# DA Acoustic Assessment – 28-32 Somerset Street, Kingswood

Boston Global

Level 29, 259 George Street, Sydney NSW 2000

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# DA Acoustic Assessment – 28-32 Somerset Street, Kingswood

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# 1 INTRODUCTION

Pulse Acoustic Consultancy Pty Ltd (Pulse Acoustics) has been engaged by Boston Global Pty Ltd to undertake an acoustic assessment for the proposed four (4) star hotel development to be constructed at 28-34 Somerset Street, Kingswood.

This report has been prepared to form part of the Development Application (DA) package to be submitted to Penrith City Council.

This assessment will address the following:

- Potential surrounding environmental noise intrusion impacts on the development (i.e. road traffic, mechanical and other external noise sources).
- Noise emissions on nearby receivers from mechanical plant and other base building services, vehicle movements as well as noise associated with the internal and external food and beverage areas; and
- Acoustic separation requirements.

This report will discuss the relevant acoustic criteria which have been adopted as well as the outcome of the assessment.

A list of acoustic terminology used in this report is included in Appendix A of this report.

## 1.1 Relevant Guidelines

Acoustic criteria which have been adopted in this assessment include requirements from the local and state authorities. Australian and International Standards will be adopted where local and state legislation are not applicable.

Noise intrusion into the development will be controlled by the requirements of Penrith City Council Development Control Plan (DCP) 2014. The objectives of Australian / New Zealand Standard AS/NZS 2107:2016 Acoustics–Recommended design sound levels and reverberation times for building interiors has been adopted.

Internal construction requirements are governed by the requirements of Section F5 of the Building Code of Australia (BCA) component of the National Construction Code (NCC).

Furthermore, the noise emission impacts from the proposed development on the adjacent receivers are regulated by the Penrith City Council Development Control Plan (DCP) 2014 and the NSW EPA Noise Policy for Industry (NPI) 2017.

## 1.2 Proposed Development

The proposed redevelopment will result in a development which includes the following:

- A seven (7)-storey building which will contain the following:
  - Two levels of basement which include carparking, loading dock, back of house areas and services.
  - Hotel lobby, function and bar and dining areas, back of house and hotel rooms located on ground level.

- Hotel rooms located on level one (1) through five (5); and
- Hotel gym, meeting areas, kitchen and rooftop dining and bar areas.

**Figure 1 Architectural Plan – Site Plan**

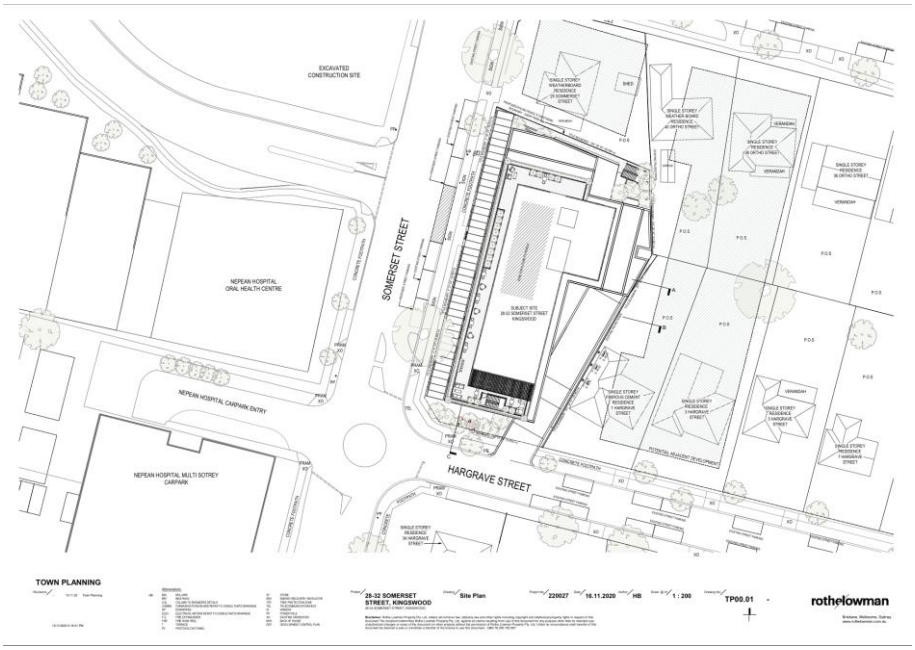
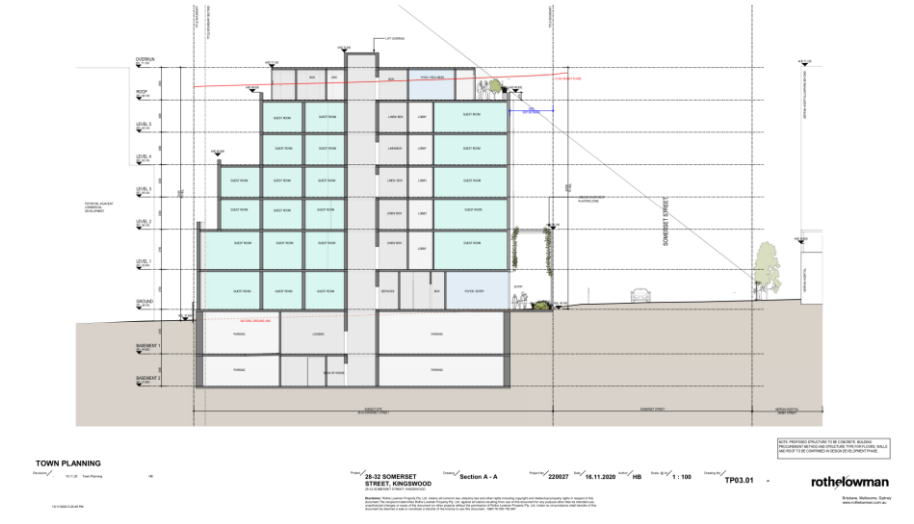



**Figure 2 Architectural Plan – Section A**




Architectural drawings for the proposed development, which have been used in our assessment, were prepared by Rothe Lowman Property Pty Ltd (Rothelowman) dated 16th November 2020.

## 1.3 Site Description

The project site is located at 28-32 Somerset Street, Kingswood which is defined as a B4 zoning based on Penrith City Council LEP Land Zoning Maps. As outlined below the site is currently surrounded by existing single storey dwellings. However, as the adjacent properties are also within a B4 zoning these land uses could also have future structures which are of similar height to the proposed.

Located along the northern boundary of the site is an existing single storey residential dwelling. Further north is Orth Street which carries a low volume of traffic, with additional residential dwellings located either side of Orth Street.

Along the eastern boundary of the site are more single storey residential dwellings.

To the south of the site along the boundary is Hargrave Street which carries a low volume of traffic with future and existing multi storey buildings as well as existing single storey dwellings.

Along the western boundary of the site is Somerset Street which carries a medium volume of traffic with Nepean Hospital located on the opposite side of the street. Potential noise sources from the hospital include traffic noise from vehicles entering or exiting from driveways/carparks as well as helicopter flight movements associated with the new CSB (Clinical Services Building) currently under construction directly opposite (see Figure 4 below).

The nearest sensitive receivers to the site have been identified below.

**Receiver 1:** Single storey residential dwelling at 26 Somerset Street, Kingswood, situated along the northern boundary of the site.

**Receiver 2:** Single storey residential dwellings located at 38-40 Orth Street, Kingswood, situated along the northern portion of the eastern boundary.

**Receiver 3:** Single storey residential dwellings located at 1-3 Hargrave Street, Kingswood, situated along southern portion of the eastern boundary.

**Receiver 4:** Existing single storey residential dwellings located to the south of the site across Hargrave Street. Situated at 34-36 Somerset Street and 2-4 Hargrave Street, Kingswood.

**Receiver 5:** Nepean Hospital located to the west of the site across Somerset Street. Hospital buildings in close proximity of the site include a multi-storey carpark located south west. Oral Health building directly opposite and the future stage 1 Clinical Services Building (CSB) currently under construction.

Information available on Penrith City Council ePlanning development services show a number of Development Applications have been approved for the adjacent properties. In particular:

- DA16/0999: *Demolition of Existing Structures, Construction of a Seven (7) Storey Mixed Use Development including Ground Floor Commercial Tenancy, 121 Residential Apartments, Three (3) Levels of Basement Car Parking & Associated Works.* Approved 26th July 2017.

- DA19/0713: *Demolition of Existing Structures & Construction of a Seven (7) Storey Mixed Use Development Including Ground & First Floor Commercial Tenancies, 41 Residential Apartments & Three (3) Levels of Basement Car Parking.* Approved 25th March 2020.

A map showing the site location and all measurement locations as well as nearest receivers is provided in Figure 3 below.

Figure 3 Site Map, Measurement Locations and Surrounding Receivers – Sourced from SixMaps NSW

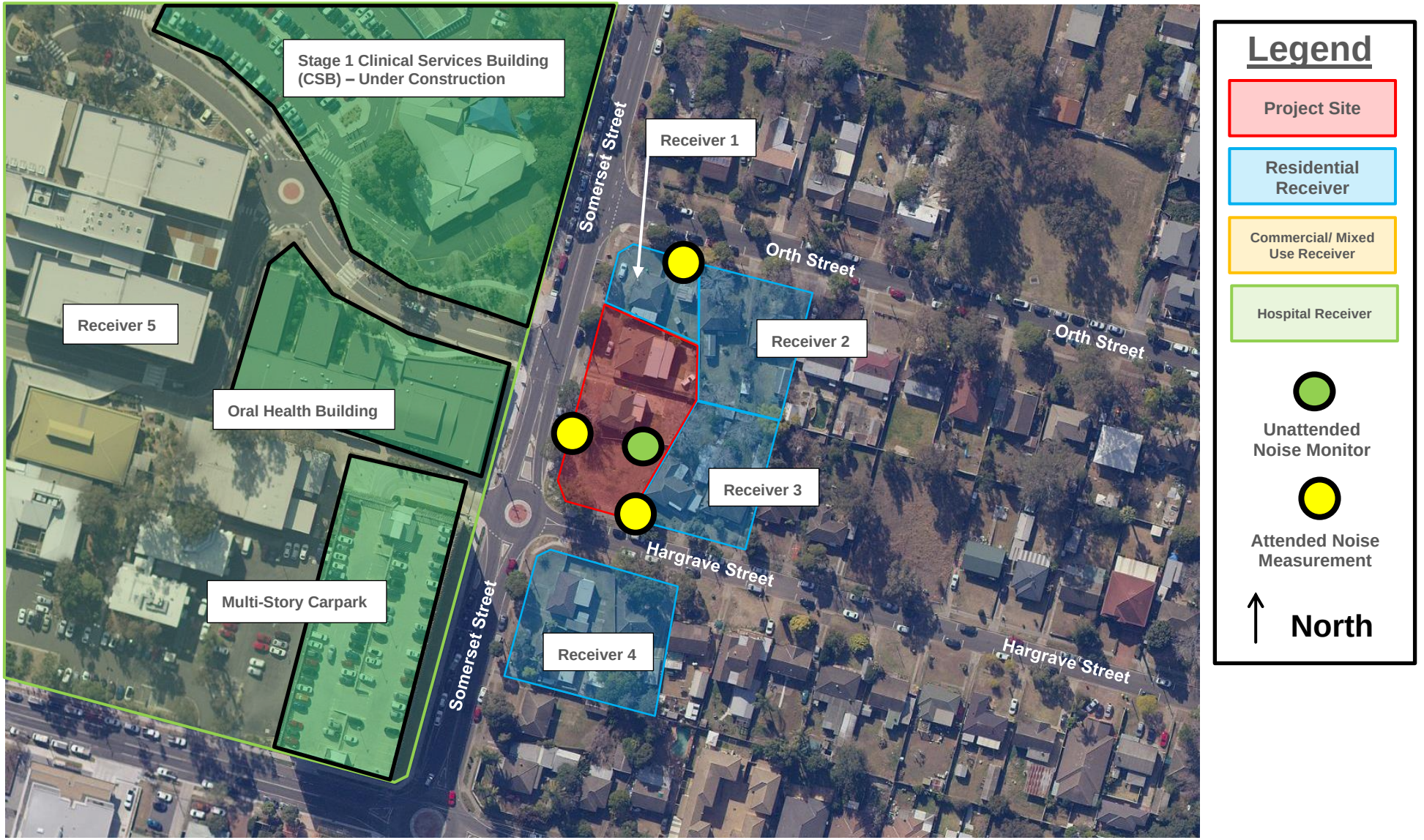


**Figure 4 Site Photos**

Nepean Hospital CSB (Under Construction)

Nepean Hospital Multi-Story Carpark

Somerset Street facing Project Site

Somerset Street facing South

Somerset Street facing North

Orth Street facing Project Site

# 2 ACOUSTIC NOISE AND VIBRATION SURVEY

## 2.1 Onsite Noise Measurements

Measured noise levels from both the unattended and attended noise surveys are outlined below.

### 2.1.1 Unattended Noise Monitoring

An unattended noise survey was conducted between Tuesday 13th October 2020 and Friday 23rd October 2020 along the boundary fence between 30 and 32 Somerset eastern boundary as shown in Figure 3 above. The monitor was installed on a level equal to ground level.

Instrumentation for the survey comprised one Svan 971 noise logger (serial number 74365). Calibration of the logger was checked prior to and following the measurements. Drift in calibration did not exceed ±0.5 dB. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates.

Charts presenting summaries of the measured daily noise data are attached in Appendix B. The charts present each 24-hour period and show the $L_{A1}$, $L_{A10}$, $L_{Aeq}$ and $L_{A90}$ noise levels for the corresponding 15-minute periods. This data has been filtered to remove periods affected by adverse weather conditions based on weather information.

**Figure 5 Noise Monitor Install Photo – Somerset Street**

Based on the unattended noise measurements outlined above, the results of each survey are presented below.

**Note: As indicated above, construction of the Stage 1 component of the Nepean Hospital CSB is currently underway. As such measured noise levels during the daytime period (7:00am to 6:00pm) will be affected by construction noise from the nearby site. As construction hours are approved for Monday to Saturday only, daytime noise levels adopted in this assessment will only be formulated based on measured levels on a Sunday.**

#### 2.1.1.1 Results in accordance with the NSW *EPA Noise Policy for Industry (NPI) 2017* (RBL's)

In order to assess the acoustical implications of the development at nearby noise sensitive receivers, the measured background noise data of the logger was processed in accordance with the NSW EPA's *Noise Policy for Industry* (NPI, 2017).

The Rating Background Noise Level (RBL) is the background noise level used for assessment purposes at the nearest potentially-affected receiver. It is the 90th percentile of the daily background noise levels during each assessment period, being day, evening and night. RBL $L_{A90\ (15minute)}$ and $L_{Aeq}$ noise levels are presented in Table 1.

Data affected by adverse meteorological conditions and by spurious and uncharacteristic events has been excluded from the results, and also excluded from the data used to determine the noise emission criteria. Meteorological information has been obtained from the Penrith Lakes AWS weather station (ID 067113).

**Table 1 Measured Ambient Noise Levels corresponding to the NPI's Assessment Time Periods**

| Measurement Location | Daytime[1] [4] 7:00 am to 6:00 pm | | Evening[1] 6:00 pm to 10:00 pm | | Night-time[1] 10:00 pm to 7:00 am | |
|---|---|---|---|---|---|---|
| | $L_{A90}$[2] (dBA) | $L_{Aeq}$[3] (dBA) | $L_{A90}$[2] (dBA) | $L_{Aeq}$[3] (dBA) | $L_{A90}$[2] (dBA) | $L_{Aeq}$[3] (dBA) |
| Location 1, 30-32 Boundary Fence. (See Figure 3) | 40 [4] | 48 [4] | 37 | 49 | 34 | 49 |

*Note 1: Typically, For Monday to Saturday, Daytime 7:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 7:00 am. On Sundays and Public Holidays, Daytime 8:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 8:00 am*

*Note 2: The $L_{A90}$ noise level is representative of the "average minimum background sound level" (in the absence of the source under consideration), or simply the background level.*

*Note 3: The $L_{Aeq}$ is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.*

*Note 4: As mentioned above, daytime noise levels during Monday to Saturday are excluded due to construction noise influences from the nearby site.*

#### 2.1.1.2 Results in accordance with the NSW Department of Planning "Development near Rail Corridors and Busy Roads – Interim Guideline"

In determining the required façade construction for the proposed building in accordance with the internal noise level requirements of NSW Department of Planning "Development near Rail Corridors and Busy Roads – Interim Guideline" measured noise levels are shown based on the time periods defined by the SEPP below.

Data affected by adverse meteorological conditions and by spurious and uncharacteristic events have been excluded from the results, and also excluded from the data used to determine the noise emission criteria.

**Table 2 Measured Ambient Noise Levels corresponding to the "Development near Rail Corridors and Busy Roads – Interim Guideline" Assessment Time Periods**

| Measurement Location | Daytime [1] 7:00 am to 10:00 pm | Night-time [1] 10:00 pm to 7:00 am |
|---|---|---|
| | $L_{Aeq\ (whole\ period)}$ [2] (dBA) | $L_{Aeq\ (whole\ period)}$ [2] (dBA) |
| Location 1, 30-32 Boundary Fence. (See Figure 3) | 54 | 49 |

*Note 1: For Monday to Sunday, Daytime 7:00 am – 10:00 pm; Night-time 10:00 pm – 7:00 am.*

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

### 2.1.2 Attended Noise Measurements

In addition to the unattended noise survey, an attended noise survey was carried out to establish levels at key locations within and surrounding the site. These are summarised below.

The attended noise measurements were conducted using a Brüel & Kjær Type 2250 sound level meter (serial number 2709757). Calibration of the sound level meter was checked prior to and following the measurements using a Brüel & Kjær Type 4231 sound calibrator (serial number 3009148). The calibrator emitted a calibration tone of 94 dB at 1 kHz. The drift in calibration did not exceed ±0.5 dB. All equipment carries appropriate and current NATA (or manufacturer) calibration certificates.

Attended noise measurements were undertaken on Tuesday 13th October 2020 between 3:15pm and 4:15pm. Additionally, night-time attended noise measurements were undertaken Tuesday 20th October 2020 between 11:30pm and 12:15am.

Results of the attended noise measurements are outlined in Table 3 below.

**Table 3 Measured Results of the Attended Noise Survey**

| Measurement Location | Date and Time | Measured Noise Level (dBA) | | Comments |
|---|---|---|---|---|
| | | $L_{A90\ (15\text{-}min)}$[1] | $L_{Aeq\ (15\text{-}min)}$[2] | |
| **Location 1:** Orth Street (See Figure 3) | Tuesday 13th October 2020, 3:15pm and 4:15pm | 55 | 61 | Occasional construction noise, vehicle movements along Somerset Street. Occasional vehicle movement along Orth and Hargrave Street. |
| **Location 2:** Somerset Street (See Figure 3) | | 57 | 64 | |
| **Location 3:** Hargrave Street (See Figure 3) | | 56 | 62 | |
| **Location 1:** Orth Street (See Figure 3) | Tuesday 20th October 2020, 11:30pm and 12:15am | 36 | 48 | Distant Hospital Mechanical Noise and Occasional Vehicle Movement. |
| **Location 2:** Somerset Street (See Figure 3) | | 38 | 51 | |
| **Location 3:** Hargrave Street (See Figure 3) | | 37 | 46 | |

*Note 1: The $L_{A90}$ noise level is representative of the "average minimum background sound level" (in the absence of the source under consideration), or simply the background level.*

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

In addition to the overall broadband noise levels (i.e. single number ambient noise level measurement results) provided above, the accompanying single (1/1) octave band spectrum noise levels for each 15-minute period throughout the identified monitoring periods were also recorded. Octave band noise level criteria are sometimes imposed by Liquor and Gaming NSW as a condition on the hotel's Liquor License. The background $L_{A90}$ noise levels in octave obtained during the monitoring periods are shown below.

**Table 4 $L_{A90}$ 1/1 Spectra – Noise Monitoring Location**

| Parameter [1] | Octave Band Centre Frequency, Hz | | | | | | | | | Overall dBA |
|---|---|---|---|---|---|---|---|---|---|---|
| | 31.5 | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k | |
| **7:00am to 6:00pm (Day)** | | | | | | | | | | |
| Measured $L_{A90}$ | 50 | 48 | 47 | 38 | 36 | 34 | 28 | 24 | 16 | **40** |
| **6:00pm to 10:00pm (Evening Time)** | | | | | | | | | | |
| Measured $L_{A90}$ | 47 | 45 | 44 | 36 | 33 | 31 | 25 | 21 | 13 | **37** |
| **10:00pm to 12:00am (Early Night)** | | | | | | | | | | |
| Measured $L_{A90}$ | 45 | 43 | 42 | 34 | 31 | 29 | 23 | 19 | 11 | **35** |
| **12:00am to 7:00am (After Midnight)** | | | | | | | | | | |
| Measured $L_{A90}$ | 44 | 43 | 42 | 34 | 31 | 29 | 23 | 19 | 11 | **34** |

*Note 1: Measured $L_{A90}$ spectrum has been adjusted to match overall RBL for corresponding periods.*

### 2.1.3 Calculated $L_{Aeq}$ Noise Levels at Future Facades (Noise Intrusion)

In determining the required construction for the future building envelope, contributing $L_{Aeq}$ noise levels from surrounding roads to each future façade need to be determined. Utilising the 15-minute interval difference between the attended measurement and the unattended monitor, as well as the difference between the 15-minute interval and the overall period result, the calculated noise levels at each façade are determined below. Where applicable, angle of view and distance corrections have also been provided.

**Table 5 Predicted Noise Level at Future Facades**

| Prediction Location | Predicted Façade Noise Level $L_{Aeq\ (Period)}$ [2] (dBA) | |
|---|---|---|
| | Day time (7:00am-10:00pm) $L_{Aeq\ (Whole\ Period)}$ | Night time (10:00pm-7:00am) $L_{Aeq\ (Whole\ Period)}$ |
| **Future Northern Façade** (Towards Orth Street) | 61 | 48 |
| **Future Eastern Façade** (Towards 1 Hargrave Street) | - | - |
| **Future Southern Façade** (Hargrave Street) | 62 | 46 |
| **Future Western Façade** (Somerset Street) | 64 | 51 |

*Note 1: For Monday to Sunday, Daytime 7:00 am – 10:00 pm; Night-time 10:00 pm – 7:00 am.*

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

*Note 3: Levels outlined above are estimated based on relationship between the attended noise survey and unattended noise monitoring.*

# 3 ACOUSTIC CRITERIA

The acoustic criteria which have been adopted for this assessment are outlined below. All criteria have been separated into the relevant assessment type. These are: *Noise Intrusion Criteria* (Assessment of building envelope), *Noise Emission Criteria* (Assessment of noise to surrounding receivers), and *Acoustic Separation Criteria* (Assessment of acoustic privacy within the building).

## 3.1 Noise Intrusion Criteria

External noise intrusion into the building will generally be via the building envelope (External wall, glazing or external roof). The design of the building envelope should be such that the requirements listed below are achieved.

### 3.1.1 Penrith City Council Development Control Plan (DCP) 2014

Acoustic related items from Penrith City Council Development Control Plan (DCP) 2014 state the following:

> ***Section C12 Noise and Vibration***
>
> ***12.1 Road Traffic Noise***
>
> ***C. Controls***
>
> *1. Road traffic noise criteria including sensitive land uses*
>
> *a) Council will not grant consent to development, particularly residential development, including subdivisions, unless the impact of traffic noise from freeway, arterial, designated or collector roads complies with the standards and guidelines for road traffic noise prepared by the relevant State Government authorities or agencies, as well as relevant Australian Standards.*
>
> *b) Council will not grant consent to development for sensitive land uses unless it complies with provisions and standards for road traffic noise prepared by the relevant State Government authorities or agencies, as well as relevant Australian Standards.*
>
> *c) Sensitive land uses subject to road traffic noise criteria referred to in b) above include educational establishments (including schools), places of public worship, hospitals, and passive and active recreation areas.*

**Note: Definitions section of the Penrith City Council LEP 2010 does not define a Hotel Development (i.e. proposed development) as a residential accommodation. However, for the future acoustic amenity of the customers we will consider the internal noise levels be in line with a typical residential space.**

### 3.1.2 NSW Department of Planning document *"Development Near Rail Corridors and Busy Roads – Interim Guideline" 2008*

Regarding airborne noise, the document titled *"Development Near Rail Corridors and Busy Roads – Interim Guideline"* (DNRC & BR – IG), recommends that residential developments should be designed so that the following is achieved:

***For Clauses 87 (Rail) and 102 (Road):***

- *If the development is for the purpose of a building for residential use, the consent authority must be satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded:*
    - *In any bedroom in the building : 35dB(A) at any time 10pm–7am*
    - *Anywhere else in the building (other than a garage, kitchen, bathroom or hallway): 40dB(A) at any time.*

**Note: This requirement is similar to which is listed in the NSW Department of Planning State Environmental Planning Policy (SEPP) (INFRASTRUCTURE) 2007.**

In addition to the requirements listed above, section 3.6.1 of the DNRC & BR – IG states the following:

> *"If internal noise levels with windows or doors open exceed the criteria by more than 10dBA, the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also to meet the ventilation requirements of the Building Code of Australia."*

Therefore, if internal noise levels within a bedroom with the windows open exceed 45dBA $L_{Aeq}$ between 10:00pm and 7:00am and/or 50dBA $L_{Aeq}$ anywhere else in the building (apartment section) other than a garage, kitchen, bathroom or hallway (at any time), alternate ventilation in accordance with the BCA must be provided.

### 3.1.3 Australian / New Zealand Standard AS/NZS 2107:2016 Acoustics - Recommended design sound levels and reverberation times for building interiors - (AS/NZS 2107:2016)

Recommended ambient noise levels and reverberation times for internal spaces are given in a number of publications including Table 1 of Australian / New Zealand Standard 2107:2016 "*Acoustics - Recommended design sound levels and reverberation times for building interiors"*. Unlike the previous version of this Standard, this latest edition recommends a range with lower and upper levels (rather than "satisfactory" and "maximum" internal noise levels) for building interiors based on room designation and location of the development relative to external noise sources. This change has occurred due to the fact that sound levels below 'satisfactory' could be interpreted as desirable, but the opposite may in fact be the case. Levels below those which were listed as 'satisfactory' can lead to inadequate acoustic masking resulting in loss of acoustic isolation and speech privacy.

Internal noise levels due to the combined contributions of external noise intrusion and mechanical ventilation plant should not exceed the maximum levels recommended in this Standard. The levels for areas relevant to this development are given in Table 6 below. The mid to maximum points of the internal noise level ranges are generally adopted as the internal design noise criteria for the combined effect of mechanical services and external noise intrusion. In this report we will confine our recommendations to dBA levels; however, where the background noise appears to be unbalanced, AS/NZS 2107:2016 provides direction in terms of suitable diagnostic tools that can be used to assess the spectrum distribution of the background noise.

**Table 6 Recommended Design Sound Levels**

| Type of Occupancy/Activity | Design sound level range dBA ($L_{Aeq,t}$) | Project Design Noise Level [1] dBA ($L_{Aeq,t}$) |
|---|---|---|
| **Residential Buildings**— | | |
| Hotels and motels— | | |
| Bars and lounges | <50 | **47** |
| Conference areas— (Up to 50 persons) | 35 to 40 | **37** |
| Dining rooms | 40 to 45 | **43** |
| Enclosed Carparks | <65 | **63** |
| Foyers and recreation areas | 45 to 50 | **47** |
| Kitchen, laundry and maintenance areas | <55 | **53** |
| Sleeping areas (night time)— Hotels and motels in suburbs or near minor roads | 30 to 35 | **33** |
| Washrooms and toilets | 45 to 55 | **50** |
| **Sports and Clubs Building** | | |
| Leisure centre and gaming (gymnasium) | **40 to 50** | **45** |

*Note 1: Overall recommended level for mechanical services noise and intrusive noise, combined.*

Section 6.18 of AS/NZ 2107:2016 notes that the presence of discrete frequencies or narrow band signals may cause the sound level to vary spatially within a particular area and be a source of distraction for occupants. Where this occurs, the sound level shall be determined as the highest level measured in the occupied location(s).

If tonal components are significant characteristics of the sound within a measurement time interval, an adjustment shall be applied for that time interval to the measured A-weighted sound pressure level to allow for the additional annoyance. If the background sounds include spectral imbalance, then the RC (Mark II) levels indicated in the Standard should be referenced (see also Appendix D of AS/NZ 2107:2016 for additional guidance).

**Generally, where the final noise levels are within +/- 2 dB of the specified level given above, the design criteria will be considered met. Both the upper and lower limits will need to be satisfied, especially where privacy is important or where noise intrusion is to be avoided.**

## 3.2 Hospital Helicopter Landing Site (HLS)

As outlined in section 1.3 above, Stage One (1) of the Clinical Services Building (CSB) at Nepean Hospital is currently under construction. Located on the roof of the future building will be a purpose-built Helicopter Landing Site (HLS) for emergency arrivals of patients.

Information included in the State Significant Development Application (SSD-8766) for the Nepean Hospital redevelopment included expected number of helicopter arrivals per week, preferred flight paths, helicopter types and associated noise levels. This information has been adopted for the purposes of our façade analysis.

With regards to internal noise levels we note:

### 3.2.1 Australian Standard AS 2021:2016 Acoustics–Aircraft noise intrusion–Building siting and construction

Noise associated with Australian Aerodromes (i.e. Airports) are assessed in accordance with Australian Standard AS 2021:2015. AS2021 recommends that the architectural acoustic treatment should be designed to achieve the indoor design noise levels listed in Table 3.3 of the Standard. These levels are shown in Table 7.

**Table 7 Indoor design noise levels to determine acoustic treatment for aircraft noise intrusion**

| Building type and activity | Indoor Design Noise Level[1], dBA |
|---|---|
| Hotels, motels, hostels | |
| sleeping: | 50 |

*Notes:*

1. ** These indoor design sound levels are not intended to be used for measurement of adequacy of construction. For measurement of the adequacy of construction against aircraft noise intrusion see Appendix D of AS2021:2015.*

**Note:**

- Section 1.1 of AS2021 states *"This Standard deals specifically with noise from take-off, landing and circuit training operations at **civil aerodromes or military airfields**"*.

- Information provided in the Australian Governments Civil Aviation Safety Authority (CASA) has a certified register of Aerodromes in Australia (https://www.casa.gov.au/aerodromes/aerodromes-register/certified-aerodromes-register). Nepean Hospital (or any Hospital HLS) HLS are not listed.

- Therefore, in our professional opinion we believe strict compliance with Australian Standard AS2021:2015 is not required for this project as the HLS located on the roof of the future CSB is not defined as a certified Aerodrome.

### 3.2.2 NSW Health Infrastructure Engineering Services Guidelines (ESG) August 2006

The purpose of the NSW Health Infrastructure Engineering Services Guideline (ESG) is to provide a performance-based guide for the development of design and specification documentation for health care facilities. With regards to internal noise levels the ESG states:

> ***Internal Noise Levels - Generally***
>
> ***Environmental Noise Intrusion***
>
> *Intermittent Noise*
>
> *Infrequent and short duration noise sources such as aircraft; trains and emergency vehicles will have varying impacts on the amenity of internal spaces relative to steady state / continuous noise and therefore should not be assessed using the same criteria.*
>
> *The design should limit intermittent noise to achieve the maximum internal noise levels outlined in Column B of Table 12.*
>
> *Helicopters Associated with Hospital Operations*
>
> *Helicopter operations can exhibit similar noise characteristics to fixed wing aircraft pass-bys and also generate high levels of short period steady noise levels hovering or idling.*

*However, emergency medical helicopter operations differ from fixed wing aircraft as follows:*

- *They can occur at any time of day or night*
- *They are generally much less frequent than fixed wing aircraft operations near a typical airport and*
- *They are directly associated with the hospital facility.*

*Criteria for managing noise from emergency medical helicopter operations therefore differ from standards that apply to noise from fixed wind aircraft. Column C of Table 12 provides recommended design noise levels applicable to frequent operations (1 or more missions per day, on average). These criteria may be adjusted, in consultation with the client, to account for the frequency of emergency operations, using a risk-based approach as follows:*

- *Up to 10dBA less stringent if helicopter operations are less than 1 mission per day, but more than 2 missions per week, on average*
- *Up to 20dBA less stringent if helicopter operations are very infrequent (less than 2 missions per week, on average) and subject to:*
- *an absolute limit of 80dBL Amax for any occupied room and*

**Table 3-8 Summary of Internal Noise Levels (ESG – Table 12)**

| Area Designation | Column C<br>Internal Noise Levels Helicopter ($L_{AMax}$ dB) |
|---|---|
| **CLINICAL SPACES** | |
| Patient Room / Single Bed Ward | 55 |

*Note 1: All sound pressure levels referenced to 20micro-Pascals (dB re 20 µPa).*

### 3.2.3 Recommended Acoustic Criteria

As detailed above, future hotel room internal noise levels from the operation of the HLS are not governed in NSW. However, Pulse Acoustics believe the consideration of the future peaceful acoustic amenity of the hotel rooms should be considered. As such, we would recommend the internal noise criteria as outlined in AS2021:2015 + 10 dBA (i.e. AS2021 + NSW Health Dispensation) still be adopted and assessed. As such we have provided two sets of recommendations based on the decision of the client to proceed with the additional acoustic treatment.

Information regarding the flight path movement, number of expected flights, helicopter type and noise level are adopted from the SSD 8766 Acoustic Report prepared by Acoustic Logic Consultancy. Further details are provided below.

## 3.3 Noise Emission Criteria (Operational Criteria)

Noise emissions from the operation of the site impacting on the adjacent land users are outlined below. Noise emissions expected from the use of the site include: basement carpark and associated driveway, mechanical services, and restaurant and bar areas.

### 3.3.1 Penrith City Council Development Control Plan (DCP) 2014

Acoustic related items from Penrith City Council Development Control Plan (DCP) 2014 state the following:

> ***Section C12 Noise and Vibration***
>
> ***12.4 Industrial and Commercial Development***
>
> ***C. Controls***
>
> *1. General*
>
> *a) Council will not grant consent to any noise generating industrial development, commercial development, or licensed premises unless it can be demonstrated that:*
>
> *i. The development complies with the relevant State Government authority or agency standards and guidelines for noise, as well as any relevant Australian Standards.*
>
> *ii. The development is not intrusive (as defined in the EPA's Industrial Noise Policy).*
>
> *iii. Road traffic noise generated by the development complies with the provisions of Section 12.1 Road Traffic Noise of this Section.*
>
> *iv. The development complies with rail noise and vibration criteria (refer Section 12.2 Rail Traffic Noise and Vibration of this Section); and*
>
> *v. The development does not adversely impact on the amenity of the area or cause sleep disturbance.*

**Note: NSW EPA's *Industrial Noise Policy (INP) 2000* has been superseded by the NSW EPA's *Noise Policy for Industry (NPI) 2017.***

### 3.3.2 NSW EPA Noise Policy for Industry (NPI) 2017

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

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

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

#### 3.3.2.1 Intrusive Noise Impacts (Residential Receivers)

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

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

#### 3.3.2.2 Protecting Noise Amenity (All Receivers)

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

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

Project amenity noise level for industrial developments is specified as the recommended amenity noise level (Table 2.2 of the NPI) minus 5 dBA. To standardise the time periods for the intrusiveness and amenity noise levels, this policy assumes that the $L_{Aeq,15min}$ will be taken to be equal to the $L_{Aeq,period}$ + 3 decibels (dB).

Where the resultant project amenity noise level is 10 dB or more lower than the existing traffic noise level, the project amenity noise levels can be set at 15 dB below existing traffic noise levels (i.e. *LAeq,period(traffic) minus 15 dBA*).

##### 3.3.2.2.1 Area Classification

The NSW NPI characterises the "Urban Residential" noise environment as an area that has the following characteristics:

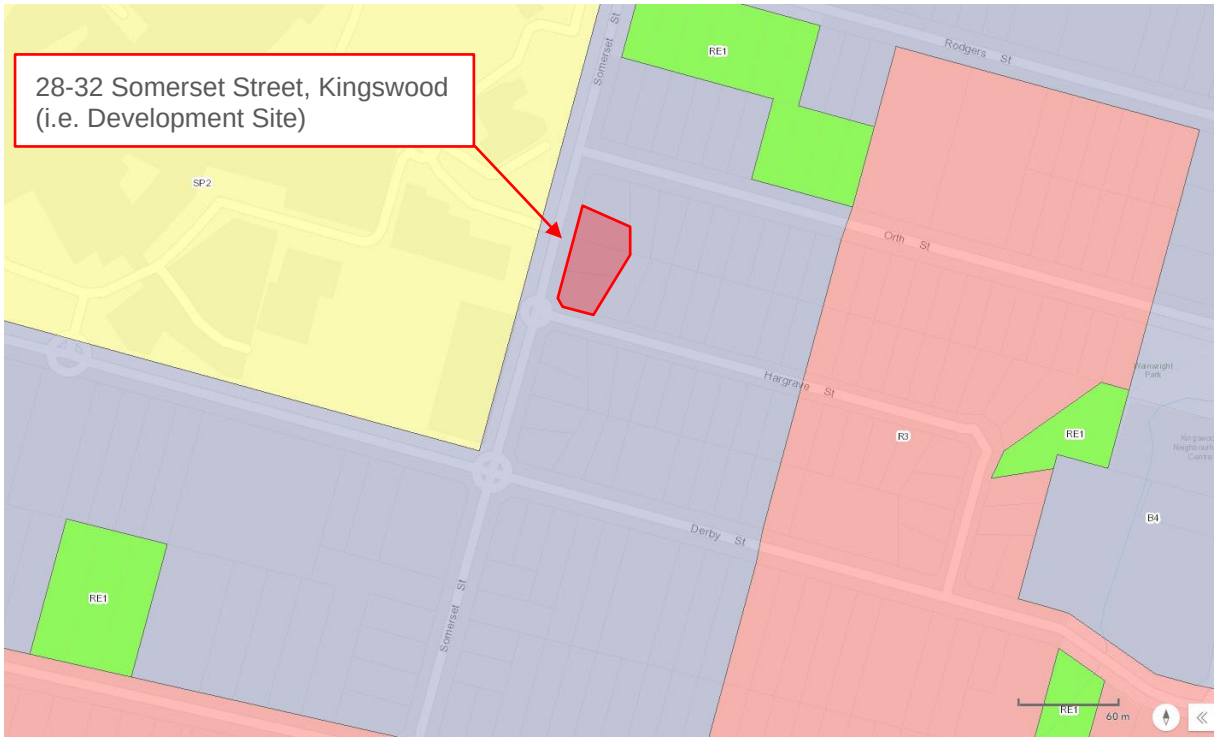
- An acoustical environment that:

  *Urban residential–*

  - *an area that is dominated by 'urban hum' or industrial source noise, where urban hum means the aggregate sound of many unidentifiable, mostly traffic and/or industrial related sound sources. Has through-traffic with characteristically heavy and continuous traffic flows during peak periods. Is near commercial districts or industrial districts. Has any combination of the above.*

Figure 6 is obtained from the NSW Planning *ePlanning Spatial Viewer* website; it shows the land zoning map of the proposed development and the nearest sensitive receivers.

**Figure 6 NSW Planning *ePlanning Spatial Viewer***




As shown above, the site and its surrounding receivers are within are a mix of SP2, R3 and B4 zoning. Based on the acoustical characteristics measured and observed onsite, as well as the description above, the surrounding residences are deemed Suburban Residential.

**Table 9 NSW NPI – Recommended $L_{Aeq}$ Noise Levels from Noise Sources**

| Type of Receiver | Indicative Noise Amenity Area | Time of Day[1] | Recommended Amenity Noise Level ($L_{Aeq, period}$)[2] (dBA) |
|---|---|---|---|
| Residence | Urban Residential | Day | 60 |
| | | Evening | 50 |
| | | Night | 45 |

*Note 1: For Monday to Saturday, Daytime 7:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 7:00 am. On Sundays and Public Holidays, Daytime 8:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 8:00 am*

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

### 3.3.2.3 Project Trigger Noise Levels

The intrusive and amenity criteria for industrial noise emissions, derived from the measured data, are presented in Table 10. These criteria are nominated for the purpose of determining the operational noise limits for mechanical plant associated with the development which can potentially affect noise-sensitive receivers.

For each assessment period, the lower (i.e. the more stringent) of the amenity or intrusive criteria are adopted, which are shown in bold text in Table 10.

**Table 10 External noise level criteria in accordance with the NSW NPI**

| Location | Time of Day [1] | Project Amenity Noise Level, $L_{Aeq, period}$ [2] (dBA) | Measured $L_{A90, 15\ min}$ (RBL) [3] (dBA) | Measured $L_{Aeq, period}$ Noise Level (dBA) | Intrusive $L_{Aeq, 15\ min}$ Criterion for New Sources (dBA) | Amenity $L_{Aeq, 15\ min}$ Criterion for New Sources (dBA) |
|---|---|---|---|---|---|---|
| Location 1, 30-32 Boundary Fence. (See Figure 3) | Day | 55 | 45 | 48 | **50** | 58 |
| | Evening | 45 | 37 | 49 | **42** | 48 |
| | Night | 40 | 34 | 49 | **39** | 43 |

*Note 1: For Monday to Saturday, Daytime 7:00 am – 10:00 pm; Night-time 10:00 pm – 7:00 am. On Sundays and Public Holidays, Daytime 8:00 am – 10:00 pm; Night-time 10:00 pm – 8:00 am.*

*Note 2: Project Amenity Noise Levels corresponding to the discussion in Section 3.3.1 (i.e. existing $L_{Aeq}$ noise level - 15dBA).*

*Note 3: $L_{A90}$ Background Noise or Rating Background Level.*

*Note 4: Project Noise Trigger Levels are shown in bold and underline.*

*Note 5: Calculated based on the attended and unattended noise surveys.*

### 3.3.3 NSW EPA Road Noise Policy (RNP) 2011

In order to determine the noise impact on local roads, the future traffic generated by the proposed site is compared with the existing traffic. The noise impact on residences from local road traffic is considered significant if the vehicle number on surrounding roads increases by around 60% of the existing traffic volumes (this would result in an increase in traffic noise by 2 dB).

### 3.3.4 Liquor & Gaming NSW

Section 79 of the Liquor Act 2007 provides mechanisms for complaints to be made when the amenity of local areas is disturbed by the use of licensed premises and registered clubs (including disturbances caused by patrons). These complaints are addressed by the Director of Liquor and Gaming, and in this process they may impose temporary or permanent noise conditions on the licensed venue. Typical noise conditions that are imposed upon licensed premises are as follows:

> *The $L_{A10}$* noise level emitted from the licensed premises shall not exceed the background noise level in any Octave Band Centre Frequency (31.5 Hz – 8k Hz inclusive) by more than 5 dB between 07:00 am and 12:00 midnight at the boundary of any affected residence.*
>
> *The $L_{A10}$* noise level emitted from the licensed premises shall not exceed the background noise level in any Octave Band Centre Frequency (31.5 Hz – 8k Hz inclusive) between 12:00 midnight and 07:00 am at the boundary of any affected residence.*
>
> *Notwithstanding compliance with the above, the noise from the licensed premises shall not be audible within any habitable room in any residential premises between the hours of 12:00 midnight and 07:00 am.*
>
> ** For the purposes of this condition, the $L_{A10}$ can be taken as the average maximum deflection of the noise emission from the licensed premises.*
>
> *This is a minimum standard. In some instances the Director may specify a time earlier than midnight in respect of the above condition.*
>
> *Interior noise levels which still exceed safe hearing levels are in no way supported or condoned by the Director.*

These criteria are applicable to noise emissions from the licensed venue component of the development, excluding noise from mechanical services. For external noise emissions, octave band spectral criteria for each assessment period has been summarised in Table 11 below.

These are based on the measured noise spectra shown in Table 4 and have been adjusted to match the overall RBLs listed in Table 1.

**Table 11 Liquor & Gaming NSW – $L_{10}$ Criteria (external)**

| Parameter [1] | Octave Band Centre Frequency, Hz | | | | | | | | | Overall dBA |
|---|---|---|---|---|---|---|---|---|---|---|
| | 31.5 | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k | |
| **7:00am to 6:00pm (Day)** | | | | | | | | | | |
| Measured $L_{A90}$ | 50 | 48 | 47 | 39 | 36 | 34 | 28 | 24 | 16 | 40 |
| **Criteria $L_{A10}$** | **55** | **53** | **52** | **44** | **41** | **39** | **33** | **29** | **21** | **45** |
| **6:00pm to 10:00pm (Evening Time)** | | | | | | | | | | |
| Measured $L_{A90}$ | 47 | 45 | 44 | 36 | 33 | 31 | 25 | 21 | 13 | **37** |
| **Criteria $L_{A10}$** | **52** | **50** | **49** | **41** | **38** | **36** | **50** | **26** | **18** | **42** |
| **10:00pm to 12:00am (Early Night)** | | | | | | | | | | |
| Measured $L_{A90}$ | 45 | 43 | 42 | 34 | 31 | 29 | 23 | 19 | 11 | **35** |
| **Criteria $L_{A10}$** | **50** | **48** | **47** | **39** | **36** | **34** | **28** | **24** | **16** | **40** |
| **12:00am to 7:00am (After Midnight)** | | | | | | | | | | |
| Measured $L_{A90}$ | 44 | 43 | 42 | 34 | 31 | 29 | 23 | 19 | 11 | **34** |
| **Criteria $L_{A10}$** | **44** | **43** | **42** | **34** | **31** | **29** | **23** | **19** | **11** | **34** |

*Note 1: Measured $L_{A90}$ spectrum has been adjusted to match overall RBL for corresponding periods.*

## 3.4 Acoustic Separation Criteria

Acoustic separation between apartments/dwellings within the development must comply with the requirements listed below.

### 3.4.1 National Construction Code (NCC) & Building Code of Australia (BCA) 2019

The Building Code of Australia (BCA) is a uniform set of technical provisions for the design and construction of buildings and other structures throughout Australia. The BCA is produced and maintained by the Australian Building Codes Board (ABCB) and given legal effect through the Building Act 1975. The National Construction Code (NCC) comprises the Building Code of Australia and the Plumbing Code of Australia (the Plumbing Code of Australia is given legal effect through the Plumbing and Drainage Act 2002 (Qld)) and is published in three volumes. Volumes one and two relate to the BCA.

Part F5 of Volume One of the BCA / NCC provides the Sound Transmission and Insulation requirements for Class 2 or 3 buildings. These requirements are identified below:

#### 3.4.1.1 Inter-Tenancy Walls (Apartment to Apartment)

***Section FP5.2 of the BCA requires:***

> *Walls separating sole-occupancy units or a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby, or the like, or parts of a different classification, must provide insulation against the transmission of -*

a) *airborne sound; and*

b) *impact generated sound, if the wall is separating a bathroom, sanitary compartment, laundry or kitchen in one sole-occupancy unit from a habitable room (other than a kitchen) in an adjoining unit,*

*Sufficient to prevent illness or loss of amenity to the occupants.*

***F5.5 of the BCA provides the sound insulation performance rating of walls as follows:***

a) *A wall in a Class 2 or 3 building must –*

   i. *have an Rw + Ctr (airborne) not less than 50, if it separates sole-occupancy units; and*

   ii. *have an Rw (airborne) not less than 50, if it separates a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification; and*

   iii. *comply with F5.3(b) if it separates—*

      a) *a bathroom, sanitary compartment, laundry or kitchen in one sole-occupancy unit from a habitable room (other than a kitchen) in an adjoining unit; or*

      b) *a sole-occupancy unit from a plant room or lift shaft.*

b) *A door may be incorporated in a wall in a Class 2 or 3 building that separates a sole-occupancy unit from a stairway, public corridor, public lobby or the like, provided the door assembly has an Rw not less than 30.*

c) *A wall in a Class 9c building must have an Rw not less than 45 if it separates—*

   i. *sole-occupancy units; or*

   ii. *a sole-occupancy unit from a kitchen, bathroom, sanitary compartment (not being an associated ensuite), laundry, plant room or utilities room.*

d) *In addition to (c), a wall separating a sole-occupancy unit in a Class 9c building from a kitchen or laundry must comply with F5.3 (b).*

e) *Where a wall required to have sound insulation has a floor above, the wall must continue to -*

   i. *the underside of the floor above; or*

   ii. *a ceiling that provides the sound insulation required for the wall.*

f) *Where a wall required to have sound insulation has a roof above, the wall must continue to-*

   i. *the underside of the roof above; or*

   ii. *a ceiling that provides the sound insulation required for the wall.*

***FV5.2 states that compliance with FP5.2(a) to avoid the transmission of airborne sound through walls is verified when it is measured in-situ that –***

a) *a wall separating sole-occupancy units has a weighted standardised level difference with spectrum adaptation term (DnT,w + Ctr) not less than 45 when determined under AS/NZS 1276.1 or ISO 717.1; or*

b) *a wall separating a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby, or the like, or parts of a different classification, has a weighted standardised level difference (DnT,w) not less than 45 when determined under AS/NZS 1276.1 or ISO 717.1; or*

c) *any door assembly located in a wall that separates a sole-occupancy unit from a stairway, public corridor, public lobby, or the like, has a weighted standardised level difference (DnT,w) not less than 25 when determined under AS/NZS 1276.1 or ISO 717.1.*

***F5.3 (b) states the following:***

a) *A floor in a building required to have an impact sound insulation rating must -*

i. *have the required value for weighted normalised impact sound pressure level (Ln,w) determined in accordance with AS ISO 717.2 using results from laboratory measurements; or*

ii. *comply with Specification F5.2.*

b) *A wall in a building required to have an impact sound insulation rating must -*

i. *for a Class 2 or 3 building be of discontinuous construction; and*

ii. *for a Class 9c building, must—*

a) *for other than masonry, be two or more separate leaves without rigid mechanical connection except at the periphery; or*

b) *be identical with a prototype that is no less resistant to the transmission of impact sound when tested in accordance with Specification F5.5 than a wall listed in Table 2 of Specification F5.2.*

c) *For the purposes of this Part, discontinuous construction means a wall having a minimum 20 mm cavity between 2 separate leaves, and*

i. *for masonry, where wall ties are required to connect leaves, the ties are of the resilient type; and*

ii. *for other than masonry, there is no mechanical linkage between leaves except at the periphery.*

### 3.4.1.2 Inter-Tenancy Floors (Apartment to Apartment)

**Section FP5.1 of the BCA states that for Class 2 or 3 buildings:**

*Floors separating -*

a) *sole-occupancy units; or*

b) *sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby, or the like, or a part of a different classification,*

*must provide insulation against the transmission of airborne and impact generated sound sufficient to prevent illness or loss of amenity to the occupants.*

F5.4 provides the sound insulation performance rating of floors as follows:

a) *A floor in a Class 2 or 3 building must have an $R_w+C_{tr}$ (airborne) not less than 50 and an $L_{n,w}$ (impact) not more than 62 if it separates—*

   *(i) sole-occupancy units; or*

   *(ii) a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification.*

b) *A floor in a Class 9c building separating sole-occupancy units must have an Rw not less than 45.*

**FV5.1 states that compliance with FP5.1 is verified when it is measured in-situ that the separating floor has -**

a) *airborne: a weighted standardised level difference with spectrum adaptation term ($D_{nT,w}$ + $C_{tr}$) not less than 45 when determined under AS/NZS 1276.1 or ISO 717.1; and*

b) *impact: a weighted standardised impact sound pressure level with ($L_{nT,w}$) not more than 62 when determined under AS ISO 717.2.*

#### 3.4.1.3 Summary of BCA Acoustic Requirements

A summary of the acoustic requirements of the NCC 2019 for Class 2 or 3 buildings is given in Table 12 below.

**Table 12 NCC 2019 Sound Insulation Requirements**

| Construction | 2019 NCC | |
|---|---|---|
| | Laboratory performance requirements | Verification method |
| Walls between sole occupancy units | $R_w + C_{tr}$ not < 50 | $D_{nT,w} + C_{tr}$ not < 45 |
| Walls between a bathroom, sanitary compartment, laundry or kitchen in one sole occupancy unit and a habitable room (other than a kitchen) in an adjoining unit | $R_w + C_{tr}$ not < 50<br>and<br>Must have a minimum 20 mm cavity between two separate leaves | $D_{nT,w} + C_{tr}$ not < 45<br>"Expert Judgment"<br>Comparison to the "Deemed to satisfy" Provisions |
| Walls between sole occupancy units and a plant room or lift shaft | $R_w$ not < 50<br>and<br>Must have a minimum 20 mm cavity between two separate leaves[1] | $D_{nT,w}$ not < 45 |
| Walls between sole occupancy units and a stairway, public corridor, public lobby or the like, or parts of a different classification | $R_w$ not < 50 | $D_{nT,w}$ not < 45 |
| Door assemblies located in a wall between a sole-occupancy unit and a stairway, public corridor, public lobby or the like | $R_w$ not < 30 [2] | $D_{nT,w}$ not < 25 |
| Floors between sole-occupancy units or between a sole-occupancy unit and a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification | $R_w + C_{tr}$ not < 50<br>$L_{n,w}$ not > 62 | $D_{nT,w} + C_{tr}$ not < 45<br>$L'_{nT,w}$ not > 62 |
| Soil, waste, water supply and stormwater pipes and ductwork to habitable rooms | $R_w + C_{tr}$ not < 40 | n/a |
| Soil, waste, water supply and stormwater pipes and ductwork to kitchens and other rooms | $R_w + C_{tr}$ not < 25 | n/a |
| Intra-tenancy Walls | There is no statutory requirement for airborne isolation via intra-tenancy walls. | |

*Note 1: A wall must be of "discontinuous construction" if it separates a sole occupancy unit from a plant room or lift shaft. Clause F5.3(c) defines "discontinuous construction" as a wall having a minimum 20mm cavity between two separate leaves with no mechanical linkage except at the periphery.*

*Note 2: Clause FP5.3(b) in the 2016 BCA states that the required insulation of a floor or wall must not be compromised by a door assembly.*

*Note 3: Masonry walls must be laid with all joints filled solid, including those between the masonry and any adjoining construction*

# 4 ACOUSTIC ASSESSMENT

In addressing all the criteria shown above, each component of the development is assessed and presented below.

## 4.1 Noise Intrusion – Building Envelope

### 4.1.1 Modelling Scenario

#### 4.1.1.1 Traffic Noise Assessment

The results of the monitoring that provides the traffic façade noise levels of the proposed building are presented in Table 5. The relevant noise intrusion criterion are summarised in Table 13 below together with the monitored external noise levels and the predicted noise levels on the northern, eastern, southern and western building facades.

**Table 13 Summary of Facade Noise Levels and Relevant Assessment Criteria – *Traffic Noise Only***

| Facade Location | Day Time [1 2] (dBA) $L_{Aeq\ (Whole\ Period)}$ | Night Time [1 2] (dBA) $L_{Aeq\ (Whole\ Period)}$ |
|---|---|---|
| **Measured/Predicted Façade Noise Levels** | | |
| **Future Northern Façade** (Towards Orth Street) | 61 | 48 |
| **Future Eastern Façade** (Towards 1 Hargrave Street) | - | - |
| **Future Southern Façade** (Hargrave Street) | 62 | 46 |
| **Future Western Façade** (Somerset Street) | 64 | 51 |
| **Noise Criteria Applicable (All Facades)** | | |
| Bars and lounges | **47** | |
| Conference areas— (Up to 50 persons) | **37** | |
| Dining rooms | **43** | |
| Enclosed Carparks | **63** | |
| Foyers and recreation areas | **47** | |
| Kitchen, laundry and maintenance areas | **53** | |
| Sleeping areas (night time)— Hotels and motels in suburbs or near minor roads | **33** | |
| Washrooms and toilets | **50** | |
| Leisure centre and gaming (gymnasium) | **40 to 50** | |

*Note 1: For Monday to Sunday, Daytime 7:00 am – 10:00 pm; Night-time 10:00 pm – 7:00 am.*

*Note 2: For internal noise level criteria which are presented as a range, compliance is determined based on the highest level in the range.*

#### 4.1.1.2 Helicopter Noise Assessment

As outlined in section 3.2 above, External noise intrusion from emergency helicopters are not mandatory for this project, however we believe in our professional opinion they should be addressed. Information regarding the flight path, operations etc. contained in the Hospital SSD Acoustic Report prepared by Acoustic Logic include:

- *A Leonardo Augusta Westland139 as the typical helicopter. In our experience, this has a sound power level of approximately 135dB(A)$L_{Max}$.*
- *A take-off/approach gradient of 2.5% for the 3500m nearest the helipad (based on typical advice from Aviation Consultant).*
- *• Typical flight paths are north/south, as shown in the aerial photo in section 2.*
- *The infrequency of flight movements should be considered (we are advised, on average, 2-3 times per week/120 times per year).*
- *Similarly, the duration of the noise event will be very short. In all likelihood there will be two noise events of less than one minute each (for the inbound and outbound movement). The maximum levels of up to 90dB(A) however (at the nearest point on the helicopter flight path) and would occur for only 3-4 seconds.*

**Figure 7 SSD Acoustic Assessment – Acoustic Logic Report – *Figure 1 – Site Context***

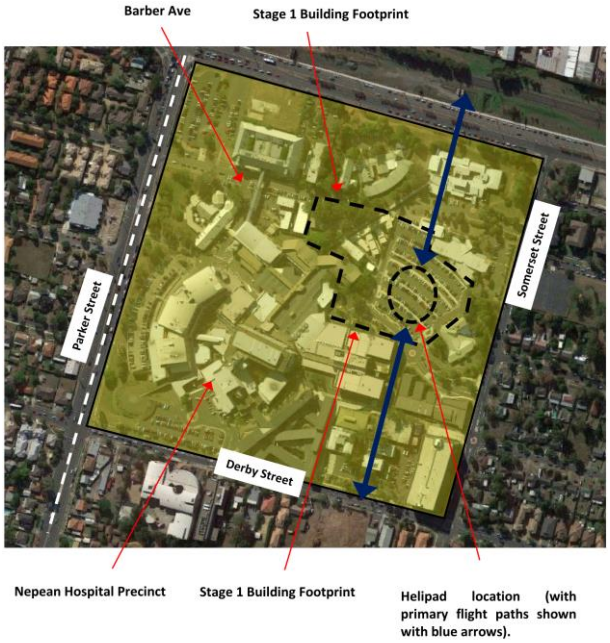



Figure 1 – Site Context

Adoption of the internal noise criteria as outlined in AS2021:2015 + 10dBA dispensation as nominated by NSW Health Infrastructure ESG for HLS which are less than one (1) flight a day, however, more than two (2) per week on average.

### 4.1.2 Glazing Recommendations

The recommended sound transmission loss requirement required to satisfy the specified internal noise level criteria outlined above are summarised in Table 14 below. As discussed above, internal noise level criteria for emergency helicopter movements is not mandatory. Therefore we have provided a façade recommendation for both options (traffic noise only or traffic noise and helicopter noise). This decision will be at the client's discretion. Please note these recommendations are also based on the floor details shown in the architectural drawings included in Appendix C.

**Table 14 In-principle Glazing Recommendations**

| Location | Level | Space | Source Attenuation | Minimum Glazing System Rating Requirements [1] | Indicative Construction |
|---|---|---|---|---|---|
| Northern Façade (Towards Orth Street) | All levels | Hotel Room | **Traffic noise only** | Rw (C;Ctr): 31 (0;-3) | Doors and windows with 6.38mm Laminate glass and acoustic rated seals, see description below. |
| | | | **Traffic Noise and Emergency Helicopter** | Rw (C;Ctr): 35 (0;-3) | Doors and windows with 10.38mm Laminate glass and acoustic rated seals, see description below. |
| | | Meeting Room | Traffic noise only | Rw (C;Ctr): 33 (0;-3) | Doors and windows with 10mm float glass and acoustic rated seals, see description below. |
| | | Gymnasium | Traffic noise only | Rw (C;Ctr): 31 (0;-3) | Doors and windows with 6.38mm Laminate glass and acoustic rated seals, see description below. |
| Eastern Facade | All levels | Hotel Room | **Traffic noise only** | Rw (C;Ctr): 31 (0;-3) | Doors and windows with 6.38mm Laminate glass and acoustic rated seals, see description below. |
| | | | **Traffic Noise and Emergency Helicopter** | Rw (C;Ctr): 35 (0;-3) | Doors and windows with 10.38mm Laminate glass and acoustic rated seals, see description below. |
| | | Gymnasium | Traffic noise only | Rw (C;Ctr): 31 (0;-3) | Doors and windows with 6.38mm Laminate glass and acoustic rated seals, see description below. |
| Southern Façade (Towards Hargrave Street) | All levels | Hotel Room | **Traffic noise only** | Rw (C;Ctr): 31 (0;-3) | Doors and windows with 6.38mm Laminate glass and acoustic rated seals, see description below. |
| | | | **Traffic Noise and Emergency Helicopter** | Rw (C;Ctr): 35 (0;-3) | Doors and windows with 10.38mm Laminate glass and acoustic rated seals, see description below. |
| | | Lounge [1] | Traffic noise only | Rw (C;Ctr): 35 (0;-3) | Doors and windows with 10.38mm Laminate glass and acoustic rated seals, see description below. |

**Table 15 In-principle Glazing Recommendations**

| Location | Level | Space | Source Attenuation | Minimum Glazing System Rating Requirements [1] | Indicative Construction |
|---|---|---|---|---|---|
| Western Façade (Towards Somerset Avenue) | All levels | Hotel Room | **Traffic noise only** | Rw (C;Ctr): 31 (0;-3) | Doors and windows with 6.38mm Laminate glass and acoustic rated seals, see description below. |
| | | | **Traffic Noise and Emergency Helicopter** | Rw (C;Ctr): 35 (0;-3) | Doors and windows with 10.38mm Laminate glass and acoustic rated seals, see description below. |
| | | Lounge [1] | Traffic noise only | Rw (C;Ctr): 35 (0;-3) | Doors and windows with 10.38mm Laminate glass and acoustic rated seals, see description below. |
| | | Foyer [1] | Traffic noise only | Rw (C;Ctr): 35 (0;-3) | Doors and windows with 10.38mm Laminate glass and acoustic rated seals, see description below. |
| | | Bar [1] | Traffic noise only | Rw (C;Ctr): 35 (0;-3) | Doors and windows with 10.38mm Laminate glass and acoustic rated seals, see description below. |
| Western Façade (Towards Somerset Avenue) | All levels | Meeting | **Traffic noise only** | Rw (C;Ctr): 31 (0;-3) | Doors and windows with 6.38mm Laminate glass and acoustic rated seals, see description below. |
| | | | **Traffic Noise and Emergency Helicopter** | Rw (C;Ctr): 35 (0;-3) | Doors and windows with 10.38mm Laminate glass and acoustic rated seals, see description below. |
| | | Dining rooms [1] | Traffic noise only | Rw (C;Ctr): 35 (0;-3) | Doors and windows with 10.38mm Laminate glass and acoustic rated seals, see description below. |

*Note 1: Recommendations for glazing constructions are also nominated above which include allowances for noise emission control.*
*Note 2: These are preliminary selections will be confirmed in the detailed design stage once the layouts and façade orientations are approved.*

Please note that, for windows, this performance is not only subject to the glazing selection but also to the construction of the window frame and the frame seal selection. Therefore, it is recommended that the window manufacturer should confirm that the required sound insulation can be achieved. It is anticipated that the window system should comprise Q-Lon (or equivalent) or fin seals with deep C channels as part of the window track **(i.e. Performance levels outlined above need to be achieved with glazed panels + frame + seals).**

### 4.1.3 External Wall Construction

External wall constructions will be constructed either from a solid dense construction (i.e. like a concrete or masonry system) or light weight cladding systems. In the event the external wall is constructed from a solid dense construction as summarised above, no further acoustic upgrading is required.

However, in the event the external walls are constructed from a lightweight cladding system, the following construction is recommended.

**Table 16 Recommended Light Weight External Wall Construction**

| Location | Occupancy Area [1] | External Lining | Studwork System | Internal Lining |
|---|---|---|---|---|
| All Facades **Traffic Noise Only** | Hotel Rooms | 1 x Architectural Finish | Minimum 92mm Steel Studwork + 75mm thick 14kg/m$^3$ glasswool insulation | 1 x 13mm layers of Standard Plasterboard. |
| | Bar, Lounge, Dining, Gym, Meeting | | | 1 x 13mm layers of Standard Plasterboard. |
| | Washrooms and Toilets | | | 1 x 13mm layers of Standard Plasterboard **OR** 1 x 6mm Fibre Cement Sheeting |
| All Facades **Traffic & Helicopter Noise** | Hotel Rooms | 1 x Architectural Finish + 1 x 9mm Fibre Cement Sheeting | | 2 x 13mm layers of Standard Plasterboard. (recommended for noise breakout) |
| | Bar, Lounge, Dining, Gym, Meeting | | | 1 x 13mm layers of Standard Plasterboard. |
| | Washrooms and Toilets | | | 1 x 13mm layers of Standard Plasterboard **OR** 1 x 6mm Fibre Cement Sheeting |

*Note 1: Recommended constructions are identical for each level.*
*Note 2: These are preliminary selections will be confirmed in the detailed design stage once the layouts and façade orientations are approved.*

If penetrations through any external skin are required, all gaps remaining in the penetration are to be filled with an acoustic grade sealant which provides an equal or better performance to the system being penetrated.

### 4.1.4 External Roof Construction

External roof constructions will be constructed from a solid dense construction (i.e. concrete), no further acoustic upgrading is required. If penetrations through any external skin are required, all gaps remaining in the penetration are to be filled with an acoustic grade sealant which provides an equal or better performance to the system being penetrated.

## 4.2 Noise from Engineering Services

At this stage of the project, the location of major plant items has been selected, however the exact selection to be installed is not known. As such, a detailed assessment of noise associated from engineering services cannot be undertaken.

However, from a preliminary review of typical noise levels in plant rooms we do note the following:

- Concrete slabs which separate habitable spaces (common or hotel rooms) should be designed as a minimum of 200mm thick and allow for an acoustically suspended ceiling below, above, or both, depending on its location.
- All plant is to be isolated from the base building structure with the correctly size isolation system.
- Air Conditioning Condenser Plant Room: All non-required areas for airflow are to be closed off with a minimum of 2 x 9mm Fibre Cement Sheeting. Areas which are required for airflow will require the installation of acoustic attenuators or acoustic louvres between 300-600mm deep (depending on performance and selections).
- Rooms which contain hydraulic pumps depending on their size and airflow requirements will need to adopt a similar approach to above.
- Mechanical plant rooms will require acoustic treatment before any discharge grilles.

**All of these recommendations are indicative only and a full detailed acoustic review should be undertaken prior to installation to ensure compliance with the project criteria.**

## 4.3 Licensed Bar and Dining Areas – Noise Emissions

The development has two main licensed areas; an internal bar and lounge area located on ground level separated by the foyer/entry. The second area located on the rooftop includes an internal bar and dining area and an external seating area around the perimeter (northern, southern, and eastern).

### 4.3.1 Assessment of Licensed Areas

For the purpose of this assessment we have assumed the following noise levels:

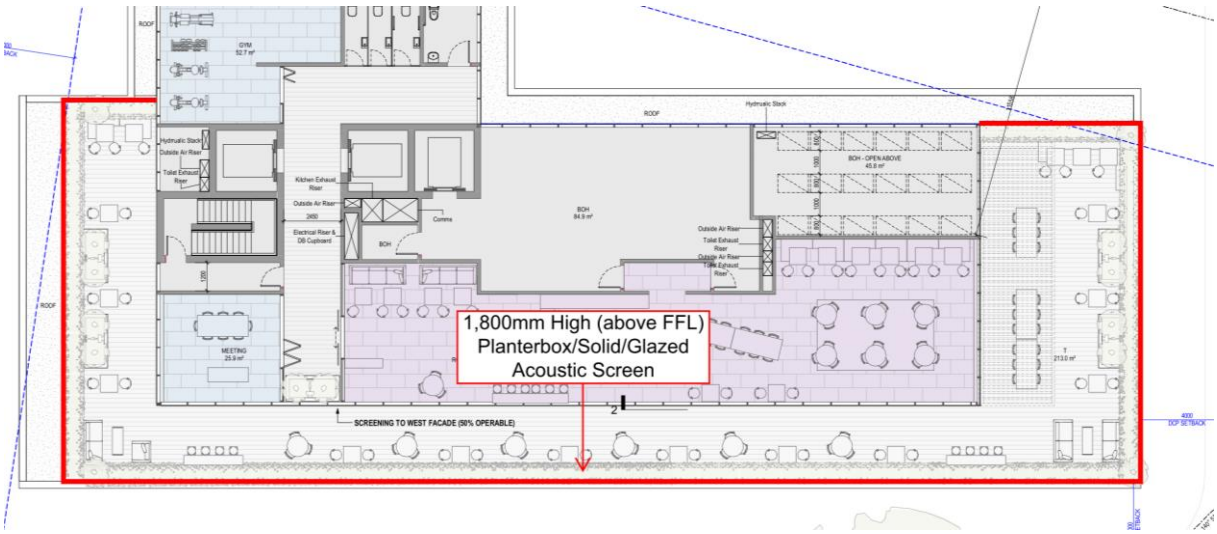
- Single person talking – 72dBA $L_{Aeq}$.
- Background music (for internal areas only) – 75dBA $L_{Aeq}$ within the space.

Predicted noise levels associated with the licensed areas is addressed in the table below. The predictions below have been determined based on the following assumptions:

- Use of the ground level lounge and bar area is between 6:00am-12:00pam Monday to Sunday and Public Holidays.
- Use of the internal rooftop bar and dining area is between 6:00am-12:00am Monday to Sundays and Public Holidays.
- All internal communal areas are to have a glazing construction of 10.38mm Laminate with a Rw (C;Ctr): 35 (0;-3). ALL facades will be closed between 10:00pm and 7:00am.
- Background music is only used within internal areas and does not exceed 75dBA within the space (i.e. SPL).

- All windows and doors of any internal areas are to be closed after 10:00pm and not open before 7:00am.
- A continuous glazed/solid balustrade must be constructed around the entire perimeter of the outdoor dining/bar area as shown below. The height of the balustrade must be a minimum of 1,800mm above the finished floor level.
- Number of people in each space:
    - Ground Level Lounge: 84 people (not including staff).
    - Ground Level Bar: 36 people (not including staff).
    - Rooftop Bar & Dining:
        - Internal: 75 people (not including staff).
        - Outdoor: Hargrave Street: 46 people (not including staff).
        - Outdoor: Somerset Street: 38 people (not including staff).
        - Outdoor: Orth Street: 15 people (not including staff).

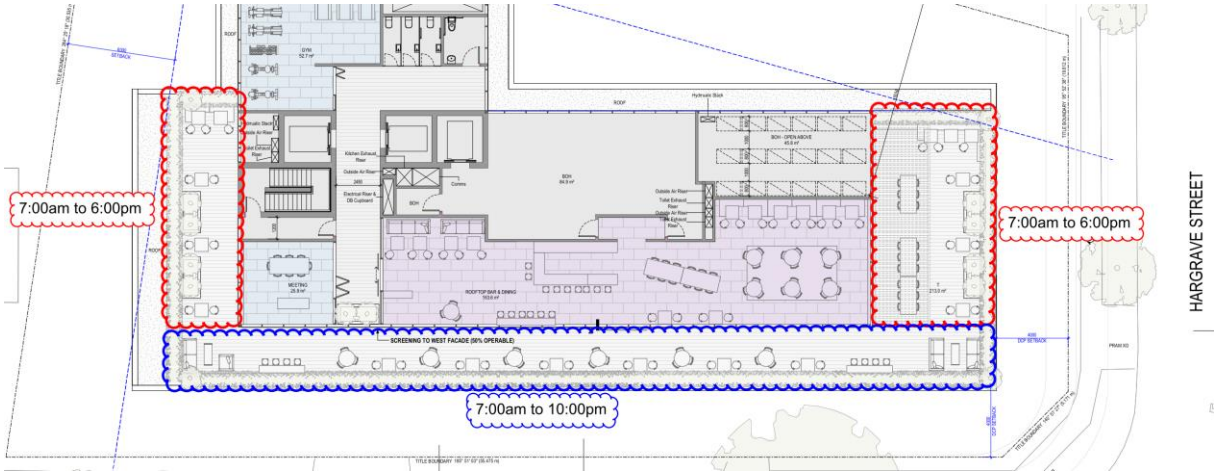
**Figure 8 Acoustic Balustrade Location – 1,800mm High**




- Use of the external rooftop bar/dining area is between 7:00am-10:00pm Monday to Saturdays and 8:00am to 10:00pm Sundays and Public Holidays.

- **However, subject to the above, use of the dining area along the Northern and Southern end of the rooftop external area must be limited to 6:00pm without additional acoustic treatments. Areas along the Western Façade (i.e. Somerset Street) can be used up to 10:00pm. See below.**

**Figure 9 Rooftop External Dining Times**




Noise levels predicted from the use of the internal and external licensed dining or bar areas are provided below.

**Table 17 Predicted Noise Level from the Licensed Areas – Day Period (7:00am to 6:00pm – BG+5dBA)**

| Receiver Location | | Predicted Noise Level dBA $L_{A10\ (15\text{-}minute)}$ | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 31.5 hz | 63 hz | 125 hz | 250 hz | 500 hz | 1 kHz | 2 kHz | 4 kHz | 8 kHz | A-wt | Compliance |
| **Receiver 1:** 26 Somerset Street, Kingswood | Predicted Noise Level | 24 | 27 | 30 | 40 | 42 | 35 | 31 | 27 | 22 | **42** | |
| | Criteria (Day Period) | **55** | **53** | **52** | **44** | **41** | **39** | **33** | **29** | **21** | **45** | |
| | Compliance | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** [1] | **Yes** | **Yes** | **Yes** | **Yes** [1] | **Yes** | **Yes** |
| **Receiver 2:** 38-40 Orth Street, Kingswood | Predicted Noise Level | 24 | 27 | 30 | 40 | 42 | 35 | 31 | 27 | 22 | **42** | |
| | Criteria (Day Period) | **55** | **53** | **52** | **44** | **41** | **39** | **33** | **29** | **21** | **45** | |
| | Compliance | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** [1] | **Yes** | **Yes** | **Yes** | **Yes** [1] | **Yes** | **Yes** |
| **Receiver 3:** 1-3 Hargrave Street, Kingswood | Predicted Noise Level | 23 | 26 | 29 | 39 | 41 | 35 | 31 | 26 | 21 | **41** | |
| | Criteria (Day Period) | **55** | **53** | **52** | **44** | **41** | **39** | **33** | **29** | **21** | **45** | |
| | Compliance | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** |
| **Receiver 4:** 34-36 Somerset Street and 2-4 Hargrave Street, Kingswood | Predicted Noise Level | 22 | 25 | 28 | 39 | 38 | 33 | 28 | 24 | 17 | **40** | |
| | Criteria (Day Period) | **55** | **53** | **52** | **44** | **41** | **39** | **33** | **29** | **21** | **45** | |
| | Compliance | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** |

*Note 1: An exceedance of 1-2dBA is considered negligible and would not constitute additional acoustic treatments to be installed. This approach is consistent with section 4.2 of the NSW EPA Noise Policy for Industry (NPI) 2017 Therefore, compliance is achieved.*

*Note 1: An exceedance of 3-5dBA is considered marginal as per section 4.2 of the NSW EPA Noise Policy for Industry (NPI) 2017.*

**Table 18 Predicted Noise Level from the Licensed Areas – Evening Period (6:00pm to 10:00pm – BG+5dBA)**

| Receiver Location | | Predicted Noise Level dBA $L_{A10\ (15\text{-}minute)}$ | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 31.5 hz | 63 hz | 125 hz | 250 hz | 500 hz | 1 kHz | 2 kHz | 4 kHz | 8 kHz | A-wt | Compliance |
| **Receiver 1:** 26 Somerset Street, Kingswood | Predicted Noise Level | 19 | 22 | 25 | 35 | 37 | 30 | 26 | 22 | 17 | 37 | **Yes** |
| | Criteria (Evening Period) | **52** | **50** | **49** | **41** | **38** | **36** | **50** | **26** | **18** | **42** | |
| | Compliance | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | |
| **Receiver 2:** 38-40 Orth Street, Kingswood | Predicted Noise Level | 14 | 17 | 20 | 30 | 32 | 25 | 21 | 17 | 12 | 32 | **Yes** |
| | Criteria (Evening Period) | **52** | **50** | **49** | **41** | **38** | **36** | **50** | **26** | **18** | **42** | |
| | Compliance | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | |
| **Receiver 3:** 1-3 Hargrave Street, Kingswood | Predicted Noise Level | 13 | 16 | 19 | 29 | 31 | 24 | 20 | 16 | 11 | 31 | **Yes** |
| | Criteria (Evening Period) | **52** | **50** | **49** | **41** | **38** | **36** | **50** | **26** | **18** | **42** | |
| | Compliance | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | |
| **Receiver 4:** 34-36 Somerset Street and 2-4 Hargrave Street, Kingswood | Predicted Noise Level | 18 | 21 | 24 | 34 | 36 | 29 | 25 | 21 | 16 | 36 | **Yes** |
| | Criteria (Evening Period) | **52** | **50** | **49** | **41** | **38** | **36** | **50** | **26** | **18** | **42** | |
| | Compliance | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | |

*Note 1: Northern and southern rooftop dining/bar area not in use.*

**Table 19 Predicted Noise Level from the Licensed Areas – Early Night Period (10:00pm to 12:00am – BG+5dBA)**

| Receiver Location | | Predicted Noise Level dBA $L_{A10\ (15\text{-}minute)}$ | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 31.5 hz | 63 hz | 125 hz | 250 hz | 500 hz | 1 kHz | 2 kHz | 4 kHz | 8 kHz | A-wt | Compliance |
| **Receiver 1:** 26 Somerset Street, Kingswood | Predicted Noise Level | 19 | 16 | 15 | 21 | 17 | 10 | 7 | 0 | 0 | 18 | |
| | Criteria (Early Night) | 50 | 48 | 47 | 39 | 36 | 34 | 28 | 24 | 16 | 40 | |
| | Compliance | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** |
| **Receiver 2:** 38-40 Orth Street, Kingswood | Predicted Noise Level | 14 | 11 | 10 | 16 | 12 | 5 | 2 | 0 | 0 | 13 | |
| | Criteria (Early Night) | 50 | 48 | 47 | 39 | 36 | 34 | 28 | 24 | 16 | 40 | |
| | Compliance | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** |
| **Receiver 3:** 1-3 Hargrave Street, Kingswood | Predicted Noise Level | 13 | 10 | 9 | 15 | 11 | 4 | 1 | 0 | 0 | 12 | |
| | Criteria (Early Night) | 50 | 48 | 47 | 39 | 36 | 34 | 28 | 24 | 16 | 40 | |
| | Compliance | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** |
| **Receiver 4:** 34-36 Somerset Street and 2-4 Hargrave Street, Kingswood | Predicted Noise Level | 17 | 14 | 13 | 19 | 15 | 8 | 5 | 0 | 0 | 16 | |
| | Criteria (Early Night) | 50 | 48 | 47 | 39 | 36 | 34 | 28 | 24 | 16 | 40 | |
| | Compliance | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** |

***Note 1: All windows and doors are closed. No external dining or bar areas in use.***

**Table 20 Predicted Noise Level from the Licensed Areas – Night Period (12:00am to 7:00am – BG+0dBA)**

| Receiver Location | | Predicted Noise Level dBA $L_{A10\ (15\text{-}minute)}$ | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 31.5 hz | 63 hz | 125 hz | 250 hz | 500 hz | 1 kHz | 2 kHz | 4 kHz | 8 kHz | A-wt | Compliance |
| **Receiver 1:** 26 Somerset Street, Kingswood | Predicted Noise Level | 19 | 16 | 15 | 21 | 17 | 10 | 7 | 0 | 0 | 18 | |
| | Criteria (Night Period) | 50 | 48 | 47 | 39 | 36 | 34 | 28 | 24 | 16 | 40 | |
| | Compliance | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** |
| **Receiver 2:** 38-40 Orth Street, Kingswood | Predicted Noise Level | 14 | 11 | 10 | 16 | 12 | 5 | 2 | 0 | 0 | 13 | |
| | Criteria (Night Period) | 50 | 48 | 47 | 39 | 36 | 34 | 28 | 24 | 16 | 40 | |
| | Compliance | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** |
| **Receiver 3:** 1-3 Hargrave Street, Kingswood | Predicted Noise Level | 13 | 10 | 9 | 15 | 11 | 4 | 1 | 0 | 0 | 12 | |
| | Criteria (Night Period) | 50 | 48 | 47 | 39 | 36 | 34 | 28 | 24 | 16 | 40 | |
| | Compliance | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** |
| **Receiver 4:** 34-36 Somerset Street and 2-4 Hargrave Street, Kingswood | Predicted Noise Level | 17 | 14 | 13 | 19 | 15 | 8 | 5 | 0 | 0 | 16 | |
| | Criteria (Night Period) | 50 | 48 | 47 | 39 | 36 | 34 | 28 | 24 | 16 | 40 | |
| | Compliance | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** |

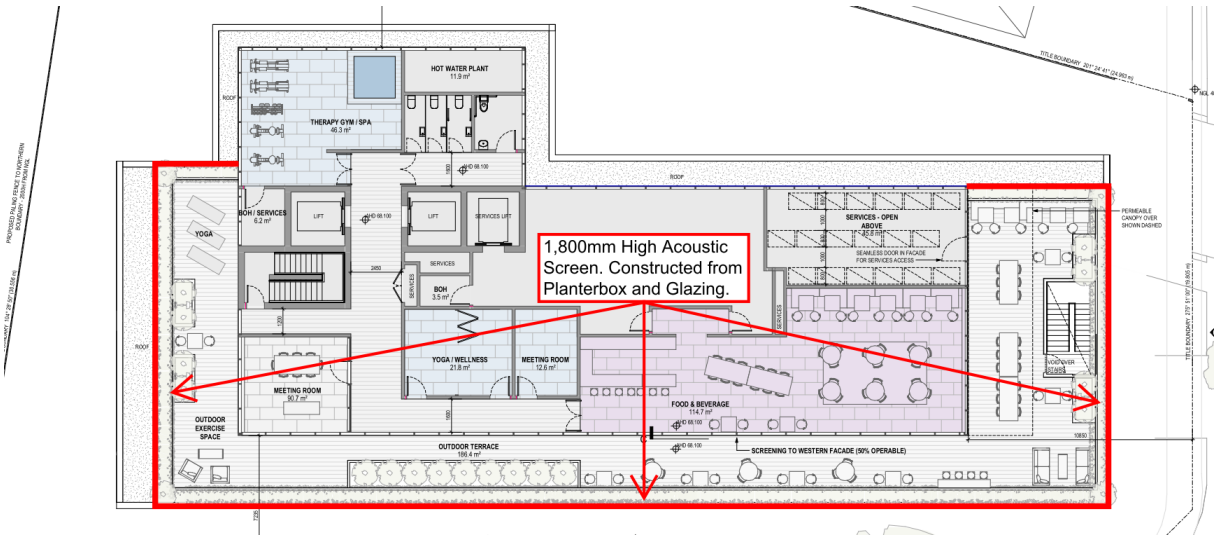
***Note 1: All windows and doors are closed. No external dining or bar areas in use.***

### 4.3.2 Licensed Areas Acoustic Treatments

From our assessment shown above, we recommend the following building treatments as well as management controls be implemented to ensure compliance with the NSW Liquor and Gaming Acoustic Requirements:

- Use of the ground level lounge and bar area is between 6:00am-12:00pam Monday to Sunday and Public Holidays.
- Use of the internal rooftop bar and dining area is between 6:00am-12:00am Monday to Sundays and Public Holidays.
- All internal communal areas are to have a glazing construction of 10.38mm Laminate with a Rw (C;Ctr): 35 (0;-3). ALL facades will be closed between 10:00pm and 7:00am.
- Background music is only used within internal areas and does not exceed 75dBA within the space (i.e. SPL).
- All windows and doors of any internal areas are to be closed after 10:00pm and not open before 7:00am.
- A continuous glazed/solid balustrade must be constructed around the entire perimeter of the outdoor dining/bar area as shown below. The height of the balustrade must be a minimum of 1,800mm above the finished floor level.
- Number of people in each space:
    - Ground Level Lounge: 84 people (not including staff).
    - Ground Level Bar: 36 people (not including staff).
    - Rooftop Bar & Dining:
        - Internal: 75 people (not including staff).
        - Outdoor: Hargrave Street: 46 people (not including staff).
        - Outdoor: Somerset Street: 38 people (not including staff).
        - Outdoor: Orth Street: 15 people (not including staff).

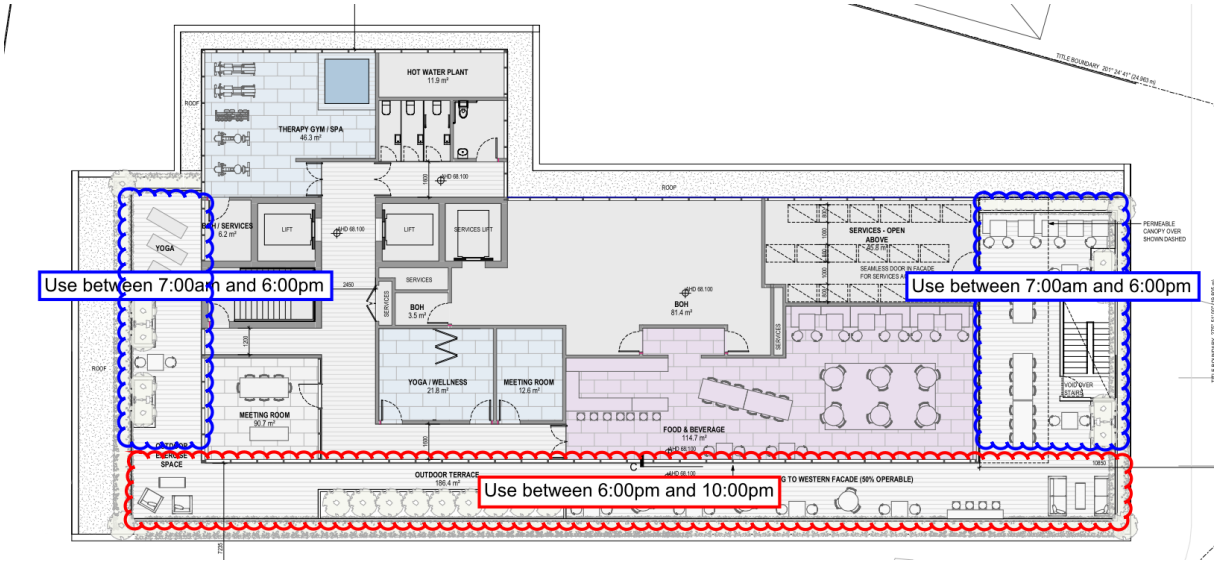
**Figure 10 Acoustic Balustrade Location – 1,800mm High**




- Use of the external rooftop bar/dining area is between 7:00am-10:00pm Monday to Saturdays and 8:00am to 10:00pm Sundays and Public Holidays.

- **However, subject to above, use of the dining area along the Northern and Southern end of the rooftop external area must be limited to 6:00pm without additional acoustic treatments. Areas along the Western Façade (i.e. Somerset Street) can be used up to 10:00pm. See below.**

**Figure 11 Rooftop External Dining Times**




- Signs must be installed within the external dining/bar area reminding customers to be mindful of noise.

## 4.4 Noise on Local Roads

Noise impacts from the increase in vehicle movements along Somerset Street and Hargrave Street are to be assessed in accordance with the NSW EPA Road Noise Policy (RNP) 2011.

TTPA Transport Planning has been engaged by the proponent to undertake a *Transportation Impact Assessment* for the proposed development. Outlined in Section 4.3 of the report, the following statement is provided.

> *The proposed medi-hotel is therefore estimated to result in a net increase of 32 vehicle trips on the surrounding road network during the peak hours as follows:*
>
> - *20 additional vehicle trips to and from the Hargrave Street driveway;*
> - *14 additional vehicle trips to and from the eastern kerb of Somerset Street; and*
> - *2 fewer vehicle trips to and from the existing Somerset Street driveways.*

A peak hour increase of as outlined above vehicles will not exceed a 2dBA increase as summarised in the NSW EPA RNP to be barely perceptible to the average person and therefore considered acoustically acceptable.

## 4.5 Vehicle Driveway Noise

Located along the eastern boundary of the site is the basement driveway. The driveway will accommodate mostly passenger accessing the parking bays from Hargrave Street. To ensure the operation of the driveway is compliant with the NSW EPA NPI we have conducted an assessment as below.

The assessment has been conducted based on the following parameters:

- No more than 10 passenger vehicles entering or exiting the facility in any single 15-minute interval.
- No more than 1 heavy rigid vehicle during any single 15-minute interval.
- Sound Power Level of Heavy Rigid Vehicle (HRV) of 84dBA.

Based on the parameters outlined above the following noise levels are predicted:

**Table 21 Predicted Noise Level**

| Receiver Location | Prediction Activity | Predicted Noise Level dB(A)$L_{Aeq(15\text{-}minute)}$ | Criteria dB(A)$L_{Aeq(15\text{-}minute)}$ | Compliance |
|---|---|---|---|---|
| **Receiver 1:** 26 Somerset Street, Kingswood | Passenger Vehicles | 40 | 50 | **Yes** |
| **Receiver 2:** 38-40 Orth Street, Kingswood | Passenger Vehicle | 44 | 50 | **Yes** |
| **Receiver 3:** 1-3 Hargrave Street, Kingswood | Passenger Vehicles | 48 | 50 | **Yes** |
| **Receiver 4:** 34-36 Somerset Street and 2-4 Hargrave Street, Kingswood | Passenger Vehicles | 49 | 50 | **Yes** |

*Note 1: Compliance is achieved on the assumption the building and management controls outlined above are installed and adhered to.*

## 4.6 Acoustic Separation

As this project is still within the development approval phase, information regarding the proposed constructions that will be separating units within the development is not known at this stage. As such, a detailed review of the constructions for compliance with the airborne and impact ratings from the National Construction Code cannot be undertaken. It is usual for such work to be conducted at the Construction Certificate (CC) stage of the development. The required airborne and impact ratings have been presented in section 3.4.1 of this report.

# 5 CONCLUSION

Pulse Acoustics has been engaged to undertake an acoustic assessment of the proposed four (4) star hotel development to be constructed at 28-32 Somerset Street, Kingswood. As part of this assessment we have undertaken a review of the building envelope, assessed noise emissions from the use of the site, as well as established the applicable acoustic separation requirements. From this assessment we note the following:

- Minimum acoustic performances and associated indicative constructions for the building envelope have been provided in section 4.1 of this report. The recommended treatments have been provided to ensure compliance with the objectives presented in 3.1.

- To control noise impacts at external receivers, recommended indicative treatments for major engineering services have been provided in section 4.2. From our review we have formulated the following opinion:

    - At this stage of the project the exact selections/locations of plant items are not known. A preliminary assessment, however, has been carried out using our experience with similar types of developments and the typical plant items installed in each type of plant room.

    - From this review we recommend the selection of high-performance acoustic treatment to ensure that the operation of the plant items comply with the project criteria. Therefore, it is recommended that prior to the issue of a Construction Certificate (CC) a detailed acoustic assessment is undertaken to ensure all cumulative noise from engineering services (including the roof plant room) comply with the requirements as listed in section 3.3.

    - Noise impacts from dining and bar areas have been reviewed, on the proviso the management and building controls outlined in section 4.3.2 are installed or adhered to; noise levels from the use of the communal spaces within the development will achieve the target levels established.

    - A review of noise from vehicles associated with the proposed development on public roads has been conducted. From this review we can confirm the project site will not provide more than a 2dBA increase in noise levels at surrounding facades.

- Establishment of the acoustic requirements for the separation between units within the development has been formulated in accordance with the National Construction Code (NCC). Details of the constructions are not known at this stage of the project. It is recommended that a detailed review is undertaken at the Construction Certificate (CC) stage to ensure all requirements are achieved.

# APPENDIX A: ACOUSTIC TERMINOLOGY

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| *Ambient Sound* | The totally encompassing sound in a given situation at a given time, usually composed of sound from all sources near and far. |
| *Audible Range* | The limits of frequency which are audible or heard as sound. The normal ear in young adults detects sound having frequencies in the region 20 Hz to 20 kHz, although it is possible for some people to detect frequencies outside these limits. |
| *Character, acoustic* | The total of the qualities making up the individuality of the noise. The pitch or shape of a sound's frequency content (spectrum) dictate a sound's character. |
| *Decibel [dB]* | The level of noise is measured objectively using a Sound Level Meter. The following are examples of the decibel readings of every day sounds;<br>0dB the faintest sound we can hear<br>30dB a quiet library or in a quiet location in the country<br>45dB typical office space. Ambience in the city at night<br>60dB Martin Place at lunch time<br>70dB the sound of a car passing on the street<br>80dB loud music played at home<br>90dB the sound of a truck passing on the street<br>100dB the sound of a rock band<br>115dB limit of sound permitted in industry<br>120dB deafening |
| *dBA* | *A-weighted decibels* The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dBA. Practically all noise is measured using the A filter. The sound pressure level in dBA gives a close indication of the subjective loudness of the noise. |
| *Frequency* | Frequency is synonymous to *pitch*. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz. |
| *Loudness* | A rise of 10 dB in sound level corresponds approximately to a doubling of subjective loudness. That is, a sound of 85 dB is twice as loud as a sound of 75 dB which is twice as loud as a sound of 65 dB and so on |
| $L_{Max}$ | The maximum sound pressure level measured over a given period. |
| $L_{Min}$ | The minimum sound pressure level measured over a given period. |
| $L_1$ | The sound pressure level that is exceeded for 1% of the time for which the given sound is measured. |
| $L_{10}$ | The sound pressure level that is exceeded for 10% of the time for which the given sound is measured. |
| $L_{90}$ | The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the $L_{90}$ noise level expressed in units of dBA. |
| $L_{eq}$ | The "equivalent noise level" is the summation of noise events and integrated over a selected period of time. |
| *Background Sound Low* | The average of the lowest levels of the sound levels measured in an affected area in the absence of noise from occupants and from unwanted, external ambient noise sources. Usually taken to mean the LA90 value |
| *Ctr* | A frequency adaptation term applied in accordance with the procedures described in ISO 717. |

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| *dB (A)* | 'A' Weighted overall sound pressure level |
| *Noise Reduction* | The difference in sound pressure level between any two areas. The term "noise reduction" does not specify any grade or performance quality unless accompanied by a specification of the units and conditions under which the units shall apply |
| *NR Noise Rating* | Single number evaluation of the background noise level. The NR level is normally around 5 to 6 dB below the "A" weighted noise level. The NR curve describes a spectrum of noise levels and is categorised by the level at 1000 Hz ie the NR 50 curve has a value of 50 dB at 1000 Hz. The NR rating is a tangential system where a noise spectrum is classified by the NR curve that just encompasses the entire noise spectrum consideration. |
| *$R_w$* | Weighted Sound Reduction Index - Laboratory test measurement procedure that provides a single number indication of the acoustic performance of a partition or single element. Calculation procedures for Rw are defined in ISO 140-2:1991 "Measurement of Sound Insulation in Buildings and of Building Elements Part 2: Determination, verification and application of precision data". |
| *$R'_w$* | Field obtained Weighted Sound Reduction Index - this figure is generally up to 3-5 lower than the laboratory test determined level data due to flanked sound transmission and imperfect site construction. |
| *Sound Isolation* | A reference to the degree of acoustical separation between any two areas. Sound isolation may refer to sound transmission loss of a partition or to noise reduction from any unwanted noise source. The term "sound isolation" does not specify any grade or performance quality and requires the units to be specified for any contractual condition |
| *Sound Pressure Level, $L_P$ dB* | A measurement obtained directly using a microphone and sound level meter. Sound pressure level varies with distance from a source and with changes to the measuring environment. Sound pressure level equals 20 times the logarithm to the base 10 of the ratio of the rms sound pressure to the reference sound pressure of 20 micro Pascals. |
| *Sound Power Level, $L_W$ dB* | Sound power level is a measure of the sound energy emitted by a source, does not change with distance, and cannot be directly measured. Sound power level of a machine may vary depending on the actual operating load and is calculated from sound pressure level measurements with appropriate corrections for distance and/or environmental conditions. Sound power levels is equal to 10 times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 picoWatt |
| *Speech Privacy* | A non-technical term but one of common usage. Speech privacy and speech intelligibility are opposites and a high level of speech privacy means a low level of speech intelligibility. It should be recognised that acceptable levels of speech privacy do not require that speech from an adjacent room is inaudible. |
| *Transmission Loss* | Equivalent to Sound Transmission Loss and to Sound Reduction Index in terminology used in countries other than Australia. A formal test rating of sound transmission properties of any construction, by usually a wall, floor, roof etc. The transmission loss of all materials varies with frequency and may be determined by either laboratory or field tests. Australian Standards apply to test methods for both situations. |

## APPENDIX B: UNATTENDED NOISE MONITORING RESULTS

**Weather Station:** Penrith Lakes AWS

**Weather Station ID:** 067113

**Co-ordinates:** Lat: -33.7195°S, Lon: 150.6783°E, Height: 25.0 m (AMSL)