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120C Old Canterbury Road, Summer Hill

DA Acoustic Assessment

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TABLE OF CONTENTS

1 INTRODUCTION

This report presents an analysis of acoustic impacts associated with the proposed mixed-use development at 120C Old Canterbury Road, Summer Hill.

The traffic / light rail noise assessment was made in reference to the following documents:

- The Inner West Council – '*Inner West Comprehensive Development Control Plan* (DCP) 2016';
- NSW Department of Planning and Environment's document – '*Developments near Rail Corridors or Busy Roads – Interim Guideline';*
- NSW Department of Planning and Environment's document – *'State Environmental Planning Policy (SEPP) (INFRASTRUCTURE) 2007*";
- Australian and New Zealand AS/NZS 3671:1989 *'Acoustics—Road traffic noise intrusion—Building siting and construction'*; and
- Australian and New Zealand AS/NZS 2107:2016 *'Recommended design sound levels and reverberation times for building interiors'*;

The light rail vibration assessment was made in reference to the following document:

- Australian and New Zealand AS/NZS 2670:1990 "*Evaluation of human exposure to whole-body vibration*";
- British Standard BS 7385 Part 2 1993;
- DECCW Assessing Vibration- A technical guideline; and
- Department of Planning '*Development Near rail Corridors and Busy Road – Interim Guideline*'.

External noise emission criteria have been setup in this report to satisfy the requirements below;

- The Inner West Council – '*Inner West Comprehensive Development Control Plan (DCP) 2016*; and
- NSW EPA Noise Policy for Industry (NPfI) 2017.

The construction noise and vibration assessment were made in reference to the following documents:

- 'The Inner West Council – '*Inner West Comprehensive Development Control Plan (DCP) 2016*;
- NSW EPA Interim Construction Noise Guideline;
- For human exposure to vibration, the acceptable vibration values set out in the Environmental Noise Management Assessing Vibration: a technical guideline (DEC, 2006); and
- For structural damage vibration, German Standard DIN 4150-3 Structural Vibration: Effects of Vibration on Structures.

The assessment will be undertaken with reference to the architectural drawings provided by Fox Johnston, Issue DA11, dated 24.05.20.

Note: This current DCP (Inner West Comprehensive Development Control Plan (DCP) 2016) applies to the following suburbs: Ashbury, Ashfield, Croydon, Croydon Park, Haberfield, Hurlstone Park, Summer Hill. Inner West Comprehensive Development Control Plan (DCP) 2016 came into effect on 10 January 2017.

2 SITE DESCRIPTION

The site is located at 120C Old Canterbury Road, Summer Hill. Developments in the vicinity of the site are as follows:

- The site is bounded by Old Canterbury Road to the south, further to the south are existing residential developments;
- The site is bounded by existing residential developments to the north-east and east. Further to the east is McGill Street; and
- West of the site is L1 Dulwich Hill Line (light rail).

Site investigation indicated that Old Canterbury Road is a busy road carrying medium to high traffic volume. McGill Street is a local road carrying low traffic volumes primarily used for residential access.

The nearest receiver around project site are below:

- Receiver 1 (R1) – Existing residential buildings located along the north-eastern boundary of the site;
- Receiver 2 (R2) – Existing residential buildings located along the eastern boundary of the site;
- Receiver 3 (R3) – Existing residential buildings on the western side of the L1 Dulwich Hill Line;
- Receiver 4 (R4) – Existing industrial / commercial development to the north-east of the site; and
- Receiver 5 (R5) - Existing residential buildings to the south along the southern side of Old Canterbury Road.

A site map, measurement description is presented in below.

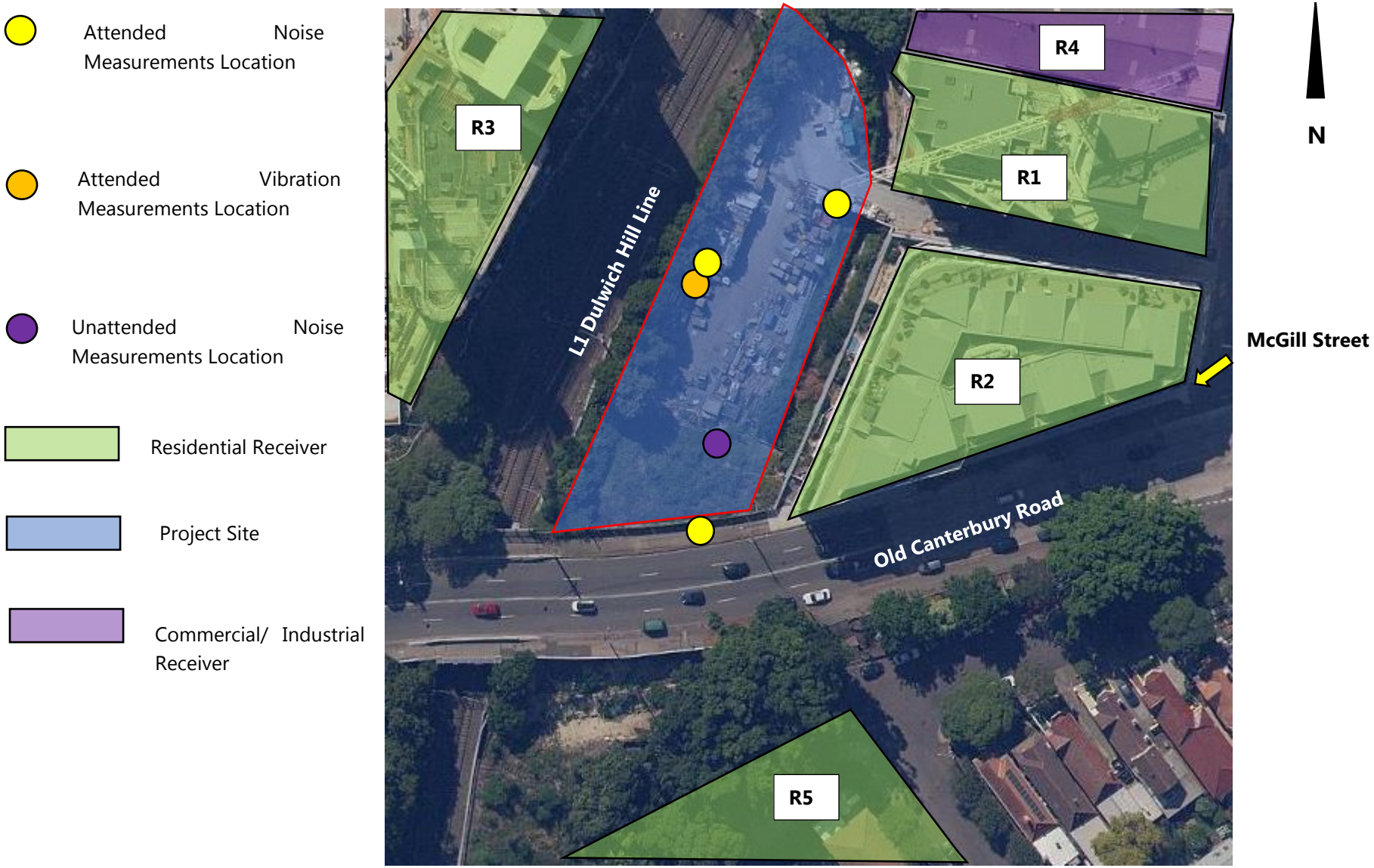


Figure 1: Site Map (from Six Maps)

3 ENVIRONMENTAL NOISE DESCRIPTORS

Environmental noise constantly varies. Accordingly, it is not possible to accurately determine prevailing environmental noise conditions by measuring a single, instantaneous noise level.

To accurately determine the environmental noise a 15-20 minute measurement interval is utilised. Over this period, noise levels are monitored on a continuous basis and statistical and integrating techniques are used to determine noise description parameters.

In analysing environmental noise, three-principle measurement parameters are used, namely L_{10}, L_{90} and L_{eq}.

The L_{10} and L_{90} measurement parameters are statistical levels that represent the average maximum and average minimum noise levels respectively, over the measurement intervals.

The L_{10} parameter is commonly used to measure noise produced by a particular intrusive noise source since it represents the average of the loudest noise levels produced by the source.

Conversely, the L_{90} level (which is commonly referred to as the background noise level) represents the noise level heard in the quieter periods during a measurement interval. The L_{90} parameter is used to set the allowable noise level for new, potentially intrusive noise sources since the disturbance caused by the new source will depend on how audible it is above the pre-existing noise environment, particularly during quiet periods, as represented by the L_{90} level.

The L_{eq} parameter represents the average noise energy during a measurement period. This parameter is derived by integrating the noise levels measured over the 15 minute period. L_{eq} is important in the assessment of environmental noise impact as it closely corresponds with human perception of a changing noise environment; such is the character of environmental noise.

4 EXISTING ACOUSTIC ENVIRONMENT

The acoustic environment is categorised by moderate background noise levels during the day and low background noise levels during the evening due to traffic movements. Low background noise levels during the night as most of the volume of traffic has finished for the day.

Acoustic monitoring was conducted at the site to establish the background noise levels which will be used as basis for this assessment.

4.1 BACKGROUND NOISE LEVELS

Background noise levels which will be used as a basis for this assessment are detailed in the following sections.

4.1.1 Measurement Equipment

Unattended noise monitoring was conducting using one Acoustic Research Laboratories Pty Ltd noise logger. The logger was programmed to store 15-minute statistical noise levels throughout the monitoring period. The equipment was calibrated at the beginning and the end of each measurement using a Rion NC-73 calibrator; no significant drift was detected. All measurements were taken on A-weighted fast response mode.

4.1.2 Measurement Locations and Period

4.1.2.1 Measured Background Noise Levels

An unattended noise monitor was installed 3m below street level at 120C Old Canterbury Road, Summer Hill. For a detailed location refer to Figure 1.

The logger was on site from the 17th October 2019 to 24th October 2019. The measured background noise levels have been corrected for meteorological conditions (excessive wind and/or rain), as required by section 3.4 of the EPA Industrial Noise Policy. Weather zone data for observations recorded at Observatory Hill, periods of precipitation or extraneous wind conditions have been removed from the data and have not been used in the assessment of existing background noise levels as detailed in Appendix 1.

Refer to Appendix 1 for unmanned noise monitoring data. The background noise levels established from the unattended noise monitoring are detailed in the table below.

Table 4-1 - Measured Background Noise Levels

Location	Time of day	Rating Background Noise Level dB(A)L_{90}
120C Old Canterbury Road, Summer Hill	Day 7am to 6pm	46
	Evening 6pm to 10pm	42
	Night 10pm to 7am	30

Note: Background noise levels have been corrected for meteorological conditions.

5 NOISE DESCRIPTORS

Traffic noise constantly varies in level, due to fluctuations in traffic speed, vehicle types, road conditions and traffic densities. Accordingly, it is not possible to accurately determine prevailing traffic noise conditions by measuring a single, instantaneous noise level.

To accurately determine the effects of traffic noise a 15-20 minute measurement interval is utilised. Over this period, noise levels are monitored on a continuous basis and statistical and integrating techniques are used to determine noise description parameters. These parameters are used to measure how much annoyance would be caused by a particular noise source.

In the case of environmental noise three principle measurement parameters are used, namely L_{10}, L_{90} and L_{eq}.

The L_{10} and L_{90} measurement parameters are statistical levels that represent the average maximum and average minimum noise levels respectively, over the measurement intervals.

The L_{10} parameter is commonly used to measure noise produced by a particular intrusive noise source since it represents the average of the loudest noise levels produced by the source.

Conversely, the L_{90} level (which is commonly referred to as the background noise level) represents the noise level heard in the quieter periods during a measurement interval. The L_{90} parameter is used to set the allowable noise level for new, potentially intrusive noise sources since the disturbance caused by the new source will depend on how audible it is above the pre-existing noise environment, particularly during quiet periods, as represented by the L_{90} level.

The L_{eq} parameter represents the average noise energy during a measurement period. This parameter is derived by integrating the noise levels measured over the 15 minute period. L_{eq} is important in the assessment of traffic noise impact as it closely corresponds with human perception of a changing noise environment; such is the character of traffic noise.

Current practice favours the L_{eq} parameter as a means of measuring traffic noise, whereas the L_{10} parameter has been used in the past and is still incorporated in some codes. For the reasons outlined above, the L_{90} parameter is not used to assess traffic noise.

6 NOISE INTRUSION ASSESSMENT

The most significant noise from the vicinity of the site is caused by road traffic from Old Canterbury Road to the south of the project site and from light rail noise to the west of the site. Our investigation indicates that traffic noise impacts from the road traffic noise is the primary noise source from the vicinity of the project site.

6.1 TRAFFIC NOISE INTRUSION ASSESSMENT

6.1.1 Noise Intrusion Criteria

The most significant traffic noise from the vicinity of the site is caused by road traffic Old Canterbury Road to the south of the project site, which carries medium to high volumes of traffic flow. Noise impacts from the road traffic noise should comply with the requirements as following:

- The Inner West Council - Inner West Comprehensive Development Control Plan (DCP) 2016
- NSW Department of Planning and Environment's document – '*Developments near Rail Corridors or Busy Roads – Interim Guideline';*
- NSW Department of Planning and Environment's document – *'State Environmental Planning Policy (SEPP) (INFRASTRUCTURE) 2007*";
- Australian and New Zealand AS/NZS 3671:1989 *'Acoustics—Road traffic noise intrusion—Building siting and construction'*; and
- Australian and New Zealand AS/NZS 2107:2016 *'Recommended design sound levels and reverberation times for building interiors'*;

6.1.1.1 The Inner West Council - Inner West Comprehensive Development Control Plan (DCP) 2016

The Inner West Council - Inner West Comprehensive Development Control Plan (DCP) 2016 has the following specific design goals for internal noise levels of habitable spaces within residential apartments-as follows:

DS6.4 Maximum noise levels for the following rooms within apartments shall be:

- Living areas 40 dBA
- Bedrooms 35 dBA

Note: *Development Applications for apartment buildings shall provide evidence that this requirement can be achieved including details of the type of glazing materials and design methods used.*

6.1.1.2 NSW Department of Planning and Environment's Document – 'Developments near Rail Corridors or Busy Roads – Interim Guideline (2008)'

Section 3.5 of the NSW Department of Planning's 'Development near Rail Corridors and Busy Roads (Interim Guideline)' states:

"The following provides an overall summary of the assessment procedure to meet the requirements of clauses 87 and 102 of the Infrastructure SEPP. The procedure covers noise at developments for both Road and Rail.

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

6.1.1.3 State Environmental Planning Policy (SEPP Infrastructure) 2007

Clause 102 of the NSW SEPP for road traffic noise stipulates,

"This clause applies to development for any of the following purposes that is on land in or adjacent to the road corridor for a freeway, a tollway or a transit way or any other road with an annual average daily traffic volume of more than 40,000 vehicles (based on the traffic volume data published on the website of the RTA) and that the consent authority considers is likely to be adversely affected by road noise or vibration:

(a) a building for residential use,

If the development is for the purposes of a building for residential use, 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 building – 35 dB(A) at any time between 10 pm and 7am,*
>
> *(b) anywhere else in the building (other than a garage, kitchen, bathroom or hallway) – 40 dB(A) at any time."*

Old Canterbury Road is nominated as a road that carries more than 40,000 vehicles AADT (Annual Average Daily Traffic), therefore, it is mandatory to be assessed according to the criteria set by this document.

Please refer to figure below for site location for the requirements of assessment against the SEPP (Infrastructure) 2007. (SEPP Map 15)

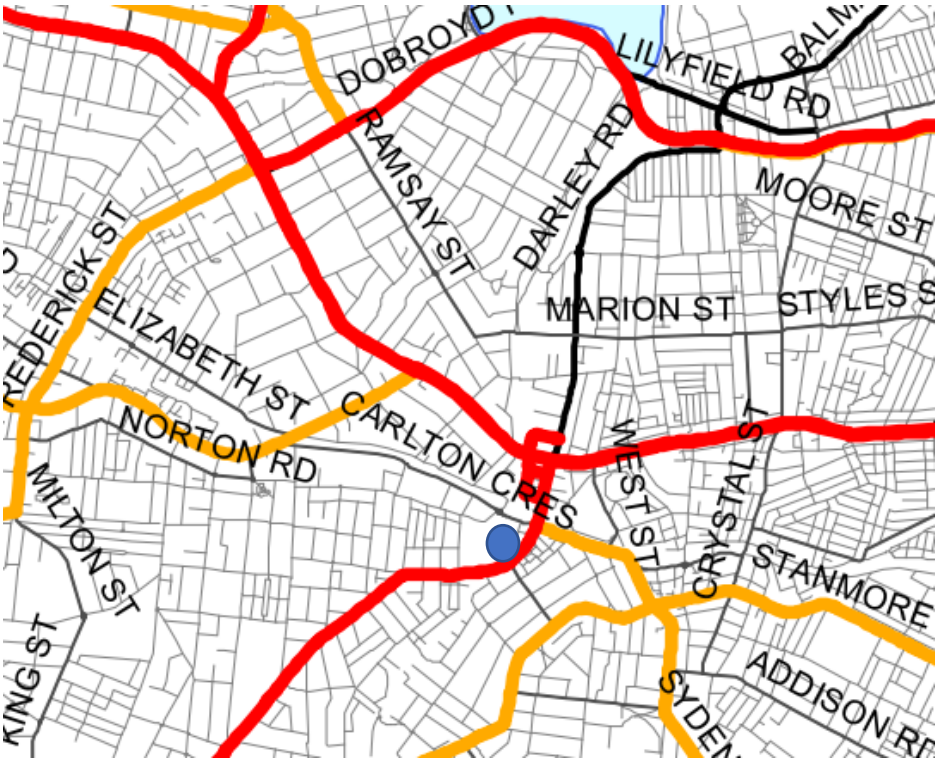


Figure 2: SEPP Map – Map 15

6.1.1.4 Australian and New Zealand AS/NZS 3671:1989 'Acoustics—Road Traffic Noise Intrusion—Building Siting and Construction'

Australian Standard AS 3671-1989 notes the following in relation to traffic noise:

- Internal noise levels should be determined in accordance with AS/NZS 2107:2016 *'Acoustics – Recommended design sound levels and reverberation times for building interiors'*.
- A suitable descriptor should be adopted relevant to the use of the development. As AS2107:2016 adopts the L_{eq} descriptor, ALC shall also use this descriptor.
- AS3671 does not specifically recommend a time interval. On this basis, ALC have adopted the interval used by the EPA Road Noise Policy for main/arterial roads, that being:
    - Day – 7am to 10pm (15 hour); and
    - Night – 10pm to 7am (9 hour).
- ALC have applied the daytime interval to the living areas of the apartment and the night time interval to the bedrooms of the apartment.

Internal noise levels have been selected in accordance with AS 2107:2016.

6.1.1.5 Australian Standard AS2107:2016

The recommended internal noise levels stipulated by Australian Standard AS2107:2016 "*Design Sound Levels and Reverberation Times for Different Areas of Occupancy in Buildings*", are presented in the table below.

Table 6-1 - AS2107:2016

Type of Occupancy	Type of occupancy/activity	Recommended Maximum Design Sound Level dB(A) L_{eq}
Apartments near major roads	Sleeping Areas	35-40 dB(A)$L_{eq(9\ hour)}$
	Living Areas	35-45 dB(A)$L_{eq(15\ hour)}$
	Commercial	40-50 dB(A)$L_{eq(when\ in\ use)}$

6.1.1.6 Summary of Noise Criteria

Below is a summary of the applicable traffic noise criteria to the development; the most stringent criteria of each time period have been adopted.

Table 6-2 –Summary of Traffic Noise Criteria

Noise Source	Type of occupancy/activity	Time Period	Recommended Maximum Design Sound Level dB(A) L_{eq}
Traffic	Sleeping Areas	10:00pm-7:00am	35 dB(A)$L_{eq(9hr)}$
	Living Areas	7:00am-10:00pm	40 dB(A)$L_{eq(15hr)}$
	Commercial	When in Use	50 dB(A)$L_{eq(when\ in\ use)}$

6.1.2 Traffic Noise Monitoring

As part of this investigation, traffic noise from the surrounding perimeter roadways has been measured. The results of this measurement will be used to determine the treatments required to reduce noise levels to within the project acoustic objectives.

Noise levels measurements conducted at the location as detailed in Figure 1 above.

6.1.2.1 Unattended Noise Measurements

Unattended noise monitoring was conducting using an Acoustic Research Laboratories Pty Ltd noise logger. The logger was programmed to store 15-minute statistical noise levels throughout the monitoring period. The equipment was calibrated at the beginning and the end of each measurement using a Rion NC-73 calibrator; no significant drift was detected. All measurements were taken on A-weighted fast response mode.

The unattended noise monitor has been used to record the existing traffic noise levels around project site. Unattended noise monitoring was conducted by this office from the 17th October 2019 to 24th October 2019. We note the noise monitor is located 3m below street level of Old Canterbury Road, due to geographical restrictions on site.

6.1.2.2 Attended Traffic Noise Measurements

Attended noise measurements was previously conducted by this office between 4:30pm and 5:30pm, on the 17th October 2019. The measurement locations are detailed above in figure 1.

Measurements were undertaken using a Norsonics Type 140 precision sound level analyser, set to A-weighted fast response. The microphone had a 180 degree, unobstructed full field of view of the roadway. The precision sound level analyser was calibrated before and after the measurements using a Norsonics 1251 precision sound level calibrator. No significant drift was recorded.

6.1.2.3 Resultant Traffic Noise Levels

The table below presents resultant measured noise levels based on attended noise and unattended noise measurements.

Table 6-3 – Resultant Traffic Noise Levels

Location	Time of Day	Traffic Noise Measured
Southern façade of proposed development, with 180 degrees of view of Old Canterbury Road	Day	69dB(A) $L_{Aeq(15hour)}$
	Night	64dB(A) $L_{Aeq(9hour)}$

6.2 LIGHT RAIL NOISE INTRUSION ASSESSMENT

6.2.1 Noise Intrusion Criteria

The noise from within the vicinity of the site is also caused by light rail to the west of the project site. Noise impacts from the light rail should comply with the requirements as following:

- The Inner West Council - Inner West Comprehensive Development Control Plan (DCP) 2016
- NSW Department of Planning and Environment's document – '*Developments near Rail Corridors or Busy Roads – Interim Guideline';*
- NSW Department of Planning and Environment's document – *'State Environmental Planning Policy (SEPP) (INFRASTRUCTURE) 2007*";

6.2.1.1 The Inner West Council - Inner West Comprehensive Development Control Plan (DCP) 2016

The Inner West Council - Inner West Comprehensive Development Control Plan (DCP) 2016 has the following specific design goals for internal noise levels of habitable spaces within residential apartments-as follows:

DS6.4 Maximum noise levels for the following rooms within apartments shall be:

- Living areas 40 dBA
- Bedrooms 35 dBA

Note: *Development Applications for apartment buildings shall provide evidence that this requirement can be achieved including details of the type of glazing materials and design methods used.*

6.2.1.2 NSW Department of Planning and Environment's document – 'Developments near Rail Corridors or Busy Roads – Interim Guideline (2008)'

Section 3.5 of the NSW Department of Planning's 'Development near Rail Corridors and Busy Roads (Interim Guideline)' states:

"The following provides an overall summary of the assessment procedure to meet the requirements of clauses 87 and 102 of the Infrastructure SEPP. The procedure covers noise at developments for both Road and Rail.

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

6.2.1.3 State Environmental Planning Policy (SEPP Infrastructure) 2007

87 Impact of rail noise or vibration on non-rail development

(1) This clause applies to development for any of the following purposes that is on land in or adjacent to a rail corridor and that the consent authority considers is likely to be adversely affected by rail noise or vibration:

(a) a building for residential use,

(b) a place of public worship,

(c) a hospital,

(d) an educational establishment or child care centre.

(2) Before determining a development application for development to which this clause applies, the consent authority must take into consideration any guidelines that are issued by the Director-General for the purposes of this clause and published in the Gazette.

(3) If the development is for the purposes of a building for residential use, 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 LAeq levels are not exceeded:

(a) in any bedroom in the building--35 dB(A) at any time between 10.00 pm and 7.00 am,

(b) anywhere else in the building (other than a garage, kitchen, bathroom or hallway)--40 dB(A) at any time.

6.2.1.4 Summary of Noise Criteria

Below is a summary of the applicable light rail noise criteria to the development; the most stringent criteria of each time period have been adopted.

Table 6-4 –Summary of Traffic Noise Criteria

Noise Source	Type of occupancy/activity	Time Period	Recommended Maximum Design Sound Level dB(A) L_{eq}
Light rail	Sleeping Areas	10:00pm-7:00am	35 dB(A)$L_{eq(9hr)}$
	Living Areas	7:00am-10:00pm	40 dB(A)$L_{eq(15hr)}$

6.2.2 Light Rail Noise Monitoring

As part of this investigation, light rail noise from the L1 Dulwich Hill Line to the west of the site has been measured. The results of this measurement will be also used to determine the treatments required to reduce noise levels to within the project acoustic objectives.

Noise levels measurements conducted at the location as detailed in Figure 1 above.

6.2.2.1 Attended Light Rail Noise Measurements

Attended noise monitoring was previously conducted by this office between 3:00pm and 4:00pm, on the 17th October 2019. The measurement locations are detailed above in figure 1.

Measurements were undertaken using a Norsonics Type 140 precision sound level analyser, set to A-weighted fast response. The microphone had a 180 degree, unobstructed full field of view of the L1 Dulwich Hill Line. The precision sound level analyser was calibrated before and after the measurements using a Norsonics 1251 precision sound level calibrator. No significant drift was recorded.

The table below presents resultant measured noise levels based on attended light rail noise measurements.

Table 6-5 – Resultant Noise Measurement Levels

Measurement Location	Time	Measured Noise Level dB(A)L_{Aeq}
Western façade of the proposed development, approximately 10m from the railway (light rail)	Daytime, 7am to 10pm	50 $L_{Aeq\ (15hours)}$
	Night – time, 10pm-7am	47 $L_{Aeq\ (9hours)}$

6.3 RECOMMENDATIONS

External noise intrusions into the proposed development were assessed using the measured traffic and light rail noise levels reported above as a basis.

Calculations were performed taking into account the orientation of windows, the total area of glazing, facade transmission loss and room sound absorption characteristics. In this way the likely interior noise levels can be predicted. Acoustic treatment required to ensure compliance with the assessment criteria are detailed in this section.

Internal noise levels will primarily be as a result of noise transfer through the windows and doors as these are relatively light building elements that offer less resistance to the transmission of sound. Noise transfer through the masonry elements will not be significant and need not be considered further.

The constructions necessary to achieve the noise levels are detailed below. The predicted noise levels have been based on the expected level and spectral characteristics of the external noise, the area of building elements exposed to traffic noise, the absorption characteristics of the rooms and the noise reduction performance of the building elements.

6.3.1.1 Glazed Windows and Doors

The following constructions are recommended to comply with the project noise objectives. Aluminium framed/sliding glass doors and windows will be satisfactory provided they meet the following criteria. All external windows and doors listed are required to be fitted with Q-lon type acoustic seals. (**Mohair Seals are unacceptable**).

Thicker glazing may be required for structural, safety or other purposes. Where it is required to use thicker glazing than scheduled, this will also be acoustically acceptable.

In addition to complying with the minimum scheduled glazing thickness, the R_w rating of the glazing fitted into operable frames and fixed into the building opening should not be lower than the values listed in Table 6-6 in all areas. Where nominated, this will require the use of acoustic seals around the full perimeter of operable frames and the frame will need to be sealed into the building opening using a flexible sealant. **Note that mohair seals in windows and doors are not acceptable where acoustic seals are required**. The proposed suppliers should provide evidence that the window systems proposed have been tested in a registered laboratory with the recommended glass thicknesses and comply with the minimum R_w requirements listed in Table 6-6, and that they will be constructed and installed in a manner equal to the test samples. Detailed glazing specifications are presented in Appendix 3- Glazing Mark-up.

Table 6-6 - Minimum R_w of Glazing (with Acoustic Seals)

Glazing Assembly	Minimum R_w of Installed Window
6mm Float	29
6.38mm Laminated	31
10.38mm Laminated	35

6.3.2 External Walls

The proposed concrete/ masonry elements external wall construction will be acoustically acceptable and will not require any acoustic treatment. There should not be vents on the internal skin of external walls. All penetrations in the internal skin of external walls should be acoustically sealed.

6.3.3 Roof

The proposed concrete roof construction will be acoustically acceptable and will not require any acoustic treatment. Penetrations in all ceilings (such as for light fittings etc.) must be acoustically treated and sealed gap free with a flexible sealant.

6.3.4 Ventilation requirements

With respect to natural ventilation of the dwelling, the NSW Department of Planning document "Development near Busy Roads and Rail Corridors - Interim Guideline" dictates that:

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

With windows open, the allowable internal noise goal is permitted to be 10dB(A) higher than when the windows are closed (i.e. – allowable level in bedrooms becomes 45dB(A), and 50dB(A) in living rooms).

The following acoustic treatments are recommended:

Table 6-7- Recommended Acoustic Treatment

Max Area	Max Passage	Room	Windows Closed Criterion 35/40dB(A)		
			Ins Thickness (mm)	Length (mm)	Other treatments
0.9	2 x 0.44	Living	100	3	Add 2 bends with 100mm thick insulation
0.7	1.5 x 0.44	Bed	100	2.5	

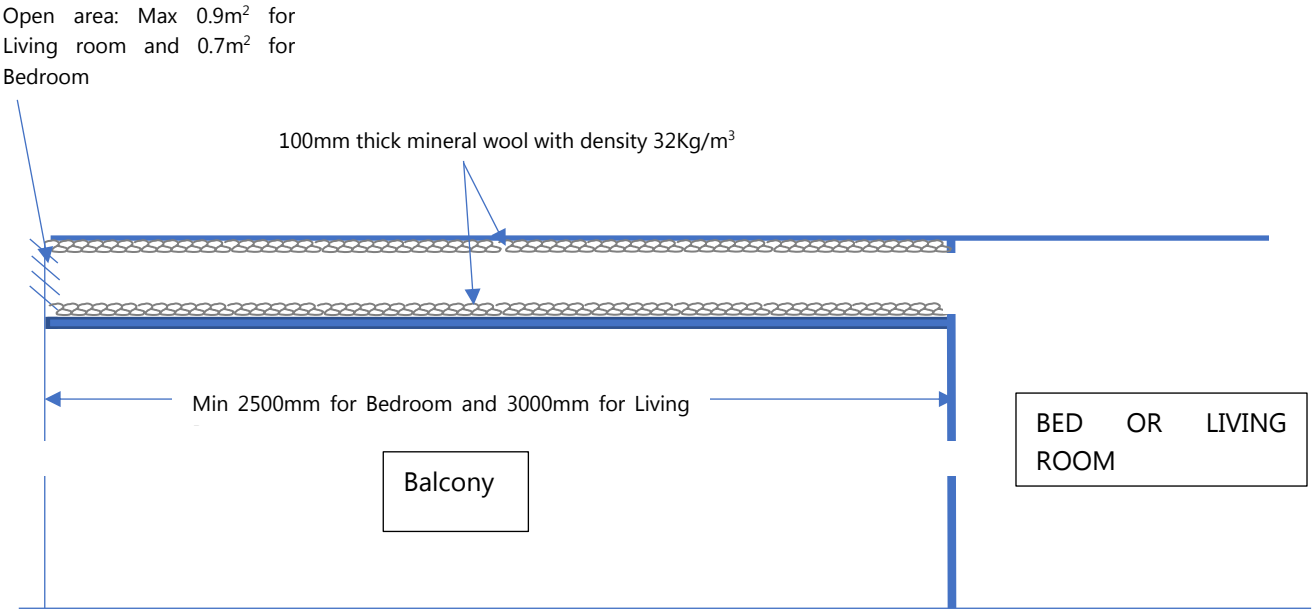


Figure 3: section drawing of ventilation system (with balcony)

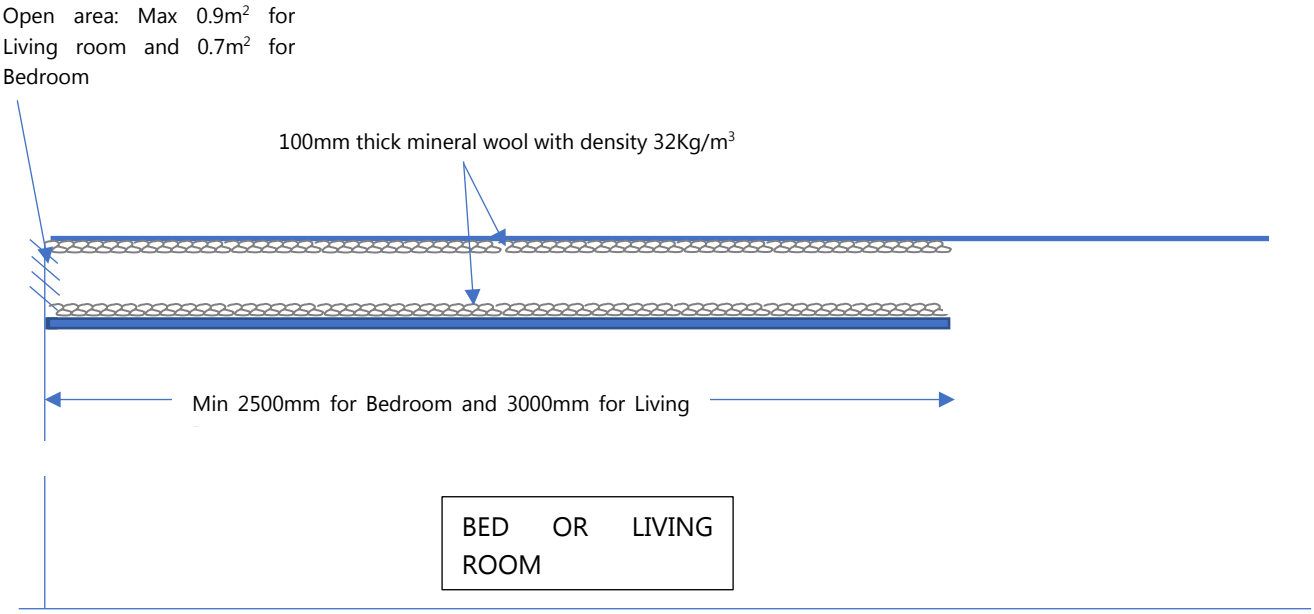


Figure 4: section drawing of ventilation system (without balcony)

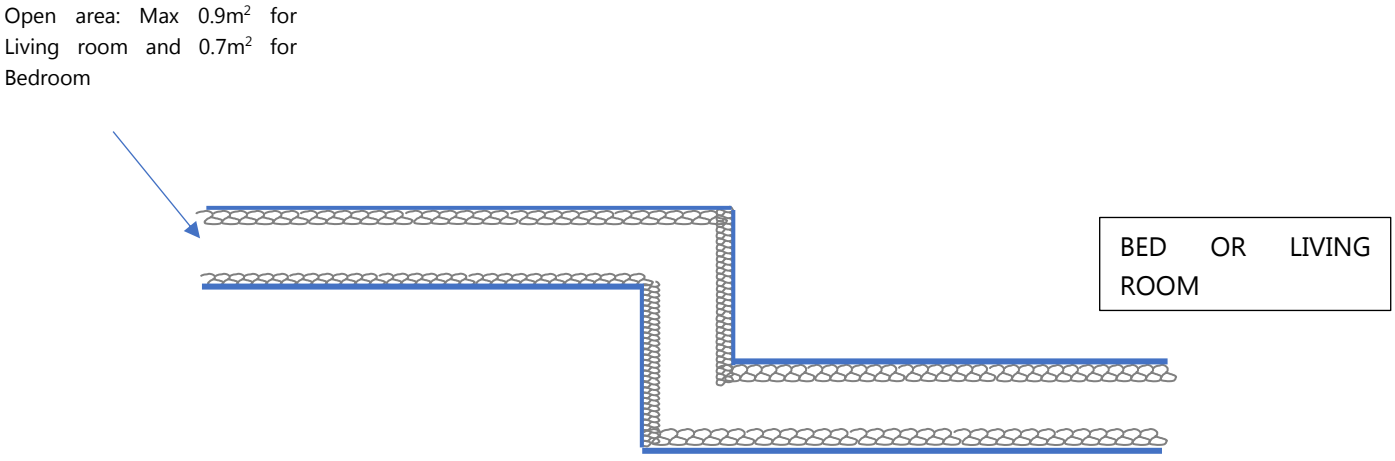


Figure 5: plan view

Internal plenum insulation is to be mineral wool insulation in a batt or board form having a minimum density of 32kg/m^3. Lining acoustic absorption shall exceed the following performance when measured in accordance with AS 1045.

Table 6-8 - Minimum Absorption Coefficient

INSULATION THICKNESS	MINIMUM ABSORPTION COEFFICIENT					
-	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz
25mm	0.08	0.30	0.64	0.90	0.90	0.90
50mm	0.35	0.72	0.95	0.95	0.95	0.95
75mm	0.45	0.8	0.95	0.95	0.95	0.95
100mm	0.5	0.9	0.95	0.95	0.95	0.95

Insulation shall be either factory faced with perforated aluminium foil similar to Sisilation 450 or faced with 30% open area perforated zincanneal steel sheet.

Should any ventilation system be installed, it should be acoustically designed to ensure that the acoustic performance of the acoustic treatments outlined above are not reduced and does not exceed Council criteria for noise emission to nearby properties. A continued acoustic review on the proposed ventilation system will be carried out at CC stage (if required).

7 RAILWAY VIBRATION ASSESSMENT (LIGHT RAIL)

Light rail induce ground borne vibration that is transmitted through the subsoil. These vibrations can be perceptible close to railways, as tactile vibrations and as structure borne noise.

7.1 PROJECT VIBRATION OBJECTIVES

7.1.1 Tactile Vibration

Human comfort is normally assessed with reference to the British Standard BS 7385 Part 2 1993 or Australian Standard AS 2670.2 1990.

The Interim Guideline references the DECCW *Assessing Vibration- A technical guideline* which recommends that habitable rooms should comply with the criteria therein which is in line with the requirements of British Standard BS 6472:1992 "Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80Hz)".

British Standard BS 6472:1992 "Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80Hz)" is recommended by the RIC's and SRA's Interim Guidelines for Councils "Consideration of rail noise and vibration in the planning process" as this standard includes guidance for the assessment of human response to building vibration including intermittent vibrations such as that caused by trains.

Human response to vibration has been shown to be biased at particular frequencies, which are related to the orientation of the person. This standard provides curves of equal annoyance for various orientations. These curves are applied as correction filters such that an overall weighted acceleration level is obtained. As the orientation of the resident is unknown or varying the weighting filter used is based on the combined base curve as given in ISO 2631 & Australian Standard 2670 "Evaluation of Human Exposure to Vibration and Shock in Buildings (1 to 80Hz)" which represents the worst case of the X, Y and Z axes. Filtered measurements are made in all three co-ordinate axes and the highest value axis used.

This standard assesses the annoyance of intermittent vibration by using the Vibration Dose Value (VDV). Alternatively the VDV may be estimated by the eVDV which is derived by a simpler calculation using an empirical factor. The VDV or eVDV is calculated for the two periods of the day being the "Daytime" (6am-10pm) and "Night time" (10pm-6am). The overall value is then compared to the levels in the table below. For this project the aim will be for a low probability of adverse comment.

Table 7-1 - Vibration Dose Values ($m/s^{1.75}$) above which various degrees of adverse comment may be expected in residential buildings.

Place	Low Probability of adverse comment	Adverse comment possible	Adverse comment probable
Residential buildings 15hr day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 9hr night	0.13	0.26	0.51

7.1.2 Structure Borne Noise

The Department of Planning 'Development Near rail Corridors and Busy Road – Interim Guideline' only requires structure borne noise assessment to be conducted where buildings or adjacent lands are over railway tunnels. Section 3.6.2 of the standard states the following:

"…Where buildings are constructed over or adjacent to land over tunnels, ground-born noise may be present without the normal masking effects of air born noise. In such cases, residential buildings should be designed so that the 95th percentile of train pass-bys complies with a ground-born L_{Amax} noise limit of 40 dB(A)(daytime and 35 dB(A) (night time) measured using the "slow" response time setting on a sound level meter."

7.2 RAIL VIBRATION MEASUREMENTS

Rail noise measurements were conducted at ground level of the existing building on site.

Attended train vibration measurements were conducted on the 17th October 2019. The measurement locations are detailed above in figure 1. A Svan 958 Vibration Analyser was used for the vibration measurements. The analyser was fitted with a Dytran triaxial accelerometer.

7.2.1 Measurement Results: Vibration Dose Values

The maximum measured VDV from a train pass, the typical pass by period and the estimated number of train pass bys were used to calculate the overall eVDV values for each period of the day. The results are presented in the table below. The eVDV will be assessed against the most stringent VDV criteria presented above.

The results of Vibration Dose Values comply with the criteria of Low Probability of adverse comment. In the event the future train use increases, say by 10%, predicted eVDV will not increase significantly (no more than approximately 0.01 more than the levels predicted in the results).

Table 7-2 – Measured Vibration Dose Values

Time Period	Calculated VDV m/s$^{1.75}$	Criteria VDV m/s$^{1.75}$	Complies
Day (7am – 10pm)	<0.1	0.2 to 0.4	Yes
Night (10pm -7am)	<0.1	0.13	Yes

7.2.2 Structure Borne Noise Measurements

Structure borne internal noise levels as a result of the train pass by have been calculated based on noise and vibration measurements conducted on site of train pass by. The predicted noise levels within the proposed development are presented in the table below.

Table 7-3 – Structure Born Vibration Levels

Location	Average Calculated/Measured Noise Level dB(A)L_{Max}	Noise Level Criteria L_{Max} dB(A)	Complies
Level 1	<35	40 Day (7am – 10pm) 35 Night (10pm -7am)	Yes

7.3 RECOMMENDATIONS

Vibration measurement results from the on-site testing reveal that the measured VDV at the site is compliant with the project criteria. No vibration attenuation treatment is required.

8 NOISE EMISSION ASSESSMENT

Noise emissions from the site have been assessed for the following noise sources:

- Noise emissions from proposed Open Communal Space at Level 7.
- Noise emissions from mechanical plant in operation

8.1 NOISE EMISSION CRITERIA

Noise emission assessment criteria for the project site have been developed with reference to the following documents;

- The Inner West Council - Inner West Comprehensive Development Control Plan (DCP) 2016;
- NSW EPA Noise Policy for Industry (NPfI);

8.1.1 The Inner West Council - Inner West Comprehensive Development Control Plan (DCP) 2016

The Inner West Council - Inner West Comprehensive Development Control Plan (DCP) 2016 does not contain any specific noise criteria. Therefore, the criteria nominated within the NSW EPA Noise Policy for Industry (NPfI) 2017 (refer below) will be adopted.

8.1.2 NSW EPA Noise Policy for Industry (NPfI) 2017

The NPfI provides guidelines for assessing noise impacts from developments and is referenced in the Council's standard conditions of consent. The recommended assessment objectives vary depending on the potentially affected receivers, the time of day, and the type of noise source. The NPfI has two requirements - an amenity criterion and an intrusiveness criterion. Both requirements apply for residential receivers, but only the amenity assessment is needed at other receivers.

8.1.3 Amenity Criterion

The guideline is intended to limit the absolute noise level from all noise sources to a level that is consistent with the general environment.

The Noise Policy for Industry sets out acceptable noise levels for various land uses. Table 2.1 on page 16 of the policy has four categories to distinguish different residential areas. They are rural, suburban, urban and urban/industrial interface. For the purposes of a conservative assessment, ALC will assess noise emissions in accordance with the 'suburban' category.

Table 8-1 – NPfI Project Amenity Criteria

Type of Receiver	Time of day	Recommended Project Acceptable Noise Level dB(A)$L_{eq(15mins)}$
Residential (Urban)	Day	53
	Evening	43
	Night	38
Commercial	When in Use	63

8.1.4 Intrusiveness Criterion

The guideline is intended to limit the audibility of noise emissions at residential receivers and requires that noise emissions measured using the L_{eq} descriptor not exceed the background noise level by more than 5 dB(A). Where applicable, the intrusive noise level should be penalised *(increased)* to account for any annoying characteristics such as tonality.

The applicable intrusiveness trigger levels are as follows:

Table 8-2 – NPfI Intrusiveness Criteria

Receiver	Time of day	Background Noise Level dB(A)L_{90}	Intrusiveness Criteria (Background + 5dB(A)$L_{eq(15min)}$)
Residential	Day	46	51
	Evening	42	47
	Night	30	35
Commercial	When in use	N/A	N/A

8.1.5 Summarised Plant Noise Emission Criteria (NPfI)

Summary for EPfI noise emission criteria associated with the development has been summarised below.

Table 8-3 – Summary of Noise Emission Criteria (NPfI)

Receiver	Time of day	Background Noise Level dB(A)L_{90}	Amenity Criteria dB(A) $L_{eq(15mins)}$	Intrusiveness Criteria (Background + 5dB(A)	Resultant Criteria
Residential Receivers	Day	46	53	51	51
	Evening	42	43	47	43
	Night	30	38	35	35
Commercial	When in Use	N/A	63	N/A	63

8.2 NOISE EMISSIONS FROM PROPOSED COMMON OPEN SPACE.

The proposed common open space at level 7 has been assessed for occupants of the building using the area for general relaxation, small gatherings and the like. Larger events with amplified music are not proposed.

The assessment has been based on the following:

- Up to 12 patrons occupying the communal terrace in daytime;
- 1 in 3 patrons talking with a raised voice at any one time;
- Outdoor terrace to be closed between 10pm and 7am;
- No music is allowed within outdoor terrace space;
- There is a minimum 1.8m height glazed balustrade (gap free) constructed in the eastern boundary and a small portion of northern boundary of the proposed communal space at Level 7. See details below:

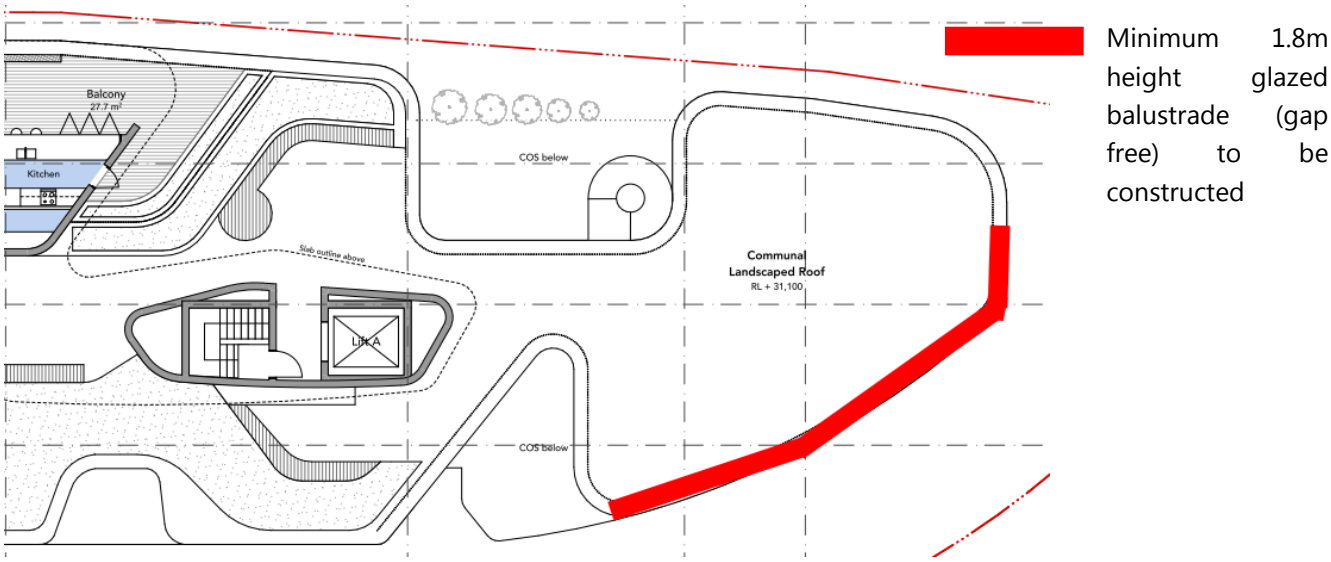


Figure 6: glazed balustrade (gap free) construction in communal space

- Patrons talking with a raised voice with a sound power level of 77dB(A) L10. As presented below

Table 8-4 – L_{10} Sound Power Level Spectrum of Single Patron, dB

	Octave Band Centre Frequency (Hz)									
	31.5	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**A-wt dB(A)L_{10}**
Patron Noise (dB(A))	62	62	67	70	74	75	70	51	48	**77**

8.2.1 Noise emission prediction

8.2.1.1 Noise emission prediction to surrounding receivers

Noise impacts have been assessed as follows:

- to the western façade of the R1(level 5) from the eastern boundary of the open communal space;
- to the western façade of the R2 (level 5) from the south-eastern boundary of the open communal space;
- to the eastern façade of the R3 from the western boundary of the open communal space;
- to the south-western façade of the R4 from the north-eastern boundary of the open communal space; and
- to the northern façade of the R4 from the eastern boundary of the open communal space.

Predicted noise levels are presented below:

Table 8-5 – Predicted Noise Levels

Receiver	Predicted Noise Level Daytime	Daytime (7am – 6pm) Criteria	Comply?	Evening (6pm – 10pm) Criteria	Comply?
To receiver 1	39	51	Yes	43	Yes
To receiver 2	40		Yes		Yes
To receiver 3	41		Yes		Yes
To receiver 4	<40	63	Yes	63	Yes
To receiver 5	<40	51	Yes	43	Yes

8.2.2 Recommendations

The following building and management controls are recommended.

- Maximum 12 patrons are allowed occupying the communal terrace between 7am and 10pm;
- Outdoor terrace to be closed between 10pm and 7am;
- No music is allowed within outdoor terrace space.
- Prominent notice shall be displayed within Communal to remind residents to minimise noise.
- There is a minimum 1.8m height glazed balustrade (gap free) constructed in the eastern boundary and a small portion of northern boundary of the proposed communal space at Level 7. See details below:

8.3 MECHANICAL PLANT

Mechanical plant items are not typically selected at selected at DA stage.

Detailed review of all external mechanical plant should be undertaken at construction certificate stage (once plant selections and locations are finalised). Based on the measured noise levels at the site acoustic screens may be recommended for the plant on the roof.

Summary for noise emission criteria associated with the development has been summarised in section 8.1. All plant can be satisfactorily attenuated to levels complying with noise emission criteria through appropriate location and (if necessary) standard acoustic treatments such as noise screens to roof top plant, enclosures, in-duct treatments (silencers/lined ducting) or similar.

9 CONSTRUCTION NOISE AND VIBRATION

This part of the assessment involves a preliminary assessment of construction works associated with 120C Old Canterbury Road, Summer Hill.

Above-mentioned document presents a discussion of the processes which will be followed in order to manage noise and vibration from the proposed works.

The principal issues, which will be addressed in this report, are:

- Identification of the noise and vibration standards which will be applicable to this project.
- Identify likely sources of noise generation and predicted noise levels at nearby development.
- Formulation of a strategy for construction to comply with the standards identified in the above point.

9.1 PROPOSED CONSTRUCTION WORKS

This office has been advised that the proposed construction works will include the following:

- Demolition – 1 week
- Excavation - 12 weeks;
- Pilling - 8 Weeks; and
- Construction - 18 months.
- The right of way off McGill street will be vehicle access onto the site. The specific locations for the cranes and pumps have been presented in Appendix 2 below.

This office has been advised that the proposed working hours are as following:

- 7:30am -5:00pm, Monday to Friday
- No work to be carried out on Saturday, Sundays and public holidays

9.2 BACKGROUND NOISE LEVELS

Background noise levels which will be used as a basis for this assessment are detailed in the Section 4 of this assessment.

9.2.1 Measured Background Noise Levels

The background noise levels established from the unattended noise monitoring are detailed in the Table below.

Table 9-1 - Measured Background Noise Levels

Location	Time of day	Rating Background Noise Level dB(A)L_{90}
120C Old Canterbury Road, Summer Hill	7:30am to 5pm Monday to Friday	46

Note: Background noise levels have been corrected for meteorological conditions.

10 NOISE LEVEL AND VIBRATION CRITERIA

10.1 NOISE CRITERIA

Noise associated with demolition/excavation/piling/construction activities on the site will be assessed in accordance with the following guidelines:

- 'The Inner West Council - Inner West Comprehensive Development Control Plan (DCP) 2016; and
- NSW EPA Interim Construction Noise Guideline.

10.1.1 The Inner West Council - Inner West Comprehensive Development Control Plan (DCP) 2016

The Inner West Council - Inner West Comprehensive Development Control Plan (DCP) 2016 does not contain any specific noise criteria associated with construction work on site. Therefore, the criteria nominated within the NSW EPA Interim Construction Noise Guideline (refer below) will be adopted.

10.1.2 EPA Interim Construction Noise Guidelines

The "quantitative" assessment procedure, as outlined in the Interim Construction Noise Guideline (ICNG) will be used. The quantitative assessment method requires: Determination of noise generation goals (based on ambient noise monitoring); Prediction of operational noise levels at nearby development; and if necessary, recommendation of noise controls strategies in the event that compliance with noise emission goals is not possible.

EPA guidelines adopt differing strategies for noise control depending on the predicted noise level at the nearest residences:

- "*Noise affected*" level. Where construction noise is predicted to exceed the "*noise effected*" level at a nearby residence, the proponent should take reasonable/feasible work practices to ensure compliance with the "noise effected level". For residential properties, the "noise effected" level occurs when construction noise exceeds ambient levels by more than 10dB(A)$L_{eq(15min)}$ within Recommended standard hours (Monday to Friday, 7 am to 6 pm; Saturday 8 am to 1 pm; No work on Sundays or public holidays). The "noise effected" level occurs when construction noise exceeds ambient levels by more than 5dB(A)$L_{eq(15min)}$ within "*outside recommended standard hours*",

- "*Highly noise affected level".* Where noise emissions are such that nearby properties are "highly noise effected", noise controls such as respite periods should be considered. For residential properties, the "highly noise effected" level occurs when construction noise exceeds 75dB(A)$L_{eq(15min)}$ at nearby residences.

Moreover, section 4.1.3 Commercial and industrial premises of the ICNG states the following:

"Due to the broad range of sensitivities that commercial or industrial land can have to noise from construction, the process of defining management levels is separated into three categories. The external noise levels should be assessed at the most-affected occupied point of the premises: industrial premises: external $L_{Aeq\ (15\ min)}$ 75 dB(A)"

Table 10-1 -Summarised Noise Management Level

Location	Day	Time	Noise Management level "*Noise Affected*" Level dB(A)$L_{eq, 15min}$	Noise Management Level "*Highly Noise Affected*" Level dB(A)$L_{eq, 15min}$
Residential receivers R1, R2, R3, R5	Monday to Friday	7:30am-5pm	56	75
Commercial / industrial premises R4	When in use	When in use	75 externally	N/A

10.2 VIBRATION CRITERIA

Vibration caused by construction at any residence or structure outside the subject site must be limited to:

- For structural damage vibration, German Standard DIN 4150-3 *Structural Vibration: Effects of Vibration on Structures; and*
- For human exposure to vibration, the evaluation criteria presented in the British Standard BS 6472:1992 *Guide to Evaluate Human Exposure to Vibration in Buildings (1Hz to 80Hz)* for low probability of adverse comment.

10.2.1 Structure Borne Vibrations (Building Damage Criteria)

German Standard DIN 4150-3 (1999-02) provides vibration velocity guideline levels for use in evaluating the effects of vibration on structures. The criteria presented in DIN 4150-3 (1999-02) are presented in Table 10-2.

It is noted that the peak velocity is the value of the maximum of any of the three orthogonal component particle velocities as measured at the foundation, and the maximum levels measured in the x- and y-horizontal directions in the plane of the floor of the uppermost storey.

Table 10-2 – DIN 4150-3 (1999-02) Safe Limits for Building Vibration

	TYPE OF STRUCTURE	PEAK PARTICLE VELOCITY (mms^{-1})			
		At Foundation at a Frequency of			**Plane of Floor of Uppermost Storey**
		< 10Hz	**10Hz to 50Hz**	**50Hz to 100Hz**	**All Frequencies**
1	Buildings used in commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8

10.3 ASSESSING AMENITY

The NSW EPA document "*Assessing Vibration: A Technical Guideline*" provides procedures for assessing tactile vibration and regenerated noise within potentially affected buildings and is used in the assessment of vibration impact on amenity.

Relevant criteria are presented below.

Table 10-3 – EPA Recommended Vibration Criteria

		RMS acceleration (m/s^2)		RMS velocity (mm/s)		Peak velocity (mm/s)	
Place	Time	Preferred	Maximum	Preferred	Maximum	Preferred	Maximum
Continuous Vibration							
Residences	Daytime	0.01	0.02	0.2	0.4	0.28	0.56
Offices		0.02	0.04	0.4	0.8	0.56	1.1
Workshops		0.04	0.08	0.8	1.6	1.1	2.2
Impulsive Vibration							
Residences	Daytime	0.3	0.6	6.0	12.0	8.6	17.0
Offices		0.64	1.28	13.0	26.0	18.0	36.0
Workshops		0.64	1.28	13.0	26.0	18.0	36.0

11 ASSESSMENT OF POTENTIAL NOISE EMISSIONS

11.1 ACTIVITIES TO BE CONDUCTED AND THE ASSOCIATED NOISE LEVELS

A summary of sound power levels of major construction processes/equipment is detailed in Table below.

Table 11-1 - Sound Power Levels of the Proposed Equipment

CONSTRUCTION ACTIVITY	EQUIPMENT /PROCESS	SOUND POWER LEVEL - dB(A)
Demolition	Excavator (hydraulic hammer attachment) (Rock breaker)	120
	Hand tools	95
Excavation	Excavator (bucket attachment)	105
	Excavator (hydraulic hammer attachment) (Rock breaker)	120
	Truck (>20 tonne)	110
Piling	CFA Piling	103
Construction	Hand tool	95
	Concrete Pumps	105
	Crane (diesel)	105

The noise levels presented in the above table are derived from the following sources, namely:

1. Table A1 of Australian Standard 2436-2010.
2. Data held by this office from other similar studies.

11.2 NOISE IMPACT ASSESMENT METHODOLOGY

The predicted noise levels during excavation and construction will depend on:

- The activity undertaken.
- The distance between the work site and the receiver. For many of the work areas, the distance between the noise source and the receiver will vary depending on which end of the site the work is undertaken. For this reason, the predicted noise levels will be presented as a range.
- The presence of any natural or purpose installed noise barriers.

Predicted noise levels are presented below. Predictions take into account the following:

- The noise emission level of the activity.
- Noise reduction as a result of distance and barriers (where applicable).
- Depending on the management level adopted, noise emission is predicted to either external areas (property boundaries/building facades/most affected area) or internal areas. Where noise levels are predicted to internal areas, the NSW EPA Interim Construction Noise Guideline suggests that a reduction from external noise levels to internal spaces of 10 dB(A) is a conservative estimate.

11.3 NOISE EMISSION PREDICTIONS

Noise emissions are assessed with reference to the relevant criteria in Section 10.1. Please see tables below for predicted noise levels for each receiver.

11.3.1 Prediction to R1: residential receiver to the north-east

Predicted noise levels of R1 to the north-east of the site are as follows:

Table 11-2 – Predicted Noise Level to R1

Stage	Activity	Predicted Level – dB(A) $L_{eq(15min)}$ (External Areas)	Comment
Demolition	Excavator (hydraulic hammer attachment) (Rock breaker)	75-98	Exceedance of HNEL of 75dB(A), when operating close to north-east boundary; Generally compliant of HNEL of 75dB(A), or minor exceedance of HNEL of 75dB(A), when operating away from north-east boundary
	Hand tools	50-73	Generally compliant of HNEL of 75dB(A)
Excavation	Excavator (bucket attachment)	60-83	Exceedance of HNEL of 75dB(A), when operating close to north-east boundary; Generally compliant of HNEL of 75dB(A), or minor exceedance of HNEL of 75dB(A), when operating away from north-east boundary
	Excavator (hydraulic hammer attachment) (Rock breaker)	75-98	
	Truck (>20 tonne)	65-88	
Piling	CFA Piling	70-93	
Construction	Hand tool	50-73 prior to construction of building shell 30-53 after construction of building shell	Noise level will generally meet HNEL of 75dB(A). After construction of building shell, Noise level will generally meet NEL of 56dB(A)
	Concrete Pumps	79	Exceedance of HNEL of 75dB(A)
	Crane (diesel)	63-77	Exceedance of HNEL of 75dB(A), when operating close to north-east boundary

11.3.2 Prediction to R2: residential receiver to the east

Predicted noise levels of R2 to the east of the site are as follows:

Table 11-3 – Predicted Noise Level to R2

Stage	Activity	Predicted Level – dB(A) $L_{eq(15min)}$ (External Areas)	Comment
Demolition	Excavator (hydraulic hammer attachment) (Rock breaker)	78-96	Exceedance of HNEL of 75dB(A), especially when operating close to east boundary
	Hand tools	53-71	Generally compliant of HNEL of 75dB(A)
Excavation	Excavator (bucket attachment)	63-81	Exceedance of HNEL of 75dB(A), when operating close to east boundary. Generally compliant of HNEL of 75dB(A), when operating away from east boundary
	Excavator (hydraulic hammer attachment) (Rock breaker)	78-96	Exceedance of HNEL of 75dB(A), especially when operating close to east boundary
	Truck (>20 tonne)	68-86	Exceedance of HNEL of 75dB(A), when operating close to east boundary; Generally compliant of HNEL of 75dB(A), when operating away from east boundary
Piling	CFA Piling	61-79	
Construction	Hand tool	53-71 prior to construction of building shell 33-51 after construction of building shell	Noise level will generally meet of HNEL 75dB(A). After construction of building shell, Noise level will generally meet NEL of 56dB(A),
	Concrete Pumps	77	Minor exceedance of HNEL of 75dB(A)
	Crane (diesel)	63-77	Minor exceedance of HNEL of 75dB(A), when operating close to east boundary

11.3.3 Prediction to R3: residential receiver to the west

Predicted noise levels of R3 to the west of the site are as follows:

Table 11-4 – Predicted Noise Level to R3

Stage	Activity	Predicted Level – dB(A) $L_{eq(15min)}$ (External Areas)	Comment
Demolition	Excavator (hydraulic hammer attachment) (Rock breaker)	76-82	Exceedance of HNEL of 75dB(A), especially when operating close to west boundary
	Hand tools	51-57	Generally compliant of HNEL of 75dB(A)
Excavation	Excavator (bucket attachment)	61-67	
	Excavator (hydraulic hammer attachment) (Rock breaker)	76-82	Exceedance of HNEL of 75dB(A), especially when operating close to west boundary
	Truck (>20 tonne)	66-70	Generally compliant of HNEL of 75dB(A)
Piling	CFA Piling	59-65	
Construction	Hand tool	51-57 prior to construction of building shell 31-37 after construction of building shell	Generally compliant of HNEL of 75dB(A). After construction of building shell, Noise level will generally meet NEL of 56dB(A),
	Concrete Pumps	63	Generally compliant of HNEL of 75dB(A)
	Crane (diesel)	61-67	

11.3.4 Prediction to R4: Industrial / commercial receiver to the north-east

Predicted noise levels of R4 to the north-east of the site are as follows:

Table 11-5 – Predicted Noise Level to R4

Stage	Activity	Predicted Level – dB(A) $L_{eq(15min)}$ (External Areas)	Comment
Demolition	Excavator (hydraulic hammer attachment) (Rock breaker)	73-92	Exceedance of HNEL of 75dB(A), when operating close to north-east boundary; Generally compliant of HNEL of 75dB(A), when operating away from north-east boundary
	Hand tools	48-67	Generally compliant of HNEL of 75dB(A)
Excavation	Excavator (bucket attachment)	58-77	Exceedance of HNEL of 75dB(A), when operating close to north-east boundary; Generally compliant of HNEL of 75dB(A), when operating away from north-east boundary
	Excavator (hydraulic hammer attachment) (Rock breaker)	73-92	
	Truck (>20 tonne)	63-76	Minor exceedance of HNEL of 75dB(A), when operating close to north-east boundary
Piling	CFA Piling	56-75	Generally compliant of HNEL of 75dB(A)
Construction	Hand tool	48-67 prior to construction of building shell 28-47 after construction of building shell	Generally compliant of HNEL of 75dB(A). After construction of building shell, Noise level will generally meet NEL of 56dB(A),
	Concrete Pumps	69	Generally compliant of HNEL of 75dB(A)
	Crane (diesel)	62-73	

11.3.5 Prediction to R5: residential receiver to the south

Predicted noise levels of R5 to the south of the site are as follows:

Table 11-6 – Predicted Noise Level to R5

Stage	Activity	Predicted Level – dB(A) $L_{eq(15min)}$ (External Areas)	Comment
Demolition	Excavator (hydraulic hammer attachment) (Rock breaker)	70-78	Minor exceedance of HNEL of 75dB(A), when operating close to south boundary; Generally compliant of HNEL of 75dB(A), when operating away from south boundary
	Hand tools	45-53	Generally compliant of NEL of 56dB(A)
Excavation	Excavator (bucket attachment)	55-63	Generally compliant of HNEL of 75dB(A)
	Excavator (hydraulic hammer attachment) (Rock breaker)	70-78	Minor exceedance of HNEL of 75dB(A), when operating close to south boundary; Generally compliant of HNEL of 75dB(A), when operating away from south boundary
	Truck (>20 tonne)	61-66	Generally compliant of HNEL of 75dB(A)
Piling	CFA Piling	53-61	
Construction	Hand tool	55-63prior to construction of building shell 25-33 after construction of building shell	
	Concrete Pumps	58	
	Crane (diesel)	56-63	

11.4 DISCUSSION – NOISE

Excavator mounted hammering during demolition / excavation is expected to exceed the relevant noise levels at the most of surrounding receivers to varying degrees, and as such mitigation measures are recommended – refer to the recommendations in Section 11.6. This activity will primarily impact R1, R2, R3 and R4. Notwithstanding the above, recommendations have been presented in Section 11.6 to mitigate noise impacts on surrounding receivers.

The predictions indicate that excavator will exceed the HNEL at the receivers close to eastern and north-eastern boundaries, and only when operating close to the eastern and north-eastern boundaries. When operating away from the eastern and north-eastern boundaries, noise levels will generally compliant of HNEL of 75dB(A). Given the relatively short period of excavation, that the exceedances of the HNEL noise criteria will only occur when operating close to these boundaries, the equipment will move around the site which makes localised barriers impractical, it is not reasonable to mitigate noise levels other than to manage impacts as recommended below (selecting quietest feasible plant, notification, etc).

All other construction processes which would be expected during the majority of construction (trucks/cranes/hand tools etc) are expected to have minor exceedance or generally compliant of HNEL noise criteria when operating away from the boundaries. Recommendations have been presented in Section 11.6 to mitigate noise impacts on surrounding receivers.

11.5 DISCUSSION – VIBRATION

Typically, demolition / excavation / piling are the activities with the greatest potential to generate ground vibration. Demolition of the basements and excavation of building footings in rock has the potential to produce vibration levels approaching the criteria set out in Section 6 at external receivers bounding the site.

It is likely that rock hammering during excavation works and structural demolition will need to be controlled to mitigate any potential risk, especially on the R1 and R2. It is recommended that a vibration level of 5mm/s initially be adopted for this north-eastern façade of R1, with vibration monitors installed at critical locations to determine any impact. It is also recommended that a vibration level of 5mm/s initially be adopted for this eastern façade of R2, with vibration monitors installed at critical locations to determine any impact. Ongoing review and assessment of vibration impact will also be conducted throughout the construction process to determine appropriate vibration levels. The specific locations and quantities of vibration monitors are to be determined in consultation with the builder, structural and façade engineers.

The primary potential vibration source will be from use of rock hammer, especially when operating on the north-eastern and northern boundaries with adjacent properties in close proximity. Vibration monitoring will be required during the demolition and excavation stages of the development to ensure that vibration levels to surrounding receivers are managed to surrounding receivers.

11.6 AMELIORATIVE MEASURES

11.6.1 Site Specific Recommendations

Site specific recommendations as follows:

11.6.1.1 Demolition

- Residents at north and north-east of the site, and the industrial receivers to the north-east, to be notified of anticipated period of demolition including use of hydraulic hammer.
- Hydraulic Hammer
    - No use prior to 8:00am to mitigate noise impact onto the neighbouring residents.
    - Fit more efficient silencer or exhaust silencer.
    - Enclosure panels, when fitted, should be kept closed.
    - Where practical install temporary barriers adjacent to the work point to screen the residential receivers to the north and north-east.
- Hand tools
    - No use prior to 8:00am to mitigate noise impact onto the neighbouring residents.

11.6.1.2 Excavation

- Residents at north and north-east of the site, and the industrial receivers to the north-east, to be notified of anticipated period of excavation including use of hydraulic hammer.
- Hydraulic Hammer
    - No use prior to 8:00am to mitigate noise impact onto the neighbouring residents.
    - Fit more efficient silencer or exhaust silencer.
    - Enclosure panels, when fitted, should be kept closed.
    - Where practical install temporary barriers adjacent to the work point to screen the residential receivers to the north and north-east.
- Vehicle Noise:
    - Truck movements should not commence prior to 7am. Trucks are not to idle with their engines running outside the site prior to 7am.
    - Trucks must turn off their engines during idling to reduce impacts on nearby residential receivers (unless truck ignition needs to remain on during concrete pumping).
    - Vehicles to use a non-tonal reversing beacon (subject to OH&S requirements) to minimise potential disturbance of neighbours.
    -

11.6.1.3 Piling

- Residents and school to be notified of anticipated period of piling.
- CFA Piling:
    - Predicted construction noise levels at R1 and R2 are likely to exceed 'Highly Noise Affected Level' of 75dB(A) $L_{eq(15mins)}$;
    - No piling work before 8:00am to mitigate noise impact onto the neighbouring residents.

11.6.1.4 Construction

- Concrete pumps and crane.
    - Equipment is to be located as far as practical from the closest receivers around the site, especially to north and north-east of the site.
    - Notification of adjacent residential development should be provided prior to days of concrete pours.
- Hand tools
    - The northern, north-eastern and western facades should be erected as soon as practical so as to form "natural" barriers to the residential receivers.
    - Noise from hand tools is typically quieter than the maximum allowable noise levels.

11.6.2 General recommendation

- Quiet work methods/technologies:
    - The primary noise generating activity at the site will be the demolition / excavation/ piling period. As much as practicable, use of quieter excavation methods is adopted.
    - Excavation is conducted initially using excavator with bucket (quietest excavation method), then use of rock rippers (as opposed to hydraulic hammers and rock saws) when rock strength permits. Use of the loudest excavation equipment (hydraulic hammers/rock saws is used only with other options are not available).
- The following noise and vibration monitoring is recommended:
    - Vibration monitoring is to be undertaken during demolition /excavation/piling phases of the development (or other periods where vibration intensive works are expected to be undertaken). Vibration monitoring is to be undertaken at locations representative of the following receivers:
        - **R1** – residential receiver to the north-east of the site;
        - **R2** – residential receiver to the north of the site.
    - Attended noise measurements at surrounding properties is be undertaken (if possible) at the beginning of each construction stage (demolition/excavation/structural works etc) to quantify the level of construction noise typically emitted from the site.
- Community Consultation
    - Point of communication/site contact is to be displayed at the site entry.
    - A complaints register is to kept, as per Section 11.8.7.
    - Letter drops and e-mail communication with immediately adjoining neighbours is to provide a minimum 48 hours notice prior to excavation, shoring, underpinning works or use of high noise emission equipment (hammering, concrete/rock saws)..
- Complaints handling:
    - An afterhours contact number is displayed outside of the building site, so that in the event that surrounding development believes that a noise breach is occurring, they may contact the site.

In the event of complaint, the procedures outlined in Section 11.8.7 are adopted. Additional methods of control of construction noise and additional noise control measures which may be adopted by the site are detailed in Section 11.8.

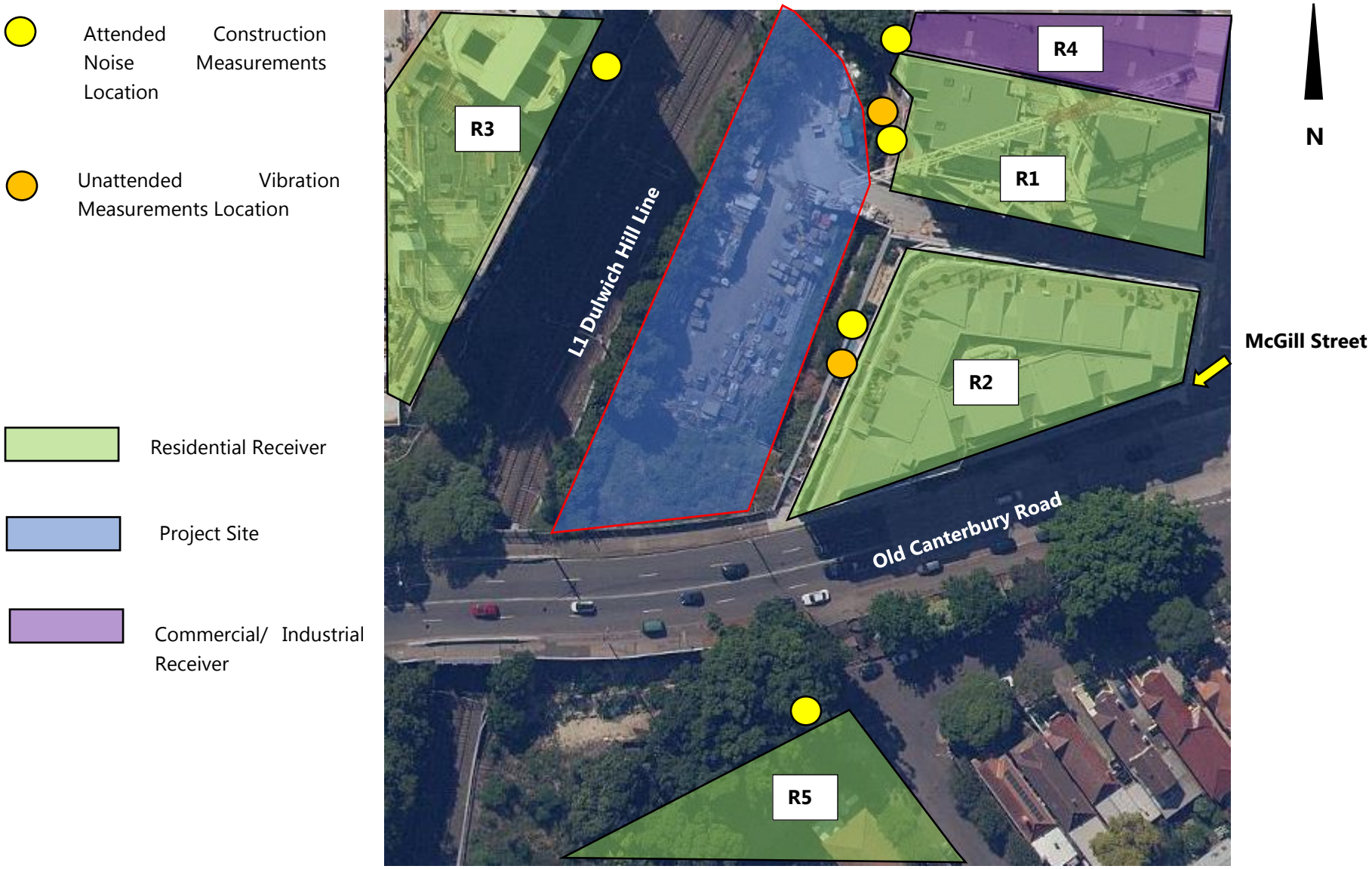
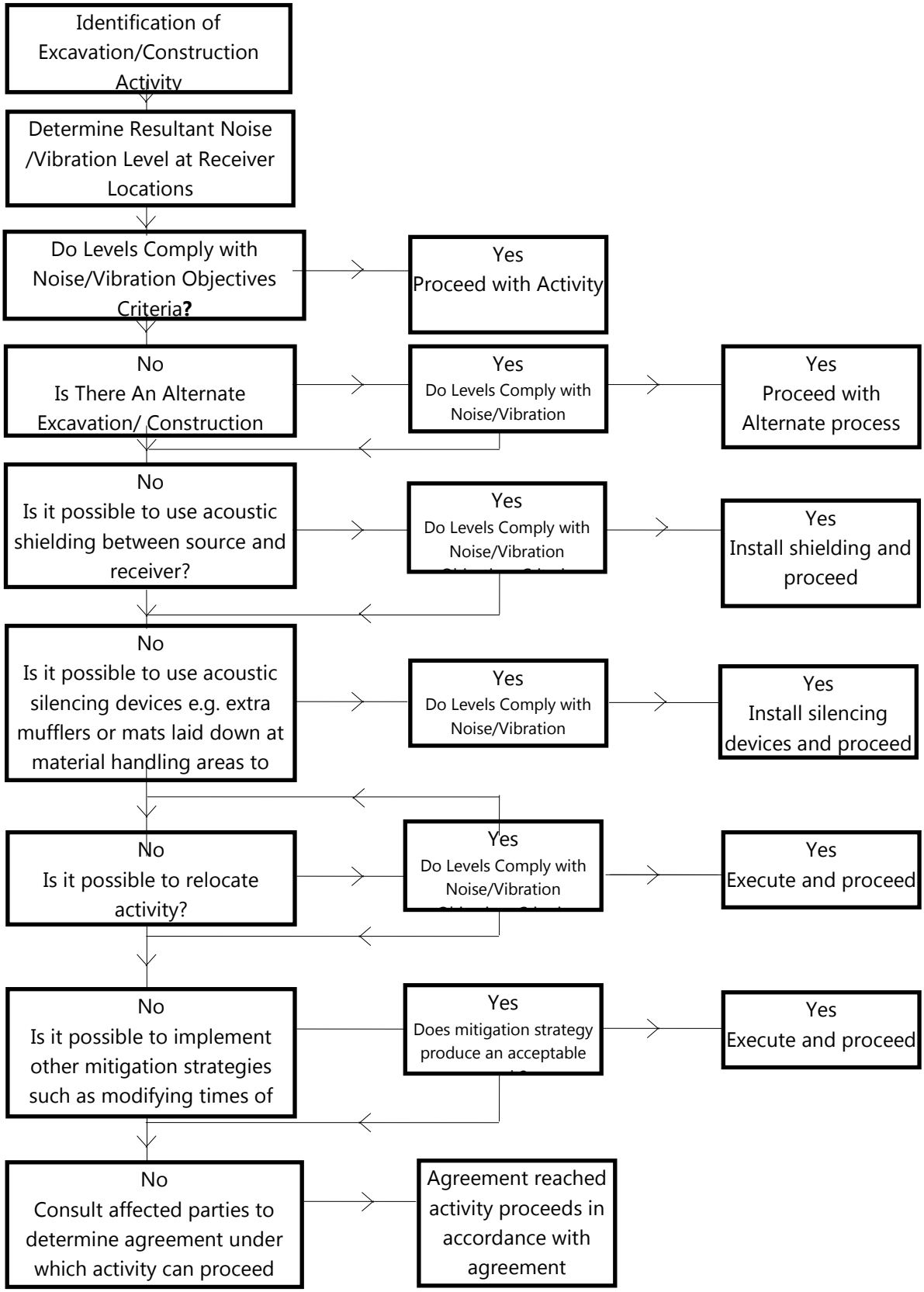


Figure 7: site map (from Six Maps)

11.7 ASSESSMENT METHODOLOGY AND MITIGATION METHODS

The flow chart that follows illustrates the process to be followed to minimise the impact associated with these activities. .



11.8 ADDITIONAL NOISE CONTROL METHODS

In the event of complaints, there are a number of noise mitigation strategies available which can be considered.

The determination of appropriate noise control measures will be dependent on the particular activities and construction appliances. This section provides an outline of available methods.

11.8.1 Selection of Alternate Appliance or Process

Where a particular activity or construction appliance is found to generate excessive noise levels, it may be possible to select an alternative approach or appliance. For example; the use of a hydraulic hammer on certain areas of the site may potentially generate high levels of noise. Undertaking this activity using bulldozers, ripping and/or milling machines will result in lower noise levels.

11.8.2 Acoustic Barrier

Given the position of adjacent development, it is unlikely that noise screens will provide significant acoustic benefit for any commercial or residential receivers but will provide noticeable improvement for those on ground level.

The placement of barriers at the source is generally only effective for static plant. Equipment which is on the move or working in rough or undulating terrain cannot be effectively attenuated by placing barriers at the source.

Barriers can also be placed between the source and the receiver.

The degree of noise reduction provided by barriers is dependent on the amount by which line of sight can be blocked by the barrier. If the receiver is totally shielded from the noise source reductions of up to 15dB(A) can be effected. Where only partial obstruction of line of sight occurs, noise reductions of 5 to 8dB(A) may be achieved. Where no line of sight is obstructed by the barrier, generally no noise reduction will occur.

As barriers are used to provide shielding and do not act as an enclosure, the material they are constructed from should have a noise reduction performance that is approximately 10dB(A) greater than the maximum reduction provided by the barrier. In this case the use of a material such as 10mm or 15mm thick plywood (radiata plywood) would be acceptable for the barriers.

11.8.3 Material Handling

The installation of rubber matting over material handling areas can reduce the sound of impacts due to material being dropped by up to 20dB(A).

11.8.4 Treatment of Specific Equipment

In certain cases it may be possible to specially treat a piece of equipment to dramatically reduce the sound levels emitted.

11.8.5 Establishment of Site Practices

This involves the formulation of work practices to reduce noise generation. A more detailed management plan will be developed for this project in accordance to the construction methodology outlining work procedures and methods for minimising noise.

11.8.6 Combination of Methods

In some cases it may be necessary that two or more control measures be implemented to minimise noise.

11.8.7 Dealing with Complaints

Should any complaints about noise occur immediate measures shall be undertaken to investigate the complaint, the cause of the exceedances and identify the required changes to work practices.

If a noise complaint is received the complaint will be recorded. The complaints register records the following:

- The name and address of the complainant (if provided);
- The time and date the complaint was received;
- The nature of the complaint and the time and date the noise was heard;
- The name of the employee who received the complaint;
- Actions taken to investigate the complaint, and a summary of the results of the investigation;
- Required remedial action, if required;
- Validation of the remedial action; and
- Summary of feedback to the complainant.

A permanent register of complaints should be held.

12 CONCLUSION

This report presents an analysis of the acoustic impacts associated with the proposed residential development at 120C Old Canterbury Road, Summer Hill.

The internal noise assessment was made in reference to the following documents:

- The Inner West Council – '*Inner West Comprehensive Development Control Plan* (DCP) 2016';
- NSW Department of Planning and Environment's document – '*Developments near Rail Corridors or Busy Roads – Interim Guideline';*
- NSW Department of Planning and Environment's document – *'State Environmental Planning Policy (SEPP) (INFRASTRUCTURE) 2007*";
- Australian and New Zealand AS/NZS 3671:1989 *'Acoustics—Road traffic noise intrusion—Building siting and construction'*; and
- Australian and New Zealand AS/NZS 2107:2016 *'Recommended design sound levels and reverberation times for building interiors'*;

Should any ventilation system be installed, it should be acoustically designed to ensure that the acoustic performance of the acoustic treatments outlined above are not reduced and does not exceed Council criteria for noise emission to nearby properties. A continued acoustic review on the proposed ventilation system will be carried out at CC stage (if required).

External noise emission criteria have been setup in this report to satisfy the requirements below;

- The Inner West Council – '*Inner West Comprehensive Development Control Plan (DCP) 2016*; and
- NSW EPA Noise Policy for Industry (NPfI) 2017.

The light rail vibration assessment was made in reference to the following document:

- Australian and New Zealand AS/NZS 2670:1990 "*Evaluation of human exposure to whole-body vibration*";
- British Standard BS 7385 Part 2 1993;
- DECCW Assessing Vibration- A technical guideline; and
- Department of Planning '*Development Near rail Corridors and Busy Road – Interim Guideline*'.

Based on noise impacts predicted in section 8.2 above, noise emissions from the proposed Communal space are capable of complying with noise emission requirements provided that acoustic treatments/assumptions in Section 8.2.2 of this report are adopted.

Detailed acoustic control measures for the plant servicing the proposed development will be determined at CC stage.

An assessment of noise from construction works associated with 120C Old Canterbury Road, Summer Hill has been presented in this report.

Noise and vibration associated with activities on the site will be assessed in accordance with the following guidelines:

- 'The Inner West Council - Inner West Comprehensive Development Control Plan (DCP) 2016; and
- NSW EPA Interim Construction Noise Guideline.
- For structural damage vibration, German Standard DIN 4150-3 *Structural Vibration: Effects of Vibration on Structures; and*

- For human exposure to vibration, the evaluation criteria presented in the British Standard BS 6472:1992 *Guide to Evaluate Human Exposure to Vibration in Buildings (1Hz to 80Hz)* for low probability of adverse comment.

Based on the assessment, noise emission from construction activities can generally meet the relevant noise emission levels. a construction noise and vibration plan has been developed that will be used to minimise impacts on the surrounding properties. The plan will be further refined as planning of the project proceeds. The construction processes will be developed having regard to the plan along with responses to the mitigation of any remaining impacts.

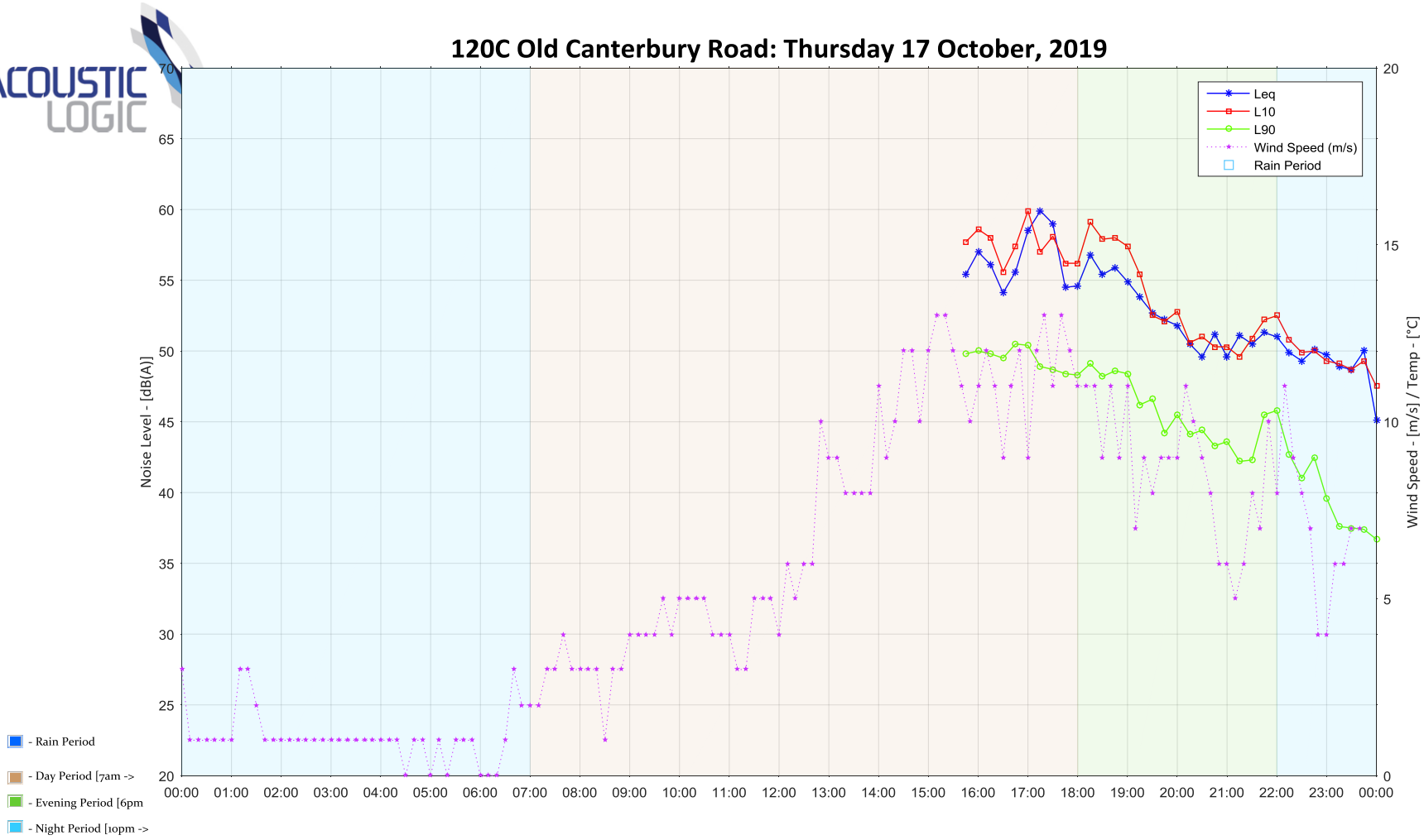
Provided that the mitigation techniques recommended in sections 11.6, 11.7, and 11.8 of this report are adopted, noise impacts associated with the development on surrounding land uses are expected to be acceptable.

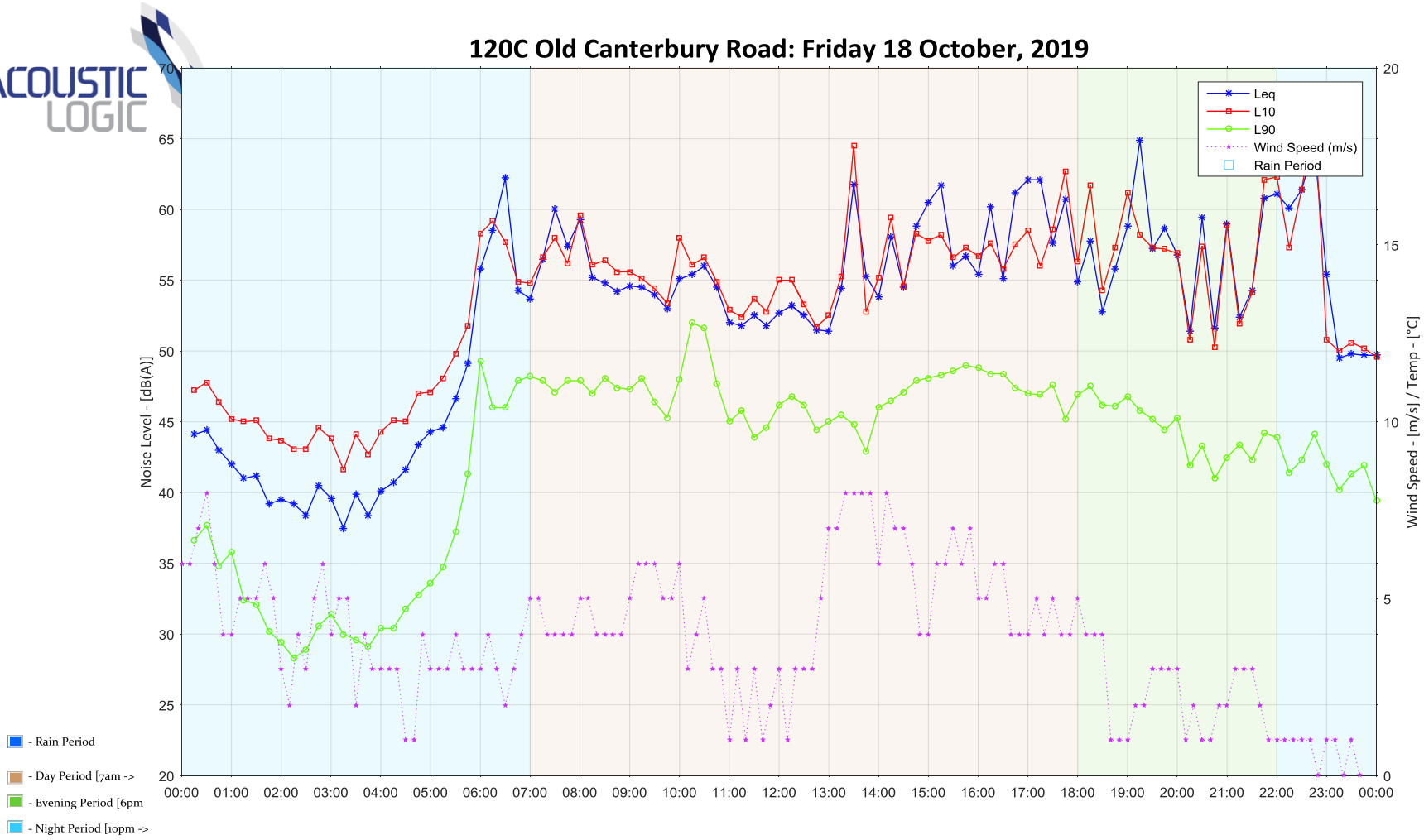
We trust this information is satisfactory. Please contact us should you have any further queries.

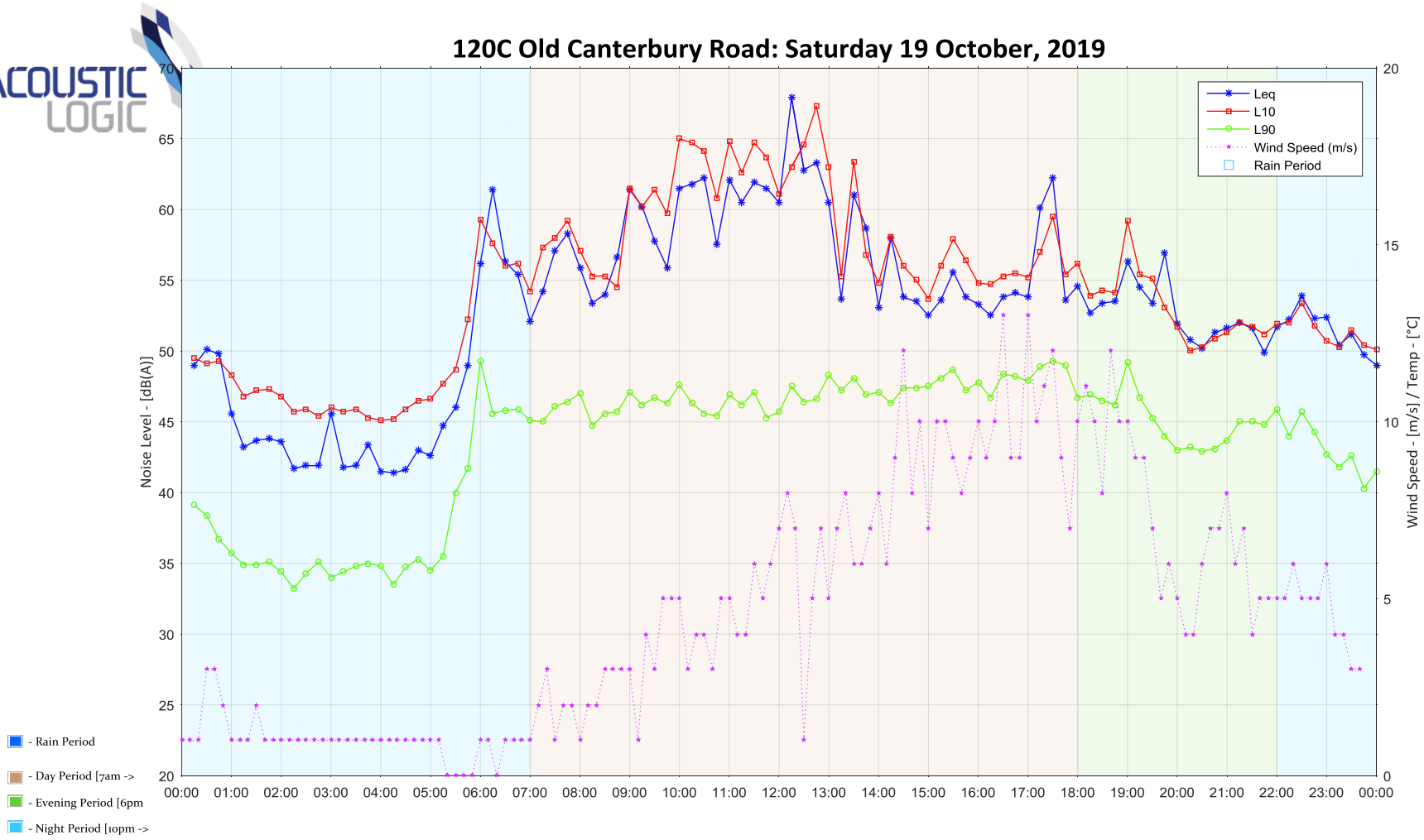
Yours faithfully,

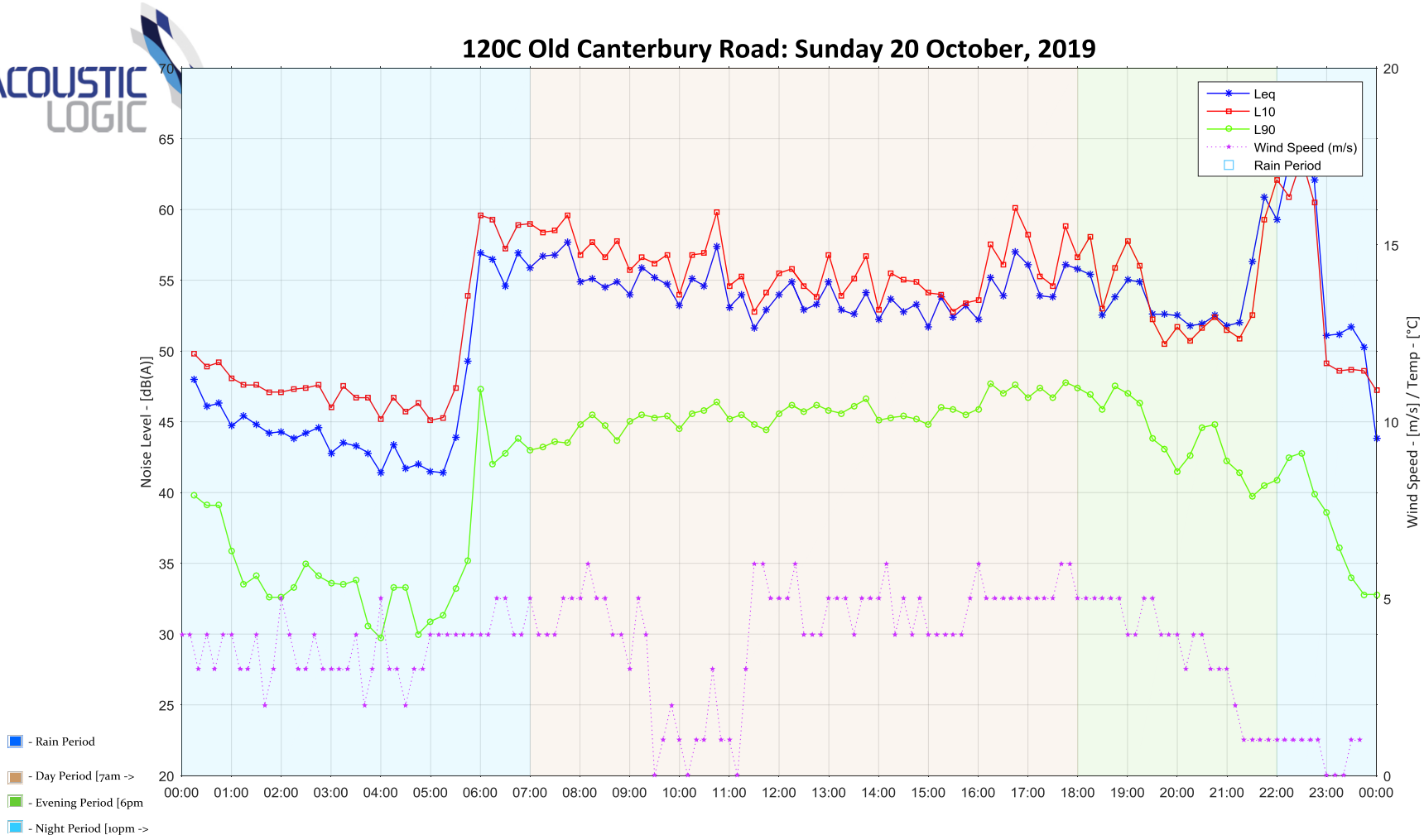
Acoustic Logic Consultancy Pty Ltd
Hugh Cao

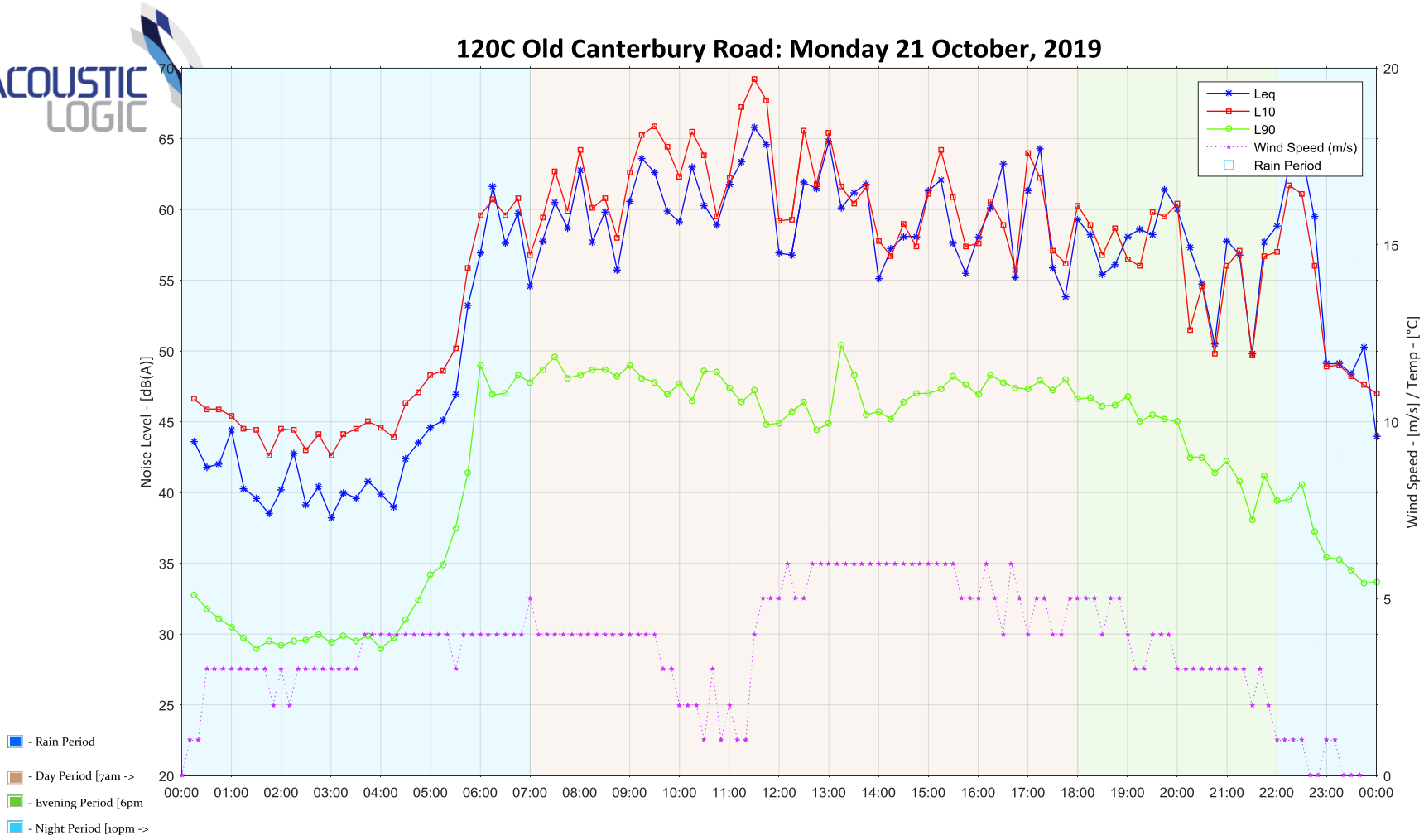
APPENDIX 1 - UNMANNED NOISE MONITORING DATA

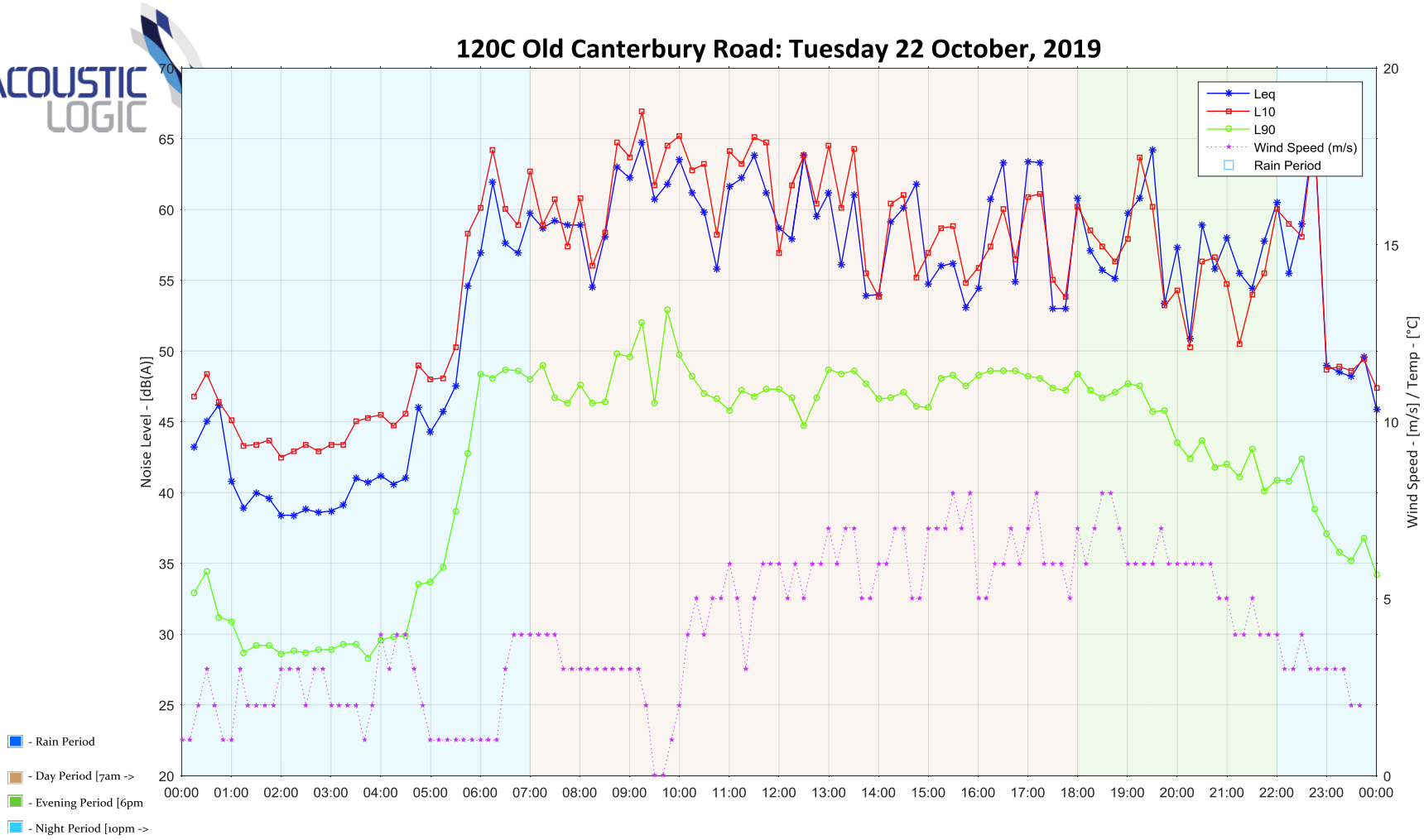


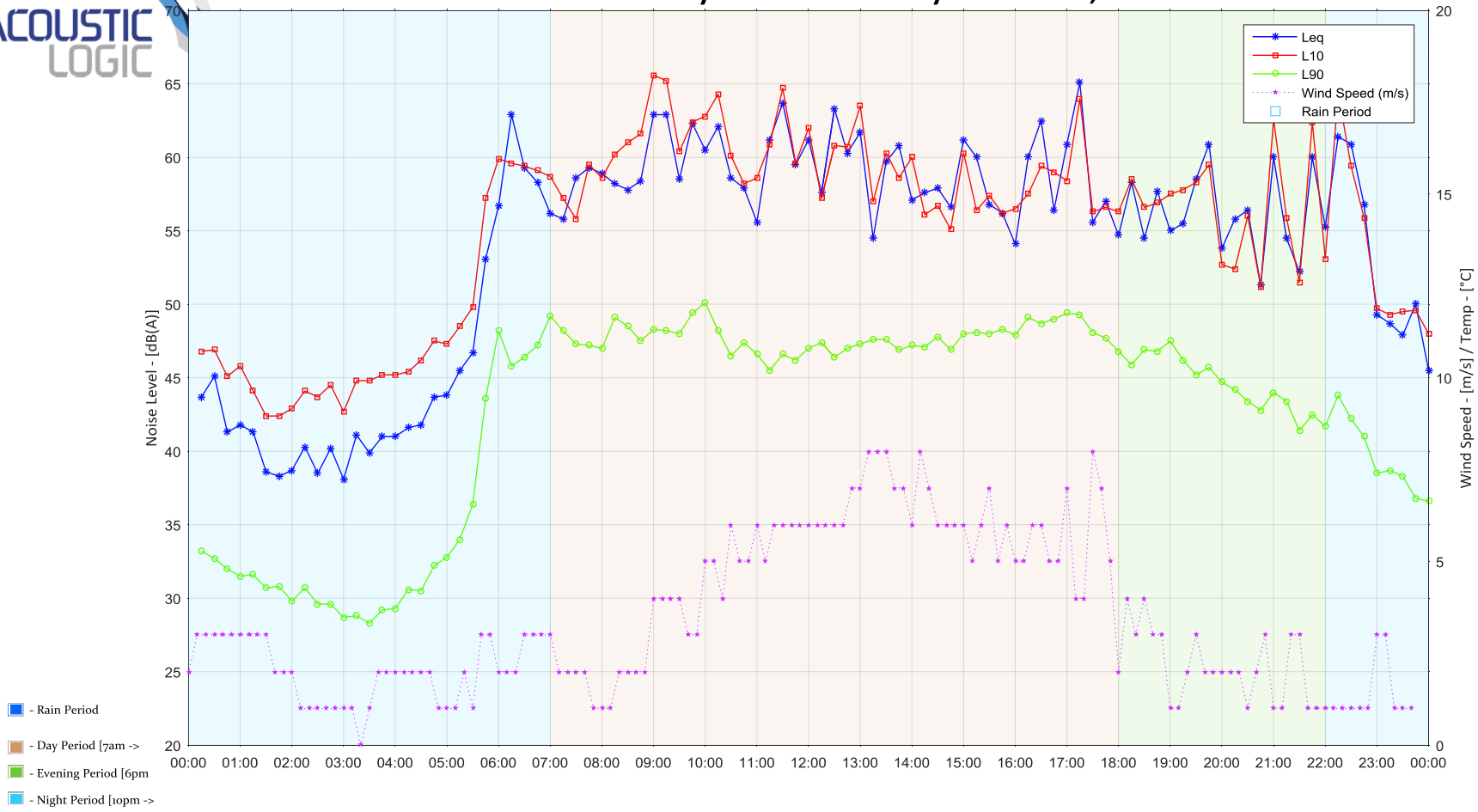


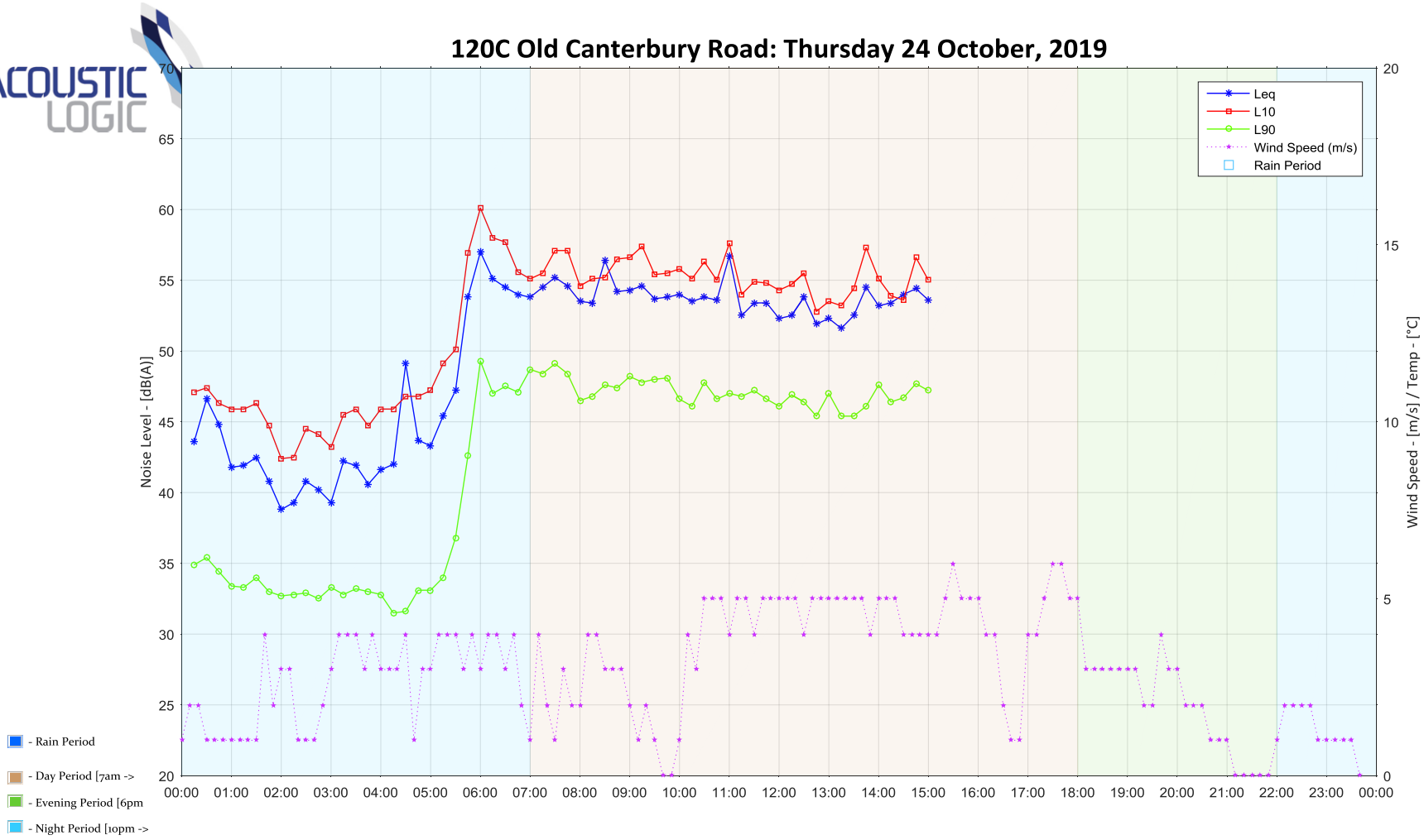




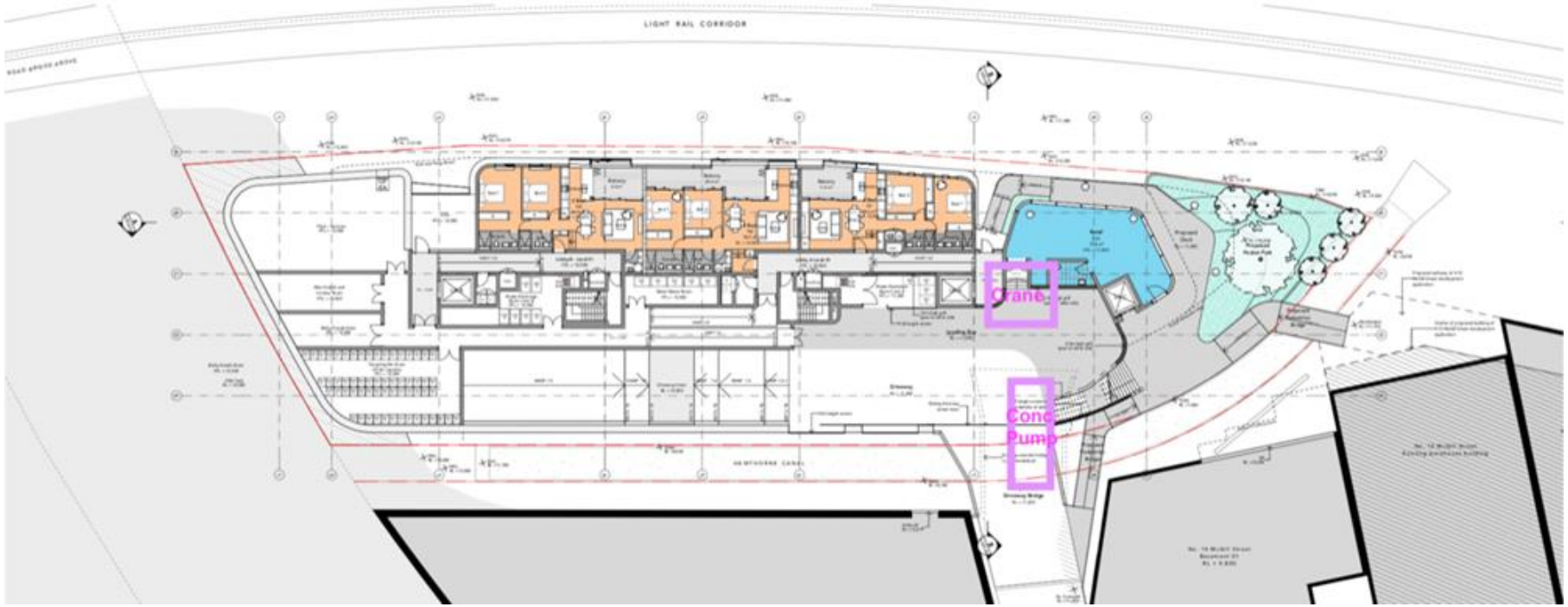








APPENDIX 2 – APPROXIMATE LOCATIONS FOR CRANE AND CONCRETE PUMP (CNVMP)



APPENDIX 3- GLAZING MARK-UP

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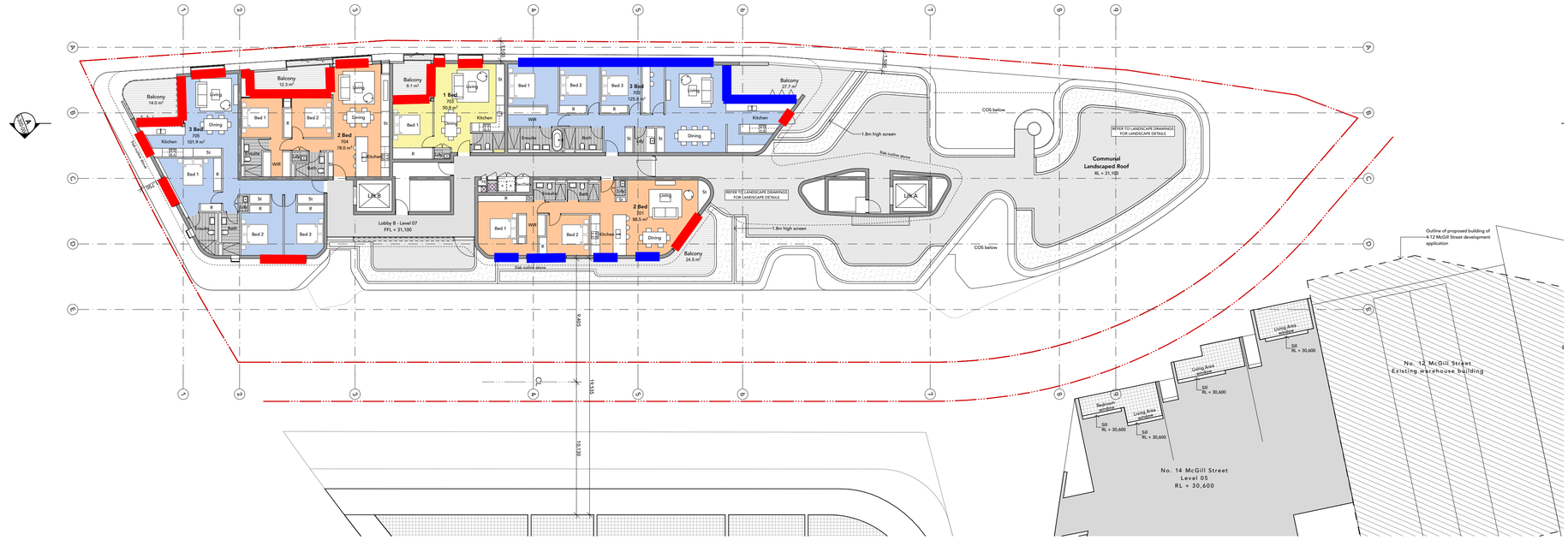

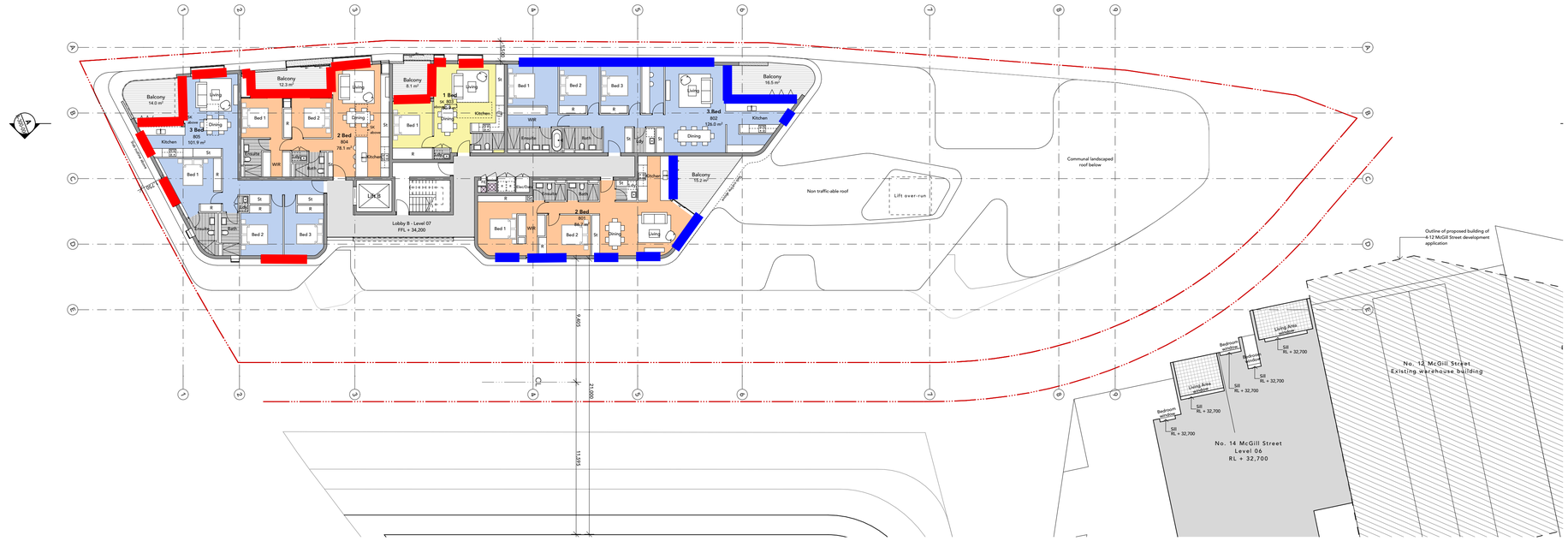

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REV	DESCRIPTION	DRAWN	Issue Date
DA11	DA for Final Coordination	BW	24/5/20

REV	DESCRIPTION	DRAWN	Issue Date

ALL LEVELS TO AUSTRALIAN HEIGHT DATUM.

IT IS THE CONTRACTORS RESPONSIBILITY TO CONFIRM ALL MEASUREMENTS ON SITE PRIOR TO COMMENCEMENT OF WORK. DRAWINGS SHOULD NOT BE SCALED. WRITTEN DIMENSIONS ONLY SHOULD BE TAKEN FROM DRAWINGS. ALL DIMENSIONING IS TO SUBSTRATE BRICKWORK / BLOCKWORK UNLESS OTHERWISE NOTED.

Project
120C Old Canterbury Road_Summer Hill

Title
Level 07 & Level 08

Job No.	#Ph
Scale	1:200 @ A1
Date	22.05.20
Drawn/Checked	BW CJ

Dwg No. **A-200-006** Rev. **DA11**

10.38 laminated

6.38 laminated

6mm Float

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Client
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REV	DESCRIPTION	DRAWN	Issue Date
DA11	DA for Final Coordination	BW	24/5/20

REV	DESCRIPTION	DRAWN	Issue Date

Project
120C Old Canterbury Road_Summer Hill

Title
Level 05 & Level 06

Job No.	#Ph
Scale	1:200 @ A1
Date	22.05.20
Drawn/Checked	BW CJ

Dwg No. **A-200-005** Rev. **DA11**

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DA11	DA for Final Coordination	BW	24/5/20

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Project
120C Old Canterbury Road_Summer Hill

Title
Level 03& Level 04

Job No.	#Pn
Scale	1:200 @ A1
Date	22.05.20
Drawn/Checked	BW CJ

Dwg No. **A-200-004** Rev. **DA11**

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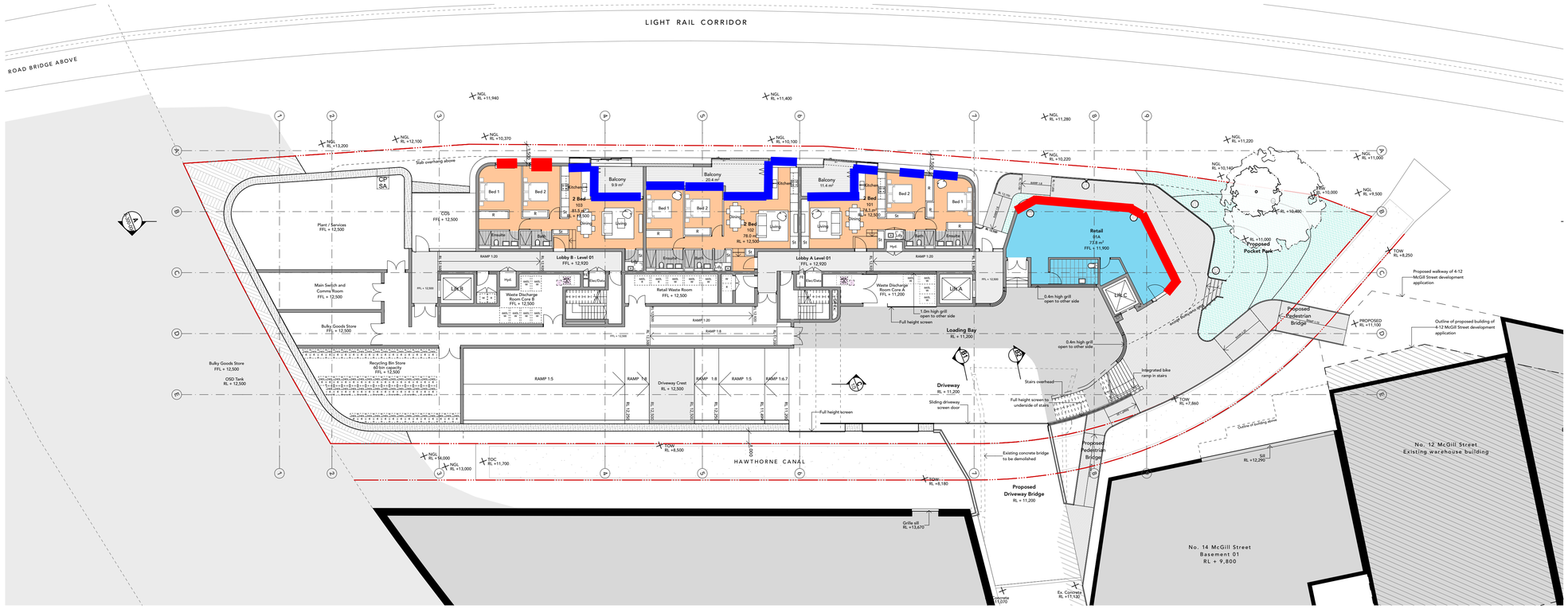

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Project

120C Old Canterbury Road_Summer Hill

Title

Level 01 & Level 02

Job No.	#Pln
Scale	1:200 @ A1
Date	22.05.20
Drawn/Checked	BW/ CJ

Dwg No. **A-200-003** Rev. **DA11**