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Acoustic Report

- **Environmental Impact Assessment,
Rail Noise & Vibration Assessment -**

For the proposed Boarding House development

at

No. 102 Broomfield Street, Cabramatta

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1.0 INTRODUCTION

The aim of this report is to determine the building materials to be used and the construction methods to be adopted such that the proposed development at No. 102 Broomfield Street, Cabramatta is built to achieve acceptable internal noise and vibration levels as per the requirements of Fairfield City Council Requirements.

In this report, noise intrusion levels are to be within the limits adopted by Clause 87 of the State Environmental Planning Policy – (Infrastructure) 2007, Australian/New Zealand Standards AS/NZS 2107:2016 “*Acoustics – Recommended Design Sound Levels and Reverberation Times*” and the Department of Planning’s document titled “*Development Near Rail Corridors and Busy Roads – Interim Guidelines*”, such that all habitable rooms in the proposed development shall be designed to limit internal noise levels.

The impact of noise emissions from the operation of the proposed Boarding House will also be assessed in accordance with the requirements of the NSW Noise Policy for Industry and Fairfield City Council.

The site is located on the corner of Broomfield Street and Bridger Street, in the suburb of Cabramatta and is located approximately 20 meters east from a railway corridor (Figure 1 – Site Location). The architectural plans by Urban Link Pty Ltd, dated November 4th, 2020 for the proposed four (4) storey boarding house including two (2) levels of basement parking.

The proposed site is in a mixed residential and commercial/retail area, with existing background noise levels dominated by traffic from Cabramatta Road (north of the site), Broomfield Street, as well as a railway corridor located approximately 20 meters west of the site and surrounding residential and commercial activities (Figure 2 – Surrounding Environment).

A Hebel Sound Panel has been installed around the railway corridor as shown in Figure 3 – (Existing Hebel Sound Panel Along Railway Corridor).



2.0 NOISE SURVEY & INSTRUMENTATION

On the 21st June, 2019, an engineer from this office visited the proposed site to carry out acoustic measurements of the existing environmental noise levels. Noise measurements were carried out at the northern boundary of the site in order to determine background noise levels as well as noise levels from the railway corridor (Figure 4 – Noise Reading Location).

The unattended noise readings were carried out for a period of seven (7) days between June 21 and June 28, 2019. The noise survey was conducted to determine a conservative reading of the existing day noise levels [7:00 -18:00], evening noise levels [18:00-22:00] and night and early morning noise levels [22:00-7:00] $L_{(A90, 15 \text{ minutes [1hr])}}$ and $L_{(Aeq, 15 \text{ minutes [1 hr])}}$.

The measurement procedure and the equipment used for the noise survey are described below. All sound pressure levels are rounded to the nearest whole decibel. All sound level measurements and analysis carried throughout this report are carried with Svantek 957 Noise and vibration level meter which has the following features:

- Type 1 sound level measurements meeting IEC 61672:2002
- General vibration measurements (acceleration, velocity and displacement) and HVM meeting ISO 8041:2005 standard
- Three parallel independent profiles
- 1/1 and 1/3 octave real time analysis
- Acoustic dose meter function
- FFT real time analysis (1920 lines in up to 22.4 kHz band)
- Reverberation Time measurements (RT 60)
- Advanced Data Logger including spectra logging
- USB Memory Stick providing almost unlimited logging capacity
- Time domain signal recording
- Advanced trigger and alarm functions
- USB 1.1 Host & Client interfaces (real time PC “front end” application supported)
- RS 232 and IrDA interfaces
- Modbus protocol

Machine was calibrated prior to reading. Any noise results affected by strong wind or rain have been disregarded. The Full Average Statistical Noise Parameters $L_{(Aeq, 15 \text{ minutes})}$, $L_{(A90, 15 \text{ minutes})}$, $L_{(A10, 15 \text{ minutes})}$, $L_{(A1, 15 \text{ minutes})}$ are presented in Figure 5 – Noise Survey. A Summary of those readings is presented in Table 2.1.



Table 2.1 - Summary of Unattended Noise Survey at rear (Point A), between June 21 and June 28, 2019

Point A	LAeq dB(A)	LA90 dB(A)
Day Time (7:00am-6:00pm)	59	54
Evening Time (6:00pm-10:00pm)	57	48
Night & Early Morning (10:00pm – 7:00am)	55	48

The Rating Background Levels have been calculated in the table below.

Table 2.2 – Calculated Rating Background Noise Levels between June 21 and June 28, 2019

Measurement Location	Time Period	Rating Background Level (RBL)		
		Day, dB(A) (7am-6pm)	Evening, dB(A) (6pm-10pm)	Night, dB(A) (10pm- 7am)
Point A – Northern Boundary at No. 102 Broomfield Street, Cabramatta	Friday (21/06/2019)	45	46	39
	Saturday (22/06/2019)	45	47	37
	Sunday (23/06/2019)	46	44	38
	Monday (24/06/2019)	47	43	39
	Tuesday (25/06/2019)	45	45	38
	Wednesday (26/06/2019)	47	43	38
	Thursday (27/06/2019)	45	44	38
	Friday (28/06/2019)	45	-	-
	Median	45	44	38

3.0 NOISE & VIBRATION DESIGN CONTROLS

3.1 DEVELOPMENT NEAR RAIL CORRIDOR AND BUSY ROADS – INTERIM GUIDELINE & CLAUSE 87 OF THE SEPP

The development is to comply with the Department of Planning's document titled '*Development Near Rail Corridors and Busy Roads – Interim Guidelines*'. This document is referred to in this report as the Interim Guideline.

The subject site is less than 80m away from the operational railway track. As per Figure 3.1 (presented below) of the Interim Guideline, noise mitigation should be incorporated into the proposed development.

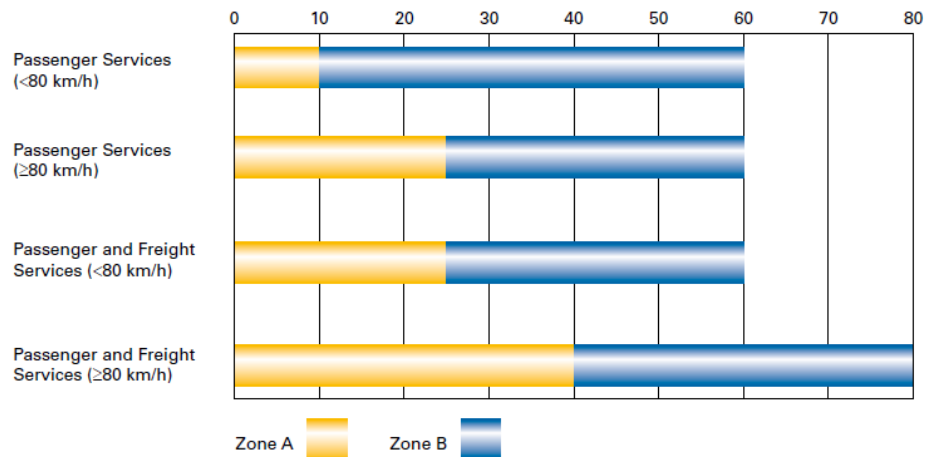


Figure 3.1: Acoustic Assessment Zones based on distance (m) of noise-sensitive development from operational track (not corridor)

Section 3.5 of the Interim Guideline states that the acoustic assessment of the above development should be carried out such that all internal noise levels within the development to comply with Clause 87 of the Sepp.

Clause 87 of the SEPP states that where the development is for residential use and is located in or adjacent to a rail corridor; a consent authority must not grant consent unless it is satisfied that appropriate measures will be taken to ensure that the following L_{Aeq} levels are not exceeded:

- In any bedroom in the building – 35db(A) at any time between 10:00pm and 7:00am and
- Anywhere else in the building (other than a garage, kitchen, bathroom, or hallway) – 40db(A) at any time.

Section 3.6.1 of the Interim Guideline states that when windows and doors are left open, indoor sound levels should not exceed the nominated noise criteria by more than 10 dB(A). If noise levels exceed the nominated rail noise criteria by more than 10 dB(A), then the provision of mechanical ventilation should be incorporated in the design of the building.

3.2 AUSTRALIAN/ NEW ZEALAND STANDARD AS/NZS 2107:2016

It is usual practice, when we find it necessary to recommend internal sound levels in buildings to refer to Australian/New Zealand Standard AS/NZS 2107:2016 “Acoustics – Recommended Design Sound Levels and Reverberations times for Building Interiors”.

This standard provides recommended noise levels for steady state such as noise from building services and quasi-steady state sounds, such as traffic and rail noise. The noise levels recommended in AS/NZS 2107:2016 take into account the function of the area and apply to the sound level measured within the space unoccupied although ready for occupancy.



The standard recommends the following noise levels for residential buildings

Type of occupancy/activity	Design sound level ($L_{Aeq,t}$) range	Design reverberation time (T) range, s
RESIDENTIAL BUILDINGS (see Note 5 and Clause 5.2)		
Houses and apartments in inner city areas or entertainment districts or near major roads—		
Apartment common areas (e.g. foyer, lift lobby)	45 to 50	—
Living areas	35 to 45	—
Sleeping areas (night time)	35 to 40	—
Work areas	35 to 45	—
Houses and apartments in suburban areas or near minor roads—		
Apartment common areas (e.g. foyer, lift lobby)	45 to 50	—
Living areas	30 to 40	—
Sleeping areas (night time)	30 to 35	—
Work areas	35 to 40	—

3.3 DEPARTMENT OF ENVIRONMENT & CONSERVATION NSW 'ASSESSING VIBRATION: A TECHNICAL GUIDELINE'

In addition to noise limits, floor vibration levels in habitable rooms should comply with the Department of Environment & Conservation NSW document titled '*Assessing Vibration: A Technical Guideline*'. Most of these vibration limits stated in the document above are adopted from the British Standard BS 6472-1:2008 '*Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80 Hz)*' criteria.

The acceptable values for intermittent vibration limits within the proposed residence as stated in section 2.4 of the NSW "*Assessing Vibration: A Technical Guideline*" are listed in Table 2.3.1 below.

Table 2.3.1– Acceptable Vibration dose values ($m/s^{1.75}$) for Residential Buildings

Location	Vibration Limit $m/s^{1.75}$
Residential buildings 16hr day (daytime)	0.2 to 0.4
Residential buildings 8hr night (night-time)	0.13to 0.26

3.4 RAIL VIBRATION MEASUREMENT

Vibration measurements were carried out at Location A using a Vibrock V9000. Typical vibration levels by various train pass-by events were found to be as followed. The vibration dose, eVDV, for each train pass-by is estimated using the following formula:

$$eVDV = eVDV = 1.4 \times a_{rms} \times t^{0.25}$$

Where;



a_{rms} = weighted rms acceleration of train (m/s^2)
 t = time taken for the train pass-by.

While the total vibration for the train pass-by is $eVDV (total) = [N(V_e)^4]^{0.25}$ where N = the number of identical events.

Using the formulas above, and based on the number of trains pass-by as obtained from the Sydney Train time table (Plus 1 freight train for 2 mins. each hour) the $eVDV (total)$ for day was found to be $0.0069 m/s^{1.75}$ and much lower for the nighttime which complies with the criteria presented in the table from BS 6472-1:2008 as shown above.

3.5 RAIL VIBRATION ASSESSMENT & CONCLUSION

The development will comply with the vibration criteria without any additional vibration treatments being installed.

4.0 EXISTING ACOUSTIC ENVIRONMENT & POTENTIAL NOISE IMPACT

The proposed boarding house is located on the corner of Broomfield Street and Bridge Street, in the suburb of Cabramatta in a mixed residential/commercial area. Existing background noise levels are dominated by the traffic emitted from Cabramatta Road and Broomfield Street, the adjacent railway corridor, surrounding commercial and residential activities (Figure 2).

The nearest residential receivers that have the potential to be affected by the proposed boarding house are the residential apartment building located directly north of the site at No. 98-100 Broomfield Street and the residential apartment building directly east of the site at No. 17 Bridge Street (Figure 6 – Nearest Residential Receivers).

The proposed boarding house will include the following:

- Thirty-six (37) boarding rooms
- One (1) indoor communal room
- One (1) outdoor communal area
- Two levels of basement parking with entry from bridge with;
 - o Nineteen (19) car spaces
 - o Eight (8) motorcycle spaces
 - o Eight (8) bicycle spaces

Noise producing activities from the proposed boarding house at No. 102 Broomfield Street, Cabramatta are categorized into major and minor as follows:

Table 4.1 – Noise Producing Activities from Proposed Boarding House

Aspects	Noise sources
Entertainment	• Entertainment in Communal Areas (major)



Car Park	Noise from Vehicles (major)
Equipment and systems	- Mechanical Plant and Air conditioning Units (major) - Washing and machine operation in laundry (minor) - Dishwashing, cleaning and cooking in kitchens (minor) - Lawnmowers and saws in gardening (minor) - Vacuum cleaners in housekeeping (minor)
Guest rooms	- Music and TV (major) - Conversation (minor) - Door closing (minor)

5.0 ACCEPTABLE NOISE LEVEL

5.1 NOISE GUIDE FOR LOCAL GOVERNMENT & POEO

The Department of Environment and Conservation (NSW) published the amended *Noise Guide for Local Government* in October 2010. The policy is specifically aimed at assessing noise from light industry, shops, entertainment, public buildings, air conditioners, pool pumps and other noise sources in residential areas.

Section 2.2.1 of the Noise Guide for Local Government states that a noise source is generally considered to be intrusive if the noise from the source when measured over a 15-minute period exceeds the background noise by more than 5 dB(A). Therefore, the noise criteria are as follows:

- Day period: $54 + 5 = 59$ dB(A)
- Evening period: $48 + 5 = 53$ dB(A)
- Night period: $48 + 5 = 53$ dB(A)

The appropriate regulatory authority (Local Council) may, by notice in writing given to such a person, prohibit the person from causing, permitting or allowing:

1. any specified activity to be carried on at the premises, or
2. any specified article to be used or operated at the premises.

or both, in such a manner as to cause the emission from the premises, at all times or on specified days, or between specified times on all days or on specified days, of noise that, when measured at any specified point (whether within or outside the premises,) is in excess of a specified level.

It is an offence to contravene a noise control notice. Prior to being issued with a noise control notice, no offence has been committed.

The Protection of the Environment Operations Act 1997 (POEO) defines “Offensive Noise” as noise:

1. (a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:
2. (i) is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or



3. (ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or
(b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances prescribed by the regulation.

5.2 NSW NOISE POLICY FOR INDUSTRY (2017)

The above policy seeks to promote environmental well-being through preventing and minimizing noise by providing a framework and process for deriving noise limits conditions for consent and licenses.

The Noise Policy for Industry 2017 recommends two separate noise criteria to be considered, the Intrusive Noise Criteria and the Amenity Noise Criteria. A project noise trigger level being the lowest of the amenity and the intrusiveness noise level is then determined.

If the predicted noise level L_{Aeq} from the proposed project exceeds the noise trigger level, then noise mitigation is required. The extent of any 'reasonable and feasible' noise mitigation required whether at the source or along the noise path is to ensure that the predicted noise level L_{Aeq} from the project at the boundary of most affected residential receiver is not greater than the noise trigger level.

5.2.1 AMENITY NOISE CRITERIA

The amenity noise levels presented for different residential categories are presented in Table 2.2 of the Noise Policy for Industry 2017. These levels are introduced as guidance for appropriate noise levels in residential areas surrounding industrial areas.

For the proposed boarding house at No. 102 Broomfield Street, Cabramatta the recommended amenity noise levels are presented in Table 5.2.1.1 below:

Table 5.2.1.1 - Recommended Noise Levels from Industrial Noise Sources

<i>Type of Receiver</i>	<i>Area</i>	<i>Time Period</i>	<i>Recommended Leq Noise Level, dB(A)</i>
Residence	Suburban	Day	55
		Evening	45
		Night	40

Where a noise source contains certain characteristics such as tonality, intermittency, irregularity or dominant low-frequency content, a correction is to be applied which is to be added to the measured or predicted noise levels at the receiver, before comparison with the criteria. Shown below are the correction factors that are to be applied:



Table 5.2.1.2 – Modifying Factor Corrections as per Fact Sheet C (Noise Policy for Industry 2017)

Factor	Correction
Tonal Noise	+ 5 dB ^{1,2}
Low-Frequency Noise	+ 2 or 5 dB ¹
Intermittent Noise	+ 5 dB
Duration	+ 0 to 2 dB(A)
Maximum Adjustment	Maximum correction of 10 dB(A) ¹ (excluding duration correction)

1. Where a source emits tonal and low-frequency noise, only one 5-dB correction should be applied if the tone is in the low-frequency range, that is, at or below 160 Hz.
2. Where narrow-band analysis using the reference method is required, as outlined in column 5, the correction will be determined by the ISO1996-2:2007 standard.

Correction for duration is to be applied where a single-event noise is continuous for a period of less than two and a half hours in any assessment period. The allowable exceedance of the $L_{Aeq,15min}$ equivalent noise criterion is depicted in Table 5.2.1.3 for the duration of the event. This adjustment accounts for unusual and one-off events and does not apply to regular and/or routine high-noise level events.

Table 5.2.1.3 – Adjustment for Duration as per Fact Sheet C (Noise Policy for Industry 2017)

Allowable duration of noise (one event in any 24-hour period)	Allowable exceedance of $L_{Aeq,15min}$ equivalent project noise trigger level at receptor for the period of the noise event, dB(A)	
	Daytime & evening (7 am–10 pm)	Night-time (10 pm–7 am)
1 to 2.5 hours	2	Nil
15 minutes to 1 hour	5	Nil
6 minutes to 15 minutes	7	2
1.5 minutes to 6 minutes	15	5
less than 1.5 minutes	20	10

According to Section 2.4 of the above policy, the project amenity noise level is determined as follows:

Project amenity noise level for industrial developments = recommended amenity noise level (Table 2.2) minus 5 dB(A)

To convert from a period level to a 15-minute level, a plus 3 is added as per section 2.2 of the policy.

Therefore, the project amenity noise level for the proposed boarding house at No. 102 Broomfield Street, Cabramatta is as follows:

- Day period: $60 - 5 + 3 = 58$ dB(A)
- Evening period: $50 - 5 + 3 = 48$ dB(A)
- Night period: $45 - 5 + 3 = 43$ dB(A)



5.2.2 INTRUSIVENESS NOISE CRITERIA

The Noise Policy for Industry in Section 2.3 summarizes the intrusive criteria as below:

$$L_{Aeq, 15 \text{ minute}} \leq \text{rating background level plus 5}$$

While the background noise level known as $LA_{90,15 \text{ minutes}}$ is the Noise exceeded 90% percent of a time period over which annoyance reactions may occur (taken to be 15 minutes). The RBL is defined as the overall single-figure $LA_{90,15 \text{ minutes}}$ background level representing each assessment period (day/evening/night) over the whole monitoring period.

For the short-term method, the rating background noise level is simply the lowest measured $LAF_{90,15\text{min}}$ level. For the long-term method, the rating background noise level is defined as the median value of:

- all the day assessment background levels over the monitoring period for the day
- all the evening assessment background levels over the monitoring period for the evening, or
- all the night assessment background levels over the monitoring period for the night.

The predicted noise from the source $L_{Aeq,15 \text{ min}}$ is measured as at the most affected point within the most affected residential at the point where the most impact occurs. Noise results listed in Section 2, Table 2.1 & 2.2 of this report, list background noise levels at the boundary of the nearest residential receiver, No. 98-100 Broomfield St, Cabramatta.

Therefore, the acceptable L_{eq} noise intrusiveness criterion for broadband noise during the day, evening & night is as follows:

- Day period: $45 + 5 = 50 \text{ dB(A)}$
- Evening period: $44 + 5 = 49 \text{ dB(A)}$
- Night period: $38 + 5 = 43 \text{ dB(A)}$

5.2.3 PROJECT NOISE TRIGGER LEVEL

A summary of intrusiveness and amenity noise levels as determined in Section 5.2.1 & 5.2.2 are shown in Table 5.2.3 below:

Table 5.2.3 - Summary of Intrusiveness and project amenity noise levels

<i>Period</i>	<i>Intrusiveness Noise Level, dB(A)</i>	<i>Project Amenity Noise level, dB(A)</i>
Day Time (7am-6pm)	50	58
Evening Time (6pm-10pm)	49	48



Night and Early Morning (10pm – 7am)	43	43
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The project noise trigger level is the lower (that is, the most stringent) value of the amenity and intrusiveness noise levels for the day, evening and night-time. Therefore, the project noise trigger levels for the proposed development are as shown below

- Day period $L_{Aeq,15\text{ min}}$: 50 dB(A)
- Evening period $L_{Aeq,15\text{ min}}$: 48 dB(A)
- Night period $L_{Aeq,15\text{ min}}$: 43 dB(A)

The proposed boarding house and its activities including all mechanical plant will not exceed the project noise trigger level at the most sensitive location (boundary of No. 98-100 Broomfield Street and No. 17 Bridge Street), provided all noise control recommendations in Section 7 of this report are adhered to.

6.0 PREDICTED NOISE FROM THE PROPOSED BOARDING HOUSE

As stated in Section 4.0 of this report noise levels from the boarding house are classified into major and minor offensive noise sources. The main major noise sources are:

- Noise from occupants entering and existing the basement car park
- Noise from lodgers gathering in the indoor communal lounge and outdoor common open space
- Noise from air-conditioning units, pumps and compressors and mechanical plant

6.1 NOISE FROM CARPARK

The proposed basement car park of the boarding house will accommodate a total of nineteen (19) car spaces and eight (8) motorcycle spaces (Figure 7 – Proposed Basement Parking). Access to the car park will be from Bridge Street, with the driveway ramp adjacent to the eastern boundary of the site. Therefore, the nearest residential receiver affected by vehicles entering/exiting the basement car park is No. 17 Bridge Street due to the basement driveway.

It is expected that most tenants will utilize public transport as bus services are readily available in the surrounding area and Cabramatta Railway Station is located directly opposite the site. However, some residents will utilize the parking available in the car park.

Car park noises typically may comprise of people talking, car radios and car doors closing. The loudest activity being the noise produced by the opening and closing of the car park basement roller door and the closing of car doors.



Table 6.1.1 – SPL Levels for Different Car Activities Expected to Occur in the Car Park

Car Park Noise Source	Average Sound Power Level, dB(A)
Car Door Closing	91*
Car Starting	91*
Car Accelerating	91*
Car Moving	87

***Activity taking place inside enclosed basement**

Table 6.1.2 – Typical car park roller-door Sound Power Levels Leq

Frequency [Hz]	63	125	250	500	1k	2k	4k	8k	dB(A)
Car-Park Security Roller Door	73	75	77	79	82	77	76	74	85

Predicted noise levels from the operation of the garage roller door presented in Table 6.1.2 above, have been established from our database according to typical motorized roller doors/panel lift doors installed at other developments. The average time duration for a garage roller door to fully open or close is approximately 30 seconds.

For vehicles entering the basement carpark, the only noise generated will be by cars moving in and out of the driveway. The remainder of car activities listed in the table above, will occur inside the basement and therefore noise produced by those activities will be attenuated by the basement enclosure.

The predicted noise levels at the nearest residential receiver (No. 17 Bridge Street) due to vehicles entering/exiting the carpark will comply with the criteria of the Noise Policy for Industry 2017, provided the recommendations in Section 7 of this report are adhered to. Distance attenuation loss and loss from the enclosure of the parking area have been taken into consideration when making our predictions.

Predicted noise levels at the boundary of the nearest residential receiver (No. 17 Bridge Street) due to cars entering and exiting the basement car park, are presented in Table 6.1.3.

Table 6.1.3 – Predicted Noise from Vehicles entering and exiting the basement at boundary of No. 17 Bridge Street

Total Leq 15 minutes (sound power)	67 dB(A)
Sound Pressure Level (per car Trip)	59 dB(A)
Number of trips in 15 mins	5
Total sound Pressure Level	66 dB(A)
Distance from Receiver	5m
Less Distance Mitigation	10
Less Fence Mitigation	10
Leq 15 minutes @ Nearest Receiver No. 17 Bridge St	43 dB(A)



Complies with Criteria in Section 5 and NSW Noise Policy for Industry	Yes ✓
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6.2 NOISE FROM MUSIC & TV IN GUESTS ROOM & COMMUNAL AREAS

The proposed boarding house will include thirty-six (36) boarding rooms and one (1) indoor communal room and one (1) outdoor communal area, both located on the ground floor (Figure 8 – Proposed Common Areas).

Lodgers may listen to music or watch television in their rooms or in the common room. Noise from amplified music inside a room can reach approximately 100dB(A) to 120dB(A) at 1m from the centre of source. The public health in a study of social noise in a population sample of representative 18-25-year-old showed that the level of preferred listening was 74 dB(A).

No entertainment is proposed in the indoor and outdoor common areas, but social gatherings may occur between the lodgers. The following table lists the sound level of different levels of speech.

Table 6.2 - Noise produced in conversation – Male-*

<i>Descriptor</i>	<i>Sound Power Level</i>	<i>Standard Deviation</i>
Casual Speech	63 dB(A)	± 4dB
Normal Speech	69dB(A)	± 4dB
Raised Speech	76 dB(A)	± 5dB
Loud Speech	87 dB(A)	± 6dB
Shouting	100 dB(A)	± 7dB

***Pearsns et al (1977) – Original Mean Sound levels in anechoic chamber**

The noise level from the crowd inside/outside the communal area is estimated by the following equation:

$$L_{W,Aeq}(A \text{ weighted sound power level}) = 15 \log N + 64 \text{ dB(A)};$$

Where N is the crowd size.

The sound loss through the façade of a lodger's room in general and the communal room in particular is calculated using Templeton/Saunders equation:

$$L_2 = SWL_2 - 11 - 20 \log_{10}(r) + DI$$

$$L_2 = L_1 - 6 - R + 10 \log_{10} S - 11 - 20 \log_{10}(r) + DI$$

L_2 is Noise level at location 2 from the source

L_1 is Noise level at the source

r is distance in meters to location 2 from the source

R is the weighted sound reduction index of the facade



S is the area of the facade

DI is the directivity associated with the source.

If sound from music and TV are played inside the guest room or common room at a level of or close to 74 dB(A), then the noise transmitted into the most affected residences at No. 98-100 Broomfield Street and No. 17 Bridge Street, will comply with the criteria allowed as per Section 6 of this report, provided noise control recommendations in Section 7 are also adhered to.

6.3 NOISE FROM MECHANICAL PLANT & AIR CONDITIONING UNITS

A range of mechanical plant, equipment and ventilation will be included in the proposed development at No. 102 Broomfield Street, Cabramatta. Noise emitted by the use of the proposed mechanical plant is assessed by the Noise Policy for Industry 2017 and Fairfield City Council conditions/requirements.

The proposed two level of basement parking is located below ground level and that makes providing natural ventilation not possible and a mechanical extract system should be used. The mechanical ventilation system will include the use of supply air fans/exhaust air fans to achieve all required air changes for exhaust fume and extract smoke clearance in accordance with Australian Standard AS 1668.2:2012 “*The use of ventilation and air-conditioning in buildings -Mechanical ventilation in buildings*”. Air-conditioning might also be installed in the proposed development. Typical noise levels for car park exhaust fans, condensing unit and car-park roller door and are presented in Table 6.3.

Table 6.3 – Typical Mechanical Plant Leq Sound Power Levels

<i>Frequency [Hz]</i>	63	125	250	500	1k	2k	4k	8k	<i>dB(A)</i>
Typical Car park Exhaust Fan	80	82	84	87	86	83	78	71	90
Typical Condensing Unit	71	69	67	61	58	54	47	44	64
Car-Park Security Roller Door	73	75	77	79	82	77	76	74	85

In order for the operation of the car park & basement garage door to meet NSW Noise Policy for Industry 2017, we recommend the following:

- Ensure maintenance and lubrication of motor bearings, door tracks and joints.
- The proposed security door fitted to the car parking area entrance must be independently mounted on rubber pads to prevent vibration noise transmission through the concrete walls and/or columns

The proposed development is likely to include air conditioning units and kitchen and toilet exhaust fans. In general, the mechanical plant noise emission can be controlled by implementing the following:



- Procurement of quiet plant (when required) and the maintenance of existing plant;
- Strategic positioning of plant away from potential sensitive receivers;
- Commercially available silencers or acoustic attenuators for air discharge and air intakes of plant;
- Acoustically lined and lagged ductwork;
- Acoustic screens and barriers between plant and sensitive neighbouring premises; and/or,
- Partially enclosed or fully enclosed acoustic enclosures around plant.

As the proposed development is still in the initial application stage, we recommend that further acoustic assessment is carried out when the development has been approved and Mechanical Services plans have been prepared for our review. However, provided recommendations in Section 7.2 of this report are adhered to, all proposed mechanical plant and equipment is likely to comply with the criteria of the Noise Policy for Industry 2017 and Council Conditions.



7.0 RECOMMENDATIONS

7.1 EXTERNAL BUILDING SPECIFICATIONS

To limit the level of noise emission from the proposed boarding house and to limit the effect of rail noise on the internal amenity of boarding rooms, we recommend the following materials are used in the construction:

Building Component	Rw Rating to be Achieved
Windows & Sliding Doors in Boarding Rooms <i>facing the Railway Corridor</i> are to be 10.38 mm laminated with full perimeter Schlegel Q-Lon acoustic seals ⁽¹⁾ .	35
Windows & Sliding Doors in all other Boarding Rooms and Common Room are to be 6.38 mm laminated with full perimeter Schlegel Q-Lon acoustic seals ⁽¹⁾ .	32
Windows in Bathrooms/Ensuites/Laundries etc in all areas are to be unrestricted and to be in accordance with AS 2047 (Windows in Buildings) ⁽¹⁾ .	-
External Walls are to be 270/250 mm double brick, brick veneer construction or any other method of wall construction with an Rw of 44.	40-44
Roof is to be Minimum 150mm Concrete Roof, on 10 gypsum plaster board ceiling with 75mm thick, 11kg/m ³ mineral wool batts between ceiling joists ⁽²⁾ .	39-41

NB: This report is to be read in conjunction with the BASIX certificate and any other related building specification.

⁽¹⁾ No weep holes in windows/sliders. All gaps between window & door frames and the masonry walls are to be sealed using acoustic foam Hilti CP620 or similar. Glass wool batts can be applied prior to the application of the foam to seal larger gaps. ⁽²⁾ All gaps are to be acoustically sealed.

*****Glazing Notes -Leaks & Glazing Attenuation-**

- The Acoustic performance of a glazing system highly depends on the leaks around and within the glazing frame and façade. A double-glazing system with Rw of 40 will have its acoustic performance dropped to Rw of 30 (less than that of 6.38 mm glass) at a leak of 0.1 %. Moreover, a double-glazing system with Rw of 40 will have its acoustic performance dropped to Rw of 20 (less than that of 3.0 mm float glass) at a leak of 1 % of the glazing area.
- A 10.38mm laminated glazing system with Rw of 35 will have its acoustic performance dropped to Rw of 29 (less than that of 6.38 mm glass) at a leak of 0.1 %. Moreover, 10.38mm laminated glazing system with Rw of 35 will have its acoustic performance dropped to Rw of 20 (less than that of 3.0 mm float glass) at a leak of 1 % of the glazing area.
- A double-glazing system with Rw of 40, a 10.38mm laminated glazing system with Rw of 35, and a 6.38 mm laminated glazing system with Rw of 32 will all attain almost the same Rw of around 20 (less than that of 3.0 mm float glass) at a leak of 1 % in the façade or a within/around the glazing system.



The graph below shows the actual transmission loss achieved inside a room with different glazing thicknesses relative to small leaks occurring along the window frame and façade.



A test report is to be provided from a recognized acoustic laboratory, verifying that the glazing system (glass, frame and seals) will meet the nominated sound rating required.

7.2 AIR CONDITIONING UNITS, MECHANICAL VENTILATION

We have assumed that mechanical services plant may operate as required up to 24 hours each day. As previously mentioned, we recommend acoustic assessment of all proposed Mechanical Plant & Equipment once the development has been approved and Mechanical Services Plans have been prepared.

In general, in order for the operation of the building mechanical plant and equipment to meet the noise criteria listed in Section 5 of this report, we recommend that all new external air-conditioning units are to be acoustically enclosed or set away by more than 3.0m from any boundary.

7.3 SOUND BARRIER FENCING

We recommend that a 1.8metre gap free fence is installed on the ground floor boundaries adjacent to the nearest receivers at No. 98-100 Broomfield Street and No. 17 Bridge Street (Figure 9 – Sound Barrier Location). The fence can be of lapped & capped timber, colourbond steel or masonry construction.



7.4 PLAN OF MANAGEMENT

The use of the boarding house is usually regulated through a Plan of Management (POM). The Plan of Management is to ensure that no music is to be played at any time in the outdoor common open space on the ground floor level. It is recommended that when TV or music is played when all windows and doors of rooms be closed.

In addition, no residents/visitors are to be gathered in the outdoor communal area during night hours (ie between 10:00pm and 7:00am). All residences and visitors are not to make unreasonable noise while on the premises.

7.5 SIGNS

Signs reminding residents to minimise noise at all times shall be installed at entry and hallways of the boarding house, indoor common rooms and outdoor common areas, to ensure that all music and sound from residents/visitors are restricted within the property and not transmitted into adjoining residences. Signs are also to be placed in the outdoor common area at the rear of the property, advising that access is restricted during night hours (10:00pm – 7:00am).

7.6 NOISE MANAGEMENT PLAN

A Noise Management Plan should be implemented and should include the following:

- Install a contact number at the front of the Boarding House so that complaints regarding the station operation can be made.
- Implement a complaint handling procedure. If a noise complaint is received the complaint should be recorded on a Complaint Form, containing the following:
 - Name and Address of the Complainant
 - Time and Date the Complaint was received
 - The nature of the complaint and the time/date the noise was heard
 - The name of the employee that received the complaint
 - Actions taken to investigate the complaint and the summary of the results of the investigation
 - Indication of what was occurring at the time the noise was happening (if applicable)
 - Required remedial action (if applicable)
 - Validation of the remedial action
 - Summary of feedback to the complaint

Also, a permanent register of complaints should be held on the premises, which shall be reviewed monthly by staff to ensure all complaints are being responded to. All complaints received shall be reported to management with initial action/investigation commencing within 7 days. The complaint should also be notified of the results and actions arising from the



investigation.



8.0 CONCLUSION

The proposed development at No. 102 Broomfield Street, Cabramatta if carried out as recommended in plans and specifications and including the acoustic recommendations in this report, will meet the required noise reduction levels as required by Clause 87 of the State Environmental Planning Policy – (Infrastructure) 2007, Australian Standards AS 2107 ‘Acoustics – Recommended Design Sound Levels and Reverberation Times’ and the Department of Planning’s document titled “Development Near Rail Corridors and Busy Roads – Interim Guidelines” and Fairfield City Council Council requirements, as well as satisfy the requirements of the AS 2021-2015 “Acoustics-Aircraft Noise Intrusion –Building Siting and Construction”. The internal noise levels in the proposed units will enable reasonable amenity for the occupants.

Acoustic, Vibration & Noise Solutions Pty Ltd has taken noise level measurements at the most noise sensitive locations near the proposed boarding house located at No. 102 Broomfield Street, Cabramatta. The levels of noise emission from the proposed boarding house have been calculated and quantified using reliable test data.

Provided the noise controls as recommended in Section 9 of this report are fully implemented, we are confident that the noise emission levels from the proposed boarding house and its various uses including the mechanical plant will comply with the relative sections of the EPA and Fairfield City Council requirements and will not create any offensive noise to the surrounding residential & commercial environment.

We hope this report meets your requirements. Should you require further explanations, please do not hesitate to contact us.

Yours sincerely,

M. Zaioor
M.S. Eng’g Sci. (UNSW).
M.I.E.(Aust), CPEng.
Australian Acoustical Society (Member).



9.0 APPENDIX

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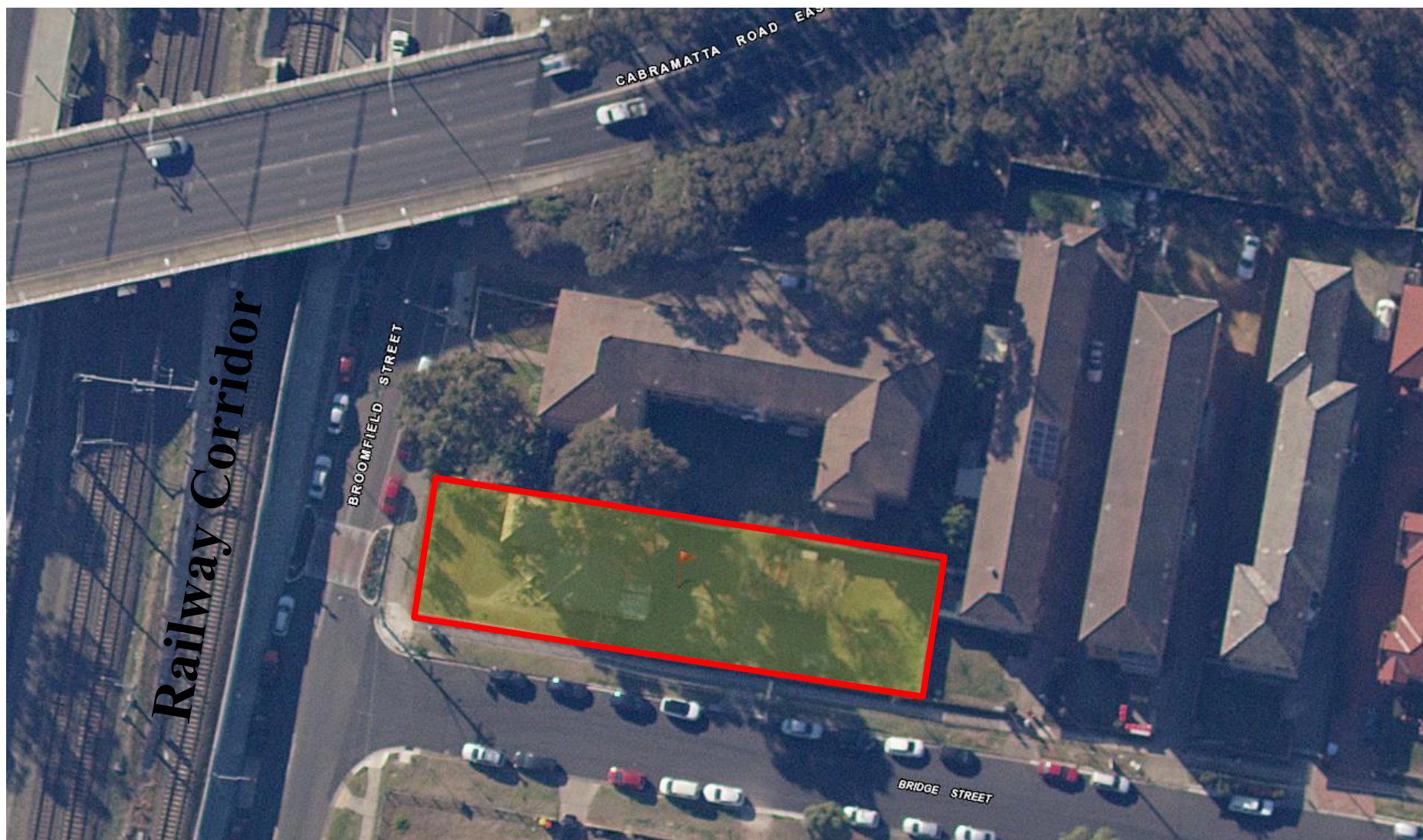


Figure 1 - Site Location

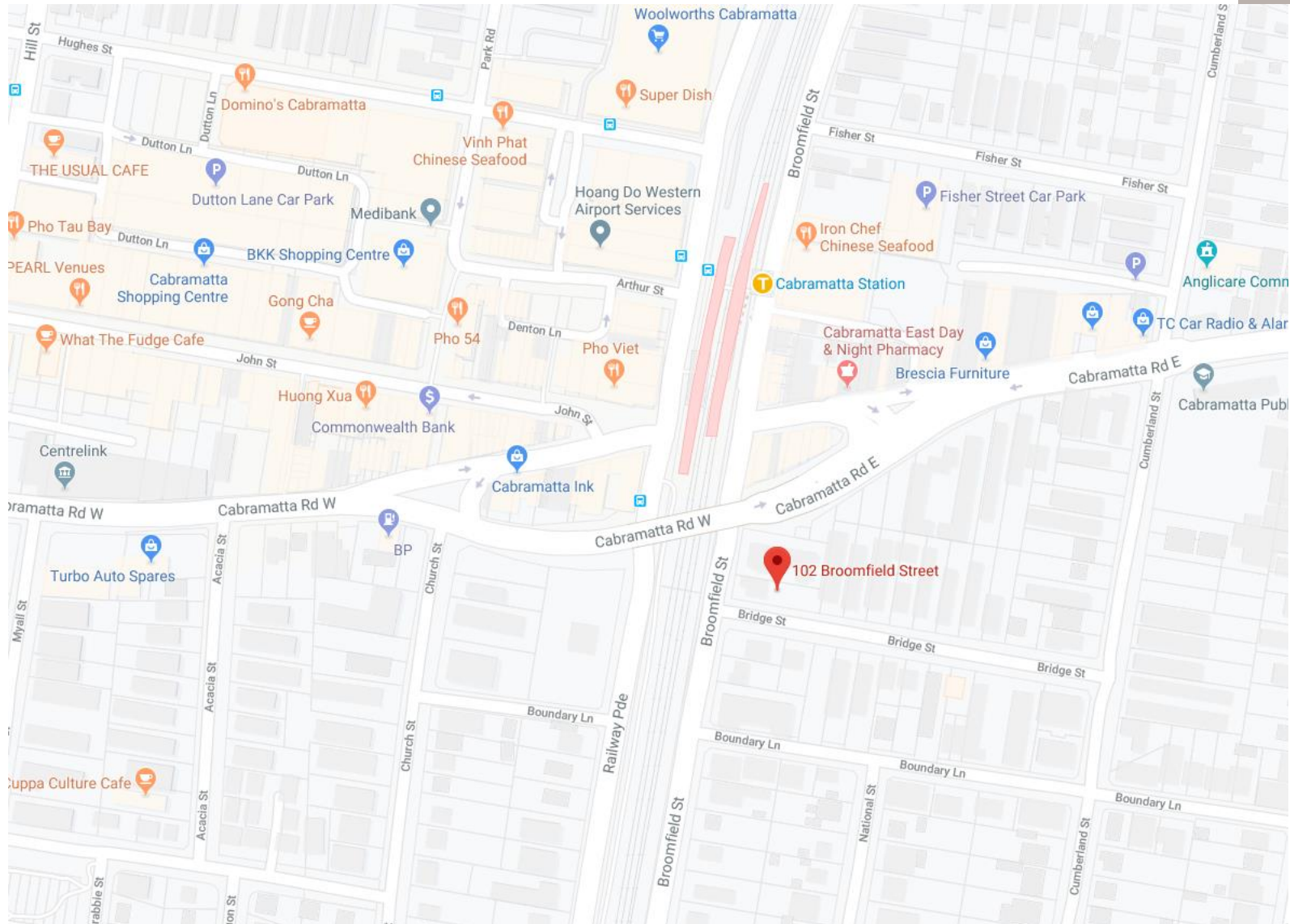


Figure 2 - Surrounding Environment



Figure 3 - Existing Hebel Sound Panel Around Railway Corridor



Figure 4 - Noise Reading Location

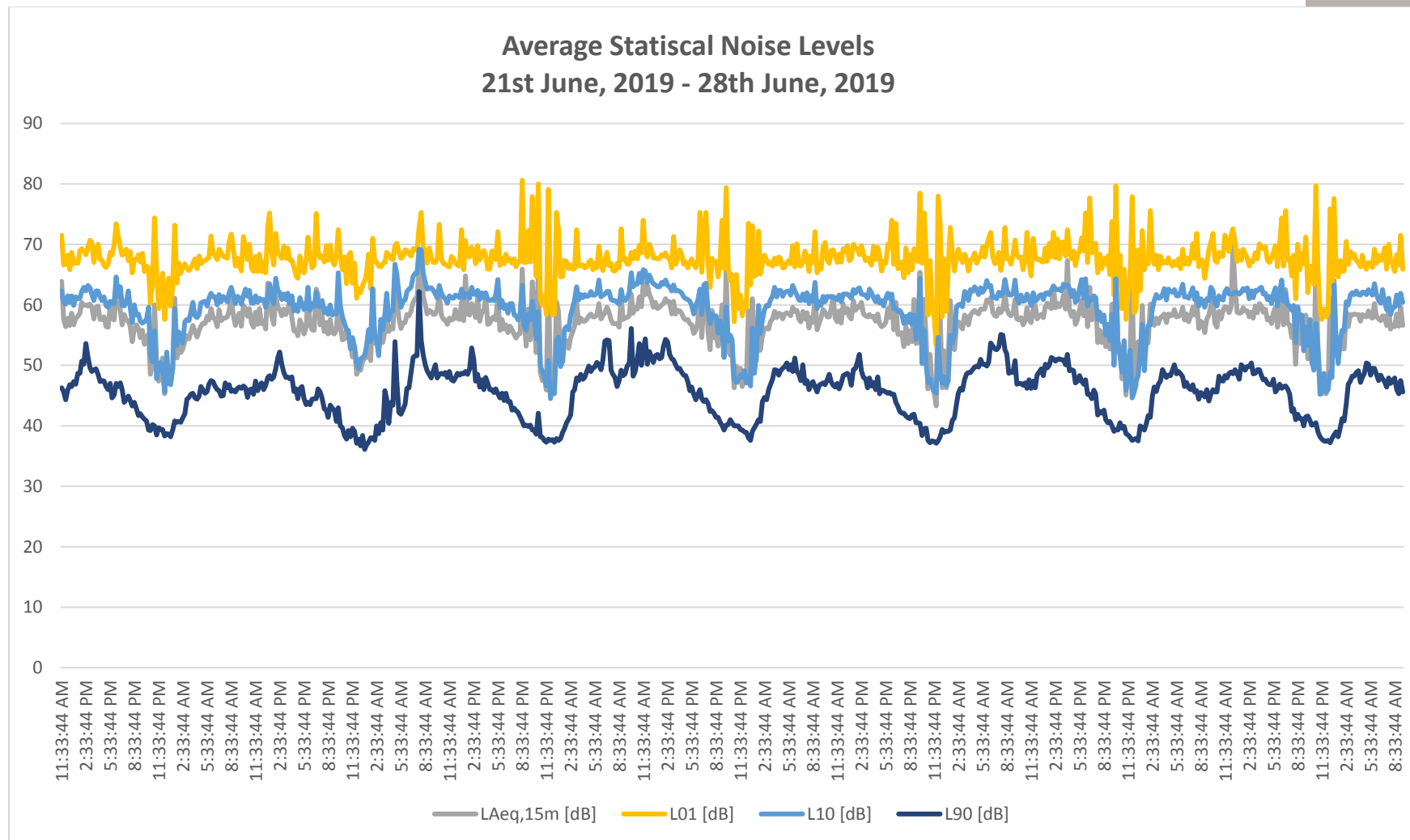


Figure 5 - Noise Survey



Figure 6 - Nearest Residential Receivers

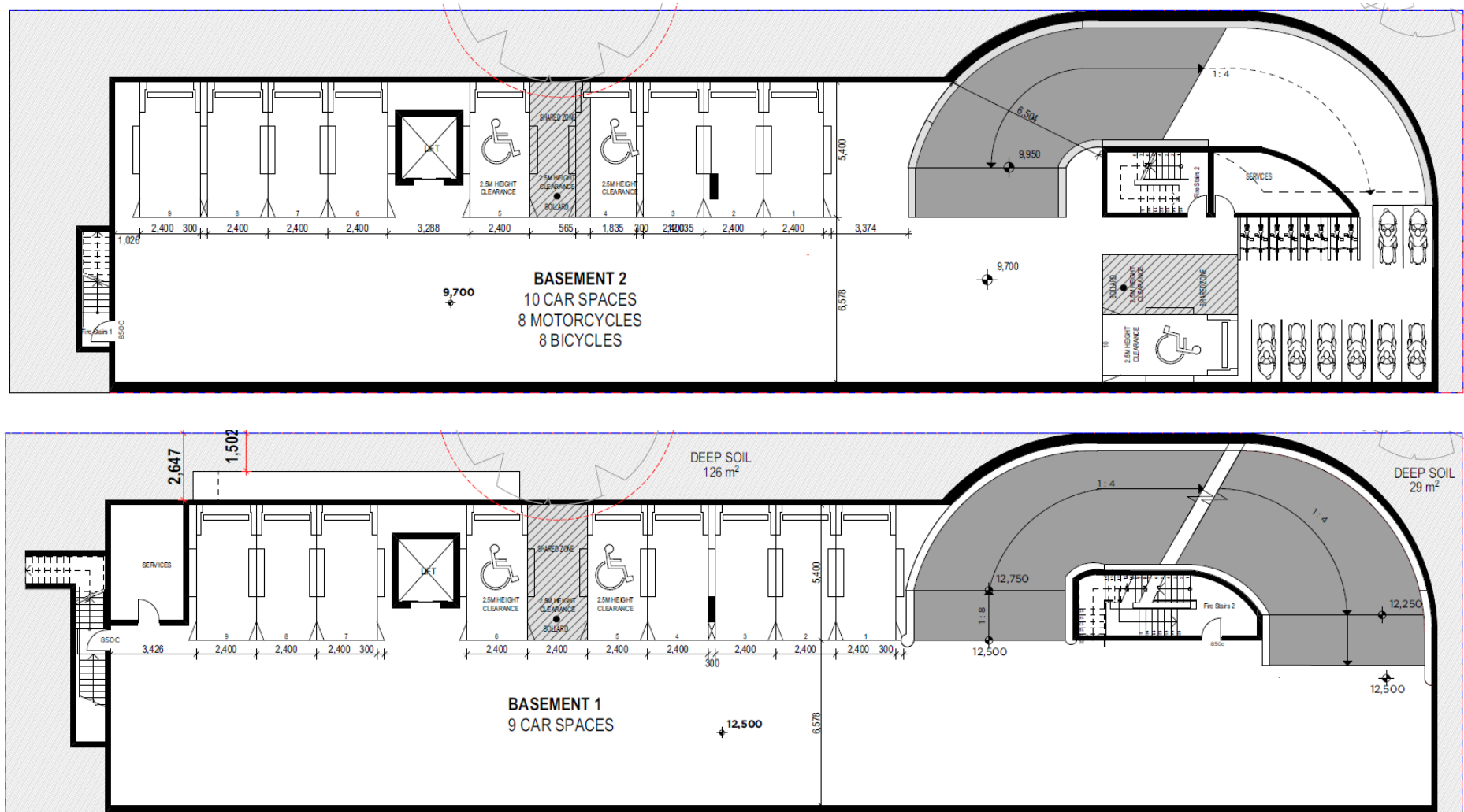
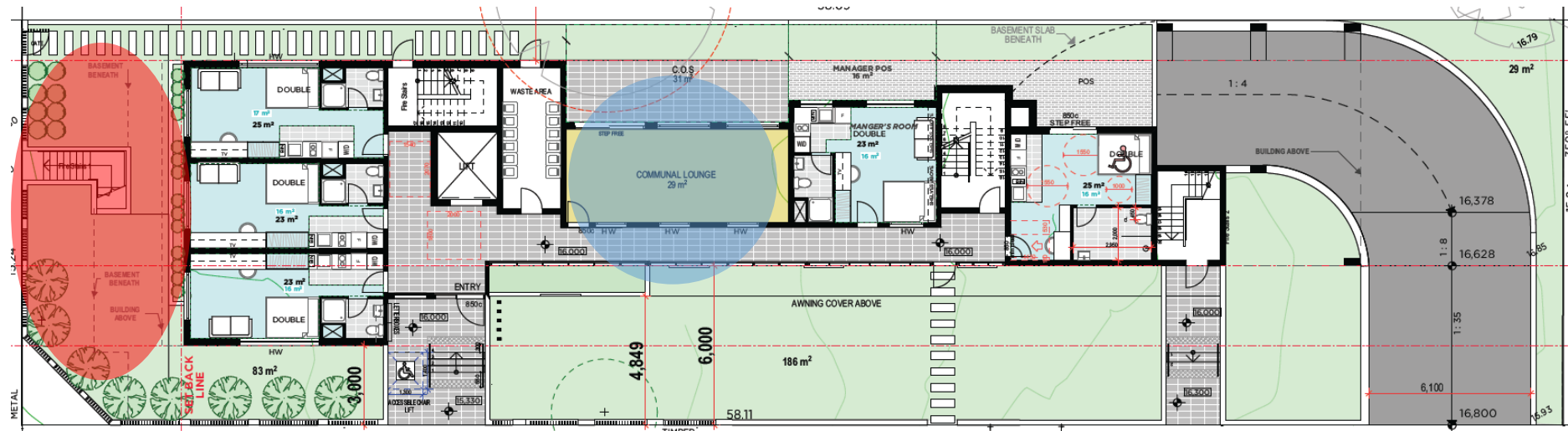


Figure 7 - Proposed Basement Parking



- Communal Outdoor Space
- Communal Indoor Space

Figure 8 - Proposed Communal Areas



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