SEARS Acoustic DA Report

Macarthur Garden North, Site R3

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Contents

1. Introduction

This acoustic report has been prepared by BSE (Acoustics) to accompany a State Significant Development Application (SSDA) for an affordable housing development within the Macarthur Gardens North precinct (MGN) in the Campbelltown Local Government Area (LGA). The MGN precinct is identified as Lot 1097 in DP1182558.

This report has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) issued for the project (SSD-80482713) on 16 July 2025.

This report concludes that the proposed development is suitable and warrants approval subject to the implementation of the following mitigation measures.

- Minimum acoustic performance of façade construction for proposed apartments (Site R3)
- Preliminary recommendations of façade construction for proposed apartments (Site R4) – to be finalised during future assessment and application of that specific part of the masterplan
- Limitation of communal area use to daytime and evening periods only
- Limitations to outdoor speakers to ground level communal area only, and limit of source noise levels of speakers
- Recommendations to carpark construction/finishes
- Implementation of best practice measures in AS2436, during onsite construction – exact requirements should be finalised with a future construction and vibration management plan
- Future assessment of mechanical plant noise during design stage, and implementation of acoustic treatments/controls where necessary, based on noise criteria detailed in this report

Following the implementation of the above mitigation measures, the remaining impacts are considered appropriate.

The purpose of this noise assessment is to address potential noise impacts to nearby sensitive receivers in accordance with Secretary's Environmental Assessment Requirements (SEARs) and NSW Noise Policy for Industry (NPfI) (2017) requirements.

The proposed development is eligible for the planning SEARs (Housing) due to meeting the relevant conditions of the State Environmental Planning Policy (Planning Systems) 2021, Schedule 1, Section 26.

This report has been prepared in response to the requirements contained with the Secretary's Environmental Assessment Requirements (SEARs) dated 16 July 2025 and issued for the SSDA (SSD-80482713). Specifically, this report has been prepared to respond to the SEARs requirement issued below:

Table 1: SEARs Acoustic Requirements

Item	Description of requirement
10. Noise and Vibration	Provide a noise and vibration impact assessment prepared in accordance with the relevant NSW Environment Protection Authority (EPA) guidelines. The assessment must detail construction and operational noise and vibration impacts on nearby sensitive receivers and structures and outline the proposed management and mitigation measures that would be implemented.

Background noise data and traffic and rail noise impacts for the R3 Site have been based on the masterplan report issued by Renzo Tonin & Associates on 3 December 2021 (ref. TL100-05F01 Masterplan acoustic and vibration assessment r1). Based on these criteria, a further environmental acoustic assessment has been conducted by BSE and recommendations are included in this report to minimise noise impacts to offsite and onsite sensitive receivers where necessary.

2. Proposed Development

2.1. Background

On 14 December 2022, the Sydney Western City Planning Panel approved 3944/2021/DA-SW which comprised:

- a concept masterplan for mixed use development within MGN (see figure below)
- stage 1 works (parks, civil works, landscaping and subdivision of the site into superlots)

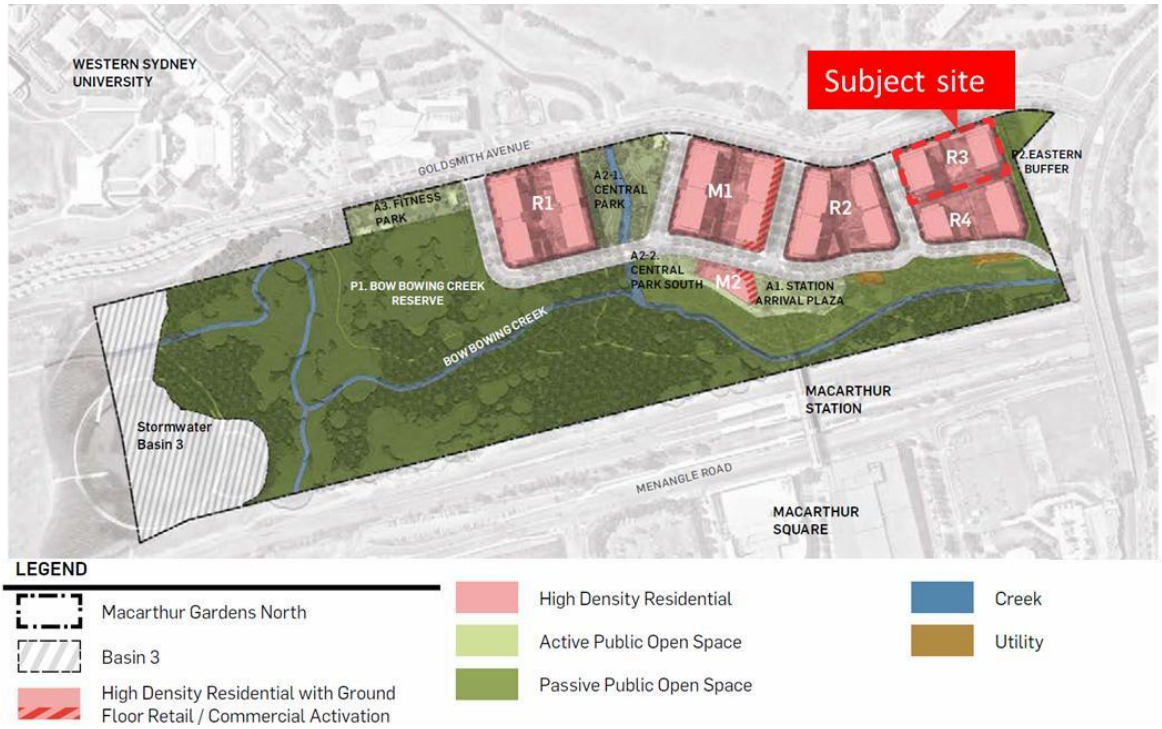

Figure 1: Macarthur Gardens North Masterplan

The masterplan sets the planning context for MGN. Importantly, the use and building envelopes for the site subject to this SSDA outlined in red below.

2.2. Site Description

The site is located in the MGN precinct within the Campbelltown LGA. The MGN Precinct is legally described as Lot 1097 in DP1182558.

As shown within the figure below, the site is within the north eastern corner of MGN and is rectangular in shape. The site has an area of 4,895m^2 and is currently bound by Goldsmith Avenue to the north, vacant land (known as site R4 within the 3944/2021/DA- SW concept masterplan) to the south and a pedestrian link and road, which are under construction, to the east and west respectively.

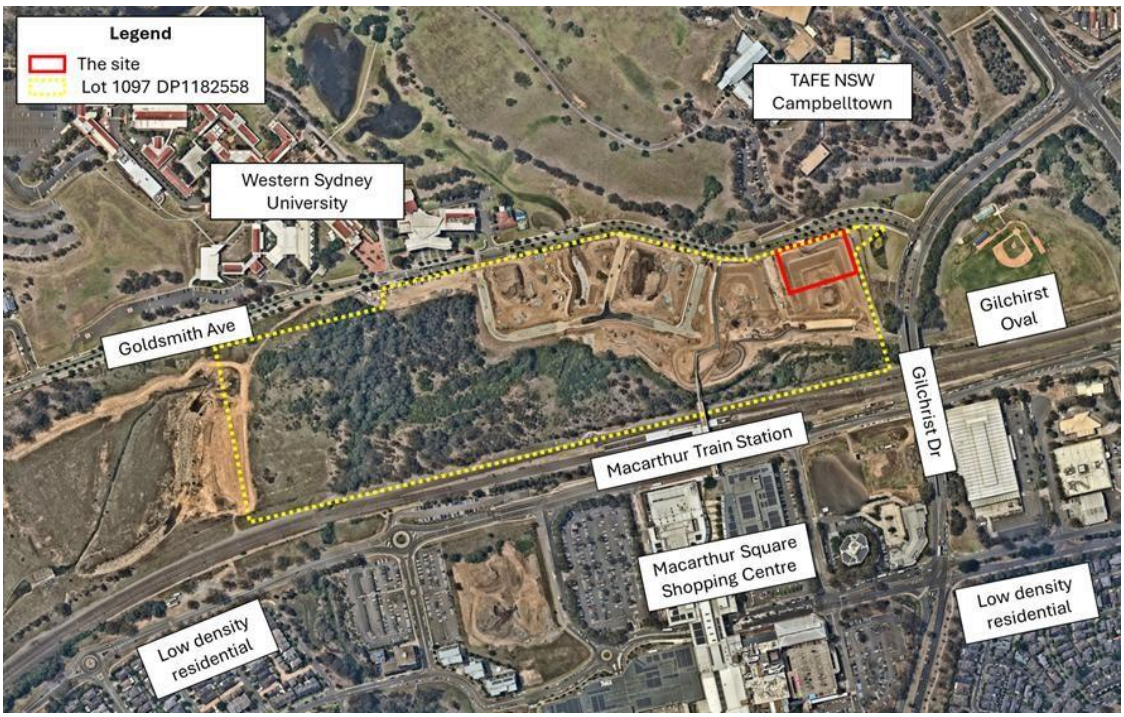

Figure 2: Site Location and Surrounding Area (Source: Nearmaps)

The site is zoned R4 High Density Residential pursuant to the *Campbelltown Local Environmental Plan 2015* and is currently vacant land which has been excavated in accordance with Stage 1 of the 3944/2021/DA-SW approval.

The site is also strategically located within the Glenfield to Macarthur Urban Renewal Corridor which is identified by the Department of Planning Housing and Infrastructure as a corridor to accelerate housing and jobs.

The vision on MGN is a mixed-use development precinct. Once developed, the site will be immediately bound by high density residential, roads and landscape buffers.

Outside of the MGN precinct, the broader site context is characterised by educational establishments to the north and northwest (Western Sydney University and TAFE), vacant undeveloped land to the west, Macarthur Train Station, railway lines, commercial premises (including Macarthur Square Shopping Centre) and low density residential to the south and a recreation area known as Gilchrist Oval to the east.

The site is also located approximately 43 kilometres south west of the Sydney CBD, and 20km south west of Liverpool.

2.3. Proposal

The project involves construction of the new 100% affordable housing development on site R3 of the MGN Precinct. Specifically, the SSDA seeks development consent for:

- construction of two 3 to 9 storey residential flat buildings
- 130 dwellings, all of which are affordable housing
- one basement level for car parking
- landscaping
- communal open space area

The purpose of the project is to facilitate the delivery of high-quality affordable housing, on a strategically located site consistent with the vision for MGN.

Based on the current architectural drawings by DKO Architecture, reference *13822 Macarthur Gardens North R3*, dated 25 July 2025. Specific aspects of the proposal relevant to the acoustic assessment are:

- 1 basement carparking level containing a total capacity of 63 car spaces, 1 car wash bay, 15 bike parking spaces, pump/equipment rooms, storage rooms, and bin areas.
- 2 residential towers from Ground Level to Level 8 above, with a total of 130 apartments as follows:
    - 18 apartments on Ground Level (9 in each tower).
    - 20 apartments on each of Levels 1-2 (10 in each tower).
    - 14 apartments on each of Levels 3-5 (7 in each tower).
    - 10 apartments on each of Levels 6-8 (5 in each tower).
- Communal open space between the towers on Ground Level, and on Level 3.
- Vehicle driveway entrance on the newly constructed secondary street, on the western boundary of the R3 site.

The current floor layouts by DKO Architecture, dated 25 July 2025, are shown in Figure 3 to Figure 10.

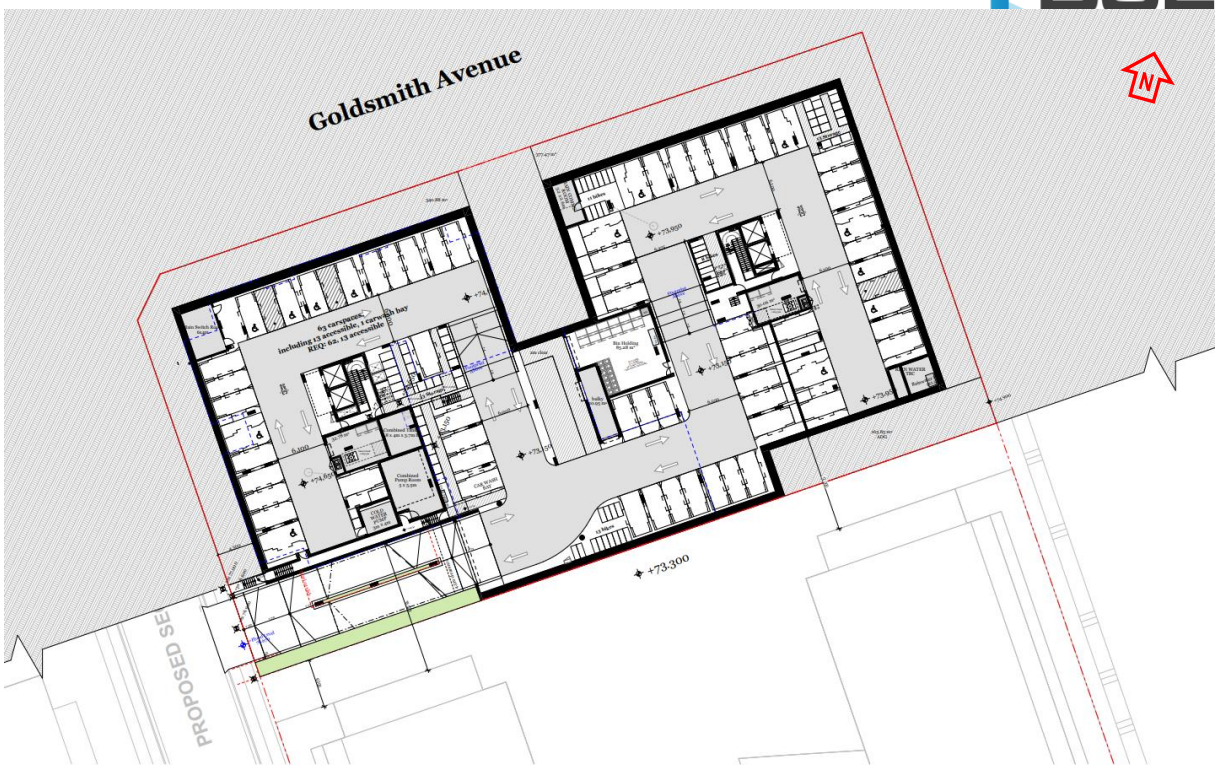

Figure 3: Proposed Basement Level (DKO Architecture)

Figure 4: Proposed Ground Floor (DKO Architecture)

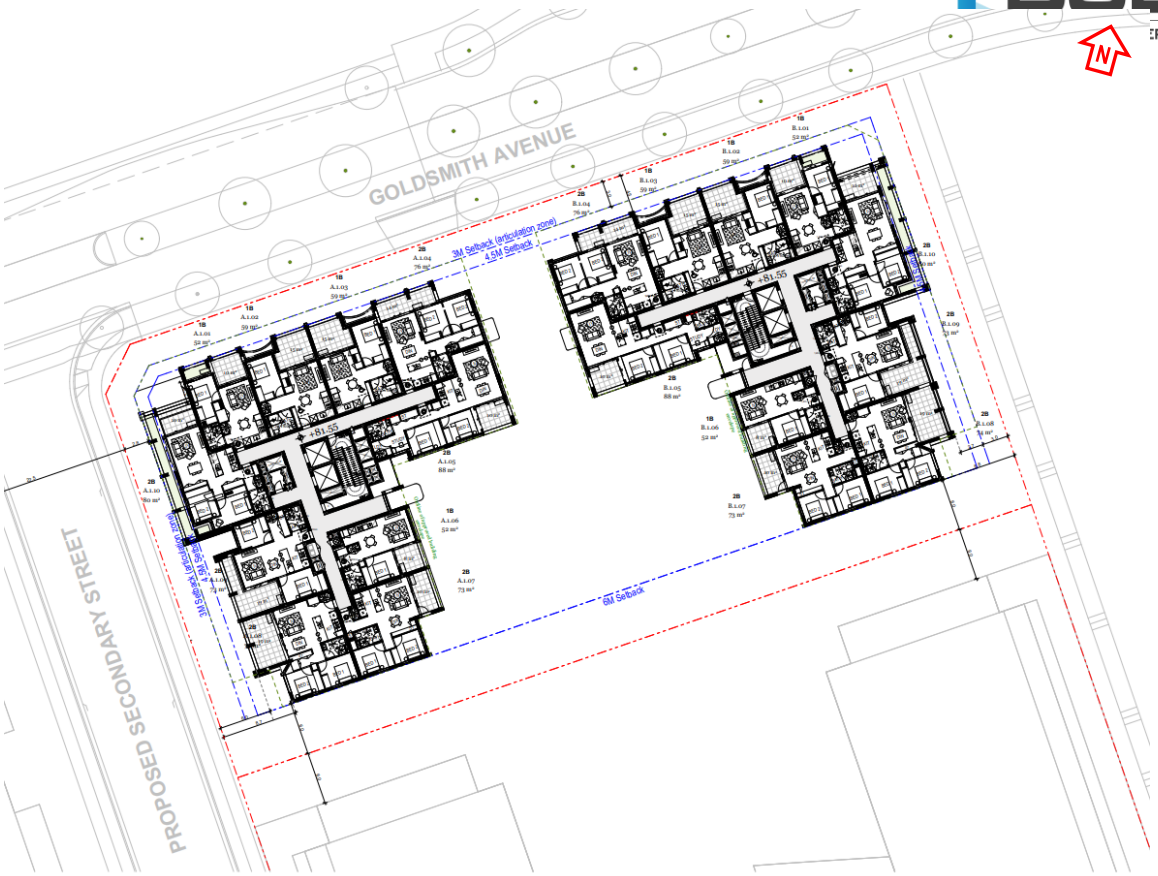

Figure 5: Proposed Level 1 (DKO Architecture)

Figure 6: Proposed Level 2 (DKO Architecture)

Figure 7: Proposed Level 3 (DKO Architecture)

Figure 8: Proposed Level 4 – Level 5 (DKO Architecture)

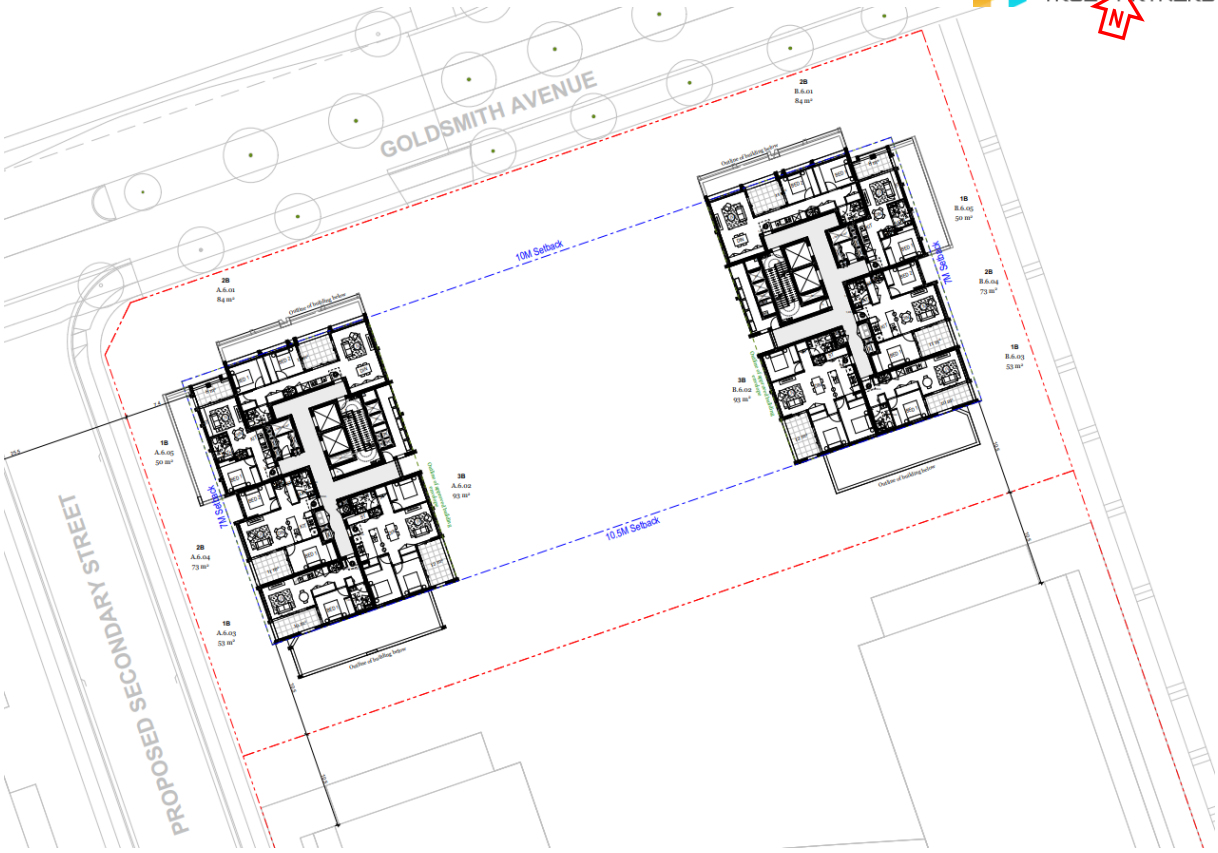

Figure 9: Proposed Level 6 (DKO Architecture)

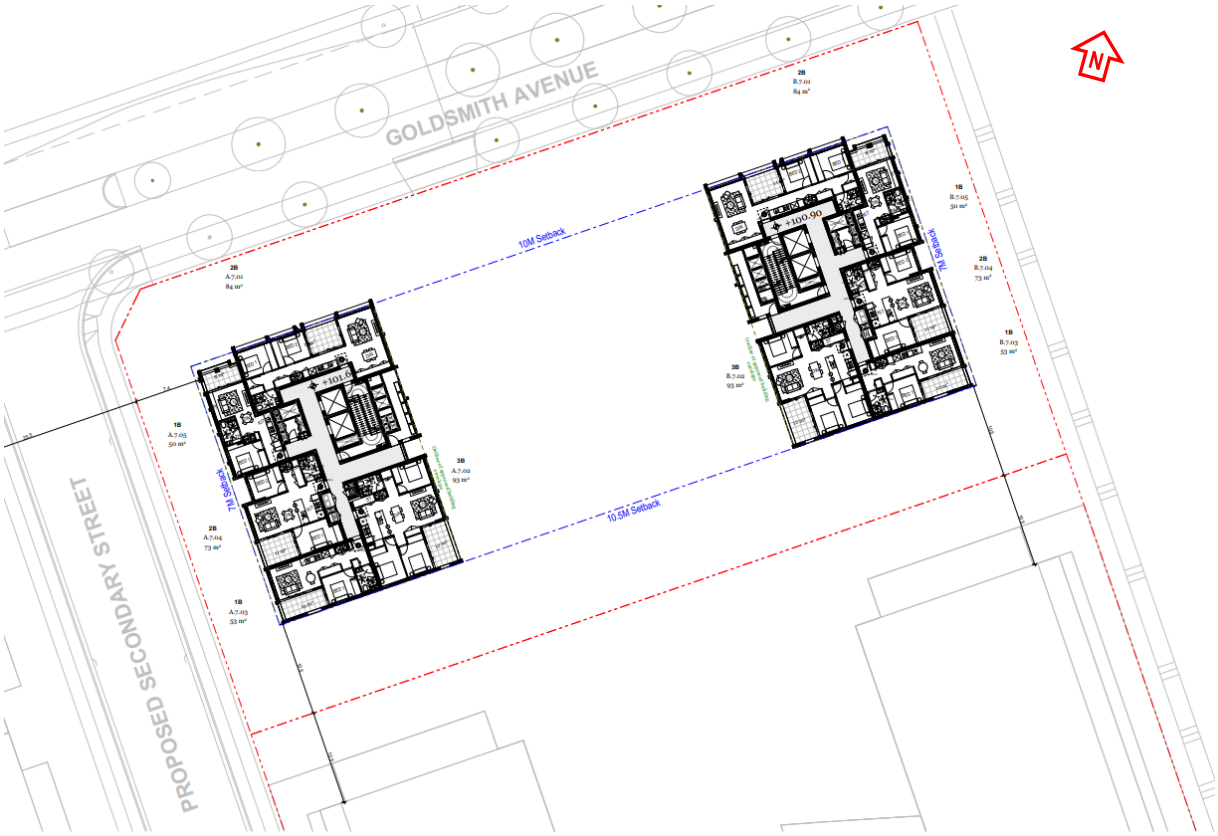

Figure 10: Proposed Level 7 – Level 8 (DKO Architecture)

2.4. Referenced Documents

This assessment is based upon client provided site drawings shown in Table 2.

Table 2: Client Provided Site Drawings

Drawn By	Document	Drawing No.	Drawing Title	Drawing Revision	Date Drawn
DKO Architecture	Project No. 13822 Macarthur Gardens North R3	DA200	Basement 1	A	25/07/25
		DA201	Ground Floor	A	25/07/25
		DA202	Level 1	A	25/07/25
		DA203	Level 2	A	25/07/25
		DA204	Level 3	A	25/07/25
		DA205	Level 4 – Level 5	A	25/07/25
		DA206	Level 6	A	25/07/25
		DA207	Level 7 – Level 8	A	25/07/25
		DA208	Level 9	A	25/07/25
		DA300	North and South Elevations	A	25/07/25
		DA301	East and West Elevations	A	25/07/25

3. Existing Acoustic Environment

The site is located in a currently suburban area but will be developed into a high-density urban location. Currently the acoustic environment consists predominantly of road traffic and rail noise.

Additional background noise monitoring around the site was proposed by BSE in late May 2025; the site at that time was undergoing excavation works and was therefore not suitable for placement of an acoustic monitor.

The Campbelltown TAFE to the north was contacted several times in an attempt to install a monitor on their grounds, however no final permission was received by BSE to undertake monitoring at this location.

Following discussions with Landcom, it was proposed that sections of the original Masterplan assessment report be used for the purposes of this submission.

Therefore, this report has utilised noise monitoring data from the previous Renzo Tonin and Associates (RTA) acoustic report (ref. *TL100-05F01 Masterplan acoustic and vibration assessment r1*, dated 3 December 2021) that was issued for the entire masterplan site. Based upon our assessment of the site we note that site conditions may have changed to a minor extent due to current construction related activity. Despite some recent changes the RTA Masterplanning report was still deemed to be acceptable for the purposes of establishing baseline conditions associated with this development.

In summary, Renzo Tonin and Associates conducted unattended monitoring in 4 locations around the site – the closest 3 locations to the proposed R3 site are selected to determine background noise levels for this project. Noise monitoring was conducted between 31 October and 8 November 2019.

The location of nearby sensitive receivers, and details of the unattended noise monitoring conducted by Renzo Tonin and Associates are detailed in this section.

3.1. Potentially Affected Receivers

The sensitive receivers potentially most affected from noise from the source under consideration are listed in Table 3 and shown in the aerial image of the surrounding area in Figure 11. As the predominant noise sources from the proposed site will consist of outdoor communal gatherings and carpark activity, the proposed residential within the overall Macarthur Gardens masterplan will be most affected.

Table 3: Table of potential affected receivers

Receiver ID	Receiver Type	Address	Description
R01	Proposed Residential (Macarthur North site)	Goldsmith Avenue, Campbelltown Lot 1097 on DP1182558	Proposed residential building (up to 32m or approx. 10 storeys)
R02	Proposed Residential (Macarthur North site)	Goldsmith Avenue Lot 1097 on DP1182558	Proposed residential building (up to 32m or approx. 10 storeys)
R03	TAFE NSW - Education Facility	181 Narellan Road, Campbelltown Lot 2 on DP253700	TAFE Education site with many buildings
R04	Gilchrist Park – Public Recreation	Narellan Road, Campbelltown Lot 3 on DP253700	Baseball field and public recreation area
R05	Proposed R3 Onsite Apartments	Goldsmith Avenue Lot 1097 on DP1182558	Proposed residential building, R3 site

Figure 11: Site location, potentially affected receivers, and monitoring locations

3.2. Sound Monitoring Results

Rating Background Levels (RBL) measured by Renzo Tonin for day, evening, and night periods are shown in Table 4. Noise monitoring was conducted by Renzo Tonin between 31 October and 8 November 2019.

Table 4: Overall L_{eq} ambient levels and Rating Background Levels (RBL)

Location	NSW NPI Ambient Assessment – Measured RBL $L_{A90,T}$			NSW Road Traffic Assessment – Measured $L_{Aeq,T}$	
	Day (Mon-Sat 7am-6pm, Sun 8am-6pm)	Evening (6pm-10pm)	Night (Mon-Sat 10pm-7am, Sun 10pm-8am)	15-hour day (7am-10pm)	9-hour night (10pm-7am)
1 (SW of Site R3)	45	45	38	N/A	N/A
2 (West of Site R3)	51	51	41	63	60
3 (East of Site R3)	46	47	41	63	58

4. Acoustic Criteria

4.1. NSW Protection of the Environment Operations Act (1997)

Under the POEO, the NSW Environment Protection Authority, has the responsibility to issue policy statements to set out criteria and methods of management for noise within the state. Campbelltown Council continues to use its powers under the Protection of the Environment Operations Act (1997) to enforce noise controls in the community.

4.2. Campbelltown (Sustainable City) Development Control Plan 2015

The Campbelltown (Sustainable City) Development Control Plan 2015 (SCDCP 2015) applies to the whole of the Campbelltown Local Government Area. *Acoustic privacy Section 2.20* has the objective to ensure the provision of a reasonable level of acoustic amenity and to ensure adverse noise and vibration impacts are appropriately mitigated. Design requirements are shown Table 5 below.

Table 5: The Campbelltown (Sustainable City) Development Control Plan 2015 (SCDCP 2015) - Design Requirements

a) Development shall comply with any relevant provisions in the following documents. The event of an inconsistency between the noise related controls in this plan and the documents below, the documents below prevail to the extent of the inconsistency.	*i) The NSW Noise Policy for Industry (NPfI).* *ii) The NSW Road Noise Policy* *iii) The NSW Development Near Rail Corridors and Busy Roads - Interim Guideline* *iv) Association of Australasian Acoustical Consultants Guideline for Child Care Centre Acoustic Assessment*
b) A Noise Impact Assessment prepared by a suitably qualified acoustic consultant will be required in cases where the consent authority is not satisfied that a development will:	*i) Achieve a satisfactory level of acoustic amenity for occupants within the existing noise environment; and* *ii) Produce noise only at levels that will not exceed the relevant noise criteria*
c) Subdivisions shall be designed to avoid physical noise barriers except along arterial roads.	

4.3. Australian/New Zealand Standards 2107-2016

Australian / New Zealand Standard AS/NZS 2107:2016 *'Acoustics – Recommended design sound levels and reverberation times for building interiors'* is a widely accepted guide to desirable interior background noise for residential buildings as summarised below in Table 6. It is used to determine the required noise limits within onsite apartments.

Table 6: AS 2107 Recommended internal noise levels and midfrequency reverberation times (s).

Type of Occupancy/Activity		**Design Sound Level $L_{eq,T}$**
Residential Buildings – Apartments in inner city areas or entertainment districts or near major roads	Common areas	45 to 50 dB(A)
	Living areas	35 to 45 dB(A)
	Sleeping areas	35 to 40 dB(A)
	Work areas	35 to 45 dB(A)

4.4. NSW Noise Policy for Industry (NPfI) 2017

4.4.1. Intrusive/Amenity Criteria

The NSW NPfI (2017) provides assessment methodologies, criteria and detailed information on the assessment of environmental noise emissions in NSW. The NSW NPfI criteria for noise sources consider two (2) components, amenity and intrusive noise. Assessment of the components are summarised as follows:

- Maintaining noise amenity for various categories of land use (including residential receivers and other sensitive receivers). The amenity criterion is based on the sensitivity of a particular land use affected by industrial noise. The recommended amenity noise levels detailed in Table 2.2 of NSW NPfI represent the objective for total industrial noise at a receiver location, whereas the project amenity noise level represents the objective for noise from a single industrial development at a receiver location. This is to ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area. The project amenity criteria for each new source of industrial noise are equal to the recommended amenity noise level minus 5dBA.
- A +3dBA conversion is to be added to project amenity noise level for conversion from a period level to a 15-minutes level. Where the resultant project amenity noise level is 10dB or lower than the existing industrial noise level, the project amenity noise levels can be set at 10 dB below existing industrial noise levels if it can be demonstrated that existing industrial noise levels are unlikely to reduce over time.
- Controlling intrusive noise impacts for residential receivers. Assessing intrusiveness usually requires noise measurements to quantify background (LA90) noise levels at a location considered representative of the most potentially affected residential receiver(s). The intrusiveness criterion essentially means that for a given receiver the equivalent continuous noise level (Leq) of the source(s) under consideration should be controlled to 5 dB above the background noise level.
- Where early morning (5am-7am) operations are proposed, it may be unreasonable to expect such operations to be assessed against the night-time project noise trigger levels – especially if existing background noise levels are steadily rising in these early morning house. It may be appropriate to assign a shoulder period rating background noise level based on:
    - The lowest 10th percentile of $L_{AF90,15min}$ dB measurements for the equivalent of one weeks' worth of valid data taken over the shoulder period.

Note that according to the Policy, intrusive noise levels are only applied to residential receivers.

4.4.2. Sleep Disturbance Criteria

Sleep disturbance criteria are nominated in the policy for industry, as follows:

- $L_{Aeq,15min}$ 40 dB(A) or the prevailing RBL plus 5dB, whichever is the greater, and
- L_{AFMax} 52 dB(A) or the prevailing RBL plus 15dB, whichever is the greater

Sleep disturbance criteria are applicable in relation to residential receivers during the night-time (10pm-7am Mon-Sat, 10pm-8am Sun/Public Holidays only).

4.5. Construction Noise

Construction noise is a major environmental noise issue in NSW, and it is well accepted that this activity can adversely affect, sleep, concentration and learning performance and mental and physical health. While construction noise is temporary in nature, its impacts need to be controlled.

The NSW Interim Guideline for Construction Noise (2009) (IGCN) is specifically aimed at managing noise from construction works. From a regulatory perspective, the local Council is the appropriate regulatory authority for non-scheduled construction activities. The following application of the policy is summarised below in Table 7.

Table 7: IGCN noise criteria at residences, using quantitative assessment, L_{eq}.

Time of Day	Management Level, $L_{Aeq\ (15min)}$	How to apply
Recommended Standard Hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays	Noise affected RBL+10dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq\ (15min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration as well as contact details.
	Highly noise affected 75dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining, regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, considering: Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences) If the community is prepared to accept longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5dB	A strong justification would typically be required for work outside the recommended standard hours The proponent should apply all feasible and reasonable work practices to meet the noise affected level Where all feasible and reasonable practices have been applied and noise is more than 5dB(A) above the noise affected level, the proponent should negotiate with the community For guidance on negotiating agreements see Section 7.2.2 (NSW Interim Construction Noise Guideline)

Table 8: GCN noise criteria at commercial receivers, using quantitative assessment, L_{eq}.

Land Use	Management Level, $L_{Aeq\ (15min)}$ (applies when properties are being used)	How to apply
Classrooms at schools and other educational institutions	Internal noise level 45dB(A)	The proponent should consult with noise sensitive land use occupants likely to be affected by noise from the works to schedule the project's work hours to achieve a reasonable noise outcome.
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level 65dB(A)	

4.6. Construction Vibration Limits

Construction vibration levels depend on several factors. These include the activity, the machine, the geology of the ground and the distance between the building and the source. In Australia there is no current specific standard for construction vibration.

The NSW EPA Assessing Vibration: a technical guideline (2006) provides some guidance in relation to human comfort but does not directly relate to damage levels to buildings. This methodology is equivalent to the guidelines issued in current international standards and described in *'AS2670 Vibration and shock - Guide to the evaluation of human exposure to whole body vibration'*, as shown below in Table *9*.

Table 9: Multiplying Factors to obtain limit vibration levels (mm/s) - human comfort criteria

Place	Multiplying Factors		
	Time	Continuous Vibration	Intermittent or Impulsive
Residential	Day 0700-2200	2	60
	Night 2200-0700	1.4	20
Office	Day 0700-2200	4	128
	Night 2200-0700	4	128
Workshops	Day 0700-2200	8	128
	Night 2200-0700	**8**	**128**

With regards to structural damage, the German DIN4150 and NSW EPA and British Standard BS6472 provide guidelines relevant to this assessment. These criteria are summarised below in Table 10.

Table 10: Typical Vibration Limit Criteria (mm/s) – structural damage criteria

Criterion	Typical Vibration Velocity (mm/s)	Standard
Disturbance to Persons (Day) 0700-2200	0.3 – 0.6 peak	BS6472
Disturbance to Persons (Night) 2200-0700	0.2 peak	BS6472
Damage to Dwellings	5 – 15 rms	DIN 4150
Damage to Heritage Buildings	**3 – 8 rms**	**DIN 4150**

Management of noise and vibration impacts during construction is best mitigated through the implementation of a site noise and vibration management plan by the prospective lead building contractor.

4.7. NSW Traffic Noise

4.7.1. NSW Road Noise Policy

The requirements of the NSW Road Noise Policy (RNP) applicable to this assessment are summarised below in Table 11.

The functional role for each type of road category definition relevant to this assessment is as follows:

a) Sub-arterial roads:

- Provide connection between arterial roads and local roads.
- May support arterial roads during peak periods.
- May have been designed as local streets but can serve major traffic generating developments or support non-local traffic.

b) Local roads:

- Provide vehicular access to abutting property and surrounding streets.
- Provide a network for the movement of pedestrians and cyclists and enable social interaction in a neighbourhood.
- Should connect, where practicable, only to sub-arterial roads.

Table 11: NSW RNP – Traffic Noise Criteria by road category, dB(A).

Road Category	Type of Project / Land Use	Assessment Criteria dB(A)	
		$L_{Aeq15hr}$, Day 7am to 10pm	$L_{Aeq\ 9hr}$ Night 10pm to 7am
Freeway/Arterial/Sub-Arterial	1. Existing residences affected by noise from new freeway/arterial/sub arterial road corridors	55 (external)	50 (external)
	2. Existing residences affected by noise from redevelopment on existing freeways	60 (external)	55 (external)
	3. Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments.		
Local Roads	4. Existing residences affected by noise from new local road corridors	55 (external)	50 (external)
	5. Existing residences affected by noise from redevelopment of existing roads.		
	6. Existing residences affected by additional traffic on existing local roads generated by land use developments.		

The NSW Road Noise Policy notes the following:

> *"Where existing traffic noise levels are above the noise assessment criteria, the primary objective is to reduce these through feasible and reasonable measures to meet the assessment criteria. In assessing feasible and reasonable mitigation measures, an increase of up to 2dB represents a minor impact that is considered barely perceptible to the average person."* .

For the purposes of this assessment and with reference to the Calculation of Road Traffic Noise (CORTN) the following assessment applicable to the NSW RNP was calculated on the following basis.

Change in Traffic Noise = 10 x log (Proposed vehicles per hour/Existing vehicles per hour) – where all other *environmental factors e.g. speed, gradient, % heavy vehicles are largely constant;*

Where a change of >2dB is considered to represent a perceptible change in traffic noise levels.

4.7.2. State Environmental Planning Policy Transport and Infrastructure (2021)

The State Environmental Planning Policy (SEPP) (Transport and Infrastructure) of 2021 provides internal noise limits for residential uses in regard to nearby traffic and rail noise. The noise limits for residential dwellings are stated in Section 2.120, part (3) as follows:

(1) If the development is for the purposes of residential accommodation, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following L_{Aeq} levels are not exceeded:

(a) In any bedroom in the residential accommodation – 35 dB(A) at any time between 10pm and 7am,
(b) Anywhere else in the residential accommodation (other than a garage, kitchen, bathroom or hallway) – 40 dB(A) at any time.

4.8. Project Specific Criteria

4.8.1. Intrusive/Amenity Noise Criteria

The selection of the project specific criterion is detailed in Table 12. Based on the future development of the site which will include high-density residential uses and mixed-use developments, as well as the existing nearby arterial roads, the urban residential amenity noise category has been selected for all residential receivers.

Table 12: NSW Noise Policy for Industry Project Criteria, dB(A).

Receivers	Time Period	Measured L_{90} RBL	Intrusiveness Criteria (RBL + 5dBA)	Nominated Noise Amenity Area	Designated Amenity Noise Level	Project Amenity Criteria (Amenity Level -5dBA + 3dBA)	Overall Criteria (Lower of Intrusiveness/ Amenity)
1 (Residential)	Day	46	51	Urban Residential	60	58	**51**
	Evening	47	52		50	48	**48**
	Night	41	46		45	43	**43**
2 (Residential)	Day	45	50	Urban Residential	60	58	**50**
	Evening	45	50		50	48	**48**
	Night	38	43		45	43	**43**
3 (TAFE)	When in Use	N/A	N/A	Education/Classroom	45*	43*	**43***
4 (Recreation)	When in Use	N/A	N/A	Active Recreation Area	55	53	**53**
*Noise limits for school classrooms are nominated as 35dB(A) internally in the Interim Construction Noise Guideline. A reduction of 10dB(A) from external levels to internal levels is applied, assuming open windows, according to the EPA. The levels listed in this table are the external levels (55dBA).							

4.8.2. Sleep Disturbance

Based on the measured background levels during the night-time period, noise criteria $L_{Aeq,15min}$ 51dB(A) for receiver 1 and 48 dB(A) for receiver 2, is applicable for the development. Note that these criterion are higher than the applied amenity noise criteria.

The L_{AFMax} criteria for the night-time period are 61dB(A) for Receiver 1 and 58dB(A) for Receiver 2 based on the measured background levels.

It should be noted that the sleep disturbance criteria does not apply to non-residential receivers.

4.8.3. Construction Noise

Following the determination of daytime RBL values, during Recommended Standard Hours, the following Noise Affected and Highly Noise Affected Construction Noise Management Levels are summarised below in

Table 13. Predicted construction noise impacts have been determined in Section 5.4 of this report.

Table 13: Construction Noise Management Levels $L_{eq,15min}$ dBA – Recommended Standard Hours.

Time of Day	Receiver	Measured RBL (dBA)	Management Level, $L_{Aeq\ (15min)}$	Highly Affected Management Level, $L_{Aeq\ (15min)}$
Recommended Standard Hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays	1 (Residential)	51	Noise affected (51+10) = 61	75
	2 (Residential)	50	Noise affected (50+10) = 60	75
Recommended standard hours and When properties are in use	3 (Classrooms at schools and other education institutions)	N/A	55*	N/A
	4 (Active recreation areas)	N/A	65	N/A
*Noise limits for classrooms are nominated as 45dB(A) internally in the Interim Construction Noise Guideline. A reduction of 10dB(A) from external levels to internal levels is applied, assuming open windows, according to the EPA. The levels listed in this table are the external levels (55dBA).				

Note that Receivers 1 & 2 are proposed residential buildings – noise limits for construction would only be applicable in these buildings if they are constructed and occupied before construction of the subject site (R3).

5. Noise Impacts to Offsite Receivers

5.1. Environmental Noise Impacts

Noise impacts from the proposed development to nearby sensitive receivers are assessed in relation to nominated EPA criteria. The noise methodology and predicted noise impacts are detailed in this section. Relevant recommendations are detailed in Section 6.

5.2. Noise Methodology

Noise assessment from the communal areas, both the Ground Level central courtyard and the Level 3 areas, is based on the nominated activities as used by residents of the R3 site apartments.

BSE have modelled as the following a typical worst-case 15-min period based on the following information:

- Predicted noise levels from patron/resident voices are modelled on raised voice levels of 66dB(A) L_{eq} at 1m per person.
- Noise from communal area voices are modelled as follows in each area. Half of the people in each area are assumed to be speaking at any given time.
    - 100 residents in the Ground Level central courtyard dining – raised voices
    - Background amplified music in the Ground Level central courtyard
    - 20 residents in each of the Level 3 communal areas – raised voices
- Vehicle carparking is assessed at the following rates:
    - 15 vehicle passes in the worst-case daytime 15-minute period
    - 15 vehicle passes in the worst-case evening 15-minute period
    - 5 vehicle passes in the worst-case night-time 15-minute period
- Each car pass, including door closure and car start noise, is assessed as a sound power level of:
    - $L_{eq,15sec}$ 85dB(A)
    - L_{Max} 90dB(A)
- The carwash bay in the basement carpark is assumed to be a manual carwash location with typical commercial spray-hose and soap guns etc. It is likely to have a sound power of Lw 84dB(A) and due to its location would be emit generally insignificant noise at neighbouring receivers when compared to traffic passes and other noise sources. It is however, recommended to be used during the daytime and evening periods only (7am-10pm) as discussed in Section 6.
- Sound power level was approximated to 8dB(A) higher than the sound pressure level at 1m.

Assessed noise sources, locations, and sound power levels are provided in Table 14 and Table 15.

Table 14: Proposed onsite noise source levels octave band centre frequency sound power levels L_{weq} [dB]

Area	Noise Source	Octave Band Centre Frequency, Leq dB								
		63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dB(A)
Ground Level Communal	Voice (50 raised voice)	75	80	90	91	83	81	77	72	**91**
Ground Level Communal	Amplified Music	73	73	81	81	79	74	69	59	**83**
Level 3 Communal Area (West)	Voice (10 raised voice)	68	73	83	84	76	74	70	65	**84**
Level 3 Communal Area (West)	Voice (10 raised voice)	68	73	83	84	76	74	70	65	**84**
Driveway/Carpark	Car Parking (single 15sec pass)	86	84	81	78	80	80	75	67	**85**

Table 15: Proposed noise source levels octave band centre frequency sound power levels L_{wmax} [dB]

Area	Noise Source	Octave Band Centre Frequency, Lmax dB								
		63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dB(A)
Ground Level Communal	Voice (50 raised voice)	84	89	99	100	92	90	86	81	**100**
Ground Level Communal	Amplified Music	78	78	86	86	84	79	74	64	**88**
Level 3 Communal Area (West)	Voice (20 raised voice)	80	85	95	96	88	86	82	77	**96**
Level 3 Communal Area (West)	Voice (20 raised voice)	80	85	95	96	88	86	82	77	**96**
Driveway/Carpark	Car Parking	91	89	86	83	85	85	80	72	**90**

Noise calculations assumed relevant screening from buildings, as well as distance attenuation to each nominated receiver. Based on this information, predicted noise impacts in comparison to nominated criteria are detailed in Section 5.3.

5.3. Predicted Operational Noise Impacts

Following calculations to the nearest affected sensitive receivers the following predicted site generated noise levels are presented in Table 16 below.

Table 16: Predicted site noise impacts to receivers, dB(A) – typical worst case.

Time Period	Receiver	Predicted Noise Level dB(A) $L_{eq,15min}$	Project Criteria dB(A) $L_{eq,15min}$	Predicted Noise Level dB(A) L_{Max}	Sleep Disturbance Criteria dB(A) L_{Max}	Complies Yes/No
Daytime (7am-6pm)	1 (South) Residential	56	51	N/A	N/A	No*
	2 (West) Residential	49	50	N/A	N/A	Yes
	3 (North) Education	42	43	N/A	N/A	Yes
	4 (East) Active Recreation	28	53	N/A	N/A	Yes
	5 (Onsite Residential)	59	N/A	N/A	N/A	N/A
Evening (6pm-10pm)	1 (South) Residential	56	48	N/A	N/A	No*
	2 (West) Residential	49	48	N/A	N/A	Yes
	3 (North) Education	42	43	N/A	N/A	Yes
	4 (East) Active Recreation	28	53	N/A	N/A	Yes
	5 (Onsite Residential)	59	N/A	N/A	N/A	N/A
Night-time (10pm-7am)	1 (South) Residential	48	43	43	61	No*
	2 (West) Residential	42	43	56	58	Yes
	3 (North) Education	41	43	N/A	N/A	Yes
	4 (East) Active Recreation	27	53	N/A	N/A	Yes
	5 (Onsite) Residential	54	N/A	N/A	N/A	N/A
*In the case of exceedance or other residential apartments within the overall masterplan, upgraded façade construction may be incorporated in order to achieve internal noise levels stated in AS2107:2016, instead of external noise limits from NPI. Further discussion is below.						

The onsite communal areas are predicted to comply with the relevant NPI noise criteria at all external receivers (receivers 3-4). They are predicted to exceed the external NPI criteria at the proposed residential buildings with the overall masterplan, to the south and west (sites R4 and R2 respectively) In this case, it is therefore recommended that upgraded façade treatments are incorporated into affected apartments in these buildings, so that internal AS2107:2016 criteria are achieved. The masterplan for these apartments has been approved but the site-specific DAs are not submitted at this stage, and no specific drawings are available.

When more information becomes available, further assessment of noise impacts to specific apartments and rooms should be conducted to determine required façade treatments.

At this stage, it is expected that up to Rw27 glazing would be required for bedrooms in building R4 surrounding the Ground level communal area. Other rooms overlooking the Ground level and level 3 communal areas would likely require acoustic seals around glazing and mechanical ventilation to allow windows and doors to be closed.

Compliance is predicted for all nominated receivers during operational hours, provided the recommendations in Section 6 are implemented.

5.4. Construction Noise Impacts

To predict the impact of noise associated with construction, estimated plant and sound power levels were split across the main construction stages. At this stage, the proposed construction methodology has not been finalised. For assessment purposes, we have assumed typical construction plant and equipment will be used at each stage of the project, as summarised below in Table 17.

Table 17: Typical construction plant and sound power levels L_W dB(A) (DEFRA)

Typical Plant	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dBA
Excavation Works									
Bobcat (5t)	99	99	94	87	87	86	82	76	**93**
Truck Delivery	114	110	105	102	98	94	90	83	**104**
Screw Piler	104	101	90	94	90	86	82	77	**95**
Structural Works									
Truck Delivery	114	110	105	102	98	94	90	83	**104**
Concrete Pump	112	104	98	99	101	101	94	86	**106**
Saw	110	110	100	99	97	96	90	92	**103**
Mobile Crane (50t)	106	97	95	92	90	85	77	68	**95**
Angle Grinder	85	79	80	88	98	105	101	101	**110**
Hammer	94	94	96	96	91	85	83	79	**97**
Fit out Works									
Angle Grinder	85	79	80	88	98	105	101	101	**110**
Hammer	94	94	96	96	91	85	83	79	**97**

Predicted construction noise impacts are presented below in Table 18. Fitout works are assessed with a conservative 10dB(A) reduction due to being undertaken internally within the building. This assessment is conservative, as equipment may not all operate simultaneously, and therefore noise impacts may often be under the relevant criteria at all receivers.

Table 18 Predicted Construction Noise Levels $L_{eq15min}$. during regular hours dB(A)

Receiver	Phase	Predicted Noise Levels, $L_{Aeq15min}$	Noise Affected Management Level – Typical Standard Hours, $L_{Aeq15min}$	Highly Noise Affected Management Level, $L_{Aeq15min}$
1 (Residential, South)	Excavation Works	68	61	75
	Structural Works	77	61	75
	Fit out Works	64	61	75
2 (Residential, West)	Excavation Works	58	60	75
	Structural Works	70	60	75
	Fit out Works	57	60	75
3 (TAFE, North)	Excavation Works	48	55	N/A
	Structural Works	60	55	N/A
	Fit out Works	47	55	N/A
4 (Gilchrist Oval, East)	Excavation Works	37	65	N/A
	Structural Works	45	65	N/A
	Fit out Works	32	65	N/A

Note that receivers 1 and 2 are only relevant to the construction noise assessment if these buildings are constructed and occupied during the construction work on the subject site. Otherwise, the TAFE NSW would likely be the most-affected receiver.

Construction noise levels are predicted in the worst case to exceed the Noise Affected Management Levels at receivers 1-3. Therefore, reasonable work controls may need to be implemented to minimise disruption to neighbouring residents and other sensitive receivers. In particular, work times should be organised to minimise the potential for disruption of neighbouring Macarthur Gardens residential (if relevant) and TAFE NSW.

To achieve acceptable construction noise levels, it is recommended that best practice measures outlined in AS2436-2010 *'Guide to noise and vibration control on construction, demolition and maintenance sites'* and recommended best practice procedures in the NSW EPA Interim Guide are used. As stated, noise management measures such as scheduling, and community consultation are practical management measures to minimise the impacts to neighbouring residences.

In addition, engineering measures such as site boundary hoardings may also be used to minimise these impacts. AS2436-2010 provides a summary of measures and their effectiveness in reducing noise impacts, as shown below in Table 19. As specified by the EPA ICNG (2009) these mitigation measures must be feasible and reasonable options for use.

Table 19: AS2436 typical best practice construction noise mitigation measures

Control by	Nominal noise reduction, in total A-Weighted sound pressure level, dB(A)	Comments
Distance Attenuation	6 dB(A) reduction per doubling of distance	Due to small distances to the nearest residential receiver, this measure has only limited effectiveness, particularly at the adjoining property boundary (see barriers/hoardings).
Barriers/Hoardings	Normally 5 to 10 dB(A), maximum 15 dB(A)	Site hoardings are both practical and effective means of reducing noise levels from the site to the nearest affected receivers. These are highly recommended, particularly for activities which may occur in close proximity to the nearest affected residential boundaries.
Enclosures	Normally 10 to 15 dB(A), maximum 50 dB(A)	This measure is best used on individually noisy plant items, such as saws, drills, pumps.
Silencing/Mufflers	Normally 5 to 10 dB(A), maximum 20 dB(A)	Consider the use of quiet plant and equipment, where possible.

5.5. Construction Vibration Impacts

Vibration impacts may become a potential issue to the onsite building where equipment such as piling rigs, vibratory rollers, or jackhammers are used. Although the construction methodology has not been finalised, this equipment is not expected to be used for the project, and therefore it is unlikely that significant vibration will occur.

Subject to the confirmed construction methodology, the construction vibration plan should be conducted where vibration limits could potentially cause cosmetic damage or exceed the limits stated in DIN4150-3 (2016) (Vibration in Buildings – Effects on Structures). As a preliminary guide, recommended safe working distances for typical equipment are provided in Table 20. Further assessment should be conducted when equipment selection and construction metohdology have been finalised.

Table 20: Recommended safe working distances for construction plant, metres (m).

Plant Item	Rating Description	Cosmetic Damage	Human Response (OHSE Vibration Guideline - AVATG
Vibratory Roller	<50kN (Typically 1-2 tonnes)	5m	15-20m
	<100kN (Typically 1-2 tonnes)	6m	20m
	<200kN (Typically 1-2 tonnes)	12m	40m
	<300kN (Typically 1-2 tonnes)	15m	100m
Small hydraulic hammer	(300kg – 5 to 12t excavator)	2m	7m
Medium hydraulic hammer	(900kg – 12 to 18t excavator)	7m	23m
Large hydraulic hammer	(1600kg –18 to 34t excavator)	22m	73m
Jack hammer	Hand-held	1m	2m

5.6. Traffic and Rail Noise Impacts

The assessment of road traffic and rail noise intrusion into the proposed apartment building has been utilised from Renzo Tonin's measurements and assessment for the entire masterplan site. As stated in Renzo Tonin's acoustic report (ref. *TL100-05F01 Masterplan acoustic and vibration assessment r1*, dated 3 December 2021), noise impacts from road traffic and rail were assessed through Cadna-A modelling and verified with the onsite noise monitors.

The assessment horizon year and the number of vehicles, heavy vehicle percentage, speed, etc. used in the assessment are not specified in the report by Renzo Tonin. This report by BSE has taken the nominated impacts from road traffic and rail which are shown in graphical form in the Renzo Tonin report, and below in Figure 12.

Noise impacts for each façade are determined by BSE based on the provided graphical results in the Renzo Tonin report, and are stated in The $LA_{eq,15hr}$ day results are corrected provided night-time impacts using the difference in the Renzo Tonin monitoring noise levels.

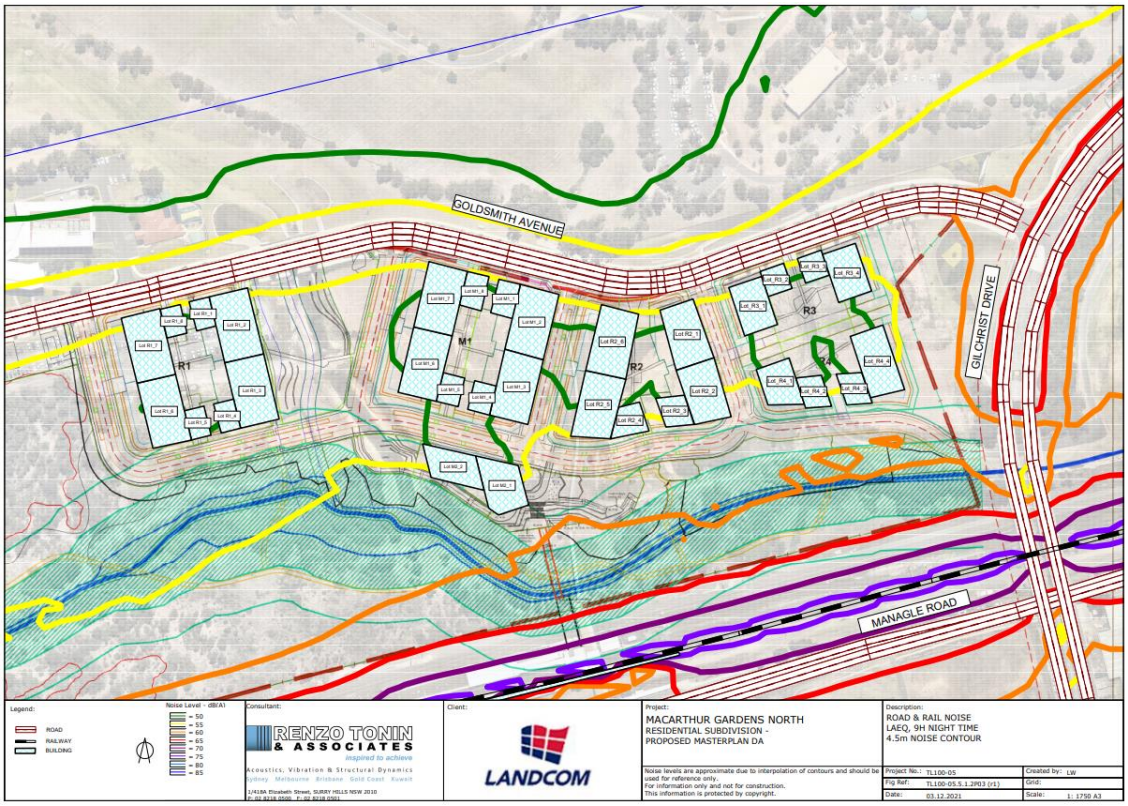

Figure 12: Renzo Tonin Graphical Noise Impacts - LAeq,9hr Night-time, Level 1

Renzo Tonin states that the graphical data should be used for reference only. This report only provides more specific faced treatments for the proposed R3 building based on current drawings, and previous results stated in the Renzo Tonin report.

This report details noise impacts conservatively where possible, but a more precise assessment with future 10-year horizon traffic numbers and calculated impacts for each façade is recommended, as shown in Table 21.

Table 21: Predicted Traffic and Rail Noise Impacts to site, dB(A)

Level	Tower	Façade	Predicted External Noise Impact (dBA)	
			$L_{Aeq,15hr\ day}$	$L_{Aeq,9hr\ night}$
Ground Floor-Level 2	East	Northern Façade	62	57
		Eastern Façade	63	58
		Southern Façade	57	52
		Western Façade	60	55
	West	Northern Façade	62	57
		Eastern Façade	57	52
		Southern Façade	57	52
		Western Façade	60	55
Level 3 – Level 8	East	Northern Façade	61	56
		Eastern Façade	63	58
		Southern Façade	57	52
		Western Façade	60	55
	West	Northern Façade	61	56
		Eastern Façade	57	52
		Southern Façade	57	52
		Western Façade	60	55

Based on the nominated noise impacts above, in addition to the calculated noise impacts from proposed onsite activities, general façade recommendations for the proposed apartments are provided in Section 6.1.

6. Recommendations

The development is predicted to comply with noise criteria stated in the NSW (NPfI) 2017 and AS2107:2016, provided the following recommendations are implemented:

6.1. Façade Construction Recommendations

Based upon the specified traffic noise impacts from Renzo Tonin, recommended façade treatments are listed in Table 22 in order to minimise traffic and rail noise impacts in accordance with SEPP requirements. Noise impacts from proposed onsite sources (communal areas and carparking) are assessed in accordance with the maximum noise level nominated in AS2107:2016.

Where a room is nominated as affected by both traffic/rail and onsite noise impacts, the highest nominated treatment should be implemented. Mechanical ventilation is also necessary in nominated habitable areas, so that the façade doors and windows can remain closed.

Table 22:Traffic Noise - minimum transmission loss requirements (Rw).

Level	Tower	Façade	Room	Recommended Façade Glazing Treatments		
				Minimum Rw		Mechanical Ventilation
				Glazing	Wall	
Ground Floor – Level 2	East	Northern Façade	Bedroom	28	35	Yes
			Other habitable rooms	28	35	Yes
		Eastern Façade	Bedroom	29	35	Yes
			Other habitable rooms	29	35	Yes
		Southern Façade	Bedroom	23	35	Yes
			Other habitable rooms	23	35	Yes
		Western Façade	Bedroom	26	35	Yes
			Other habitable rooms	26	35	Yes
	West	Northern Façade	Bedroom	28	35	Yes
			Other habitable rooms	28	35	Yes
		Eastern Façade	Bedroom	23	35	Yes
			Other habitable rooms	23	35	Yes
		Southern Façade	Bedroom	23	35	Yes
			Other habitable rooms	23	35	Yes
		Western Façade	Bedroom	26	35	Yes
			Other habitable rooms	26	35	Yes
Level 3 – Level 8	East	Northern Façade	Bedroom	27	35	Yes
			Other habitable rooms	27	35	Yes
		Eastern Façade	Bedroom	29	35	Yes
			Other habitable rooms	29	35	Yes
		Southern Façade	Bedroom	23	35	Yes
			Other habitable rooms	23	35	Yes
		Western Façade	Bedroom	26	35	Yes
			Other habitable rooms	26	35	Yes
	West	Northern Façade	Bedroom	27	35	Yes
			Other habitable rooms	27	35	Yes
		Eastern Façade	Bedroom	23	35	Yes
			Other habitable rooms	23	35	Yes
		Southern Façade	Bedroom	23	35	Yes
			Other habitable rooms	23	35	Yes
		Western Façade	Bedroom	26	35	Yes
			Other habitable rooms	26	35	Yes

Table 23: Onsite Noise–minimum transmission loss requirements (Rw).

Level	Apartments	Room	Recommended Façade Glazing Treatments		
			Minimum Rw		Mechanical Ventilation
			Glazing	Wall	
Ground Floor	Apartments adjacent to entrance driveway ramp leading to basement	Bedroom	24	35	Yes
		Other habitable rooms	24	35	Yes
Ground Floor – Level 2	All apartments overlooking the ground level communal area	Bedroom	29	35	Yes
		Other habitable rooms	27	35	Yes
Level 3 – Level 6	All apartments overlooking the Level 3 communal areas	Bedroom	24	35	Yes
		Other habitable rooms	22	35	Yes

Nominal façade wall constructions are listed below. Other systems may be implemented if they achieve the specified Rw rating.

- Wall Rw35:
  - Single 64mm steel studs, 50mm thick insulation (11kg/m^3) in cavity. 6mm thick fibre cement cladding externally and 10mm standard plasterboard (min. 8.5kg/m^2) internally.

Nominal glazing solutions are also stated below. Note that other systems may be implemented if they achieve the specified Rw rating. These systems are only typical recommendations; a laboratory (NATA or equivalent) test should be reviewed to determine the rating of the applied system, once the exact product has been selected. The nominated Rw rating is required for the entire system which includes glass, frames, and seals.

- Glazing Rw29:
  - 5mm thick single glazing, with full acoustic seals such as Q-Lon, or
  - 6mm/12mm air gap/4mm, with full acoustic seals such as Q-Lon
- Glazing Rw24-27:
  - 4mm thick single glazing, with full acoustic seals such as Q-Lon
- Glazing Rw22-23:
  - 4mm thick single glazing, with standard weather (mohair) seals

6.2. Other Construction and Management Controls

The following management controls should also be implemented to operation of the development.

- Amplified speakers should not be used in the Level 3 outdoor communal areas. Any amplified speakers used in the ground level outdoor communal area should be limited to the daytime and evening periods only (Mon-Sat 7am-10pm, Sun & public holidays 8am-10pm), and not exceed a level of 75dBA at 1m from the speakers.
- Use of the outdoor ground-level communal area should be limited to the daytime and evening periods only (Mon-Sat 7am-10pm, Sun & public holidays 8am-10pm).
- Waste collection should be undertaken in accordance with the surrounding residential and commercial uses.
- The following recommendations are proposed for the carpark:
  - Secure metal grating/drains to prevent any rattling.
  - Avoid any floor finishes that produce squealing tyres, e.g. polished concrete.

6.3. Mechanical Plant

At this stage, the majority of mechanical plant equipment is nominated on the rooftop, however the selection and final locations of equipment has not been finalised and therefore a full assessment cannot be conducted at this stage.

All mechanical plant should be designed to comply with relevant noise criteria in Section 4.4.2. Acoustic design should be undertaken throughout the design phases of the project once information regarding the location and equipment models have been selected.

6.4. Construction Noise

This report has included a preliminary assessment and recommendations for construction noise and vibration, as detailed in Section 5.4 and 5.5. Further assessment as part of a noise and vibration management plan should be conducted after the equipment, and location/schedule of works is selected.

7. Conclusion

This noise impact assessment has been conducted for the proposed residential development at Site R3, Macarthur Gardens North, Campbelltown. Façade treatments have been provided based on the assessment of the entire masterplan site by Renzo Tonin and Associates (ref. *TL100-05F01 Masterplan acoustic and vibration assessment r1*, dated 3 December 2021). Further assessment is recommended in order to review future traffic impacts based on the expected future traffic numbers after full development.

Following from calculations of the expected noise sources, recommendations have been provided in relation to the noise criteria stated in the NSW Noise Policy for Industry (2017). General recommendations to minimise noise impacts to onsite and offsite locations, and for façade construction in order to achieve nominated internal noise levels in residential areas, have been detailed in Section 6 of this report.

Additional assessment of noise impacts to neighbouring proposed residential buildings (Sites R2 and R4 within the Macarthur Gardens North masterplan) is recommended to be conducted when more information about those buildings is available.

A. Appendix A – Acoustic Terminology

Absorption

The properties of a material composition to convert sound energy into heat, thereby reducing the amount of energy that can be reflected.

Airborne Noise

A condition when sound waves are being carried by the atmosphere.

Attenuation

The reduction of sound energy as a function of distance travelled.

A-Weighted Sound Level (Noise level)

A measure of sound pressure designed to reflect the response of the human ear, which does not respond equally to all frequencies. The ear is less efficient at low and high frequencies than at medium or speech-range frequencies. To describe sound in a manner representative of the human ear's response, it is necessary to reduce the effects of the low and high frequencies with respect to the medium frequencies. The resultant sound level is said to be A-weighted, and the units are dBA. The A-weighted sound level is also called the 'noise level'. Sound level meters have an A-weighting network for measuring A-weighted sound levels. Most levels of occupational, industrial and environmental noise are measured using A-weighting.

Barrier

A material that when placed around a source of noise inhibits the transmission of that noise beyond the barrier. Also, an environment or any physical thing that interferes with communication or listening.

Decibel (dB)

Sound level in Bels as a logarithmic ration. Relative quantity of sound intensity compared to a standard unit used as a reference. The decibel or dB cannot be used by itself. Both the quantity considered (sound power level or sound pressure level) and the standard unit used as a reference must be specified when the decibel is used.

Diffuse Sound Field

A diffuse sound field is one in which the sound field at any given point is made up of sound waves of all angles of incidence.

Direct Field

The sound in a region in which all or most of the sound arrives directly from the source without reflection.

Free Field

Sound waves from an outdoor source where there are no obstructions.

Frequency

The number of oscillations or cycles per unit of time. Acoustical frequency is usually expressed in units of Hertz (Hz) where one Hz is equal to one cycle per second.

Hertz (Hz)

Frequency of sound expressed by cycles per second.

Intensity Level (LI) (IL)

A measure of the acoustic power passing through a unit area expressed on a decibel scale referenced to some standard (usually 10-12) watt per square meter.

Noise Reduction Coefficient (NRC)

The NRC of an acoustical material is the mathematical average, to the nearest multiple of 0.05, of its absorption coefficients at centre frequencies of 250,500,1000, 2000 Hertz Octaves.

Octave Bands

Sounds that contain energy over a wide range of frequencies are divided into sections called bands. A common standard division is in 10 octave bands identified by their centre frequencies 63, 250, 500, 1000, 2000, 4000 and 8000Hz.

Reverberation

Sound after it is ended at the source will continue to reflect off surfaces until the sound wave loses energy by absorption to eventually die out.

Reverberation Time

The time taken for sound to decay 60 dB to 1/1,000,000 of its original sound level after the sound source has stopped. Sound after it has ended will continue to reflect off surfaces until the wave loses enough energy by absorption to eventually die out. Reverberation time is the basic acoustical property of a room, which depends only on its dimensions and the absorptive properties of its surfaces and contents. Reverberation has an important impact on speech intelligibility.

Sound Absorption

The property possessed by materials, objects and air to convert sound energy into heat. Sound waves reflected by a surface create a loss of energy. That energy not reflected is referred to as the absorption coefficient.

Sound Absorption Coefficient

The fraction of energy striking a material or object that is not reflected. For instance, if a material reflects 70% of the sound energy incident upon its surface, then its Sound Absorption Coefficient would be 0.30. SAC=Absorption/Area in sabins per sq. m.

Sound Level

A subjective measure of sound expressed in decibels as a comparison corresponding to familiar sounds experienced in a variety of situations.

Sound Pressure Level (SPL)

An important measure of sound loudness, the level is calculated in decibels by 20 times the logarithm to the base 10 of the ratio of the measured sound pressure level and the reference point.

Sound Level Meter

A device that converts sound pressure variations in air into corresponding electronic signals. The signals are filtered to exclude sound waves outside the desired frequencies.

Sound Transmission Class (STC)

A single-number system used to rate the sound transmission performance of a wall, panel, ceiling, etc. The higher the ranking, the better the ability to obstruct sound transmission.

Structure-Borne Noise

A condition when the sound waves are being carried by a solid material. Sound waves in this state are inaudible to the human ear, since they cannot carry energy to it. Airborne noise can be created from the radiation of structure-borne noise into the air. Structure-borne noise may be propagated by shear waves, tension-compression waves, bending waves, or complicated combinations of waves.

Transmission Loss (TL)

The reduction of airborne sound power that is caused by placing a wall or barrier between the reverberant sound field of a source and the receiver. Transmission loss is a property of the wall or barrier.