                                                                                                | Noise affected<br>RBL + 5 dB                  | A strong justification would typically be required for works outside the recommended standard hours.<br><br>The proponent should apply all feasible and reasonable work practices to meet the noise affected level.<br><br>Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community.<br><br>For guidance on negotiating agreements see section 7.2.2 of the ICNG.                                                                                                                                                                                                                                     |

Note:

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

Table 23: Construction noise management levels (NMLs) at other noise sensitive land uses

| Land use                                                 | Where objective applies                    | Noise Management level dBL <sub>Aeq,15 min</sub> <sup>1</sup>       |
|----------------------------------------------------------|--------------------------------------------|---------------------------------------------------------------------|
| Classrooms at schools and other educational institutions | Internal noise level                       | 45                                                                  |
| Hospital wards and operating theatres                    | Internal noise level                       | 45                                                                  |
| Places of worship                                        | Internal noise level                       | 45                                                                  |
| Active recreation areas                                  | External noise level                       | 65                                                                  |
| Passive recreation areas                                 | External noise level                       | 60                                                                  |
| Community centres                                        | Depends on the intended use of the centre. | Refer to the 'maximum' internal levels in AS2107 for specific uses. |
| Commercial premises                                      | External noise level                       | 70                                                                  |
| Industrial premises                                      | External noise level                       | 75                                                                  |

Note:

1\_ Noise management levels apply when receiver areas are in use only.

### 6.1.1 Project construction noise targets

Table 24 summarises relevant project construction noise targets for the project. For the residential receivers, the construction noise criteria are set based on the noise measurements results in Section 3.2.

Table 24: Construction Noise Management Levels – recommended Standard hours

| Receiver ID            | Type               | External NML, dBL <sub>Aeq,15min</sub><br>(Recommended standard hours) <sup>1</sup> |                       |
|------------------------|--------------------|-------------------------------------------------------------------------------------|-----------------------|
|                        |                    | Noise affected                                                                      | Highly Noise affected |
| RES1, RES2, RES3, RES4 | Residential (NCA1) | 59                                                                                  | 75                    |
| RES7, RES8, RES9       | Residential (NCA2) | 62                                                                                  | 75                    |
| RES5, RES6             | Residential (NCA3) | 62                                                                                  | 75                    |
| CC1, CC2 <sup>2</sup>  | Childcare Centre   | 55 <sup>2</sup>                                                                     | -                     |
| REC1                   | Passive recreation | 60                                                                                  | -                     |
| COM1 – COM15, HOT1     | Commercial         | 70                                                                                  | -                     |

Notes:

1\_ Standard hours are Monday to Friday 7 am to 6 pm and Saturday 8 am to 1 pm.

2\_ Based on internal noise levels for classroom + 10 dB, assuming a 10 dB difference between indoor noise levels and external noise levels (with windows open).

## 6.2 Construction noise assessment

### 6.2.1 Assessment methodology

Noise emissions from construction activities have been assessed to NMLs defined in Table 24. Noise emissions have been modelled using SoundPlan 9.1 using the ISO 9613-2:2024 algorithm.

The model included:

- Receivers listed in Section 3.1,
- Noise sources listed in Section 6.2.4,
- Surrounding buildings,
- Ground terrain and absorption

Equipment, staging, hours of work and locations and duration are unavailable at this stage of the project. Therefore, assumptions have been made based on similar projects. The magnitude of construction noise impacts is dependent upon several aspects including the intensity and location of activities, the type of equipment used and background noise levels during the construction period.

No mitigation measures have been included in the predictions.

### 6.2.2 Construction activities

Construction activities likely to be conducted for the project are:

- Activity 1: Site establishment and excavation
- Activity 2: Foundations
- Activity 3: Pavement and road works
- Activity 4: Building construction.
- Activity 5: Plant installation and connection

### 6.2.3 Hours of work

Construction works are proposed to be conducted during ICNG recommended standard construction hours, outlined in Table 25.

Table 25: ICNG recommended standard hours of construction

| Day                        | ICNG recommended standard hours of construction |
|----------------------------|-------------------------------------------------|
| Monday – Friday            | 7 am – 6 pm                                     |
| Saturday                   | 8 am – 1 pm                                     |
| Sundays or Public holidays | No construction work                            |

### 6.2.4 Plant and equipment sources

Equipment sound power levels ( $L_w$ ) have been determined by reference to AS2436 [10], the Transport for NSW *Construction Noise and Vibration Guideline* (CNVG) [8], BS5228 [12] and UK Department for Environment, Food & Rural Affairs (DEFRA) construction noise database [21]. The equipment has been assumed to operate concurrently and for durations listed over a 15-minute period (a typical worst-case assumption).

Table 26: Equipment and plant sound power levels

| Plant item                                                                                   | Plant item sound power level $\text{dBL}_{\text{Aeq}}$ | Penalty <sup>1</sup> , dB | % of use in worst case 15 min | Number of items operation in worst case 15-minute period |                         |                                     |                                   |                                               |
|----------------------------------------------------------------------------------------------|--------------------------------------------------------|---------------------------|-------------------------------|----------------------------------------------------------|-------------------------|-------------------------------------|-----------------------------------|-----------------------------------------------|
|                                                                                              |                                                        |                           |                               | Activity 1: Site establishment and excavation            | Activity 2: Foundations | Activity 3: Pavement and road works | Activity 4: Building construction | Activity 5: Plant installation and connection |
| Backhoe                                                                                      | 108                                                    | -                         | 100                           | 1                                                        |                         |                                     |                                   |                                               |
| Compactor                                                                                    | 115                                                    | 5                         | 100                           | 1                                                        |                         | 1                                   |                                   |                                               |
| Concrete Pump                                                                                | 109                                                    | -                         | 100                           |                                                          | 1                       | 1                                   | 1                                 |                                               |
| Concrete Pump Truck                                                                          | 113                                                    | -                         | 100                           |                                                          | 1                       | 1                                   | 1                                 |                                               |
| Crane (Franna)                                                                               | 98                                                     | -                         | 100                           |                                                          |                         |                                     | 1                                 |                                               |
| Crane (Electric tower)                                                                       | 105                                                    | -                         | 100                           |                                                          |                         |                                     | 1                                 |                                               |
| Excavator (30 t) + bucket                                                                    | 110                                                    | -                         | 100                           | 1                                                        |                         |                                     |                                   |                                               |
| Excavator (30 t) + rock saw                                                                  | 119                                                    | 5                         | 50                            | 1                                                        |                         |                                     |                                   |                                               |
| Excavator (30 t) + hydraulic hammer                                                          | 122                                                    | 5                         | 50                            | 1                                                        |                         | 1                                   |                                   |                                               |
| Generator (Diesel)                                                                           | 113                                                    | -                         | 100                           | 1                                                        |                         | 1                                   | 1                                 |                                               |
| Grader                                                                                       | 115                                                    | -                         | 100                           | 1                                                        |                         | 1                                   |                                   |                                               |
| Hand power tool                                                                              | 105                                                    | -                         | 100                           |                                                          |                         |                                     | 2                                 | 2                                             |
| Jack Hammer                                                                                  | 121                                                    | 5                         | 100                           |                                                          |                         | 1                                   |                                   |                                               |
| Loader (Front-end) (23 t)                                                                    | 112                                                    | -                         | 100                           | 1                                                        |                         | 1                                   |                                   |                                               |
| Pavement Laying Machine                                                                      | 114                                                    | -                         | 100                           |                                                          |                         | 1                                   |                                   |                                               |
| Roller (Smooth-drum)                                                                         | 107                                                    | -                         | 100                           |                                                          |                         | 1                                   |                                   |                                               |
| Scraper                                                                                      | 116                                                    | -                         | 100                           | 1                                                        |                         |                                     |                                   |                                               |
| Truck (>20 Tonne)                                                                            | 107                                                    | -                         | 100                           | 1                                                        | 1                       | 1                                   |                                   |                                               |
| Truck (Water Cart)                                                                           | 108                                                    | -                         | 100                           | 2                                                        |                         | 2                                   | 1                                 |                                               |
| Vehicle (Light Commercial e.g. 4WD)                                                          | 103                                                    | -                         | 100                           | 2                                                        |                         | 2                                   | 2                                 | 1                                             |
| <b>Total <math>\text{L}_{\text{Aeq},15\text{min}}</math> sound power level per Activity.</b> |                                                        |                           |                               | <b>127</b>                                               | <b>115</b>              | <b>128</b>                          | <b>118</b>                        | <b>109</b>                                    |

Note:

1\_Penalty applies if equipment has special characteristics in accordance with ICNG [3]

## 6.2.5 Noise prediction results

Predicted construction noise levels at the surrounding receiver are presented in Table 27.

A maximum range of noise levels have been predicted for receivers located the closest to the site as the construction noise levels at those receivers will vary greatly depending on location of equipment. The lower level assumes that all equipment listed in Table 26 is operating concurrently within the site which represents the maximum average noise levels at the receivers throughout the construction period while the upper noise levels in the range represents the maximum noise levels at the receivers when the noisiest piece of equipment operates the closest to the receivers.

It is noted that the predicted construction noise levels are generally conservative and do not represent a constant noise emission that would be experienced by the community on a daily basis throughout the project construction period. In reality the predicted noise levels will vary in intensity and would only be experienced for limited periods of time when works are occurring.

Table 27: Predicted construction noise levels - Residential and non-residential receivers

| Receivers        | NML, dBL <sub>Aeq,15min</sub> |                       | Predicted noise level, dBL <sub>Aeq,15min</sub> <sup>2</sup> |                         |                                     |                                   |                                               |
|------------------|-------------------------------|-----------------------|--------------------------------------------------------------|-------------------------|-------------------------------------|-----------------------------------|-----------------------------------------------|
|                  | Standard hours                | Highly Noise Affected | Activity 1: Site establishment, demolition and excavation    | Activity 2: Foundations | Activity 3: Pavement and road works | Activity 4: Building construction | Activity 5: Plant installation and connection |
| CC1 <sup>1</sup> | 55                            | -                     | 78                                                           | 66                      | 79                                  | 69                                | 60                                            |
| CC2              | 55                            | -                     | 48                                                           | 36                      | 49                                  | 39                                | 30                                            |
| COM1             | 70                            | -                     | 79                                                           | 67                      | 80                                  | 70                                | 61                                            |
| COM2             | 70                            | -                     | 69                                                           | 57                      | 70                                  | 60                                | 51                                            |
| COM3             | 70                            | -                     | 62                                                           | 50                      | 63                                  | 53                                | 44                                            |
| COM4             | 70                            | -                     | 59                                                           | 47                      | 60                                  | 50                                | 41                                            |
| COM5             | 70                            | -                     | 56                                                           | 44                      | 57                                  | 47                                | 38                                            |
| COM6             | 70                            | -                     | 48                                                           | 36                      | 49                                  | 39                                | 30                                            |
| COM7             | 70                            | -                     | 48                                                           | 36                      | 49                                  | 39                                | 30                                            |
| COM8             | 70                            | -                     | 47                                                           | 35                      | 48                                  | 38                                | 29                                            |
| COM9             | 70                            | -                     | 76                                                           | 64                      | 77                                  | 67                                | 58                                            |
| COM10            | 70                            | -                     | 69                                                           | 57                      | 70                                  | 60                                | 51                                            |
| COM11            | 70                            | -                     | 61                                                           | 49                      | 62                                  | 52                                | 43                                            |
| COM12            | 70                            | -                     | 79                                                           | 67                      | 80                                  | 70                                | 61                                            |
| COM13            | 70                            | -                     | 80                                                           | 68                      | 81                                  | 71                                | 62                                            |
| COM14            | 70                            | -                     | 72                                                           | 60                      | 73                                  | 63                                | 54                                            |
| COM15            | 70                            | -                     | 68                                                           | 56                      | 69                                  | 59                                | 50                                            |
| HOT1             | 70                            | -                     | 57                                                           | 45                      | 58                                  | 48                                | 39                                            |
| REC1             | 60                            | -                     | 58                                                           | 46                      | 59                                  | 49                                | 40                                            |
| RES1             | 59                            | 75                    | 68                                                           | 56                      | 69                                  | 59                                | 50                                            |
| RES2             | 59                            | 75                    | 69                                                           | 57                      | 70                                  | 60                                | 51                                            |
| RES3             | 59                            | 75                    | 56                                                           | 44                      | 57                                  | 47                                | 38                                            |
| RES4             | 59                            | 75                    | 47                                                           | 35                      | 48                                  | 38                                | 29                                            |
| RES5             | 62                            | 75                    | 63                                                           | 51                      | 64                                  | 54                                | 45                                            |
| RES6             | 62                            | 75                    | 63                                                           | 51                      | 64                                  | 54                                | 45                                            |

| Receivers | NML, dBL <sub>Aeq,15min</sub> |                       | Predicted noise level, dBL <sub>Aeq,15min</sub> <sup>2</sup> |                         |                                     |                                   |                                               |
|-----------|-------------------------------|-----------------------|--------------------------------------------------------------|-------------------------|-------------------------------------|-----------------------------------|-----------------------------------------------|
|           | Standard hours                | Highly Noise Affected | Activity 1: Site establishment, demolition and excavation    | Activity 2: Foundations | Activity 3: Pavement and road works | Activity 4: Building construction | Activity 5: Plant installation and connection |
| RES7      | 62                            | 75                    | 41                                                           | 29                      | 42                                  | 32                                | 23                                            |
| RES8      | 62                            | 75                    | 52                                                           | 40                      | 53                                  | 43                                | 34                                            |
| RES9      | 62                            | 75                    | 61                                                           | 49                      | 62                                  | 52                                | 43                                            |
| RES10     | 62                            | 75                    | 54                                                           | 42                      | 55                                  | 45                                | 36                                            |
| RES11     | 62                            | 75                    | 53                                                           | 41                      | 54                                  | 44                                | 35                                            |

Note:

1\_ Child care centre currently vacant

2\_ Cells highlighted in grey indicate an exceedance of standard hours NMLs

Results show that construction noise levels are predicted to exceed the NMLs at the nearest commercial, residential, childcare centre and recreational receivers particularly during the highest impact activities (i.e. Activity 1 and 3). Only the nearest adjacent receivers are predicted to exceed the NMLs during Activity 4, and only the nearest childcare centre is predicted to exceed the NML during Activity 2 and 5.

It is noted that the nearest childcare centre is currently vacant. Additionally, residential receivers RES1 to RES4 are planned developments and may not yet be constructed or occupied at time of construction. These receiver locations should be confirmed prior to construction works starting.

Construction noise levels are predicted to be below the 'highly noise affected' NML.

Preliminary noise mitigation measures are detailed in Section 6.6.

### 6.3 Construction traffic assessment

Increased traffic generated on the public road network is assessed in accordance with the NSW *Road Noise Policy* (RNP) [2].

When assessing noise impact using the existing road network, an initial screening test is applied to evaluate whether noise levels are expected to increase by more than 2 dBA due to the additional traffic generated by the construction of the Proposal.

Where noise levels are predicted to increase by more than 2 dBA (i.e. 2.1 dBA or greater) further assessment is required against the criteria in Table 3 and Table 4 of the RNP for residential and non-residential land uses, respectively.

Access to and from the site will be via Julius Avenue and Richardson Place which is a local road with traffic generally coming from Delhi Road. It is noted land uses along Julius Avenue generally consist of commercial premises and a child care centre.

Existing peak hourly traffic volumes for weekday morning and afternoon periods are presented in Table 20 and vehicle movements anticipated to be generated by construction works are presented in Table 28.

Table 28: Traffic anticipated to be generated by construction works<sup>1</sup>

| Vehicle type               | Daily movements                | Hourly movements          |
|----------------------------|--------------------------------|---------------------------|
| Heavy vehicle              | 20 (10 inbound / 10 outbound)  | 2 weekdays / 3 weekends   |
| Light vehicle <sup>2</sup> | 144 (72 inbound / 72 outbound) | 13 weekdays / 18 weekends |

Note:

1\_ Traffic volumes generated by construction works based on advice provided by PTC Consultants

2\_ Based on 80 workers within the construction site at one time and 90% (72) drive single occupancy vehicle

Due to the anticipated low number of vehicles generated by the construction of the proposal and high existing traffic volumes, construction traffic noise is anticipated to comply with RNP.

## 6.4 Construction vibration criteria

The effect of vibration in buildings can be divided into three main categories:

1. **Human perception of vibration:** when the occupants or users of the building are potentially disturbed by vibration. Relevant guidance is provided in *NSW Assessing Vibration: a technical guideline* [4]. This document is based on BS 6472:1992 [13].
2. **Effects on building contents:** People can perceive floor vibration at levels well below those likely to cause damage to typical building contents. However, some scientific equipment (e.g. electron microscopes and microelectronics manufacturing equipment) can require more stringent objectives than those applicable to human comfort. Where appropriate, objectives for the satisfactory operation of critical instruments or manufacturing processes should be sourced from manufacturer's data and/or other published objectives.

Note that it is not expected that scientific equipment would be located near the site.

3. **Effects of vibration on structures:** A level of vibration where the integrity of the building or the structure itself may be affected, ranging from cosmetic to major structural damage. The relevant criteria are typically well above the level of vibration which people may consider intrusive. Guidance may be found in AS 2187:Part 2 [9], BS 7385 Part 2 [6] and DIN 4150 [7] which also has criteria of particular reference for heritage structures and buried pipework.

Further details are included in Appendix H.

## 6.5 Vibration assessment

The CNVG [8] recommends minimum working distances from vibration-intensive equipment, as shown in Table 30. With regard to the proposed development works, no sensitive receivers have been identified within the recommended minimum working distances for cosmetic damage. A rock shelter located south of the proposal has been identified as a heritage item. This heritage item is located over 100 metres from the nearest proposed works area. Thus, in accordance with recommended minimum working distances for unsound structures (DIN 4150 Line 3) typically applicable to heritage items, vibration impacts are not expected from the construction works and risk of cosmetic damage is low.

There are commercial / office receivers identified directly adjacent to site that are within the recommended minimum working distances for 'human response'. The nearest commercial building has been identified at approximately 25 metres from the proposal site. Occupants may be impacted by vibratory rollers greater than 4 tonnes and the largest hydraulic hammer. However, it should be noted that this is based on criteria for residential dwellings. Office-based building occupants are subject to higher vibration limits as per the guideline (*Assessing Vibration: a technical guideline* [4]; reproduced in Appendix H.1) and thus a low probability of adverse comment is expected from commercial receivers for the proposed construction works. Moreover, these activities are unlikely to take place over extended periods of time and works would be distributed across the site at distances greater than 25 metres.

Notwithstanding, reselection of low vibration generating equipment should be considered and/or vibration monitoring may be warranted during vibration generating works to confirm impacts to adjacent commercial receivers. This is to be confirmed along with any additional mitigation measures during the preparation of the Construction Noise and Vibration Management Plan.

All reasonable and feasible mitigation measures should be applied for the construction of the project. Section 6.6 discusses in-principal management measures that could be employed.

## 6.6 Construction noise and vibration measures

Mitigation and management measures are outlined in Table 29. The mitigation measures are considered 'feasible and reasonable' for implementation on the project. The contractor will have a key role in managing

potential noise and vibration impacts during the works and the following recommendations should be integrated into the overarching management plan for the works.

Table 29: Construction noise and vibration mitigation and management measures

| Item                    | Detail                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Management Plan         | <p>A Construction Noise and Vibration Management Plan (CNVMP) shall be formalised prior to the issuing of a Construction Certificate. Alternatively, relevant noise and vibration requirements should be integrated into the project's Construction Management Plan (CMP).</p> <p>The CNVMP should include but not be limited to the following:</p> <ul style="list-style-type: none"> <li>• Roles and responsibilities</li> <li>• Noise and vibration sensitive receiver locations, structures and infrastructure</li> <li>• Identify works that have the potential to cause impact, accompanied by an appropriate assessment (predictive assessment or risk evaluation)</li> <li>• Mitigation and management strategy</li> <li>• Monitoring methodology (as relevant)</li> <li>• Community engagement strategy.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Temporary noise barrier | <ul style="list-style-type: none"> <li>• Temporary noise barriers such as construction hoarding are most effective when located close to the source or the receiver.</li> <li>• Considering the urban environment and given the multi-level nearest sensitive receivers surrounding the project site temporary noise barriers of reasonable and feasible height may provide limited noise attenuation. The large existing site cut (12m set down) provides significant shielding to receivers north of the site. Nevertheless, construction hoarding surrounding the site may provide some reduction of noise levels to the adjacent sensitive receiver locations.</li> <li>• The benefits of the noise barrier should be reevaluated when a more detailed assessment is conducted during the preparation of the CNVMP.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Community consultation  | <p>Community consultation should occur prior to, and during works as follows:</p> <ul style="list-style-type: none"> <li>• Discuss with affected neighbours any atypical sensitivities (such as vibration sensitive equipment/processes in research or medical establishments, or exam periods for education establishments) to inform determination of criteria and where scheduling of activities may aid to minimise impacts</li> <li>• Seek to establish long-term contact personnel or processes to aid notification of planned activities and expected disruption/effects and their duration. Notifications should be as specific as practicable with regarding to nature, timing of works and any scheduled respite periods.</li> <li>• Advise neighbours of mitigation and management processes and complaints handling procedures. Where respite periods may be warranted, discuss community preferences in terms of respite vs shorter overall works duration. Where respite is to be provided, seek to align with receiver preferences.</li> <li>• Guidance regarding noise and vibration complaints management process is included in Appendix I.</li> <li>• Keep a register of any complaints, including details such as date, time, contact number, complainant location, description of complaint and action taken.</li> <li>• Provide quick response to complaints, both to aid understanding the cause of the complaint and reduce extended impacts.</li> </ul> |
| Staff / training        | <ul style="list-style-type: none"> <li>• Appoint a named member of the site staff who will act as the Responsible Person with respect to noise and vibration.</li> <li>• Site managers to periodically check the site and subjectively assess emissions to nearby receivers to proactively manage works.</li> <li>• All employees, contractors, and subcontractors to receive an environmental induction which should include: <ul style="list-style-type: none"> <li>– Standard noise and vibration mitigation measures</li> <li>– Permissible hours of work outlined in Section 6.2.3</li> <li>– Limitations on high noise and vibration generating activities</li> <li>– Location of nearest sensitive receivers</li> </ul> </li> <li>• Regularly train workers and contractors (such as at toolbox talks) to reinforce good work practices and communicate any received complaints, responses and changes to work practices where relevant.</li> <li>• Document and communicate methods for use and maintenance of equipment to minimise noise and vibration.</li> <li>• Avoid dropping of items, particularly from height.</li> </ul>                                                                                                                                                                                                                                                                                                                                       |

| Item                 | Detail                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                      | <ul style="list-style-type: none"> <li>• Avoid the use of radios or stereos outdoors.</li> <li>• Avoid the overuse of public address systems.</li> <li>• No swearing or unnecessary shouting.</li> <li>• No slamming of doors.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Site/works planning  | <ul style="list-style-type: none"> <li>• Where practicable, strategically locate primary site entries, access roads, loading areas etc, away from the most noise sensitive receptors.</li> <li>• Where practicable, fixed equipment should be located away from the most sensitive receptors. Where relevant to the equipment type, enclosures should be provided or acoustically shielded by structures or site sheds etc.</li> <li>• Route heavy vehicle movements away from noise sensitive areas, such as residential streets where possible.</li> <li>• Where practicable, pre-fabricate and/or prepare materials off-site.</li> <li>• Carry out building/structures/utility condition surveys as per Section 6.5</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Condition surveys    | <ul style="list-style-type: none"> <li>• To be conducted prior to commencement of works</li> <li>• Required where it has been established that the property, structure or utility is at risk of damage during the construction work.</li> <li>• The findings of the survey may require amendment to proposed vibration criteria or management measures and therefore should be undertaken in suitable advance of the start date.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Works scheduling     | <ul style="list-style-type: none"> <li>• Works to be scheduled taking into account approved works hours, any restrictions relevant to specific equipment/activities and respite periods etc.</li> <li>• Highest noise generating activities should be scheduled for the least sensitive times, where practicable.</li> <li>• The acceptability for any out-of-hours works should be confirmed with authorities</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Plant and equipment  | <ul style="list-style-type: none"> <li>• Use quieter and less vibration emitting construction methods where feasible and reasonable. For example: <ul style="list-style-type: none"> <li>– Use of static or oscillating rollers rather than vibratory rollers.</li> <li>– Use of electric / hydraulic equipment</li> <li>– Use of non-tonal reversing beepers (or an equivalent mechanism) for all construction vehicles and mobile plant regularly used onsite. Note, the use of non-tonal reversing alarms is recommended to minimise noise impacts however WHS requirements must be fully satisfied.</li> </ul> </li> <li>• Use only the necessary size and power of equipment.</li> <li>• Limit use of activities with potentially ‘annoying’ or intrusive characteristics such as impulsive, tonal or excessive low frequency sources.</li> <li>• Ensure plant is regularly maintained, and repair or replace equipment as necessary (e.g. ensure air lines on pneumatic equipment do not leak).</li> <li>• Turn off all vehicles, plant and equipment when not in use.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Noise monitoring     | <ul style="list-style-type: none"> <li>• Generally short-term attended measurements will be conducted in response of a complaint</li> <li>• Attended monitoring may be undertaken at the start of new construction activities to confirm alignment with predicted noise levels in the impact assessment.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Vibration monitoring | <ul style="list-style-type: none"> <li>• Vibration monitoring should be conducted where works are proposed within the ‘minimum working distance’ to a sensitive receiver/structure/utility with respect to cosmetic damage. Refer to Section 6.6.1</li> <li>• Preliminary attended monitoring should be carried out to evaluate risk of works exceeding relevant limits. Screening measurements should be carried out with plant operating outside the minimum working distance, and progressively move closer.</li> <li>• Where works are at risk of exceeding criteria, establish long-term monitoring. The monitors should provide ‘real-time’ alerts (SMS messages and/or flashing lights) when vibration criteria are exceeded. A warning level (below the relevant criteria) should be set in addition to the criteria limit.</li> <li>• In the event that the vibration criterion is exceeded, works should cease.</li> <li>• An exceedance of the vibration criterion may necessitate a change in work method. This could include: <ul style="list-style-type: none"> <li>– Re-evaluation of the vibration criterion based on results of the initial condition investigation and inspections of the structure following the commencement of works.</li> <li>– Maintain vibration monitoring throughout works within ‘minimum working distances’.</li> <li>– Reduce the size of demolition and construction equipment and develop alternative methodologies to minimise vibration.</li> </ul> </li> </ul> |

| Item                   | Detail                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                        | <ul style="list-style-type: none"> <li>– Use less vibration emitting demolition methods if necessary closer to the sensitive building or structure</li> <li>– Balance variable speed vibrating plant and operate at speeds that do not produce resonance.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Review and improvement | <ul style="list-style-type: none"> <li>• The CNVMP forms the framework for the contractor to minimise noise and vibration impacts at the nearby receivers.</li> <li>• Evaluation of the management performance against the applicable policies, objectives and targets should occur for the purpose of identifying opportunities for improvement. This should include: <ul style="list-style-type: none"> <li>– Determine the cause or causes of non-conformances and deficiencies</li> <li>– Develop and implement a plan of corrective and preventative action to address any non-conformances and deficiencies</li> <li>– Verify the effectiveness of the corrective and preventative actions</li> <li>– Document any changes in procedures resulting from process improvement</li> </ul> </li> </ul> |

### 6.6.1 Vibration – minimum working distances

With regards to vibration impacts during construction, these will be managed by the Contractor and will depend on the type, size, number and location of equipment used. Preliminary screening criteria are provided in Table 30. Table 30 shows that where vibration generating equipment is to be located within a certain distance from a receiver vibration impact may occur.

Should vibration monitoring be conducted, the criteria to be achieved at the location of monitoring would be the criteria presented in Appendix H.

Table 30: Recommended minimum working distances for vibration intensive plant

| Plant item                                                                                                                | Rating / description           | Minimum working distance (m)                                                             |                                                                                            |                                                   |                |
|---------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|---------------------------------------------------|----------------|
|                                                                                                                           |                                | Cosmetic damage – screening criteria                                                     |                                                                                            |                                                   | Human response |
|                                                                                                                           |                                | Industrial and heavy commercial buildings<br>BS 7385<br>Line 1 - 25 mm/s<br>(See note 2) | Residential and light commercial buildings<br>BS 7385<br>Line 2 - 7.5 mm/s<br>(See note 2) | Structures unsound<br>DIN 4150<br>Line 3 - 3 mm/s |                |
| Vibratory roller                                                                                                          | < 50 kN (~ 1 to 2 t)           | 2 m                                                                                      | 5 m                                                                                        | 11 m                                              | 15 m to 20 m   |
|                                                                                                                           | < 100 kN (~ 2 to 4 t)          | 2 m                                                                                      | 6 m                                                                                        | 13 m                                              | 20 m           |
|                                                                                                                           | < 200 kN (~ 4 to 6 t)          | 5 m                                                                                      | 12 m                                                                                       | 26 m                                              | 40 m           |
|                                                                                                                           | < 300 kN (~ 7 to 13 t)         | 6 m                                                                                      | 15 m                                                                                       | 31 m                                              | 100 m          |
|                                                                                                                           | > 300 kN (~ 13 to 18 t)        | 8 m                                                                                      | 20 m                                                                                       | 40 m                                              | 100 m          |
|                                                                                                                           | > 300 kN (> 18 t)              | 10 m                                                                                     | 25 m                                                                                       | 50 m                                              | 100 m          |
| Hydraulic hammer – Small                                                                                                  | 300 kg / 5 to 12 t excavator   | 1 m                                                                                      | 2 m                                                                                        | 5 m                                               | 7 m            |
| Hydraulic hammer – Medium                                                                                                 | 900 kg / 12 to 18 t excavator  | 3 m                                                                                      | 7 m                                                                                        | 15 m                                              | 23 m           |
| Hydraulic hammer – Large                                                                                                  | 1600 kg / 18 to 34 t excavator | 9 m                                                                                      | 22 m                                                                                       | 44 m                                              | 73 m           |
| Piling – Vibratory                                                                                                        | Sheet piles                    | 9 m                                                                                      | 22 m                                                                                       | 44 m                                              | 73 m           |
| Piling – Bored                                                                                                            | ≤ 800 mm                       | 1 m (nominal)                                                                            | 2 m                                                                                        | 5 m                                               | 10 m           |
| Piling – Hammer                                                                                                           | 12t down force                 | 6 m                                                                                      | 15 m                                                                                       | 30 m                                              | 50 m           |
| Jackhammer                                                                                                                | Hand-held                      | 1 m (nominal)                                                                            | 1 m (nominal)                                                                              | 3 m                                               | 5 m            |
| Mechanised bored tunnelling works (Tunnel Boring Machine, Horizontal Directional Drilling, Micro-tunnelling) <sup>1</sup> |                                | 1 m to 5 m                                                                               | 2 m to 12 m                                                                                | 4 m to 24 m                                       | 6 m to 35 m    |

| Plant item | Rating / description | Minimum working distance (m)                                                             |                                                                                            |                                                   |                |
|------------|----------------------|------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|---------------------------------------------------|----------------|
|            |                      | Cosmetic damage – screening criteria                                                     |                                                                                            |                                                   | Human response |
|            |                      | Industrial and heavy commercial buildings<br>BS 7385<br>Line 1 - 25 mm/s<br>(See note 2) | Residential and light commercial buildings<br>BS 7385<br>Line 2 - 7.5 mm/s<br>(See note 2) | Structures unsound<br>DIN 4150<br>Line 3 - 3 mm/s |                |

Notes:

1\_ Based on TRL document [22] using Godio et al formula, equation 24

2\_ Where vibration might give rise to resonant responses in structures

## 7. Conclusion

A Noise and Vibration Impact Assessment has been conducted for the proposed data centre at 6-8 Julius Avenue, North Ryde NSW in accordance with the requirements of the Planning Secretary's Environmental Assessment Requirements (SSD-80018208) for the Proposal.

The operational noise assessment has carried out noise predictions in accordance with the *NSW Noise Policy for Industry* [1], including consideration of noise-enhancing meteorological conditions. Both ISO 9613-2:2024 [17] and CONCAWE [18] algorithms were utilised to assess standard meteorological conditions. The assessment identified the noise sensitive receivers, overall site criteria, noise sources and noise mitigation measures. Operating conditions were defined for normal operations and maintenance operations including generator testing.

Predicted results indicate that, with the implementation of the indicative noise mitigation measures presented in this report, the noise emissions from the project comply with the overall site noise criteria during both normal operations and maintenance operations at all receivers under standard and enhanced weather conditions. A negligible 1 dB(A) exceedance was predicted at the nearest residential receiver locations during the night time period with noise enhancing conditions. However, it is expected that under night-time operating conditions, cooling towers would have reduced noise emissions and nominal compliance would be readily achieved.

Further acoustic design will be required during the design development phase to confirm the detailed specification of equipment and mitigation measures.

The increase in traffic noise from vehicles traveling to and from the site on the road network was assessed as compliant with the provisions of the *NSW Road Noise Policy* [2].

Regarding construction, while specific activities and work schedules are not yet confirmed, a preliminary assessment has been conducted. Criteria has been established in accordance with the *NSW ICNG* [3] and *Assessing Vibration: a technical guideline* [4]. Predicted noise levels indicate that NMLs are likely to be exceeded albeit only for intermittent periods during standard hours and mainly during the early stage of construction until the building structure is complete. Regarding vibration, should any sensitive structures be identified within the minimum working distances, mitigation measures as recommended in Section 6.6 should be applied. Recommendations regarding mitigation and management measures are outlined in Section 6.6 and are expected to be developed further in a formal Construction Noise and Vibration Management Plan, to be prepared prior to commencement of works.

During construction, heavy vehicles are expected to travel on Julius Avenue and Delhi Road. Construction traffic noise is anticipated to comply with provisions of the *NSW Road Noise Policy*.

Mitigation and management measures for the operation and construction of the site are discussed in Section 4.4 and Section 6.6 respectively.

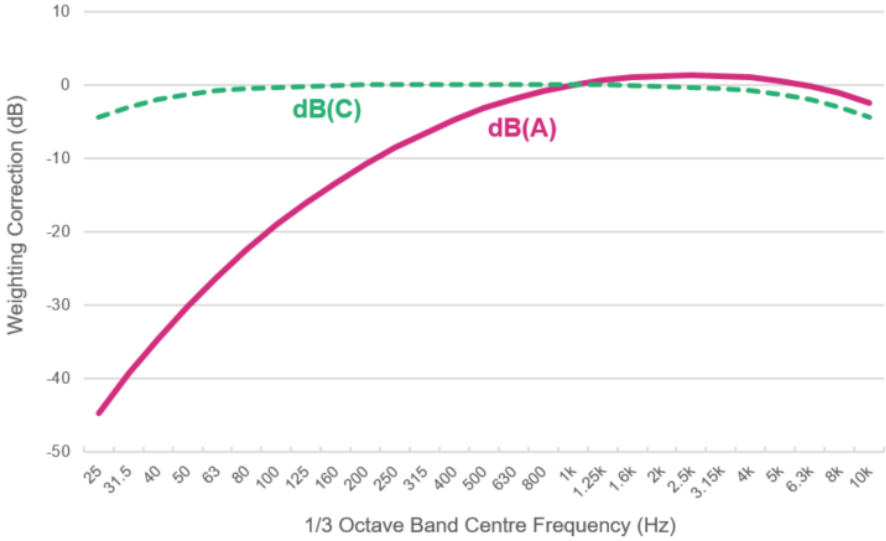
## 8. References

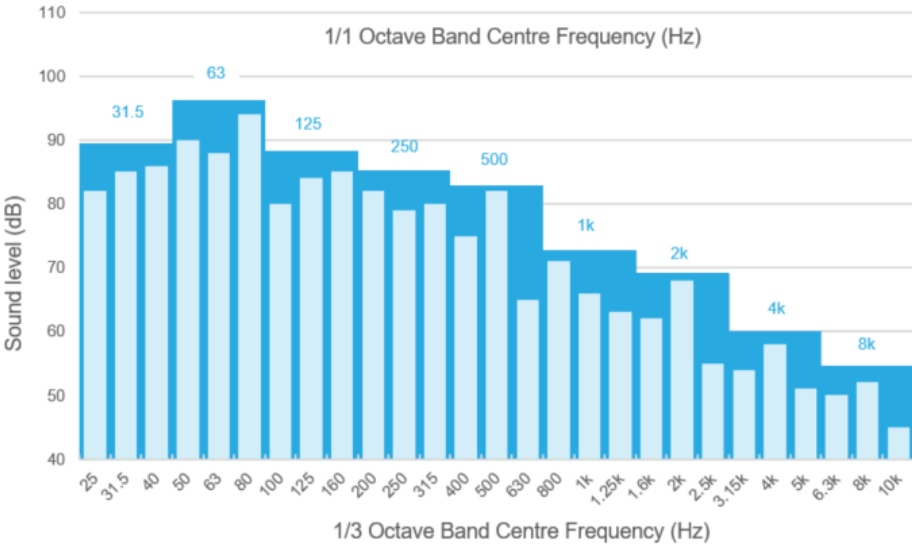
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- [5] Standards Australia, “AS2187.2 Explosives - Storage and use Part 2: Use of explosives,” Standards Australia, 2006.
- [6] British Standards, “BS 7385-2:1993 Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration,” British Standards, 1993.
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- [21] Department for Environment, Food & Rural Affairs (DEFRA), “Update of noise database for prediction of noise on construction and open sites - Phase 3: Noise measurement data for construction plant used on quarries,” 2006.
- [22] C. H. D and G. I. Miller, “Transport Research Laboratory (TRL), GroundBorne vibration caused by mechanised construction works,” 2000.
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# Appendix A

## Glossary

| Term                          | Definition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Ambient noise level</b>    | The ambient noise level is the overall noise level measured at a location from multiple noise sources. When assessing noise from a particular development, the ambient noise level is defined as the remaining noise level in the absence of the specific noise source being investigated. For example, if a fan located on a building is being investigated, the ambient noise level is the noise level from all other sources without the fan operating, such as traffic, birds, people talking and other noise from other buildings.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Background noise level</b> | <p>The background noise level is the noise level that is generally present at a location at all or most times. Although the background noise may change over the course of a day, over shorter time periods (e.g. 15 minutes) the background noise is almost-constant. Examples of background noise sources include steady traffic (e.g. motorways or arterial roads), constant mechanical or electrical plant and some natural noise sources such as wind, foliage, water and insects.</p> <p>Assessment Background Level (ABL): A single-number figure used to characterise the background noise levels from a single day of a noise survey. ABL is derived from the measured noise levels for the day, evening or night period of a single day of background measurements. The ABL is calculated to be the tenth percentile of the background <math>L_{A90}</math> noise levels – i.e. the measured background noise is above the ABL 90% of the time.</p> <p>Rating Background Level (RBL / <math>\min L_{A90,1\text{hour}}</math>): A single-number figure used to characterise the background noise levels from a complete noise survey. The RBL for a day, evening or night period for the overall survey is calculated from the individual Assessment Background Levels (ABL) for each day of the measurement period, and is numerically equal to the median (middle value) of the ABL values for the days in the noise survey.</p> |
| <b>Decibel (dB)</b>           | <p>The logarithmic scale used to measure sound and vibration.</p> <p>Human hearing is not linear and involves hearing over a large range of sound pressures, which would be challenging to present on a linear scale. A logarithmic scale allows all sound levels to be expressed based on how loud they are relative to a reference sound (typically 20 <math>\mu\text{Pa}</math>, which is the approximate human threshold of hearing). For sound in other media (e.g. underwater noise) a different reference level (1 <math>\mu\text{Pa}</math>) is used instead.</p> <p>An increase of approximately 10 dB corresponds to a subjective doubling of the loudness of a noise. The minimum increase or decrease in noise level that can be noticed is typically 2 to 3 dB.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>dB weighting curves</b>    | <p>The frequency of a sound affects its perceived loudness and human hearing is less sensitive at low and very high frequencies. When seeking to represent the summation of sound pressure levels across the frequency range of human hearing into a single number, weighting is typically applied. Most commonly, A-weighting, denoted as dB(A), is used for environmental noise assessment. This is often supplemented by the linear or C-weighting curves, where there is the potential for excess low-frequency sound at higher sound pressure levels.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>dB(A)</b>                  | dB(A) denotes a single-number sound pressure level that includes a frequency weighting ('A-weighting') to reflect the subjective loudness of the sound level.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

| Term                          | Definition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                               | The frequency of a sound affects its perceived loudness. Human hearing is less sensitive at low and very high frequencies, and so the A-weighting is used to account for this effect. An A-weighted decibel level is written as dB(A).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>dB<sub>peak</sub></b>      | The peak value is the maximum amplitude identified during a measurement period.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>dB<sub>rms</sub></b>       | The root mean squared (rms) value takes into account both time history variation and energy content. The rms value is typically equal to 0.707 (1/√2) times the peak value                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Frequency</b>              | <p>Frequency is the number of cycles per second of a sound or vibration wave. In musical terms, frequency is described as ‘pitch’. Sounds towards the lower end of the human hearing frequency range are perceived as “bass” or ‘low-pitched’ and sounds with a higher frequency are perceived as ‘treble’ or ‘high pitched’.</p> <p>The unit of frequency is the hertz (Hz), which is identical to cycles per second. A thousand Hz is generally denoted as kHz. Human hearing ranges approximately from 20 Hz to 20 kHz.</p> <p>While single weighted sound pressure levels simplify the assessment and evaluation of sound levels, frequency analysis is often undertaken. ‘Octave bands’, either 1/1 or 1/3 octave bands are most commonly utilised and are referred to by the nominal centre frequency of the band (e.g. 31.5 Hz), while being the summation of all frequencies between a defined lower and upper frequency.</p>  |
| <b>L<sub>1</sub>(period)</b>  | <p>The sound level exceeded for 1% of the measurement period.</p> <p>For example, 65 dBL<sub>A1,1min</sub> indicates that the A-weighted sound level would not exceed 65 dB for more than 0.6 seconds in the 1-minute measurement period.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>L<sub>10</sub>(period)</b> | <p>The sound level exceeded for 10% of the measurement period, or alternatively, the sound levels would be lower for 90% of the time.</p> <p>The L<sub>10</sub> is often defined as the ‘average maximum’ sound levels, as in AS1055-2018 with the advent of statistical sound level meters.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>L<sub>90</sub>(period)</b> | <p>The sound level exceeded for 90% of the measurement period.</p> <p>The L<sub>90</sub> is often defined as the ‘average minimum’ or ‘background’ noise level for a period of measurement. For example, 45 dBL<sub>A90,15min</sub> indicates that the sound level is higher than 45 dB(A) for 90% of the 15-minute measurement period.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>L<sub>eq</sub>(period)</b> | <p>The equivalent (‘eq’) continuous sound level, used to describe the level of a time-varying sound or vibration measurement.</p> <p>The L<sub>eq</sub> is often defined as the ‘average’ level, and mathematically, is the energy-average level over a measurement period – i.e. the level of a constant sound that contains the same sound energy as the measured sound.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>L<sub>max</sub></b>        | <p>The L<sub>max</sub> is the ‘absolute maximum’ level of a sound or vibration recorded over the measurement period.</p> <p>As the L<sub>max</sub> is often caused by an instantaneous event, it can vary significantly between measurements.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

| Term                                  | Definition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Peak Particle Velocity (PPV)</b>   | The highest velocity of a particle (such as part of a building structure) as it vibrates. PPV is commonly used as a vibration criteria, and is often interpreted as a PPV based on the $L_{\max}$ or $L_{\max, \text{spec}}$ index.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Sound Power and Sound Pressure</b> | <p>The sound power level (<math>L_w</math>) of a source is a measure of the total acoustic power radiated by a source. The sound pressure level (<math>L_p</math>) varies as a function of the environment and distance from a source.</p> <p>The sound power level is an intrinsic characteristic of a source (analogous to its mass), which is not affected by the environment within which the source is located.</p>                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Structureborne noise</b>           | The transmission of noise energy as vibration of building elements. The energy may then be re-radiated as airborne noise. Structureborne noise is controlled by structural discontinuities, i.e. expansion joints and floating floors.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Vibration</b>                      | <p>Waves in a solid material are called 'vibration', as opposed to similar waves in air, which are called 'sound' or 'noise'. If vibration levels are high enough, they can be felt; usually vibration levels must be much higher to cause structural damage.</p> <p>A vibrating structure (e.g. a wall) can cause airborne noise to be radiated, even if the vibration itself is too low to be felt. Structureborne vibration limits are sometimes set to control the noise level in a space.</p> <p>Vibration levels can be described using measurements of displacement, velocity and acceleration. Velocity and acceleration are commonly used for structureborne noise and human comfort. Vibration is described using either metric units (such as mm, mm/s and mm/s<sup>2</sup>) or else using a decibel scale.</p> |

# Appendix B

## Background and ambient noise survey

## B.1 Unattended long-term noise monitoring

### B.1.1 Noise monitoring equipment

Unattended monitoring was carried out using the equipment in Table 31 in general accordance with the NPfI [1] and AS1055.2018 [9].

Table 31: Unattended Noise Monitoring Equipment information

| Measurement Location                        | Equipment/model                      | Serial No.     | Logger/SLM Type                    |
|---------------------------------------------|--------------------------------------|----------------|------------------------------------|
| L1 <sup>1</sup> – 39 Delhi Road, North Ryde | Rion NL-42 (Type 2)                  | - <sup>1</sup> | Class 2 noise logger               |
| L2 - 35 Gilda Street, North Ryde            | ARL Ngara Environmental Noise Logger | 8780D0         | Class 1 Environmental noise logger |
| L3 – 25 Walkers Drive, Lane Cove North      | ARL Ngara Environmental Noise Logger | 87807F         | Class 1 Environmental noise logger |

Notes:

1\_Long term noise monitoring conducted by Acoustic Logic as part of the EIS prepared for the Stockland Trinita Stage 2 Build-to-Rent development located at 39 Delhi Road, North Ryde (ref. *RTS Noise & Vibration Assessment* 20230459.1/2106A/R5/RF, dated 21/06/2024)

All noise monitoring instrumentation used was compliant with the requirements of AS IEC 61672.1-2004: Electroacoustics - Sound level meters – Specifications [11] and carried appropriate and current National Association of Testing Authorities (NATA) (or manufacturer) calibration certificates. The calibration of the equipment was checked both before and after the survey and no significant drift in calibration ( $\pm 0.5$  dB) was noted at any location.

### B.1.2 Extraneous/weather affected data

Measurement samples affected by extraneous noise, wind (greater than 5m/s) or rain were excluded from the recorded data in accordance with the procedures outlined in Fact Sheet A of the NSW Noise Policy for Industry (NPfI) [1].

The noise long-term noise monitoring results were processed to exclude weather affected data following consultation of weather reports from the Bureau of Meteorology (BOM) Sydney Olympic Park Weather Station (Station ID 066212).

The noise level-vs-time graphs of the data are included in Section B.1.3.

### B.1.3 Noise monitoring graphs

The following noise level vs time graphs present overall dB(A) levels recorded by the unattended logger(s) for a range of noise descriptors, including  $L_{Aeq}$ ,  $L_{A90}$ ,  $L_{A10}$  and  $L_{Amax}$ . While line graphs are presented, sampling is at 15-minute intervals.

Wind speeds are also shown where relevant, and periods of excluded data are shaded grey.

## 35 Gilda Street (Free Field)

Additional detail:



### Background and ambient noise monitoring results - NSW 'Industrial Noise Policy', 2000

| Date                                      | L <sub>A90</sub> Background noise levels <sup>4</sup> |                      |                    | L <sub>Aeq</sub> Ambient noise levels |                      |                    |
|-------------------------------------------|-------------------------------------------------------|----------------------|--------------------|---------------------------------------|----------------------|--------------------|
|                                           | Day <sup>1</sup>                                      | Evening <sup>2</sup> | Night <sup>3</sup> | Day <sup>1</sup>                      | Evening <sup>2</sup> | Night <sup>3</sup> |
| Thursday-05-December-2024                 |                                                       | 50                   | 40                 |                                       | 54                   | 49                 |
| Friday-06-December-2024                   | 51                                                    | 48                   |                    | 60                                    | 54                   |                    |
| Saturday-07-December-2024                 |                                                       | 48                   | 41                 |                                       | 57                   | 56                 |
| Sunday-08-December-2024                   | 51                                                    | 48                   | 40                 | 61                                    | 58                   | 52                 |
| Monday-09-December-2024                   | 52                                                    | 46                   | 37                 | 57                                    | 54                   | 50                 |
| Tuesday-10-December-2024                  | 51                                                    | 48                   | 38                 | 61                                    | 59                   | 54                 |
| Wednesday-11-December-2024                | 52                                                    | 48                   | 39                 | 60                                    | 54                   | 51                 |
| Thursday-12-December-2024                 | 55                                                    | 50                   | 40                 | 63                                    | 56                   | 52                 |
| Friday-13-December-2024                   | 54                                                    | 49                   | 39                 | 62                                    | 57                   | 52                 |
| Saturday-14-December-2024                 | 49                                                    | 46                   | 39                 | 62                                    | 57                   | 53                 |
| Sunday-15-December-2024                   | 53                                                    | 47                   | 37                 | 62                                    | 57                   | 53                 |
| Monday-16-December-2024                   | 56                                                    | 47                   | 38                 | 63                                    | 56                   | 49                 |
| Tuesday-17-December-2024                  |                                                       |                      |                    |                                       |                      |                    |
| <b>Representative Weekday<sup>5</sup></b> | <b>52</b>                                             | <b>48</b>            | <b>39</b>          | <b>61</b>                             | <b>56</b>            | <b>52</b>          |
| <b>Representative Weekend<sup>5</sup></b> | <b>51</b>                                             | <b>47</b>            | <b>39</b>          | <b>62</b>                             | <b>57</b>            | <b>54</b>          |
| <b>Representative Week<sup>5</sup></b>    | <b>52</b>                                             | <b>48</b>            | <b>39</b>          | <b>61</b>                             | <b>56</b>            | <b>52</b>          |

Notes:

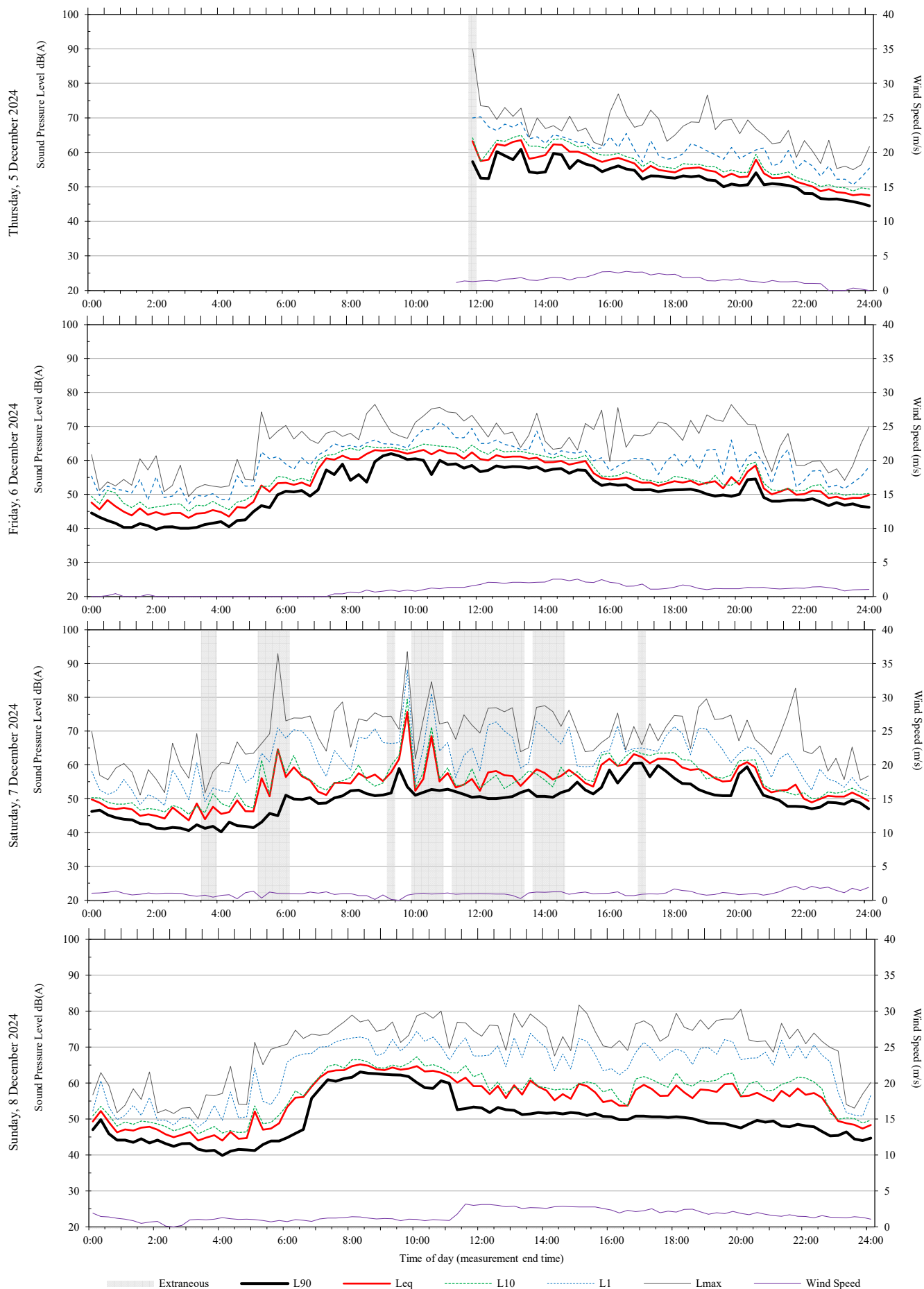
1. Day is 8:00am to 6:00pm on Sunday and 7:00am to 6:00pm at other times

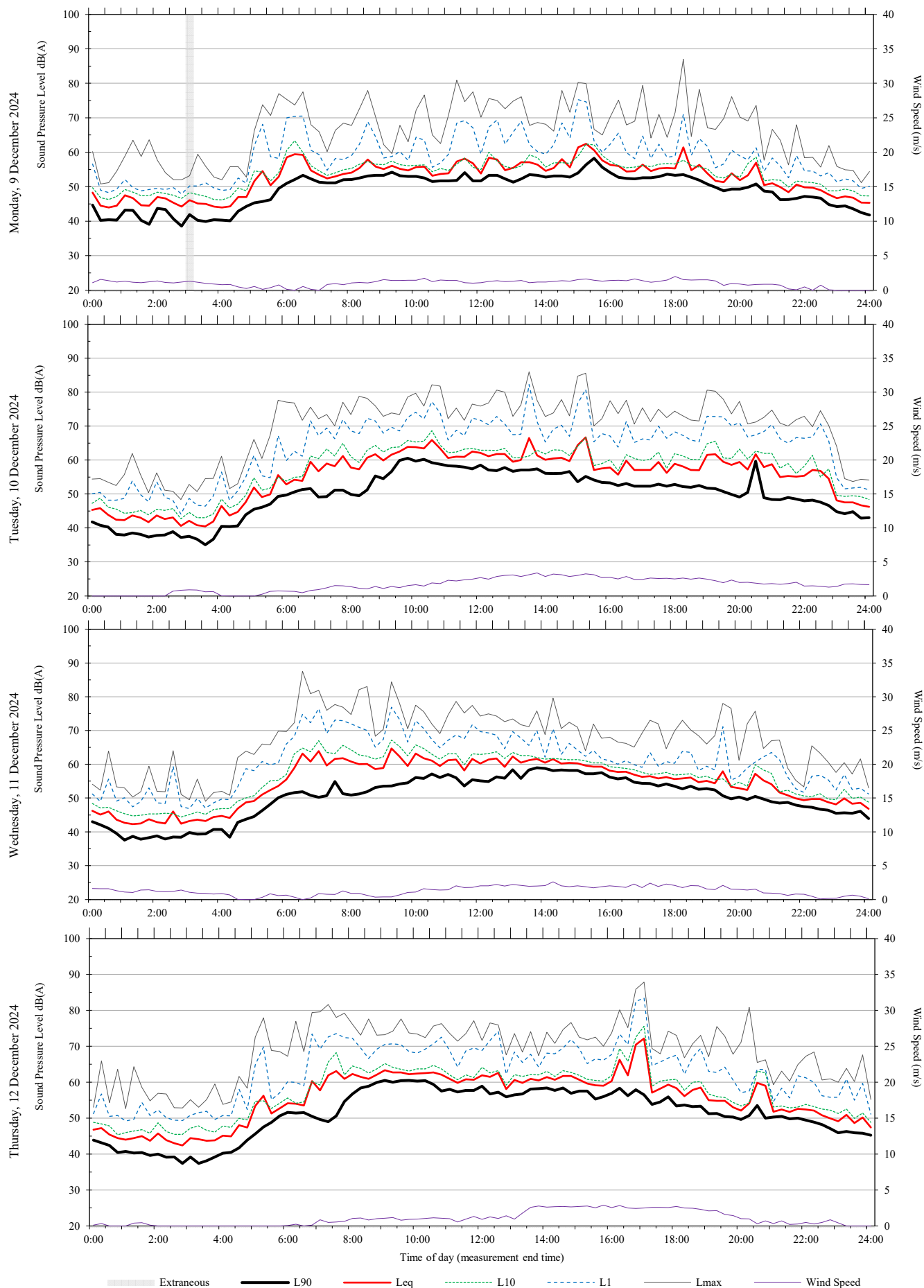
2. Evening is 6:00pm to 10:00pm

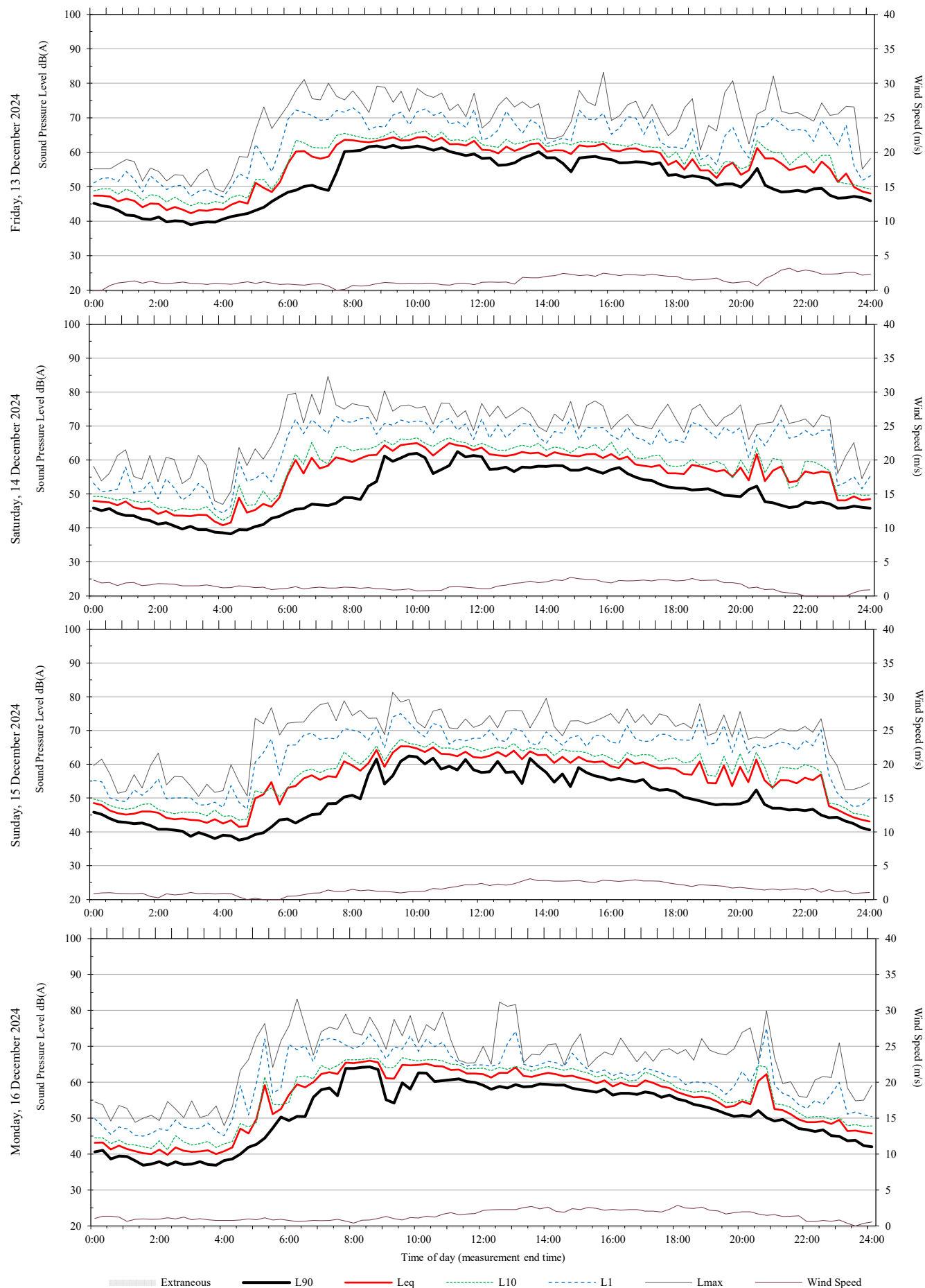
3. Night is the remaining periods

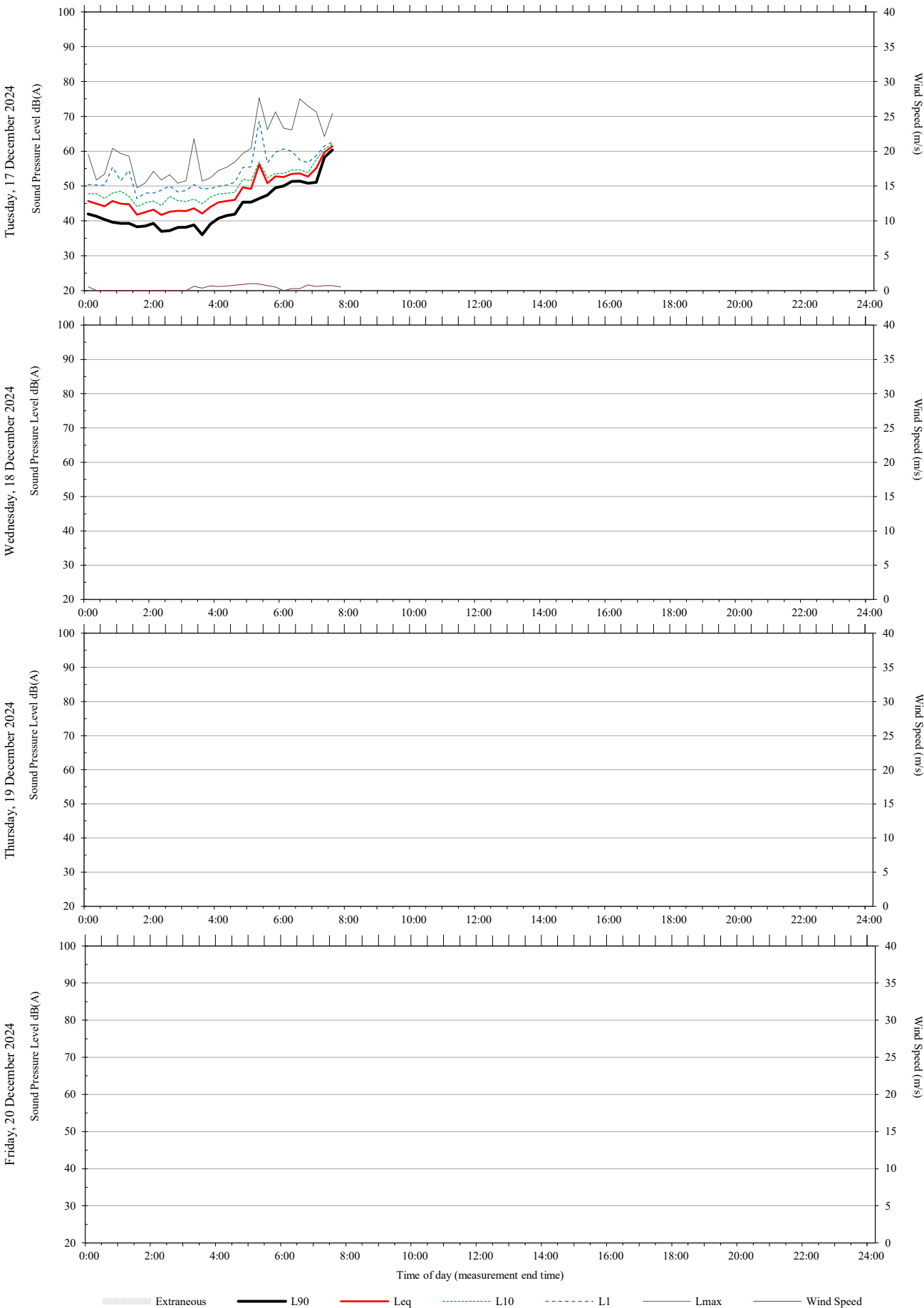
4. Assessment Background Level (ABL) for individual days

5. Rating Background Level (RBL) for L<sub>A90</sub> and logarithmic average for L<sub>Aeq</sub>



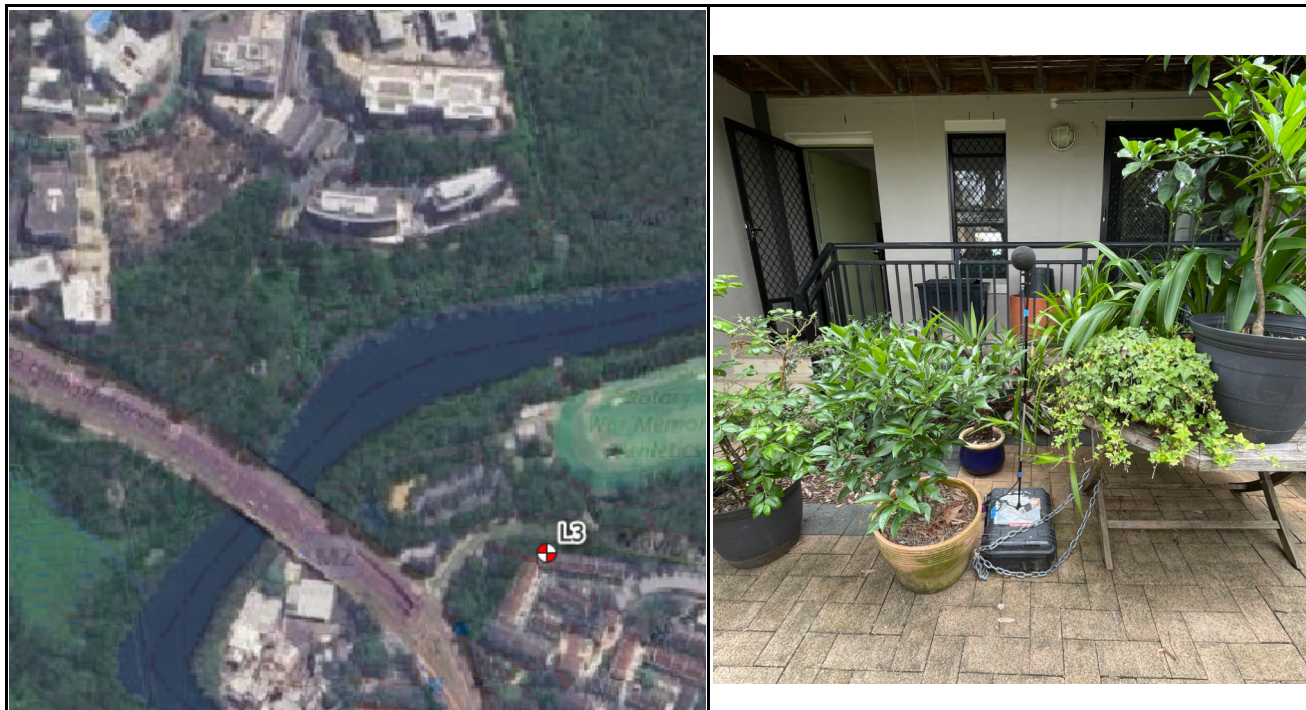






## 25 Walkers Drive (Free Field)

Additional detail:



### Background and ambient noise monitoring results - NSW 'Industrial Noise Policy', 2000

| Date                                      | L <sub>A90</sub> Background noise levels <sup>4</sup> |                      |                    | L <sub>Aeq</sub> Ambient noise levels |                      |                    |
|-------------------------------------------|-------------------------------------------------------|----------------------|--------------------|---------------------------------------|----------------------|--------------------|
|                                           | Day <sup>1</sup>                                      | Evening <sup>2</sup> | Night <sup>3</sup> | Day <sup>1</sup>                      | Evening <sup>2</sup> | Night <sup>3</sup> |
| Thursday-05-December-2024                 |                                                       | 49                   | 36                 |                                       | 57                   | 49                 |
| Friday-06-December-2024                   | 52                                                    | 49                   |                    | 71                                    | 57                   |                    |
| Saturday-07-December-2024                 |                                                       | 55                   | 38                 |                                       | 67                   | 53                 |
| Sunday-08-December-2024                   | 50                                                    | 48                   | 34                 | 72                                    | 56                   | 50                 |
| Monday-09-December-2024                   | 51                                                    | 48                   | 34                 | 63                                    | 54                   | 49                 |
| Tuesday-10-December-2024                  | 52                                                    | 48                   | 33                 | 67                                    | 60                   | 51                 |
| Wednesday-11-December-2024                | 52                                                    | 49                   | 38                 | 65                                    | 59                   | 50                 |
| Thursday-12-December-2024                 | 52                                                    | 50                   | 36                 | 69                                    | 59                   | 50                 |
| Friday-13-December-2024                   | 54                                                    | 50                   | 37                 | 71                                    | 63                   | 51                 |
| Saturday-14-December-2024                 | 49                                                    | 48                   | 36                 | 66                                    | 60                   | 51                 |
| Sunday-15-December-2024                   | 54                                                    | 48                   | 33                 | 64                                    | 59                   | 50                 |
| Monday-16-December-2024                   | 55                                                    | 50                   |                    | 66                                    | 58                   |                    |
| <b>Representative Weekday<sup>5</sup></b> | <b>52</b>                                             | <b>49</b>            | <b>36</b>          | <b>68</b>                             | <b>59</b>            | <b>50</b>          |
| <b>Representative Weekend<sup>5</sup></b> | <b>50</b>                                             | <b>48</b>            | <b>35</b>          | <b>69</b>                             | <b>62</b>            | <b>51</b>          |
| <b>Representative Week<sup>5</sup></b>    | <b>52</b>                                             | <b>49</b>            | <b>36</b>          | <b>68</b>                             | <b>60</b>            | <b>51</b>          |

Notes:

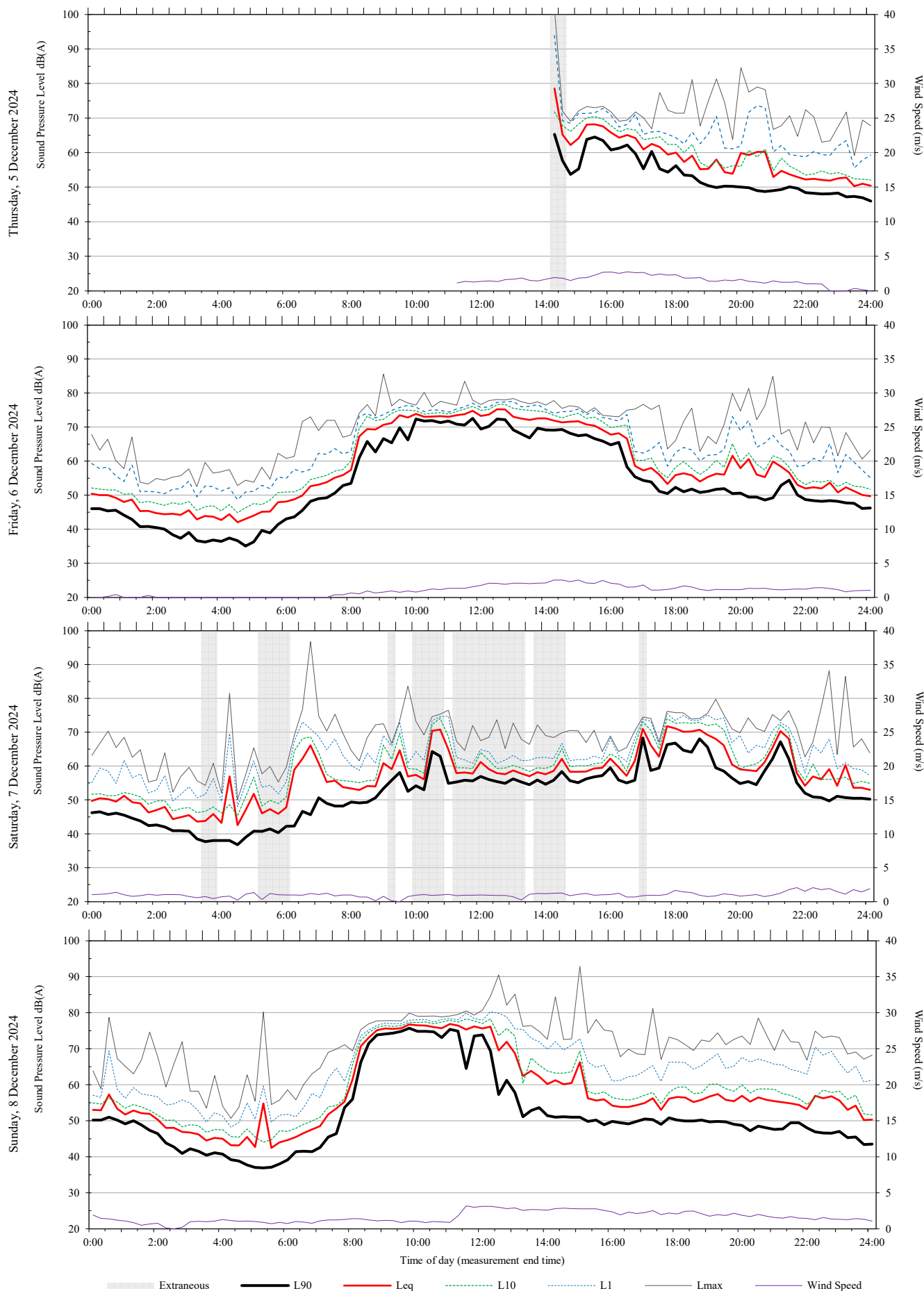
1. Day is 8:00am to 6:00pm on Sunday and 7:00am to 6:00pm at other times

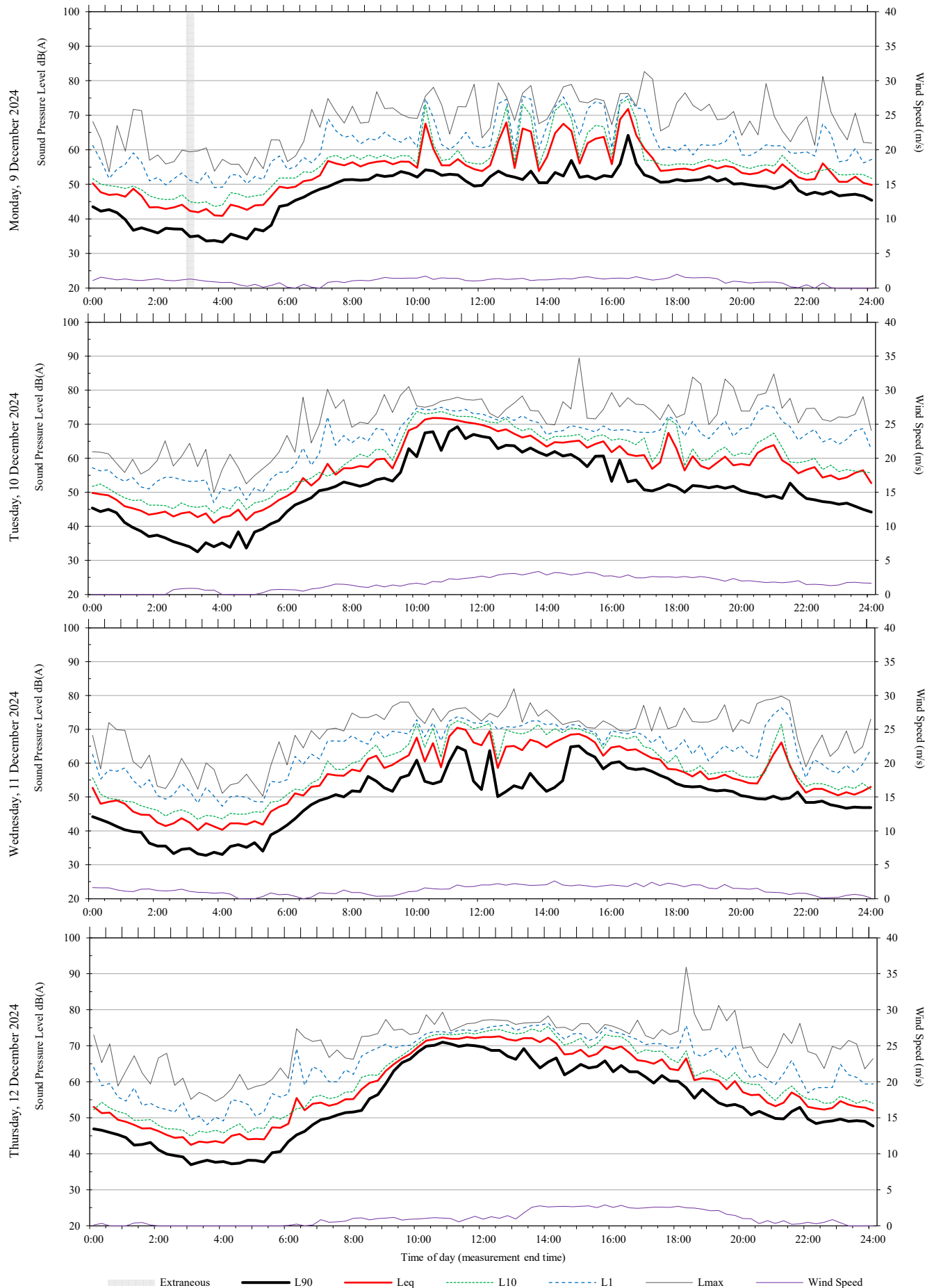
2. Evening is 6:00pm to 10:00pm

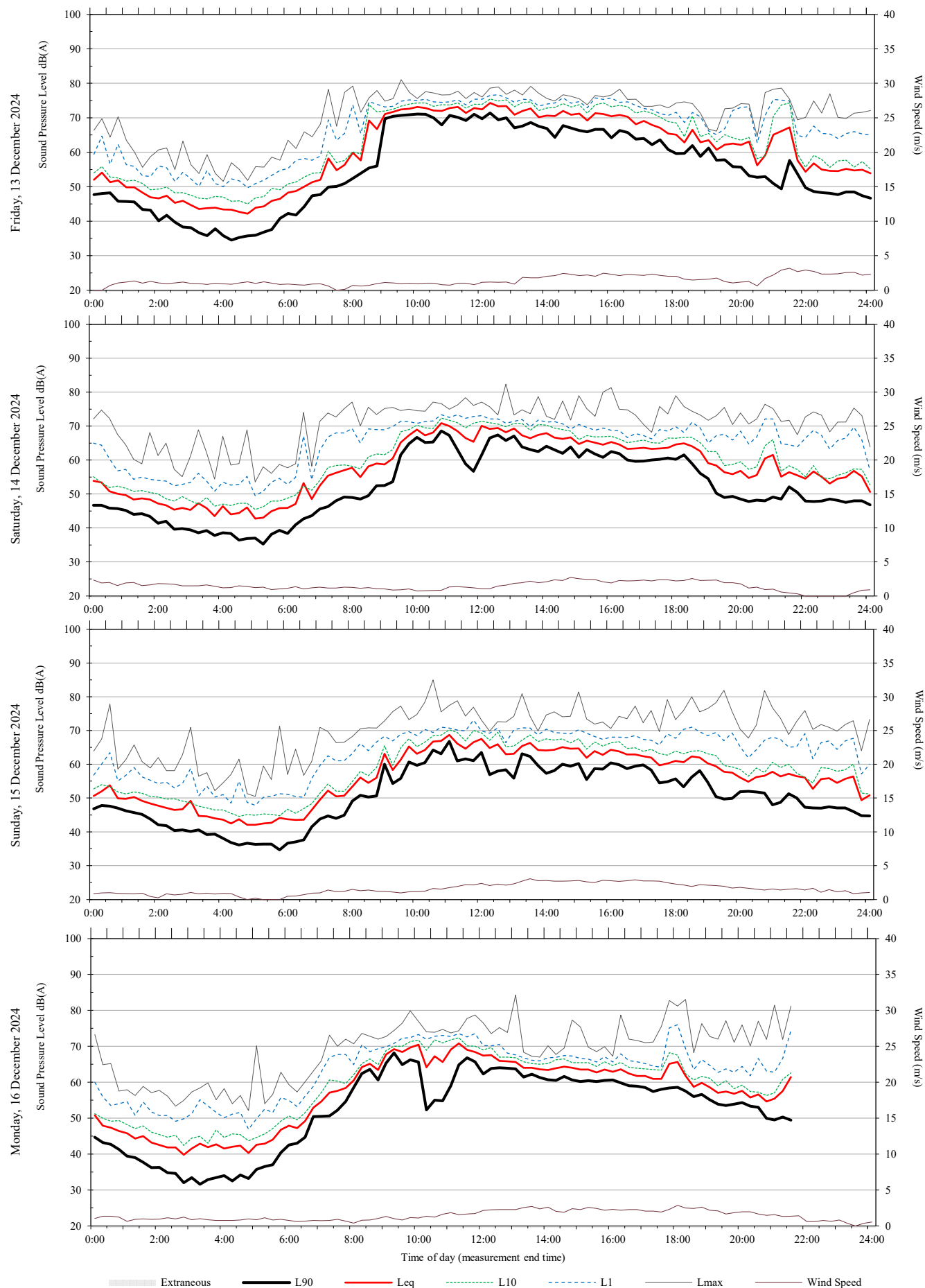
3. Night is the remaining periods

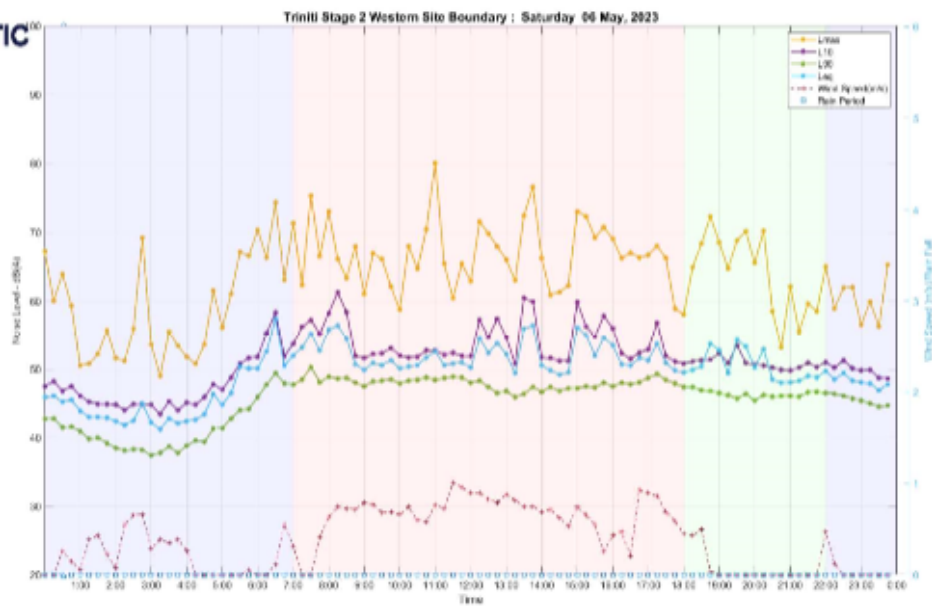
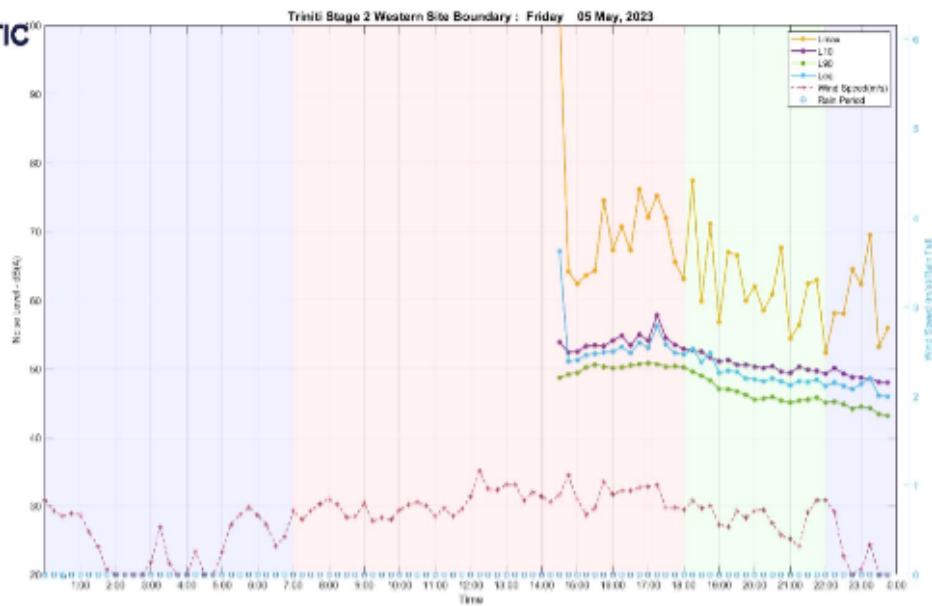
4. Assessment Background Level (ABL) for individual days

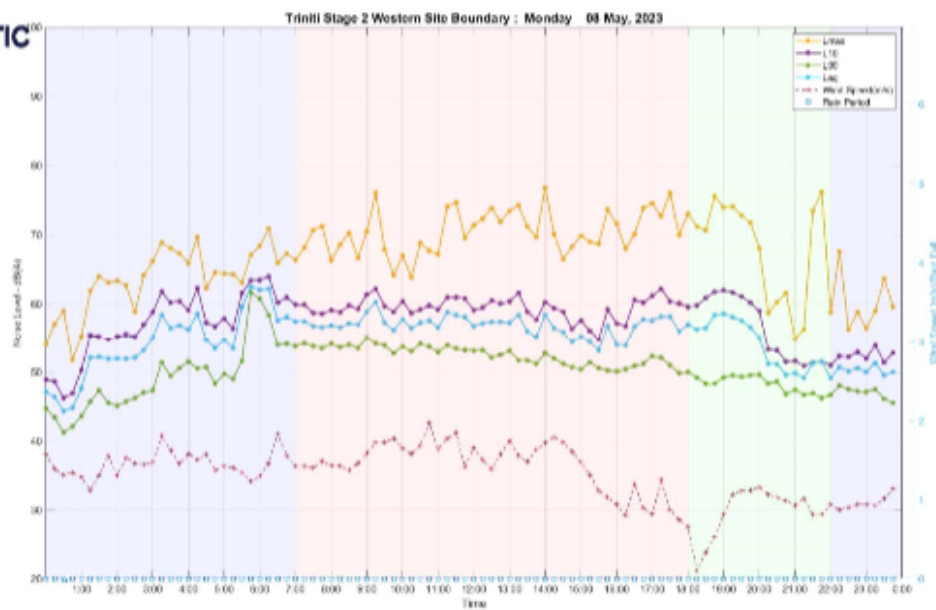
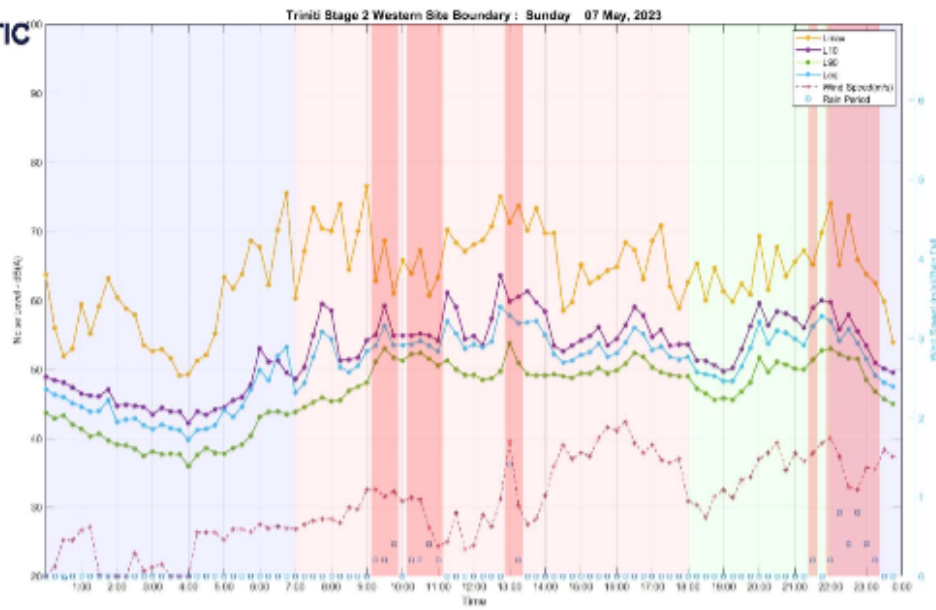
5. Rating Background Level (RBL) for L<sub>A90</sub> and logarithmic average for L<sub>Aeq</sub>

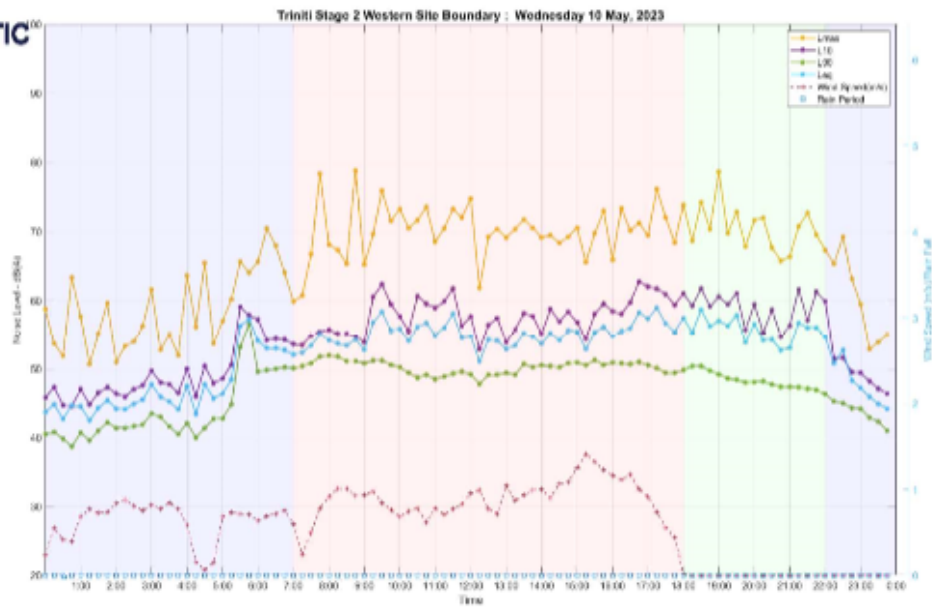
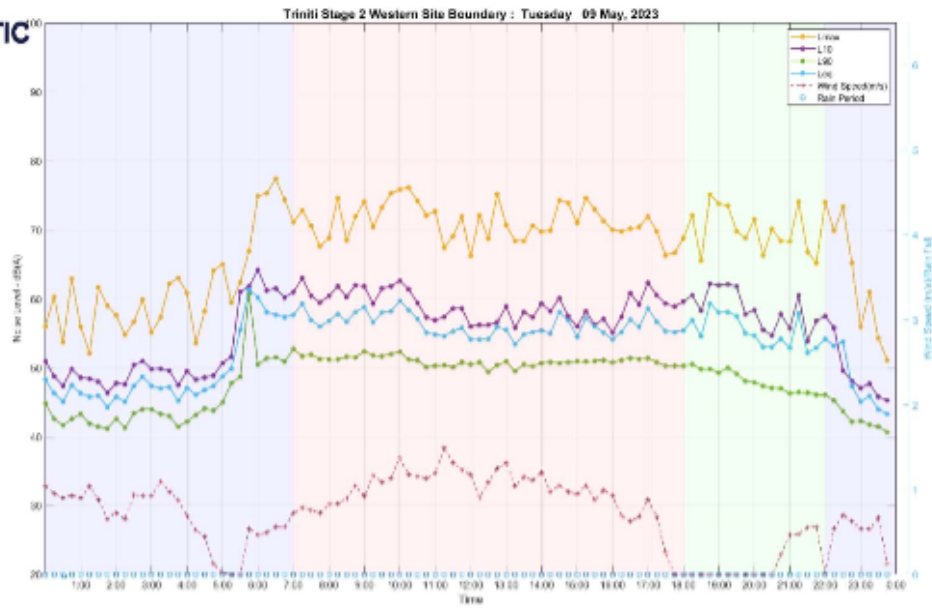


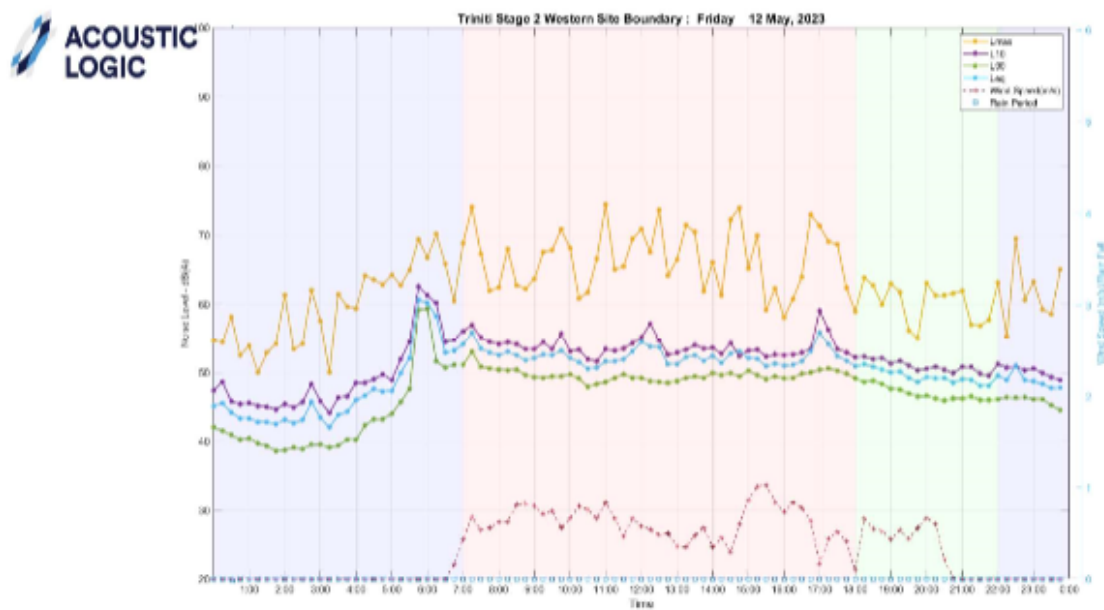
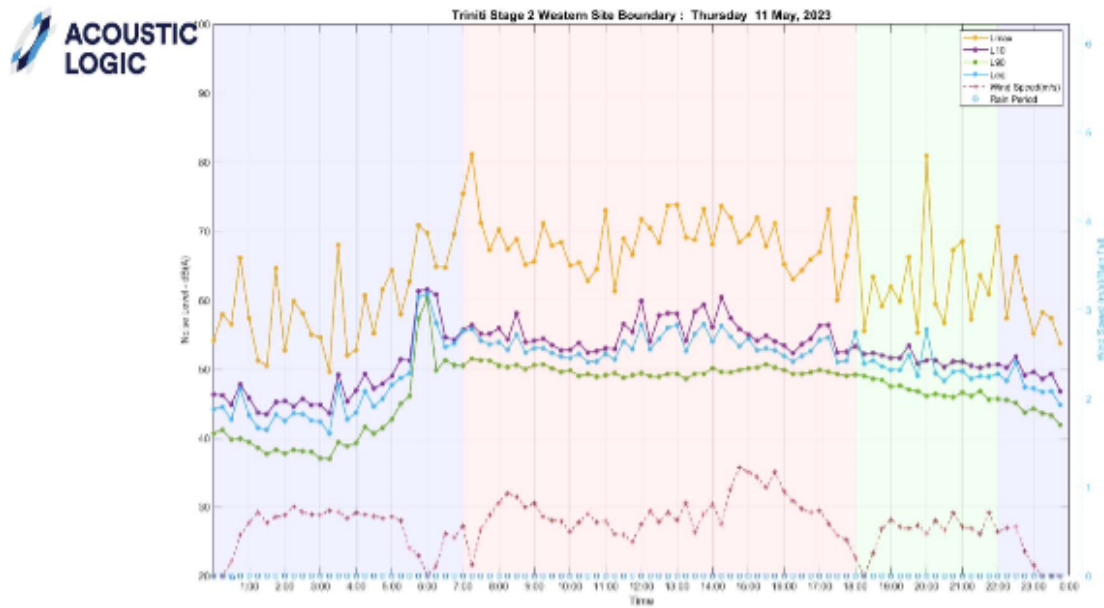


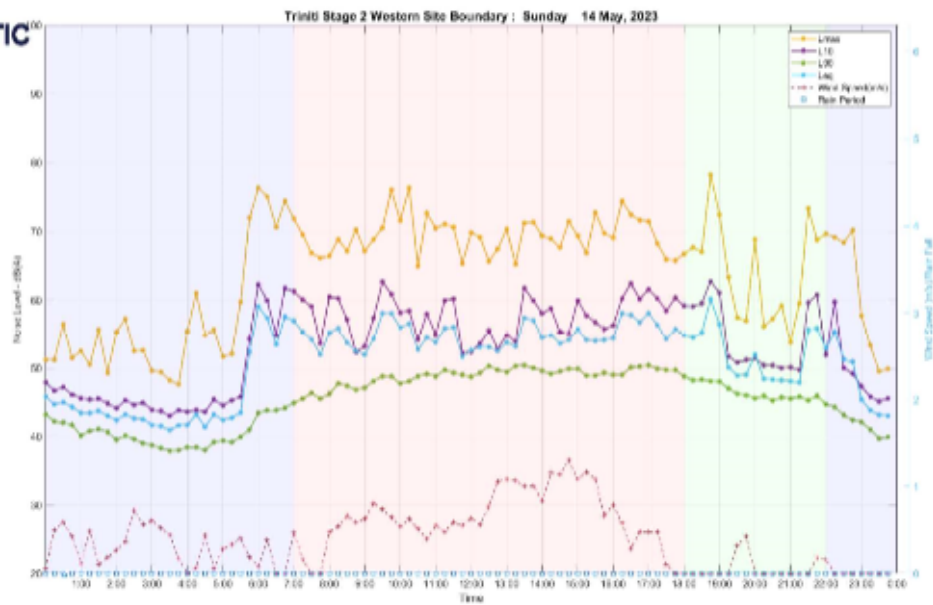
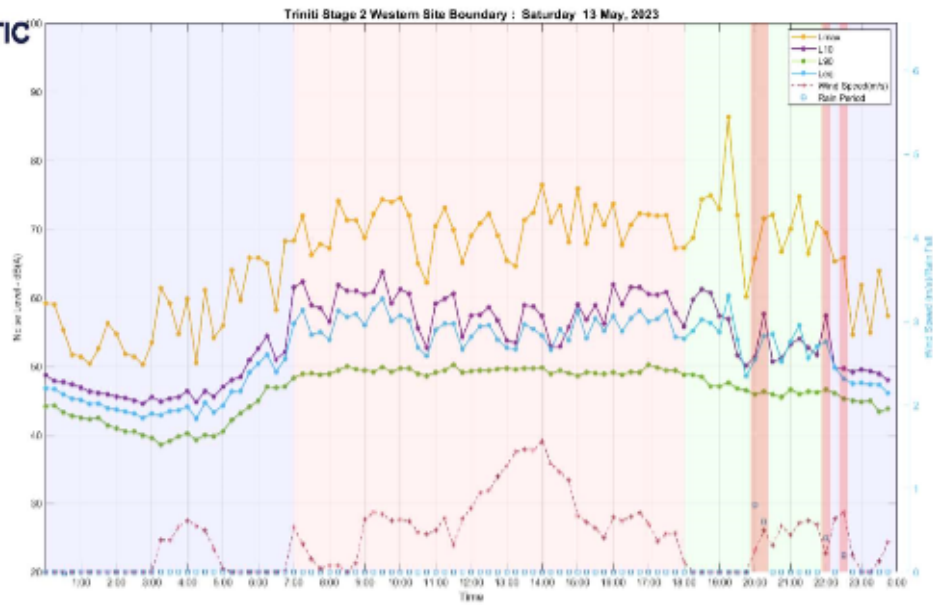


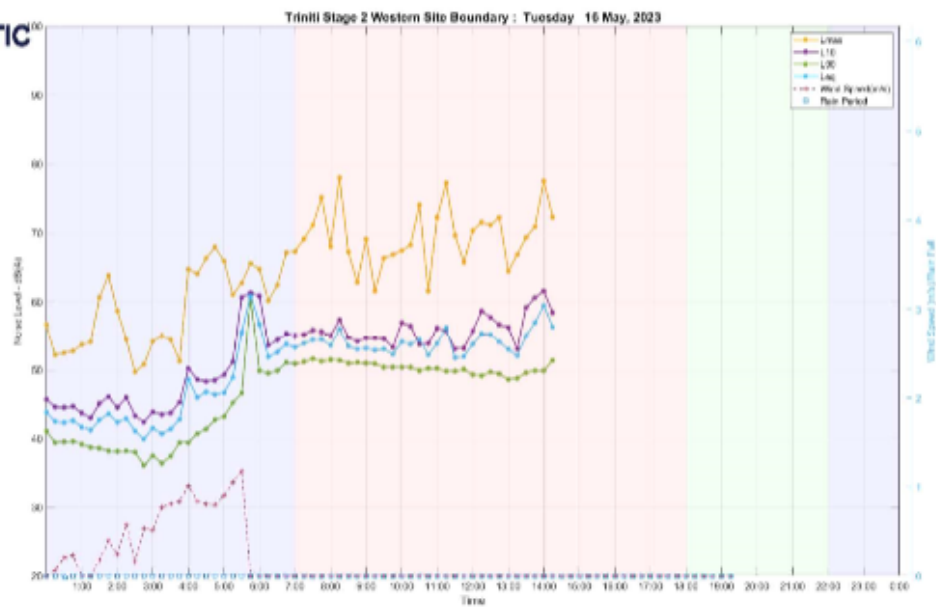
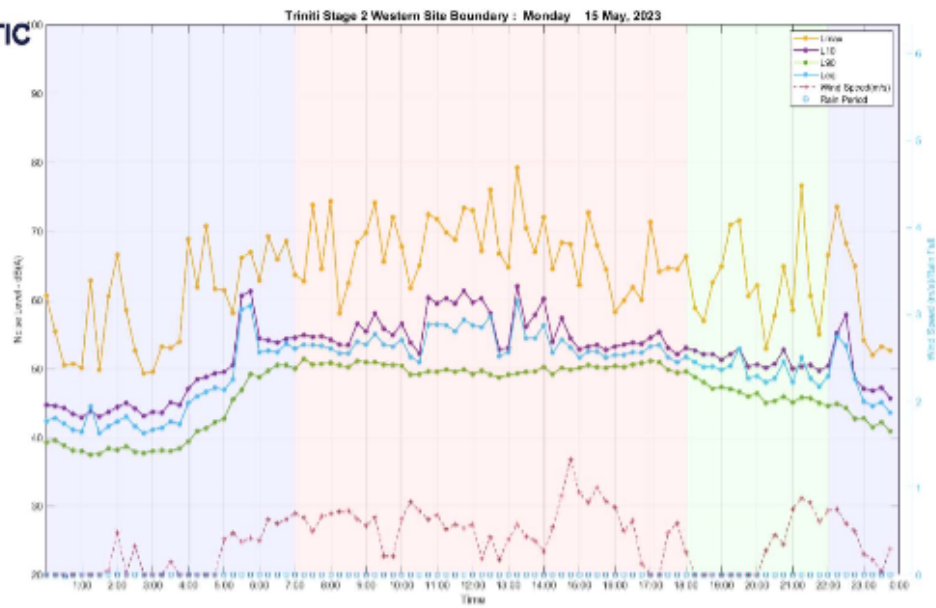












Wind Speed is corrected using factor 0.0200 based on logger location

# Appendix C

## Generator testing regime

Table 32: Generator testing regime

| Parameter                        | Detail                                                    |
|----------------------------------|-----------------------------------------------------------|
| Total number of generators       | 72                                                        |
| Testing frequency                | Monthly (12 testing periods)                              |
| Operational testing hours        | Daytime hours (7:00am to 6:00pm)                          |
| Generators tested simultaneously | Two (one in eastern gantry, one in western gantry)        |
| Tests per period                 | 36                                                        |
| Duration per test                | 27 minutes total (22 minutes runtime, 5 minutes cooldown) |
| Total testing time per period    | 972 minutes                                               |
| Total testing time per year      | 11,664 minutes                                            |
| Total testing hours per year     | 194.4 hours                                               |

# Appendix D

## Operational noise criteria

## D.1 Noise Policy for Industry (NPfI)

The NPfI [1] sets out the procedure to determine the project noise trigger levels (PNTLs) relevant to a particular industrial development. The PNTL is the lower (that is, the more stringent) value of the **project intrusiveness noise level** and **project amenity noise level**.

The project intrusiveness noise level aims to protect against significant changes in noise levels, whilst the project amenity noise level seeks to protect against cumulative noise impacts from industry and maintain amenity for particular land uses.

### D.1.1 Intrusive noise level

The intrusiveness noise trigger level is applicable to residential premises only and is established relative to the existing background noise level, as follows:

- $L_{Aeq,15min} \leq \text{Rating Background Level (RBL) plus 5 dB}$

### D.1.2 Recommended and project amenity noise level

The Project Amenity Noise Levels (PANLs) are derived from the Recommended Amenity Noise Levels (RANLs). The RANLs represent the maximum desirable total level of industrial noise at a receiver location while the PANLs represents the objective for noise from a single industrial development at a receiver location.

To derive the PANL, the NPfI outlines a simplified method of RANL minus 5 dB, which is based on a receiver not being impacted by more than three to four individual industrial premises.

Section 2.4 of the NPfI states:

*To ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area, a project amenity noise level applies for each new source of industrial noise as follows:*

*Project amenity noise level for industrial developments = recommended amenity noise level minus 5 dB(A)*

Section 2.4.2 of the NPfI states:

*The approach of deriving the project amenity noise level resulting from a new development on the basis of the recommended amenity noise level minus 5 dB is based on a receiver not being impacted by more than three to four individual industrial noise sources.*

This approach is considered appropriate given the minimal industrial noise generating sites located adjacent to the proposed data centre.

Hence, the project amenity noise levels have been derived assuming that any receivers will not be impacted by more than three to four industrial noise sources.

The recommended amenity noise levels (RANLs) and project amenity noise level (PANLs) are summarised in Table 33.

Table 33: NPfI RANLs and PANLs

| Receiver         | Time Period <sup>1</sup> | Recommended Amenity Noise Level (RANL) dBL <sub>Aeq,period</sub> | Project Amenity Noise Levels (PANL) dBL <sub>Aeq,period</sub> (RANL – 5 dB) | Project Amenity Noise Levels (PANL) dBL <sub>Aeq,15 min</sub> (PANL L <sub>Aeq,period</sub> + 3 dB) |
|------------------|--------------------------|------------------------------------------------------------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| Residential NCA1 | Day                      | 60 <sup>2</sup>                                                  | 55                                                                          | 58                                                                                                  |
|                  | Evening                  | 50 <sup>2</sup>                                                  | 45                                                                          | 48                                                                                                  |
|                  | Night                    | 45 <sup>2</sup>                                                  | 40                                                                          | 43                                                                                                  |
| Residential NCA2 | Day                      | 55 <sup>3</sup>                                                  | 50                                                                          | 53                                                                                                  |
|                  | Evening                  | 45 <sup>3</sup>                                                  | 40                                                                          | 43                                                                                                  |

| Receiver           | Time Period <sup>1</sup> | Recommended<br>Amenity Noise Level<br>(RANL) dBL <sub>Aeq,period</sub>                                   | Project Amenity Noise<br>Levels (PANL) dBL <sub>Aeq,period</sub><br>(RANL – 5 dB) | Project Amenity Noise<br>Levels (PANL) dBL <sub>Aeq,15 min</sub><br>(PANL L <sub>Aeq,period</sub> + 3 dB) |
|--------------------|--------------------------|----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
|                    | Night                    | 40 <sup>3</sup>                                                                                          | 35                                                                                | 38                                                                                                        |
| Residential NCA3   | Day                      | 55 <sup>3</sup>                                                                                          | 50                                                                                | 53                                                                                                        |
|                    | Evening                  | 45 <sup>3</sup>                                                                                          | 40                                                                                | 43                                                                                                        |
|                    | Night                    | 40 <sup>3</sup>                                                                                          | 35                                                                                | 38                                                                                                        |
| Hotel / motel      | Day                      | 65 <sup>4</sup>                                                                                          | 60                                                                                | 63                                                                                                        |
|                    | Evening                  | 55 <sup>4</sup>                                                                                          | 50                                                                                | 53                                                                                                        |
|                    | Night                    | 50 <sup>4</sup>                                                                                          | 45                                                                                | 48                                                                                                        |
| Childcare centre   | When in use              | 40 (internal, noisiest 1-hour period) <sup>5</sup><br>50 (external, noisiest 1-hour period) <sup>6</sup> | 45 (external)                                                                     | 48 (external)                                                                                             |
| School classroom   | When in use              | 40 (internal, noisiest 1-hour period) <sup>5</sup><br>50 (external, noisiest 1-hour period) <sup>6</sup> | 45 (external)                                                                     | 48 (external)                                                                                             |
| Hospital ward      | When in use              | 50 (external, noisiest 1-hour period)                                                                    | 45 (external)                                                                     | 48 (external)                                                                                             |
| Passive recreation | When in use              | 50                                                                                                       | 45                                                                                | 48                                                                                                        |
| Active recreation  | When in use              | 55                                                                                                       | 50                                                                                | 53                                                                                                        |
| Commercial         | When in use              | 65                                                                                                       | 60                                                                                | 63                                                                                                        |
| Industrial         | When in use              | 70                                                                                                       | 65                                                                                | 68                                                                                                        |

Notes:

- The NPfI defines day, evening and night periods as:
  - Day: the period from 7 am to 6 pm Monday to Saturday; or 8 am to 6 pm on Sundays and Public Holidays
  - Evening: the period from 6 pm to 10 pm
  - Night: the remaining period
- The residential receivers in NCA1 have been categorised as ‘Urban’ based on the results of the noise monitoring and in accordance with Table 2.3 of the NPfI
- The residential receivers in NCA2 and NCA3 have been categorised as ‘Suburban’ based on the results of the noise monitoring and in accordance with Table 2.3 of the NPfI
- In accordance with the NPfI, RANL are based on 5 dB(A) above the RANL for a residence for the relevant noise amenity area and time of day. The hotel and motel receivers have been categorised as ‘Urban’.
- In accordance with the NPfI, where existing classrooms are affected by noise from existing industrial sources, the acceptable L<sub>Aeq</sub> noise level may be increased to 40 dB L<sub>Aeq,1hr</sub>
- The criteria for school classrooms and childcare centres are based on the NPfI recommended internal noise level for school classrooms. It is conservatively assumed that the childcare facilities have openable windows, so the external noise criteria at the facade have been derived with a 10 dB difference between indoor and outdoor noise levels, resulting in a 45 dBA external RANL L<sub>Aeq,period</sub>.

### D.1.3 Project Noise Trigger Levels (Site criteria)

The Project Noise Trigger Levels (PNTL) are summarised in Table 34.

The PNTL are the lowest of the Intrusive and Project Amenity Noise Levels.

Table 34: Site Intrusive and amenity noise levels – external noise levels,  $dBLA_{eq(15\ min)}$

| Receiver           | Time Period <sup>1</sup> | Intrusive Noise Trigger Level <sup>2</sup> | Project Amenity Noise Levels (PANL) | Project Specific Noise Trigger Levels (PNTL) |
|--------------------|--------------------------|--------------------------------------------|-------------------------------------|----------------------------------------------|
| Residential NCA1   | Day                      | 54 <sup>3</sup>                            | 58                                  | 54                                           |
|                    | Evening                  | 51 <sup>3</sup>                            | 48                                  | 48                                           |
|                    | Night                    | 43 <sup>3</sup>                            | 43                                  | 43                                           |
| Residential NCA2   | Day                      | 57 <sup>4</sup>                            | 53                                  | 53                                           |
|                    | Evening                  | 53 <sup>4</sup>                            | 43                                  | 43                                           |
|                    | Night                    | 44 <sup>4</sup>                            | 38                                  | 38                                           |
| Residential NCA3   | Day                      | 57 <sup>5</sup>                            | 53                                  | 53                                           |
|                    | Evening                  | 54 <sup>5</sup>                            | 43                                  | 43                                           |
|                    | Night                    | 41 <sup>5</sup>                            | 38                                  | 38                                           |
| Hotel / motel      | Day                      | N/A                                        | 63                                  | 63                                           |
|                    | Evening                  | N/A                                        | 53                                  | 53                                           |
|                    | Night                    | N/A                                        | 48                                  | 48                                           |
| Childcare centre   | When in use              | N/A                                        | 48                                  | 48                                           |
| School classroom   | When in use              | N/A                                        | 48                                  | 48                                           |
| Hospital ward      | When in use              | N/A                                        | 48                                  | 48                                           |
| Passive recreation | When in use              | N/A                                        | 48                                  | 48                                           |
| Active recreation  | When in use              | N/A                                        | 53                                  | 53                                           |
| Commercial         | When in use              | N/A                                        | 63                                  | 63                                           |
| Industrial         | When in use              | N/A                                        | 68                                  | 68                                           |

Notes:

1\_ The NPfI defines day, evening and night periods as:

- Day: the period from 7 am to 6 pm Monday to Saturday; or 8 am to 6 pm on Sundays and Public Holidays.
- Evening: the period from 6 pm to 10 pm.
- Night: the remaining period.

2\_  $L_{Aeq,15\min}$  = Rating Background Level (RBL) plus 5 dB

3\_ Based on results at monitoring location L1 in Section 3.2

4\_ Based on results at monitoring location L2 in Section 3.2

5\_ Based on results at monitoring location L3 in Section 3.2

# Appendix E

## Cooling tower and generator noise data

**E.1        Cooling tower manufacturer's noise data**



# Baltimore Aircoil Company Cooling Tower Selection Report

Version: 8.11.21 ANZ  
Product data correct as of: May 12, 2025

Project Name: Project Julius 2025kW  
Selection Name: XES3E-1424-12P ENDURA/H  
Project State/Province: NSW  
Project Country/Region: Australia  
Date: May 14, 2025

## Model Information

Product Line: Series 3000 (2021 WQF)  
Model: XES3E-1424-12P ENDURA/H  
Number of Units: 1

This model includes the ENDURADRIIVE® Fan System.

Fan Type: Whisper Quiet Fan (2021)  
Fan Motor: (1) 29.84 = 29.84 kW/Unit  
Total Standard Fan Power: Full Speed, 29.84 BkW/Unit  
Intake Option: None  
Internal Option: None  
Discharge Option: None

## Design Conditions

Flow Rate: 48.47 l/s  
Hot Water Temp.: 40.00 °C  
Cold Water Temp.: 30.00 °C  
Wet Bulb Temp.: 27.00 °C  
Heat Rejection: 2,025 kW  
Tower Pumping Head: 54.22 kPa  
Tower Heat Rejection: 5,209 kW  
Reserve Capability: 157.23 %

**Thermal performance at design conditions and standard total fan motor power is certified by the Cooling Technology Institute (CTI).**

## Engineering Data, per Unit

Unit Length: 4.25 m  
Unit Width: 7.33 m  
Unit Height: 6.36 m  
Air Flow: 377,013 m³/h  
Approximate Shipping Weight: 11,054 kg  
Heaviest Section: 6,636 kg  
Approximate Operating Weight: 21,414 kg

Minimum Distance Required for Single Unit:

(For multiple units, refer to Layout Guidelines)

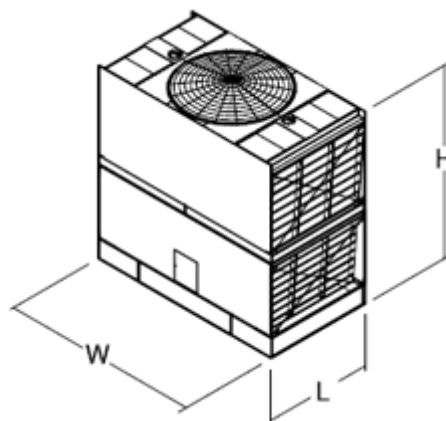
From Solid Wall: 2.2 m  
From 50% Open Wall: 1 m

Energy Rating:

83.33 USGPM/HP per ASHRAE 90.1, ASHRAE 189 and CA Title 24.

This XE model is an extremely efficient model, with a base energy rating that meets or exceeds 2x the minimum ASHRAE 90.1 energy rating.

Note: These unit weights and dimensions account for the selected fan type for the standard cataloged drive configuration, but they do not account for other options/accessories. Please contact your local BAC sales representative for weights and dimensions of units with other options/accessories.





# Baltimore Aircoil Company

## Cooling Tower Selection Report

Version: 8.11.21 ANZ  
Product data correct as of: December 07, 2021

Project Name: Project Julius  
Selection Name: XES3E-1424-12P ENDURA/H  
Project State/Province: NSW  
Project Country/Region: Australia  
Date: May 05, 2025

### Model Information

Product Line: Series 3000 (2021 WQF)  
Model: XES3E-1424-12P ENDURA/H  
Number of Units: 1

Intake Option: None  
Internal Option: None  
Discharge Option: None

This model includes the ENDURADRIVE® Fan System.

Fan Type: Whisper Quiet Fan (2021)

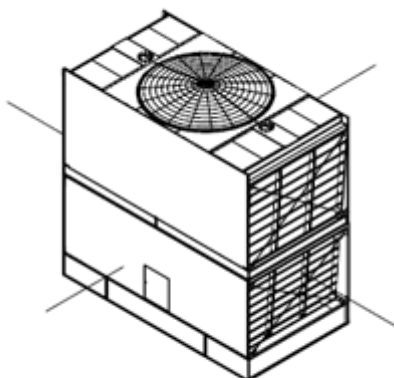
Fan Motor: (1) 29.84 = 29.84 kW/Unit

Total Standard Fan Power: 44% of Full Speed, 2.54 BkW/Unit

Octave band and A-weighted sound pressure levels (Lp) are expressed in decibels (dB) reference 0.0002 microbar. Sound power levels (Lw) are expressed in decibels (dB) reference one picowatt. Octave band 1 has a center frequency of 63 Hertz.

| Top<br>Sound Pressure (dB) |          |      |
|----------------------------|----------|------|
| Octave<br>Band             | Distance |      |
|                            | 1.5 m    | 15 m |
| 1                          | 54       | 44   |
| 2                          | 53       | 44   |
| 3                          | 48       | 39   |
| 4                          | 44       | 34   |
| 5                          | 44       | 35   |
| 6                          | 41       | 36   |
| 7                          | 37       | 28   |
| 8                          | 31       | 18   |
| A-wgtd                     | 48       | 41   |

| Air Inlet<br>Sound Pressure (dB) |          |      |
|----------------------------------|----------|------|
| Octave<br>Band                   | Distance |      |
|                                  | 1.5 m    | 15 m |
| 1                                | 54       | 45   |
| 2                                | 55       | 42   |
| 3                                | 48       | 37   |
| 4                                | 45       | 31   |
| 5                                | 46       | 35   |
| 6                                | 37       | 30   |
| 7                                | 35       | 23   |
| 8                                | 43       | 27   |
| A-wgtd                           | 50       | 38   |



| End<br>Sound Pressure (dB) |          |      |
|----------------------------|----------|------|
| Octave<br>Band             | Distance |      |
|                            | 1.5 m    | 15 m |
| 1                          | 47       | 47   |
| 2                          | 49       | 40   |
| 3                          | 42       | 32   |
| 4                          | 39       | 25   |
| 5                          | 37       | 26   |
| 6                          | 33       | 24   |
| 7                          | 30       | 18   |
| 8                          | 25       | 11   |
| A-wgtd                     | 42       | 32   |

| End<br>Sound Pressure (dB) |          |      |
|----------------------------|----------|------|
| Octave<br>Band             | Distance |      |
|                            | 1.5 m    | 15 m |
| 1                          | 47       | 47   |
| 2                          | 49       | 40   |
| 3                          | 42       | 32   |
| 4                          | 39       | 25   |
| 5                          | 37       | 26   |
| 6                          | 33       | 24   |
| 7                          | 30       | 18   |
| 8                          | 25       | 11   |
| A-wgtd                     | 42       | 32   |

| Total Sound Power (dB) |                             |    |
|------------------------|-----------------------------|----|
| Octave<br>Band         | Center Frequency<br>(Hertz) | Lw |
| 1                      | 63                          | 78 |
| 2                      | 125                         | 77 |
| 3                      | 250                         | 71 |
| 4                      | 500                         | 66 |
| 5                      | 1000                        | 68 |
| 6                      | 2000                        | 68 |
| 7                      | 4000                        | 60 |
| 8                      | 8000                        | 54 |
| A-wgtd                 |                             | 73 |

| Air Inlet<br>Sound Pressure (dB) |          |      |
|----------------------------------|----------|------|
| Octave<br>Band                   | Distance |      |
|                                  | 1.5 m    | 15 m |
| 1                                | 54       | 45   |
| 2                                | 55       | 42   |
| 3                                | 48       | 37   |
| 4                                | 45       | 31   |
| 5                                | 46       | 35   |
| 6                                | 37       | 30   |
| 7                                | 35       | 23   |
| 8                                | 43       | 27   |
| A-wgtd                           | 50       | 38   |

**Note:** The use of frequency inverters (variable frequency drives) can increase sound levels.

**Extra Notes:** Sound data provided by CTI ATC-128 sound test code revision 2019

## E.2 Cooling tower noise modelling methodology

The manufacturer's data specifies that the sound levels are based on the CTI ATC-128 sound test code, revision 2019.

The CTI ATC-128 code prescribes the equipment and test procedures for measuring cooling tower sound, including sound pressure measurements on all four sides and overhead. Measurements are taken at distances of 1.5m and 15m from all five faces of the unit, with sound power calculated from the 15-meter sound pressure measurements.

The November 2019 revision of the CTI ATC-128 code did not alter sound pressure level measurements. It revised the formula for calculating sound power level to better align with sound power levels that would be measured by use of more rigorous measurement methods from various international standards. This revision included redefining the emission surface area considered applicable to each face for the pressure to power conversions. Previously, the code used a simple 15-meter radius hemisphere as the basis for each emission surface. The 2019 revision changed this to an overhead hemisphere starting at the unit's top elevation (for the top surface), plus a quarter-cylinder segment for each of the four sides. The recent March 2024 revision of the CTI ATC-128 code did not change the method by which sound pressure is measured for cooling towers of this type, nor change derivation of the sound power level from that used in the 2019 code version.

Arup reviewed the manufacturer's data and verified the calculation of the cooling tower's total sound power level and sound power level contribution from each side and top surface according to the CTI ATC-128 (2019 onward) calculation method. The results are reproduced below. To reasonably account for overall cooling tower directivity, these sound power levels derived per each side and top were used to model the cooling towers in SoundPlan as individual area sources.

### E.2.1 Cooling tower – modelled noise levels

Table 35, Table 36 and Table 37 present manufacturer's noise sound pressure levels, calculations for sound power levels and the sound power levels input into SoundPlan noise modelling software for cooling towers operating during the day and evening periods.

Table 35: Cooling tower sound pressure level data at 15 m – BAC XES3E-1424-12P ENDURA/H

| Surface     | Total level per item, dB(A) | Sound level spectra by octave band per item, dB(Z) |       |       |       |      |      |      |      |
|-------------|-----------------------------|----------------------------------------------------|-------|-------|-------|------|------|------|------|
|             |                             | 63Hz                                               | 125Hz | 250Hz | 500Hz | 1kHz | 2kHz | 4kHz | 8kHz |
| Air inlet 1 | 38                          | 45                                                 | 42    | 37    | 31    | 35   | 30   | 23   | 27   |
| End 1       | 32                          | 47                                                 | 40    | 32    | 25    | 26   | 24   | 18   | 11   |
| Top         | 41                          | 44                                                 | 44    | 39    | 34    | 35   | 36   | 28   | 18   |
| End 2       | 32                          | 47                                                 | 40    | 32    | 25    | 26   | 24   | 18   | 11   |
| Air inlet 2 | 38                          | 45                                                 | 42    | 37    | 31    | 35   | 30   | 23   | 27   |

Table 36: Cooling tower calculated overall sound power level – BAC XES3E-1424-12P ENDURA/H

| Surface     | L <sub>p</sub> at 15 m, dB(A) | S, m <sup>2</sup> (See note 1) | 10 log S | L <sub>w</sub> , dB(A) |
|-------------|-------------------------------|--------------------------------|----------|------------------------|
| Air inlet 1 | 38                            | 171                            | 22       | 61                     |
| End 1       | 32                            | 186                            | 23       | 55                     |
| Top         | 41                            | 1414                           | 32       | 72                     |
| End 2       | 32                            | 186                            | 23       | 55                     |
| Air inlet 2 | 38                            | 171                            | 22       | 61                     |
| Total       |                               |                                |          | 73                     |

| Surface | L <sub>p</sub> at 15 m, dB(A) | S, m <sup>2</sup> (See note 1) | 10 log S | L <sub>w</sub> , dB(A) |
|---------|-------------------------------|--------------------------------|----------|------------------------|
|---------|-------------------------------|--------------------------------|----------|------------------------|

Note:

1\_ Surface area (S) calculated as per below (refer to manufacturer data for length (L), width (W) and height (H)):

- Air inlet 1 surface = Air inlet 2 surface =  $(15 + L/2) \times \text{PI} / 2 \times H$
- End 1 surface = End 2 surface =  $(15 + W/2) \times \text{PI} / 2 \times H$
- Top surface =  $2 \times \text{PI} \times 15^2$

Table 37: Cooling tower sound power levels (for SoundPlan modelling) – BAC XES3E-1424-12P ENDURA/H

| Surface     | Total level per item, dB(A) | Sound level spectra by octave band per item, dB(Z) |       |       |       |      |      |      |      |
|-------------|-----------------------------|----------------------------------------------------|-------|-------|-------|------|------|------|------|
|             |                             | 63Hz                                               | 125Hz | 250Hz | 500Hz | 1kHz | 2kHz | 4kHz | 8kHz |
| Air inlet 1 | 61                          | 67                                                 | 64    | 59    | 53    | 57   | 52   | 45   | 49   |
| End 1       | 55                          | 70                                                 | 63    | 55    | 48    | 49   | 47   | 41   | 34   |
| Top         | 72                          | 76                                                 | 76    | 71    | 66    | 67   | 68   | 60   | 50   |
| End 2       | 55                          | 70                                                 | 63    | 55    | 48    | 49   | 47   | 41   | 34   |
| Air inlet 2 | 61                          | 67                                                 | 64    | 59    | 53    | 57   | 52   | 45   | 49   |
| Total       | 73                          | 78                                                 | 76    | 71    | 66    | 68   | 68   | 60   | 54   |

## E.2.2 Cooling tower and chiller basis of design

The specification and capacity of cooling towers are determined based on an external temperature for a once every 20-year extreme ambient temperature event, being 44.7°C dry bulb and 27°C wet bulb. These temperatures are representative of a heatwave and significantly greater than the 22.7°C wet bulb temperature derived based on the industry standard AIRAH (Australian Institute for Refrigeration Airconditioning and Heating) ambient condition for comfort cooling in Sydney (taken from AIRAH DA 09). The ambient condition of 22.7°C wet bulb is derived by AIRAH to be the condition that is exceeded 1% of the year. This operating condition has been applied for day, evening and night periods.

The air-cooled chiller operating mode for day, evening and night periods has been based on the industry standard AIRAH ambient condition for comfort cooling in Sydney, who suggest 20.3°C wet bulb (WB) and 31.8°C dry bulb (WB).

## E.2.3 Cooling tower – frequency inverters (variable frequency drives)

The manufacturer data (in Appendix E.1) notes that the use of frequency inverters (variable frequency drives) can increase sound levels.

Operating motors with VFDs may have a low risk to increase their noise, due primarily to the switching frequency of the drive's electronics and resonant frequencies in the motor. However, the BAC Global Technical Director and Arup's own industry experience has found this risk to be negligible in practice. As such, no explicit allowance is required to be made to account for risk of cooling tower VFD noise.

In the unlikely event that cooling tower sound power levels were to exhibit higher sound power levels than anticipated, and this risked exceeding NPfI noise criteria, then the VFDs would be tuned during commissioning to minimise the potential noise by adjusting switching frequency and adding harmonic filters if necessary.

## E.2.4 Cooling tower – low frequency and tonality data

As is typical, the manufacturer's noise data for cooling towers do not provide low frequency data (between 10 Hz and 50 Hz) or third-octave band detail. To address requirements of the NPfI, measured noise data from a similar data centre facility has been used, in general accordance with the guidance provided in the journal paper outlining a best practice approach to applying the low frequency noise analysis prepared by the NSW Environment Protection Authority and published by Acoustics Australia [19].

The details of the site and specifications for the equipment measured cannot be provided due to client confidentiality. Measurements from five (5) locations, ranging from approximately 50m to 100m from the site were normalised based on the broadband  $dB_{LAeq}$  and then arithmetically averaged. This data is presented graphically in Figure 4.

The operating equipment, scenario and conditions of the data centre facility could not be confirmed at the time of the measurements. However, observations at the time of the measurements were that the cooling towers were fully operational and dominant in the existing noise environment at the measurement locations.

The data from 10 Hz to 160 Hz has been utilised for the low frequency assessment in accordance with Table C1 of the NPfI. Further detail of the LF third-octave bands and the LF noise assessment is presented Appendix F.

While the data indicates peaks at 400 Hz and 500 Hz, this is not evident in the octave-band noise data provided by the manufacturer for the project. It nevertheless does not constitute tonality under the NPfI and therefore no correction has been applied.

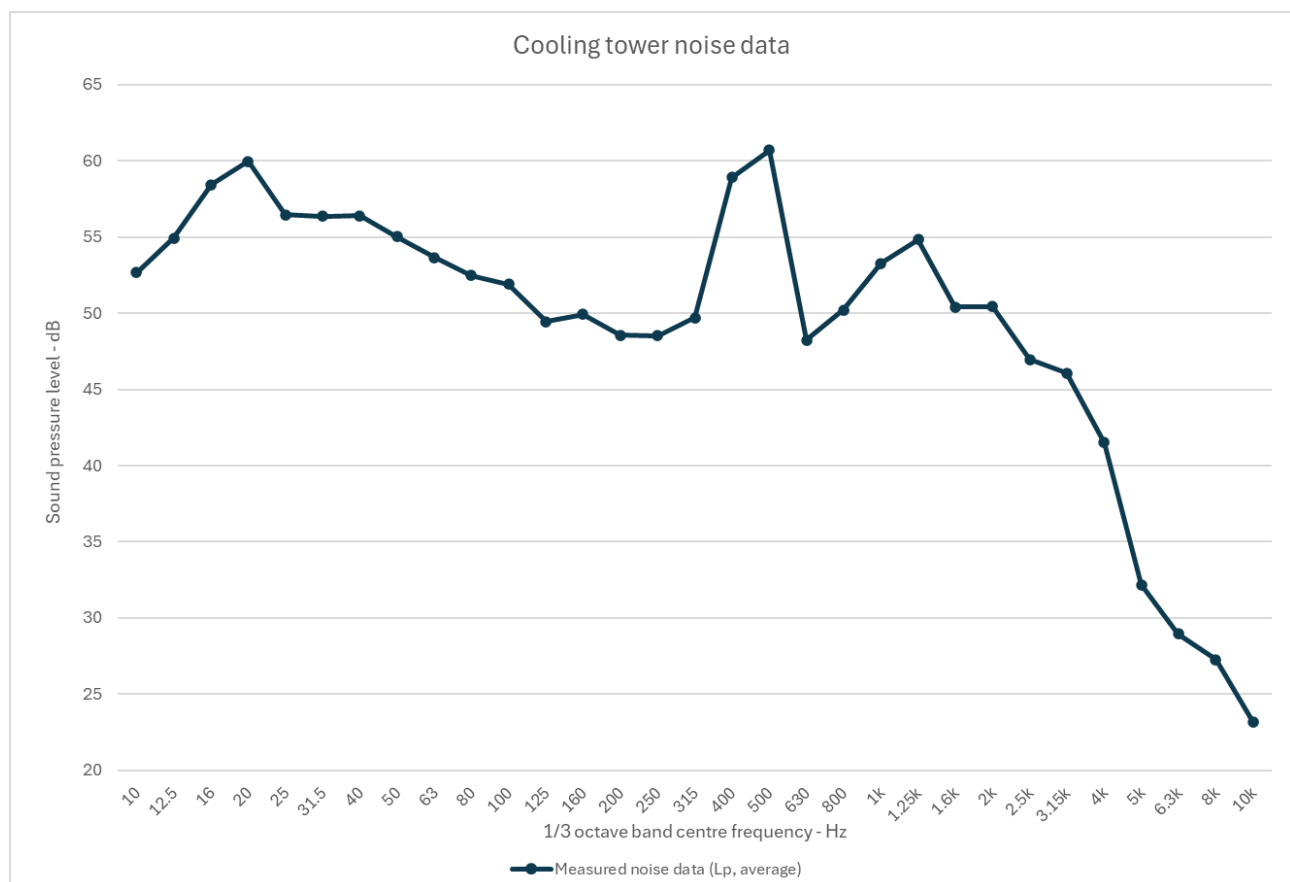


Figure 4: Average third-octave band sound pressure levels of cooling tower noise based on measured noise data

### E.2.5 Generator – low frequency and tonality data

Third octave noise bands for generators were sourced from the manufacturer for the following generator:

- Generator Engine Type: MTU 16V 4000 G63/G84F
- Power / speed: 2185 kW / 1500 rpm

This included measurement data of the engine surface noise and the exhaust gas noise at 1 metre. The manufacturer's data did not extend down to 10 Hz and was limited down to 16 Hz for the engine and 25 Hz for the exhaust. To supplement the manufacturer's data, previous Arup measurements of a similar generator were utilised.

The measured noise data was normalised based on the broadband  $dB_{LAeq}$  level and arithmetically averaged.

The manufacturer and measured noise data for generators is presented graphically in Figure 5.

Analysis of the noise data indicates that the measured low-frequency (LF) third-octave band levels correlate reasonably well with the spectral shape of the manufacturer's noise data. The generator noise data shows a trend of lower noise levels at lower third-octave bands, which would not contribute to overall dB(C) noise levels and has therefore been excluded.

Furthermore, generators are not expected to emit tonal noise when assessed in accordance with Table C1 of the NPfI.

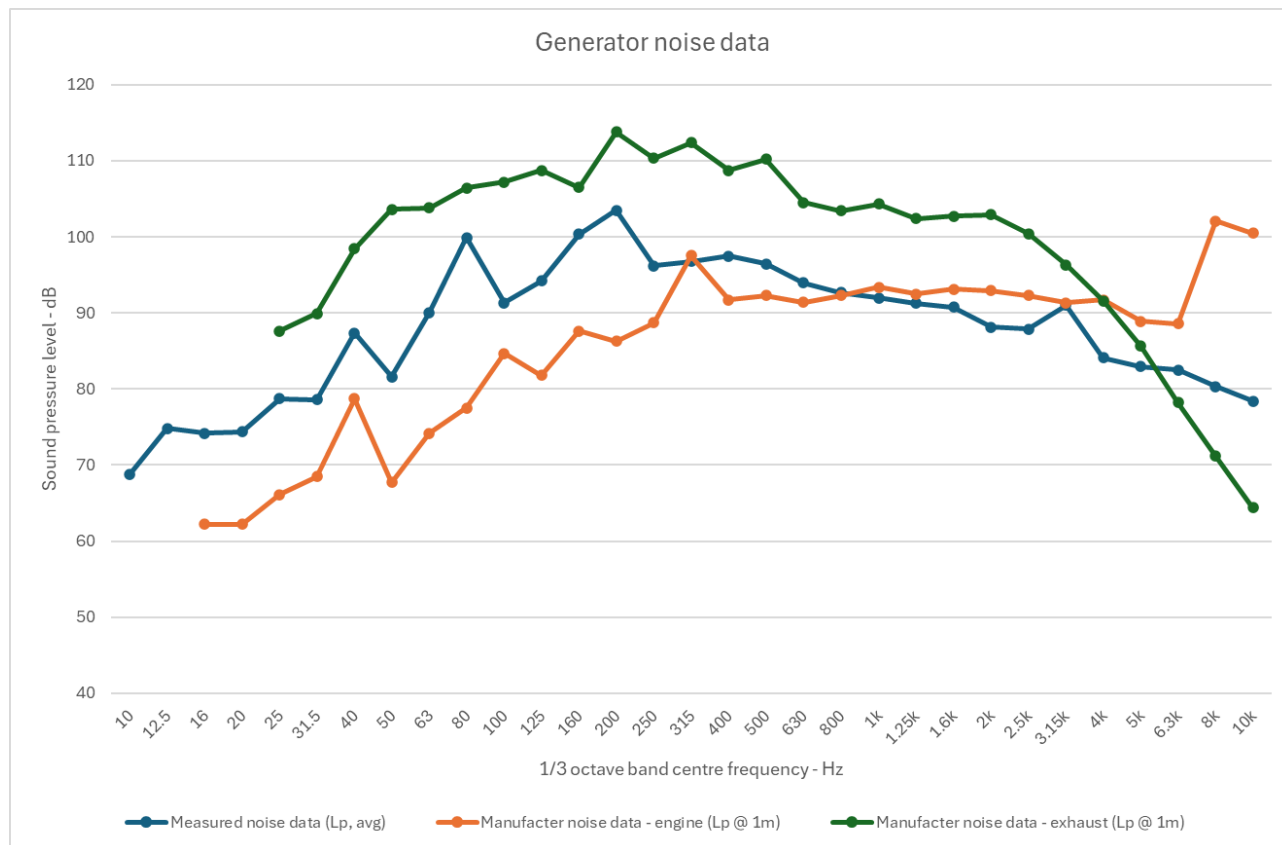


Figure 5: Third-octave band sound pressure levels of generator noise based on manufacturer's and measured noise data

This analysis indicates the absence of manufacturer's data below 16Hz / 25Hz for the engine and exhaust respectively is unlikely to result in any unforeseen low-frequency characteristics as verified by measured results.

# Appendix F

## Low frequency noise analysis

The low frequency noise analysis was undertaken in accordance with Fact Sheet C of the Noise Policy for Industry (NPfI). The NPfI requires this analysis to be undertaken for third octave bands ranging from 10 Hz to 160 Hz. Limitations in the modelling software only allow for noise predictions down to and including the 50 Hz third octave band. Hence, a best practice approach to apply the low frequency noise analysis was applied as detailed in the journal paper prepared by the NSW Environment Protection Authority published by Acoustics Australia<sup>1</sup>.

The methodology presented in the paper has been followed including the following details:

- One-third octave measurements between 10 Hz and 10 KHz were undertaken at a similar data centre facility at distances comparable to the worst affected receiver locations to be impacted by the proposed data centre. Measurements were processed to obtain the logarithmic average of the LFN measurements to derive a low frequency curve or “tail” from 50 Hz down to 10 Hz
- The low frequency “tail” was applied to the predicted noise levels for each receiver location by adjusting the tail one-third octaves, in this case 10 Hz to 50 Hz, by the difference between the predicted and the measured 50 Hz one-third octave level.
- The estimate of predicted levels from 10 Hz to 160 Hz allowed for an analysis of the low frequency noise impacts in accordance with Fact Sheet C of the NPfI.
- One receiver location was found to both exceed the overall C- minus A-weighted noise levels derived from the estimated noise predictions and exceed the low frequency thresholds defined in Table C2 of the NPfI. However, the exceedances occur during the day period and the predicted low frequency bands do not exceed the low frequency thresholds by more than 5dB. Thus, no modifying factors for low frequency are applicable.

---

<sup>1</sup> G. Downey, NSW Environment Protection Authority, “An example approach to consider low frequency noise in the context of the NSW noise policy for industry”, 2020, Acoustics Australia 48:149-180, Parramatta, Australia

| L <sub>eq, 15min</sub>                                                 |        |        |       | dBL <sub>Ceq</sub> - dBL <sub>Aeq</sub> |      | 1/3 Octave Band Centre Frequency, Hz |    |    |      |    |    |    |    |     |     |     |     |     |     |     |     |     |     |    |       |      |    |      |       |    |    |      |    |     |  |
|------------------------------------------------------------------------|--------|--------|-------|-----------------------------------------|------|--------------------------------------|----|----|------|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|-------|------|----|------|-------|----|----|------|----|-----|--|
| Item / Description                                                     | dB(C)  | dB(A)  |       | 10                                      | 12.5 | 16                                   | 20 | 25 | 31.5 | 40 | 50 | 63 | 80 | 100 | 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1k | 1.25k | 1.6k | 2k | 2.5k | 3.15k | 4k | 5k | 6.3k | 8k | 10k |  |
| NPfl Table C2 - LF noise threshold                                     |        |        |       | 92                                      | 89   | 86                                   | 77 | 69 | 61   | 54 | 50 | 50 | 48 | 48  | 46  | 44  |     |     |     |     |     |     |     |    |       |      |    |      |       |    |    |      |    |     |  |
| Day - normal operation with generator testing (CONCAWE - Enhanced Met) |        |        |       |                                         |      |                                      |    |    |      |    |    |    |    |     |     |     |     |     |     |     |     |     |     |    |       |      |    |      |       |    |    |      |    |     |  |
| CC1                                                                    | 58 (C) | 48 (A) | 10 dB | 46                                      | 47   | 51                                   | 54 | 51 | 51   | 50 | 50 | 48 | 46 | 46  | 45  | 43  | 41  | 40  | 39  | 37  | 37  | 37  | 39  | 40 | 39    | 37   | 36 | 34   | 31    | 30 | 29 | 29   | 29 | 30  |  |
| CC2                                                                    | 52 (C) | 36 (A) | 16 dB | 40                                      | 41   | 45                                   | 48 | 45 | 45   | 44 | 43 | 42 | 41 | 41  | 41  | 38  | 35  | 32  | 29  | 26  | 24  | 24  | 24  | 25 | 24    | 24   | 24 | 20   | 15    | 12 | 9  | 7    | 5  | 3   |  |
| COM1                                                                   | 67 (C) | 58 (A) | 9 dB  | 55                                      | 56   | 60                                   | 63 | 59 | 59   | 59 | 58 | 57 | 55 | 55  | 54  | 52  | 51  | 49  | 49  | 48  | 47  | 48  | 49  | 50 | 49    | 47   | 46 | 44   | 42    | 40 | 39 | 39   | 39 | 39  |  |
| COM2                                                                   | 58 (C) | 47 (A) | 11 dB | 46                                      | 47   | 51                                   | 54 | 50 | 50   | 50 | 49 | 48 | 47 | 47  | 47  | 44  | 41  | 39  | 38  | 37  | 36  | 37  | 38  | 39 | 38    | 36   | 35 | 33   | 31    | 29 | 28 | 27   | 26 | 26  |  |
| COM3                                                                   | 55 (C) | 41 (A) | 14 dB | 44                                      | 44   | 48                                   | 51 | 48 | 48   | 48 | 47 | 45 | 44 | 44  | 43  | 40  | 36  | 34  | 32  | 30  | 29  | 29  | 31  | 32 | 31    | 29   | 29 | 27   | 24    | 22 | 21 | 19   | 18 | 17  |  |
| COM4                                                                   | 55 (C) | 40 (A) | 15 dB | 43                                      | 44   | 48                                   | 51 | 48 | 48   | 48 | 47 | 45 | 44 | 44  | 44  | 41  | 37  | 35  | 33  | 31  | 30  | 30  | 30  | 31 | 29    | 28   | 27 | 25   | 22    | 20 | 17 | 13   | 11 | 8   |  |
| COM5                                                                   | 51 (C) | 39 (A) | 12 dB | 40                                      | 41   | 45                                   | 48 | 44 | 44   | 44 | 43 | 41 | 40 | 40  | 39  | 37  | 34  | 32  | 31  | 30  | 29  | 29  | 30  | 31 | 29    | 28   | 26 | 24   | 21    | 19 | 17 | 14   | 11 | 10  |  |
| COM6                                                                   | 49 (C) | 34 (A) | 14 dB | 38                                      | 39   | 43                                   | 45 | 42 | 42   | 42 | 41 | 39 | 37 | 37  | 36  | 34  | 31  | 29  | 28  | 27  | 27  | 26  | 25  | 25 | 23    | 22   | 21 | 18   | 15    | 13 | 8  | 3    | -1 | -4  |  |
| COM7                                                                   | 54 (C) | 38 (A) | 16 dB | 42                                      | 43   | 47                                   | 50 | 46 | 46   | 46 | 45 | 44 | 43 | 44  | 44  | 41  | 38  | 35  | 32  | 29  | 27  | 26  | 26  | 26 | 25    | 25   | 24 | 21   | 16    | 13 | 9  | 6    | 3  | 0   |  |
| COM8                                                                   | 48 (C) | 38 (A) | 11 dB | 38                                      | 38   | 42                                   | 45 | 42 | 42   | 42 | 41 | 38 | 37 | 35  | 34  | 32  | 30  | 29  | 27  | 25  | 23  | 24  | 27  | 28 | 28    | 28   | 27 | 25   | 24    | 19 | 13 | 9    | 6  |     |  |
| COM9                                                                   | 58 (C) | 45 (A) | 13 dB | 46                                      | 47   | 51                                   | 54 | 50 | 50   | 50 | 49 | 48 | 47 | 47  | 47  | 44  | 41  | 39  | 37  | 35  | 33  | 33  | 35  | 35 | 34    | 34   | 33 | 31   | 27    | 25 | 25 | 25   | 25 | 26  |  |
| COM10                                                                  | 60 (C) | 47 (A) | 13 dB | 48                                      | 49   | 53                                   | 55 | 52 | 52   | 52 | 51 | 50 | 49 | 50  | 50  | 47  | 42  | 40  | 38  | 37  | 36  | 35  | 35  | 35 | 35    | 37   | 38 | 36   | 33    | 31 | 28 | 24   | 21 | 18  |  |
| COM11                                                                  | 51 (C) | 41 (A) | 10 dB | 34                                      | 35   | 39                                   | 42 | 39 | 39   | 38 | 37 | 38 | 39 | 42  | 44  | 42  | 40  | 38  | 36  | 33  | 32  | 31  | 30  | 30 | 29    | 30   | 29 | 27   | 25    | 23 | 21 | 20   | 19 | 18  |  |
| COM12                                                                  | 67 (C) | 58 (A) | 9 dB  | 55                                      | 55   | 59                                   | 62 | 59 | 59   | 59 | 58 | 57 | 56 | 58  | 58  | 55  | 52  |     |     |     |     |     |     |    |       |      |    |      |       |    |    |      |    |     |  |

Notes:

- 2 **Red bolded font** indicates where the one-third octave noise level exceeds the low frequency noise thresholds detailed in Table C2 of the NPIF

| L <sub>eq</sub> , 15min                                     |        |        | dBL <sub>Ceq</sub> - dBL <sub>Aeq</sub> |    | 1/3 Octave Band Centre Frequency, Hz |    |    |    |      |    |    |    |    |     |     |     |     |     |     |     |     |     |     |    |       |      |    |      |       |    |    |      |     |     |  |
|-------------------------------------------------------------|--------|--------|-----------------------------------------|----|--------------------------------------|----|----|----|------|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|-------|------|----|------|-------|----|----|------|-----|-----|--|
| Item / Description                                          | dB(C)  | dB(A)  |                                         | 10 | 12.5                                 | 16 | 20 | 25 | 31.5 | 40 | 50 | 63 | 80 | 100 | 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1k | 1.25k | 1.6k | 2k | 2.5k | 3.15k | 4k | 5k | 6.3k | 8k  | 10k |  |
| NPF1 Table C2 - LF noise threshold                          |        |        |                                         | 92 | 89                                   | 86 | 77 | 69 | 61   | 54 | 50 | 50 | 48 | 48  | 46  | 44  |     |     |     |     |     |     |     |    |       |      |    |      |       |    |    |      |     |     |  |
| Evening & Night - normal operation (CONCAWE - Enhanced Met) |        |        |                                         |    |                                      |    |    |    |      |    |    |    |    |     |     |     |     |     |     |     |     |     |     |    |       |      |    |      |       |    |    |      |     |     |  |
| CC1                                                         | 55 (C) | 39 (A) | 16 dB                                   | 44 | 45                                   | 49 | 52 | 48 | 48   | 48 | 47 | 45 | 44 | 43  | 43  | 40  | 37  | 35  | 33  | 30  | 28  | 28  | 29  | 29 | 28    | 27   | 27 | 24   | 21    | 19 | 18 | 16   | 15  | 14  |  |
| CC2                                                         | 44 (C) | 31 (A) | 13 dB                                   | 34 | 35                                   | 39 | 42 | 38 | 38   | 38 | 37 | 35 | 33 | 32  | 31  | 28  | 26  | 23  | 22  | 20  | 19  | 19  | 20  | 21 | 21    | 22   | 23 | 19   | 14    | 11 | 5  | -4   | -10 | -15 |  |
| COM1                                                        | 65 (C) | 53 (A) | 11 dB                                   | 52 | 52                                   | 56 | 59 | 56 | 56   | 56 | 55 | 54 | 54 | 55  | 55  | 54  | 52  | 51  | 49  | 48  | 47  | 45  | 43  | 42 | 40    | 38   | 36 | 35   | 35    | 34 | 31 | 25   | 22  | 19  |  |
| COM2                                                        | 54 (C) | 37 (A) | 17 dB                                   | 42 | 43                                   | 47 | 50 | 47 | 47   | 47 | 46 | 44 | 43 | 43  | 42  | 40  | 36  | 34  | 31  | 29  | 27  | 26  | 25  | 25 | 24    | 24   | 23 | 21   | 19    | 17 | 14 | 10   | 7   | 5   |  |
| COM3                                                        | 51 (C) | 35 (A) | 17 dB                                   | 41 | 41                                   | 45 | 48 | 45 | 45   | 45 | 44 | 42 | 40 | 39  | 38  | 36  | 33  | 30  | 28  | 26  | 24  | 24  | 24  | 24 | 23    | 23   | 22 | 20   | 17    | 15 | 11 | 5    | 1   | -2  |  |
| COM4                                                        | 50 (C) | 37 (A) | 14 dB                                   | 39 | 40                                   | 44 | 47 | 44 | 44   | 44 | 43 | 41 | 39 | 39  | 38  | 35  | 33  | 31  | 30  | 28  | 27  | 27  | 27  | 27 | 26    | 25   | 25 | 23   | 20    | 18 | 12 | 3    | -3  | -8  |  |
| COM5                                                        | 48 (C) | 36 (A) | 12 dB                                   | 37 | 38                                   | 42 | 45 | 41 | 41   | 41 | 40 | 38 | 36 | 36  | 35  | 33  | 30  | 28  | 28  | 28  | 27  | 27  | 27  | 27 | 26    | 25   | 24 | 22   | 19    | 17 | 11 | 2    | -4  | -9  |  |
| COM6                                                        | 47 (C) | 33 (A) | 14 dB                                   | 36 | 37                                   | 41 | 44 | 40 | 40   | 40 | 39 | 37 | 36 | 35  | 34  | 32  | 30  | 28  | 27  | 27  | 26  | 25  | 24  | 23 | 22    | 21   | 20 | 17   | 15    | 12 | 5  | -6   | -13 | -19 |  |
| COM7                                                        | 44 (C) | 31 (A) | 13 dB                                   | 34 | 35                                   | 39 | 42 | 38 | 38   | 38 | 37 | 35 | 33 | 32  | 31  | 28  | 25  | 23  | 22  | 20  | 18  | 19  | 20  | 21 | 21    | 22   | 22 | 19   | 14    | 11 | 5  | -4   | -10 | -15 |  |
| COM8                                                        | 46 (C) | 37 (A) | 9 dB                                    | 35 | 36                                   | 40 | 43 | 39 | 39   | 39 | 38 | 36 | 34 | 33  | 32  | 29  | 26  | 24  | 23  | 22  | 22  | 23  | 26  | 27 | 27    | 28   | 28 | 26   | 25    | 24 | 18 | 8    | 2   | -4  |  |
| COM9                                                        | 55 (C) | 40 (A) | 15 dB                                   | 44 | 45                                   | 49 | 52 | 48 | 48   | 48 | 47 | 45 | 44 | 44  | 43  | 41  | 38  | 36  | 34  | 31  | 29  | 29  | 30  | 30 | 29    | 29   | 29 | 26   | 23    | 21 | 19 | 17   | 16  | 15  |  |
| COM10                                                       | 54 (C) | 44 (A) | 10 dB                                   | 43 | 44                                   | 48 | 50 | 47 | 47   | 47 | 46 | 44 | 43 | 43  | 42  | 40  | 37  | 35  | 34  | 33  | 32  | 32  | 32  | 33 | 33    | 34   | 35 | 33   | 31    | 30 | 26 | 19   | 16  | 12  |  |
| COM11                                                       | 49 (C) | 38 (A) | 11 dB                                   | 30 | 31                                   | 35 | 38 | 35 | 35   | 34 | 33 | 35 | 36 | 41  | 43  | 41  | 38  | 36  | 34  | 32  | 30  | 29  | 28  | 27 | 25    | 22   | 20 | 19   | 19    | 19 | 13 | 4    | -1  | -5  |  |
| COM12                                                       | 65 (C) | 57 (A) | 7 dB                                    | 52 | 53                                   | 57 | 59 | 56 | 56   | 56 | 55 | 54 | 53 | 54  | 54  | 5   |     |     |     |     |     |     |     |    |       |      |    |      |       |    |    |      |     |     |  |

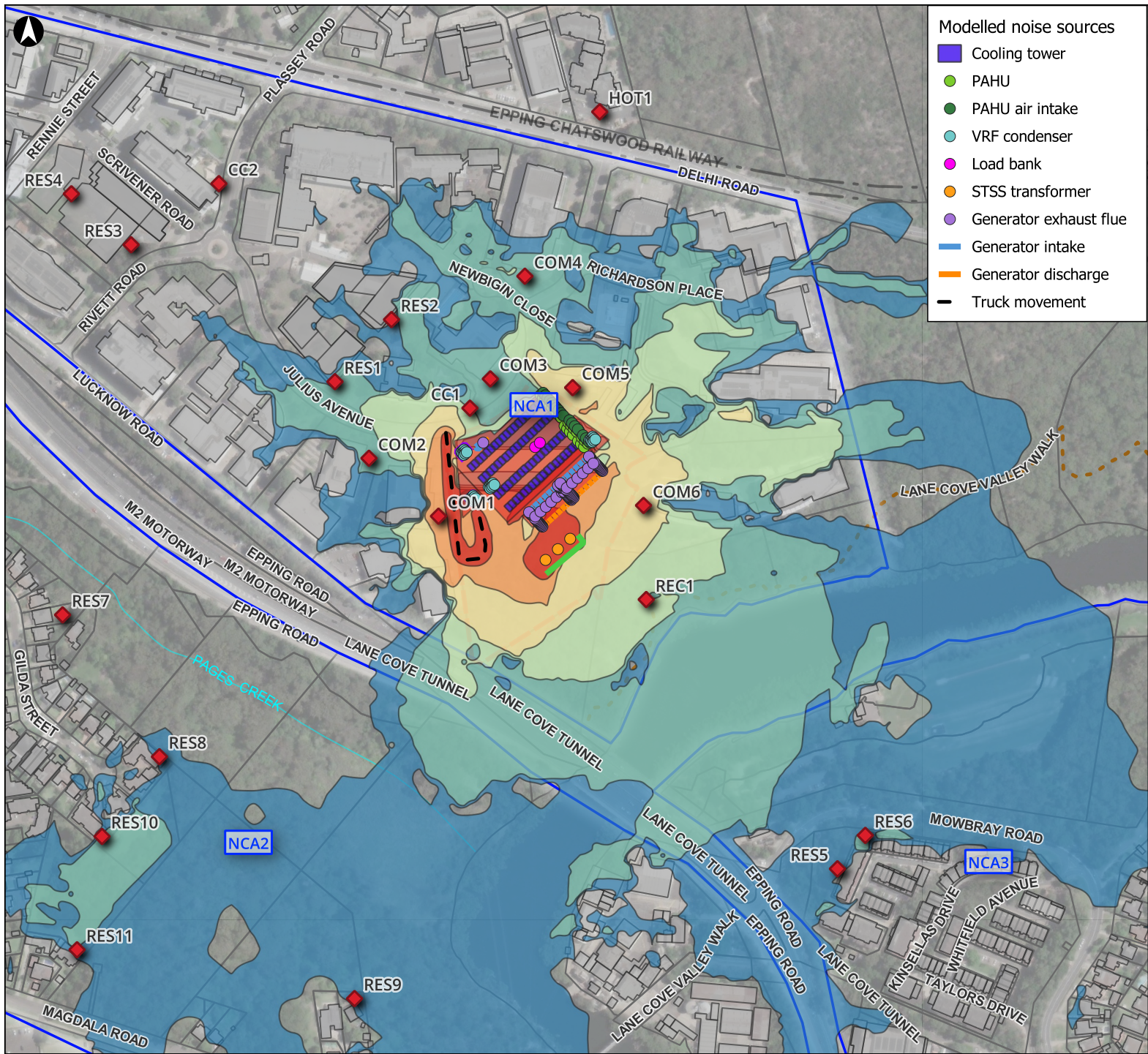
1\_ **Orange bolded font** indicates where the LCeq - LAeq level is 15 dB or more  
2\_ **Red bolded font** indicates where the one-third octave noise level exceeds the low frequency noise thresholds detailed in Table C2 of the NPfI

# Appendix G

## Noise contours

## **G.1 Noise contours (horizontal) at 2 metres relative to ground level**

### **G.1.1 Normal operation (day period) with generator testing – noise-enhancing weather conditions**



Modelled noise sources

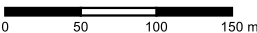
- Cooling tower
- PAHU
- PAHU air intake
- VRF condenser
- Load bank
- STSS transformer
- Generator exhaust flue
- Generator intake
- Generator discharge
- Truck movement

Legend

- Assessment location
- Noise Catchment Area
- Proposed data centre
- Modelled building
- Walking trail
- Transformer noise wall
- Condenser noise wall

Noise contour (Leq,15min) dB(A)  
(@ 2m above ground)

- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- >60



| 2   | 13/05/2025 | DKK | --   | --   | --    |
|-----|------------|-----|------|------|-------|
| Rev | Date       | By  | Chkd | Appd | Authd |

ARUP

Level 5  
151 Clarence Street  
Sydney NSW, 2000  
www.arup.com

Scale at A4

1:5000

Client

ISPT

Project Name

Julius Avenue Data Centre

Project Number

306239

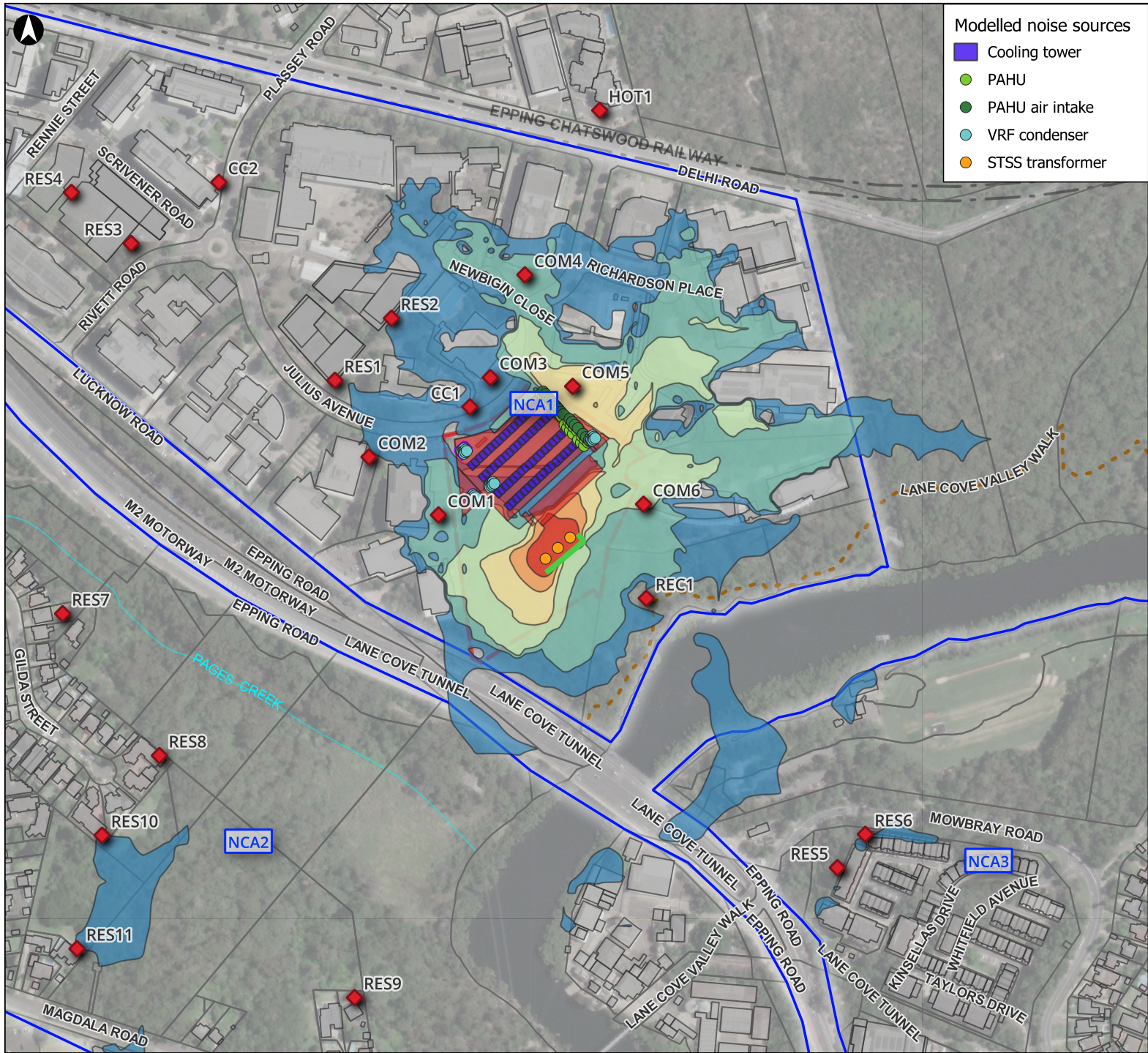
Rev

2

Drawing Title

Noise contours - normal operation with  
generator testing (LAeq,15min)  
Day period - noise-enhancing weather  
conditions @ 2m relative to ground

G.1.2      Normal operation (night period) – noise-enhancing weather conditions



Modelled noise sources

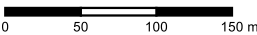
- Cooling tower
- PAHU
- PAHU air intake
- VRF condenser
- STSS transformer

Legend

- Assessment location
- Noise Catchment Area
- Proposed data centre
- Modelled building
- Walking trail
- Transformer noise wall
- Condenser noise wall

Noise contour (Leq,15min) dB(A)  
(@ 2m above ground)

- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- >60



| 2   | 13/05/2025 | DKK | --   | --   | --    |
|-----|------------|-----|------|------|-------|
| Rev | Date       | By  | Chkd | Appd | Authd |

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Scale at A4

1:5000

Client

ISPT

Project Name

Julius Avenue Data Centre

Project Number

306239

Rev

2

Drawing Title

Noise contours - normal operation  
(LAeq,15min)  
Evening and night period - noise-enhancing  
weather conditions @ 2m relative to ground

## G.2 Vertical noise grids

### G.2.1 Macquarie Park TOD Rezoning Concept Apartments – Normal operation with generator testing (Day, noise enhancing meteorological conditions)

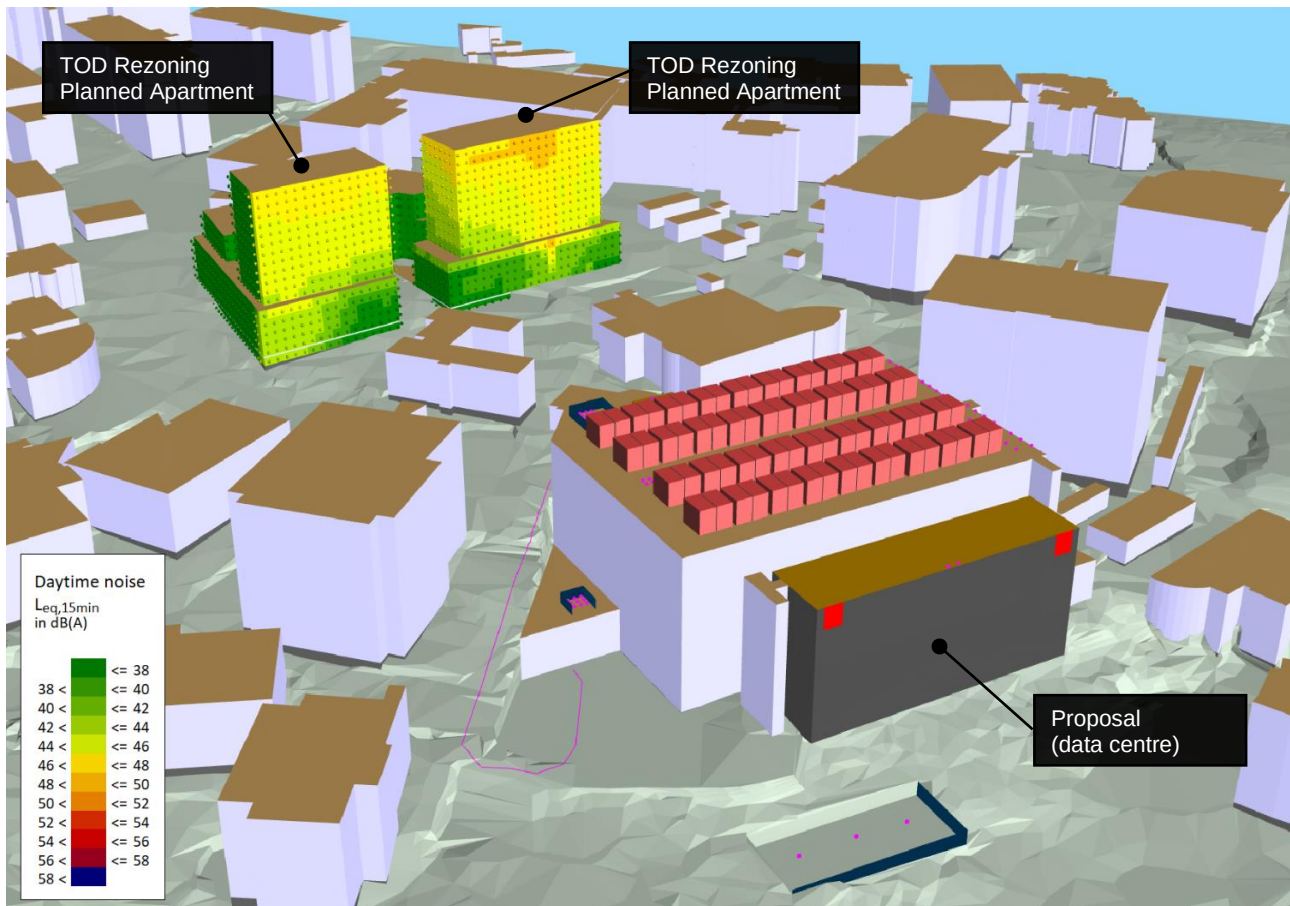


Figure 6: Nearest residential apartments façade noise map (normal operation with generator testing, day)

G.2.2 Macquarie Park TOD Rezoning Concept Apartments – Normal operation (Night, noise enhancing meteorological conditions)

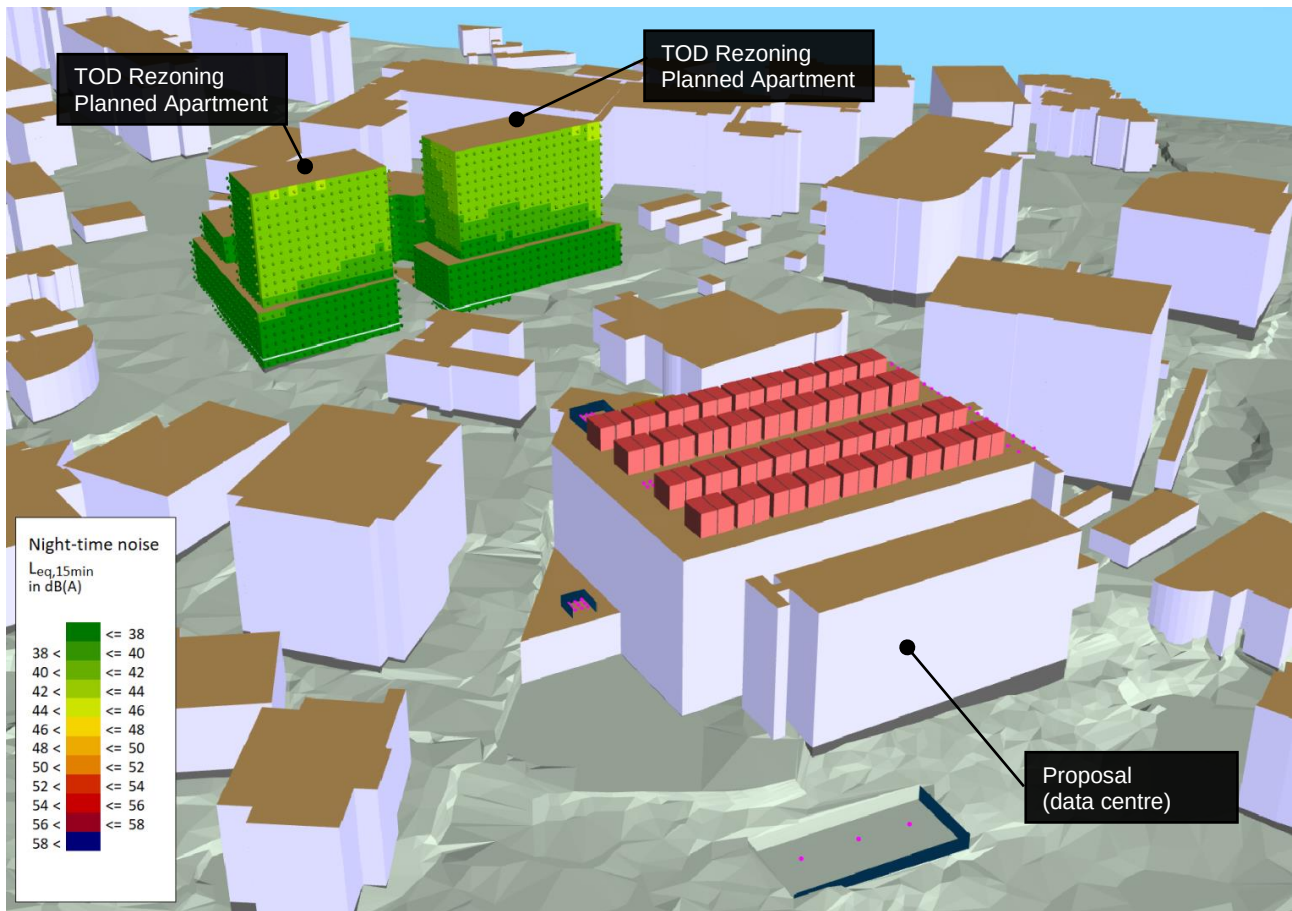


Figure 7: Nearest residential apartments façade noise map (normal operation, night)

# Appendix H

Vibration criteria

## H.1 Disturbance to building occupant

Potential vibration disturbance to human occupants of buildings is made in accordance with the NSW DEC *Assessing Vibration; a technical guideline* [4]. The criteria outlined in the guideline is based on the British Standard BS 6472-1992 *Evaluation of human exposure to vibration in buildings (1-80Hz)* [13]. Sources of vibration are defined as either 'Continuous', 'Impulsive' or 'Intermittent', as described in Table 38.

Table 38: Types of vibration - Definition

| Type of vibration      | Definition                                                                                                                                                                                                                                                                                                                 | Examples                                                                                                                                                                                                                                                                            |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Continuous vibration   | Continues uninterrupted for a defined period (usually throughout the day and/or night)                                                                                                                                                                                                                                     | Machinery, steady road traffic, continuous construction activity (such as tunnel boring machinery).                                                                                                                                                                                 |
| Impulsive vibration    | A rapid build-up to a peak followed by a damped decay that may or may not involve several cycles of vibration (depending on frequency and damping). It can also consist of a sudden application of several cycles at approximately the same amplitude, providing that the duration is short, typically less than 2 seconds | Infrequent: Activities that create up to 3 distinct vibration events in an assessment period, e.g. occasional dropping of heavy equipment, occasional loading and unloading.                                                                                                        |
| Intermittent vibration | Can be defined as interrupted periods of continuous or repeated periods of impulsive vibration that varies significantly in magnitude                                                                                                                                                                                      | Trains, nearby intermittent construction activity, passing heavy vehicles, forging machines, impact pile driving, jack hammers.<br><br>Where the number of vibration events in an assessment period is three or fewer, this would be assessed against impulsive vibration criteria. |

Table 39 reproduces the 'Preferred' and 'Maximum' values for continuous and impulsive vibration from Table 2.2 of the Guideline.

Table 39: Preferred and maximum vibration acceleration levels for human comfort, m/s<sup>2</sup>

| Location                                                                    | Assessment period <sup>1</sup> | Preferred values |               | Maximum values |               |
|-----------------------------------------------------------------------------|--------------------------------|------------------|---------------|----------------|---------------|
|                                                                             |                                | z-axis           | x- and y-axes | z-axis         | x- and y-axes |
| Continuous vibration (weighted RMS acceleration, m/s <sup>2</sup> , 1-80Hz) |                                |                  |               |                |               |
| Residences                                                                  | Day                            | 0.010            | 0.0071        | 0.020          | 0.014         |
|                                                                             | Night                          | 0.007            | 0.005         | 0.014          | 0.010         |
| Offices, schools, educational institutions and places of worship            | Day or night                   | 0.020            | 0.014         | 0.040          | 0.028         |
| Workshops                                                                   | Day or night                   | 0.04             | 0.029         | 0.080          | 0.058         |
| Impulsive vibration (weighted RMS acceleration, m/s <sup>2</sup> , 1-80Hz)  |                                |                  |               |                |               |
| Residences                                                                  | Day                            | 0.30             | 0.21          | 0.60           | 0.42          |
|                                                                             | Night                          | 0.10             | 0.071         | 0.20           | 0.14          |
| Offices, schools, educational institutions and places of worship            | Day or night                   | 0.64             | 0.46          | 1.28           | 0.92          |

Note 1 - Day is 7:00am to 10:00pm and night is 10:00pm to 7:00am

Table 40 reproduces the 'Preferred' and 'Maximum' values for intermittent vibration from Table 2.4 of the Guideline. The VDV is dependent upon the level and duration of the vibration episode and the number of vibration episodes occurring during the assessment period; a higher vibration level is permitted if the total duration of the vibration event(s) is small.

Table 40: Acceptable vibration dose values (VDV) for intermittent vibration ( $m/s^{1.75}$ )

| Location                                                         | Day <sup>1</sup> |               | Night <sup>1</sup> |               |
|------------------------------------------------------------------|------------------|---------------|--------------------|---------------|
|                                                                  | Preferred value  | Maximum value | Preferred value    | Maximum value |
| Residences                                                       | 0.20             | 0.40          | 0.13               | 0.26          |
| Offices, schools, educational institutions and places of worship | 0.40             | 0.80          | 0.40               | 0.80          |
| Workshops                                                        | 0.80             | 1.60          | 0.80               | 1.60          |

Note:

1\_ Day is 7:00am to 10:00pm and night is 10:00pm to 7:00am

## H.2 Structural damage

Potential structural or cosmetic damage to buildings as a result of vibration is typically assessed in accordance with British Standard 7385 Part 2 [6].

### H.2.1 Standard structures

British Standard 7385 Part 1: 1993, defines different levels of structural damage as:

- *Cosmetic - The formation of hairline cracks on drywall surfaces, or the growth of existing cracks in plaster or drywall surfaces; in addition, the formation of hairline cracks in mortar joints of brick/concrete block construction.*
- *Minor - The formation of large cracks or loosening of plaster or drywall surfaces, or cracks through bricks/concrete blocks.*
- *Major - Damage to structural elements of the building, cracks in supporting columns, loosening of joints, spalling of masonry cracks, etc.*

Table 1 and Section 7.4.2 of BS7385-2 sets limits for the protection against the different levels of structural damage and those levels are reproduced in Table 41 below.

Table 41: BS 7385-2 structural damage criteria

| Group | Type of structure                                                                          | Damage level       | Peak component particle velocity, mm/s <sup>1</sup> |                |                 |
|-------|--------------------------------------------------------------------------------------------|--------------------|-----------------------------------------------------|----------------|-----------------|
|       |                                                                                            |                    | 4 Hz to 15 Hz                                       | 15 Hz to 40 Hz | 40 Hz and above |
| 1     | Reinforced or framed structures<br>Industrial and heavy commercial buildings               | Cosmetic           | 50                                                  |                |                 |
|       |                                                                                            | Minor <sup>2</sup> | 100                                                 |                |                 |
|       |                                                                                            | Major <sup>2</sup> | 200                                                 |                |                 |
| 2     | Un-reinforced or light framed structures<br>Residential or light commercial type buildings | Cosmetic           | 15 to 20                                            | 20 to 50       | 50              |
|       |                                                                                            | Minor <sup>2</sup> | 30 to 40                                            | 40 to 100      | 100             |
|       |                                                                                            | Major <sup>2</sup> | 60 to 80                                            | 80 to 200      | 200             |

Notes:

1\_ Peak Component Particle Velocity is the maximum Peak particle velocity in any one direction (x, y, z) as measured by a tri-axial vibration transducer.

2\_ Minor and major damage criteria established based on British Standard 7385 Part 2 (1993) Section 7.4.2

All levels relate to transient vibrations in low-rise buildings. Continuous vibration can give rise to dynamic magnifications that may require levels to be reduced by up to 50%.

The guide values in Table 41 relate predominantly to transient vibration which does not give rise to resonant responses in structures, and to low rise buildings. Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values in Table 41 may need to be reduced by up to 50%.

## H.2.2 Sensitive structures

German Standard *DIN 4150 – Part 3 ‘Structural vibration in buildings – Effects on Structure’* [7] is generally recognised to be conservative and is often referred to for the purpose of assessing structurally sensitive buildings.

Heritage buildings and structures should not be assumed to be more sensitive to vibration unless they are found to be structurally unsound and should otherwise be assessed in accordance with BS7385-2. If a heritage building or structure is found to be structurally unsound (following inspection) DIN 4150-3, line 3 as outlined in Table 42, provides a conservative cosmetic damage objective that should be adopted unless alternative limits are justified by a dilapidation or structural survey. The sensitivity of heritage buildings and other potentially at-risk structures are subject to confirmation by the contractor prior to start of any works.

Table 42: DIN 4150-3 structural damage guideline values

| Line | Type of structure                                                                                                                                                                                               | Peak component particle velocity (PCPV), mm/s |                |                              |                                      |                                           |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|----------------|------------------------------|--------------------------------------|-------------------------------------------|
|      |                                                                                                                                                                                                                 | Vibration at the foundation at a frequency of |                |                              | At horizontal plane of highest floor | In the vertical direction, at floor slabs |
|      |                                                                                                                                                                                                                 | 1 Hz to 10 Hz                                 | 10 Hz to 50 Hz | 50 Hz to 100 Hz <sup>1</sup> | All frequencies                      | All frequencies                           |
| 3    | Structures that because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings under a preservation order) <sup>3</sup> | 3                                             | 3 to 8         | 8 to 10                      | 8                                    | 20 <sup>2</sup>                           |

Notes:

1\_ At frequencies above 100 Hz, the values given in this column may be used as minimum values.

2\_ Guideline value might have to be lowered to prevent minor damage

3\_ Line 1 refer to buildings used for commercial purposes, industrial buildings and buildings of similar design, while Line 2 refers to residential buildings and buildings of similar design and/or occupancy

Note that no sensitive structures have been identified near the site.

## H.2.3 Buried services

It is not expected that the proposed works will impact upon buried services, however the following is nonetheless provided for guidance.

DIN 4150-2:2016 sets out guideline values for vibration effects on buried pipework (see Table 43).

Table 43: Guideline values for short-term vibration impacts on buried pipework

| Line | Pipe material                                                                                        | Peak component particle velocity (PCPV) measured on pipe, mm/s                                                     |
|------|------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| 1    | Steel, welded                                                                                        | 100                                                                                                                |
| 2    | Vitrified clay, concrete, reinforced concrete, pre-stressed concrete, metal (with or without flange) | 80                                                                                                                 |
| 3    | Masonry, plastic                                                                                     | 50                                                                                                                 |
| -    | High pressure gas pipelines*                                                                         | 75<br>Monitoring required if predicted above 50.<br>No piling within 15 m of pipeline without detailed assessment. |

Notes:

- For gas and water supply pipes within 2 m of buildings, the levels given in DIN4150-3 [7] should be applied. Consideration must also be given to pipe junctions with the building structure as potential significant changes in mechanical loads on the pipe must be considered.

- For Rock breaking/hammering and sheet piling activities are considered to have the potential to cause dynamic loading in some structures and it may therefore be appropriate to reduce the transient values by 50%.

\* Based on UK National Grid's specification [23]

Other services that maybe encountered include electrical cables and telecommunication services such as fibre optic cables. While these may sustain vibration velocity levels from between 50 mm/s and 100 mm/s, the connected services such as transformers and switchgear, may not. Where encountered, site specific vibration assessment in consultation with the utility provider should be carried out.

# Appendix I

## Noise and vibration complaint management procedure

