Environmental Noise Assessment

Proposed Build to Rent Development

At 10-16 Campbell Street, Bowen Hills

On behalf of New Urban Villages

24BRA0207 R01_0

Revision Record

No.	Author	Reviewed/Approved	Description	Date
A	A Ashworth	S Yorke	Internal draft	10/03/2025
0	A Ashworth		Client issue	11/03/2025

Executive Summary

TTM was engaged by New Urban Villages to undertake an environmental noise impact assessment of a proposed Build to Rent development located at 10-16 Campbell Street, Bowen Hills. It is understood this report will be lodged with Economic Development Queensland and is based upon the Bowen Hills Priority Development Area (PDA) Development Scheme and Brisbane City Council *City Plan 2014* planning scheme.

Unattended noise monitoring was conducted to determine the current road traffic, rail and ambient noise levels at the development location.

An environmental code assessment was conducted for the development against the Multiple dwelling Code and compliance with acceptable outcomes is achieved based on screening from the building structure as detailed in Section 5.2.

Noise modelling of road traffic noise and rail noise was conducted resulting in façades requiring acoustic attenuation requirements. Solid balustrades are recommended for facades impacted by noise category 2 or higher.

An aircraft noise assessment to Australian Standards, AS2021 (Acoustics – Aircraft Noise Intrusion – Building Siting and Construction) was conducted and advice for improving acoustic comfort for building occupants was also included as detailed in Section 8. Recommendations are incorporated as shown in Section 9.

Mechanical plant selections are not available at this stage. To comply with planning scheme acceptable outcomes for mechanical plant (Multiple Dwelling Code AO42), we recommend mechanical plant is acoustically screened from nearby sensitive uses. A mechanical plant noise assessment should be conducted once plant selections are finalised during design development stage.

Compliance with the relevant planning scheme including transport noise requirements is predicted based on the implementation of the recommendations outlined in Section 9 of this report.

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1 Introduction

1.1 Background

TTM was engaged by New Urban Villages to undertake an environmental noise impact assessment of a proposed Build to Rent development located at 10-16 Campbell Street, Bowen Hills. The proposal is for build to rent dwellings up to level 26 with car parking and residential amenities on the basement, ground, podium and rooftop levels.

1.2 References

This report is based on the following:

- Bowen Hills Priority Development Area (PDA) Development Scheme
- Brisbane City Council (BCC) *City Plan 2014*
- Australian Standard AS2021:2015 Acoustics – Aircraft Noise Intrusion – Building Siting and Construction (AS2021).
- Queensland Development Code (QDC) MP4.4 – *Buildings in a Transport Noise Corridor* (August 2015)
- Development plans as shown in Appendix A
- Site inspection, noise measurements, analysis and calculations conducted by TTM

1.3 Scope

The assessment includes the following:

- Description of the site.
- Measurement of existing road traffic, rail and ambient noise levels.
- Statement of assessment criteria relating to environmental noise, road traffic noise, rail noise and aircraft impacts.
- Prediction of future road traffic, rail and aircraft noise onto the development.
- Analysis of measured and predicted noise levels.
- Details of noise control recommendations to be incorporated to achieve predicted compliance.

2 Site Description

2.1 Site Location

The site is described by the following:

- 10 - 16 Campbell Street, Bowen Hills
- Lots 3 to 5 on RP10074 and Lot 1 on RP144614

The site locality is shown in Figure 1.

Figure 1: Site Locality

2.2 Current Site Conditions

The site at 10-16 Campbell Street, Bowen Hills currently consists of commercial uses and vacant sites. The site is bound by Campbell Street to the north, commercial uses to the east, a laneway to the south and Hurworth Street to the west. The current acoustic environment at the ground level of the site is primarily comprised of road traffic noise from Campbell Street and Markwell Street.

3 The Proposed Development

3.1 Development Description

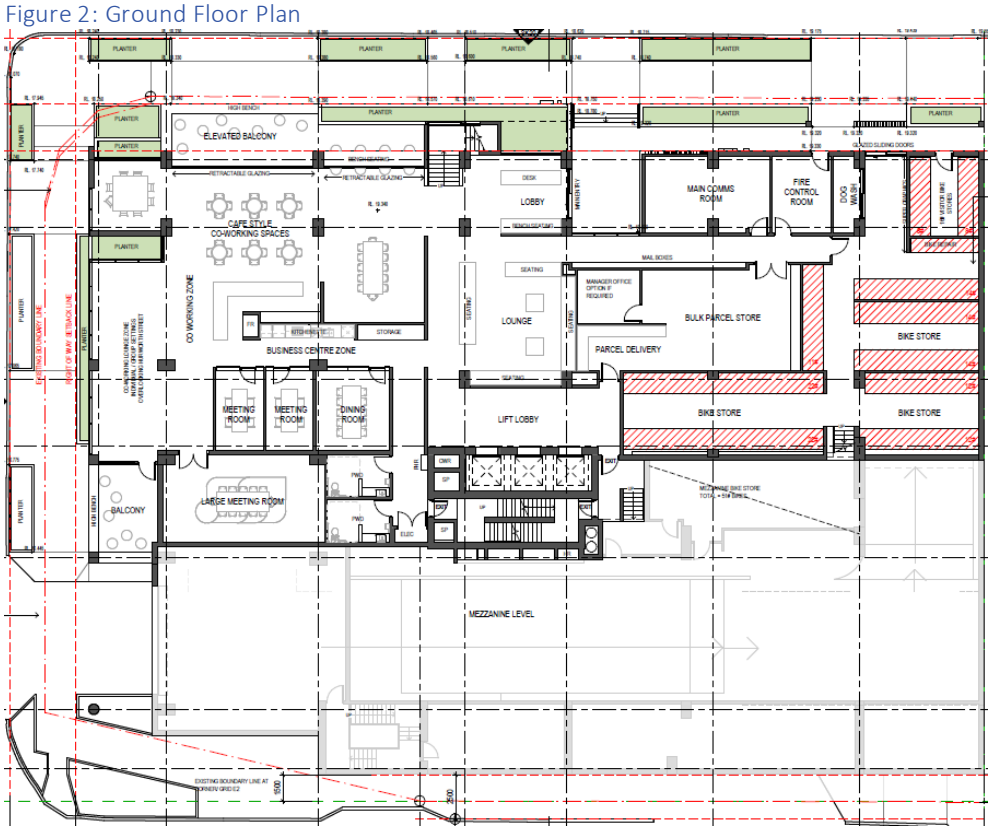
The proposal is to develop a Build to Rent development comprising of the following:

- Basement level with refuse area, loading dock, car parking and services
- Level 0 / Ground with lobby and residential amenities.
- Podium Levels 1 to 3 for car parking and residential amenities.
- Level 4 – Residential apartments and residential amenities.
- Levels 5 to 26 - Residential apartments.
- Rooftop Levels 27 to 28 - Mechanical plant and residential amenities.

This report assessed operation during all time periods and recommend restrictions where required.

The ground floor plan is presented in Figure 2. Further samples of the development plans are shown in Appendix A.

Figure 2: Ground Floor Plan



4 Measurements

4.1 Equipment

The following equipment was used to measure existing noise levels:

- ARL EL316 Environmental noise logger (SN# 16-306-005)
- ARL EL315 Environmental noise logger (SN# 15-302-489)
- Norsonic 140 noise logger (SN# 1406507)
- Norsonic 140 noise logger (SN# 1406504)
- Norsonic Nor131 Sound Level Meter (SN# 1313158)
- B&K Sound Calibrator (SN# 3009814)
- Pulsar 105 (SN#101558)

All equipment was calibrated by a National Association of Testing Authorities (NATA) accredited laboratory. The sound analysing equipment was field calibrated before and after the measurement session. No significant drift from the reference signal was recorded.

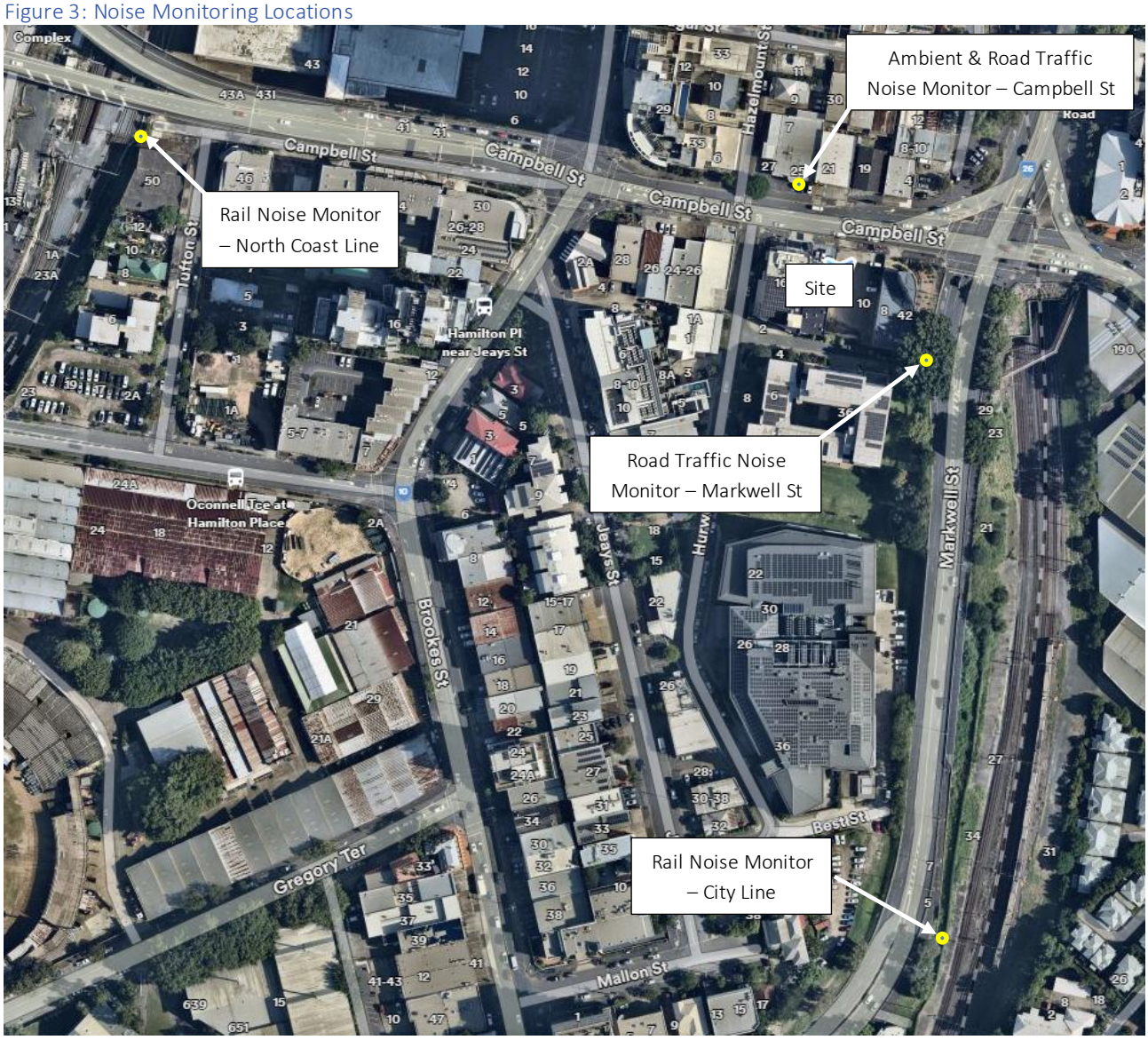
4.2 Unattended Noise Monitoring

Unattended noise monitoring was conducted to establish the existing ambient and road traffic noise levels between Monday 19th and Friday 23rd April, 2021 and rail noise levels for the city line were measured between Tuesday 6th and Friday 9th April, 2021 and rail noise levels for the north coast line were measured between Monday 3rd and Wednesday 5th February, 2025. The noise monitoring locations are shown in Figure 3.

The noise monitors were in positions considered representative of the noise environment near the site with consideration to both access and security requirements. After surveying the area, a secure and safe location to measure rail noise from the city line was only possible south of the site, and the rail line closest to the site is within a tunnel. The rail noise for the north coast line was measured west of the site at the boundary between Campbell street and the rail easement. For road traffic noise, secure and safe locations were found close to the site to measure road traffic noise for Campbell Street and Markwell Street.

Verification between the rail and road traffic noise 3D SoundPLAN models and the measured noise levels, enables the 3D models to be representative of this noise environment.

Figure 3: Noise Monitoring Locations



The microphones were in free-field locations between 1.2m and 1.5m above ground level.

The noise monitors for ambient and road traffic noise were set to measure statistical noise levels in 'A'-weighting, 'Fast' response, over 15 minute intervals. Ambient noise levels were measured in accordance with Australian Standard *AS1055:1997 Acoustics – Description and Measurement of Environmental Noise* (AS1055). Road traffic noise levels were measured in accordance with Australian Standard *AS2702:1984 Acoustics – Methods for the measurement of road traffic noise* (AS2702).

The noise monitors for rail noise were set to 1 minute intervals. The city line monitor was set to record audio with a trigger noise level of 75dB(A) and the north coast line monitor was set to record audio with a trigger noise level of 80dB(A). The audio recordings were used to confirm the L_{Amax} levels were from a train pass-by event and not an extraneous noise source. Attended noise measurements were undertaken on Monday 6th April, 2021 for the city line and Monday 3rd February, 2025 for the north coast line, these were used to verify

the unattended noise logging data. Weather during the monitoring periods was generally fine (source: Bureau of Meteorology).

4.3 Results of Measurements

4.3.1 Ambient Noise Levels

Table 1 presents the measured ambient noise levels. The Rating Background Level (RBL) was determined in accordance with the BCC *Noise Impact Assessment Planning Scheme Policy* (NIAPSP). Graphical presentation of the measured levels is shown in Appendix B.

Table 1: Measured Ambient Noise Levels

Time Period	Measured Noise Levels, dB(A)	
	RBL L_{90}	L_{eq}
Daytime (7am – 6pm)	55	67
Evening (6pm – 10pm)	50	65
Night time (10pm – 7am)	40	62

4.3.2 Road Traffic Noise Levels

Table 2 presents the measured road traffic noise levels at the unattended noise monitoring location. Graphical presentation of the measured noise levels is presented in Appendix B.

Table 2: Measured Road Traffic Noise Levels - Campbell Street

Road Traffic Noise Descriptor	Time Period	Measured Level dB(A)
$L_{A10,18hr}$	6am to midnight	69
Noisiest day-time $L_{Aeq,1\ hour}$	6am to 7am	69
Noisiest night-time $L_{Aeq,1\ hour}$	5am to 6am	65
$L_{Aeq,24\ hour}$	Midnight to midnight	66
$L_{90,\ 8\ hour}$	10pm to 6am	44
$L_{90,\ 18\ hour}$	6am to midnight	55

Table 3: Measured Road Traffic Noise Levels - Markwell Street

Road Traffic Noise Descriptor	Time Period	Measured Level dB(A)
$L_{A10,18hr}$	6am to midnight	69
Noisiest day-time $L_{Aeq,1\ hour}$	5pm to 6pm	71
Noisiest night-time $L_{Aeq,1\ hour}$	5am to 6am	64
$L_{Aeq,24\ hour}$	Midnight to midnight	66
$L_{90,\ 8\ hour}$	10pm to 6am	45
$L_{90,\ 18\ hour}$	6am to midnight	56

4.3.3 Rail Noise Levels – City Line

Rail timetables provided by Queensland Rail (QR) for the city line indicate a maximum of 850 passenger trains and up to 19 diesel powered freight train pass the site per weekday.

The Queensland Rail Code of Practice – Railway Noise Management defines the single event maximum (SEM) sound pressure level as the arithmetic average of the highest 15 single maximum noise level events over a 24-hour period. Table 4 presents the highest 15 free-field L_{Amax} rail noise levels during the measured 24-hour period.

The calculated $L_{Aeq,24hr}$ is based on these measured L_{Aeq} results (logarithmic average) and number of trains over a 24 hour period, and is therefore a conservative approach. This approach is required as the proximity of road traffic and other extraneous noises, results in a significant portion of measured non-rail noise and it is not practical to identify and remove all non-rail event measurement data over each 24 hour period.

Table 4: Measured Rail Noise Levels (Highest 15 each day)

Date	Train Type*	Maximum Noise Level L_{MAX} dB(A)	Noise Level L_{eq} dB(A)	Warning Device
7th April 2021	Passenger	99.1	80.5	No
	Passenger	96.3	75.7	Yes
	Passenger	91.4	77.5	No
	Passenger	91	75.8	No
	Passenger	90	77.4	No
	Passenger	89.5	72.8	No
	Passenger	89.4	76.8	No
	Passenger	89.1	76.2	No
	Passenger	88.8	75.8	No
	Passenger	88.7	72.3	No
	Passenger	88.5	73.5	No
	Passenger	88.3	77.4	No
	Passenger	88.2	77.9	No
	Passenger	87.9	77.2	No
	Passenger	87.8	76.2	No
	Single event maximum noise level (SEM) dB(A)	**90.2**		
	Leq,24hour dB(A)		**58.5**	
8th April 2021	Passenger	95.4	78.6	No
	Passenger	93.7	78.7	No
	Freight	90.9	78.3	No
	Passenger	90.8	77.9	No
	Passenger	90.6	76.2	No

Date	Train Type*	Maximum Noise Level L_{MAX} dB(A)	Noise Level L_{eq} dB(A)	Warning Device
	Passenger	90.4	76.3	No
	Passenger	90.4	80.3	No
	Passenger	89.7	81.5	No
	Passenger	89.6	79.8	No
	Passenger	89.5	71.6	No
	Passenger	89.4	80.2	No
	Passenger	88.9	75	No
	Passenger	88.8	72.6	No
	Passenger	88.7	75.5	No
	Passenger	88.7	78.2	No
	Single event maximum noise level (SEM) dB(A)	**90.4**		
	Leq,24hour dB(A)		**58.6**	
Maximum of both 24 hour periods	**Single event maximum noise level (SEM) dB(A)**	**90.4**		
	Leq,24hour dB(A)		**58.6**	

*L_{MAX} noise levels were dominated by the noise of train wheel / brake squeal.

4.3.4 Rail Noise Levels – North Coast Line

Rail timetables provided by Queensland Rail (QR) for the north coast / exhibition line (including additional volumes from cross river rail) indicate a maximum of 488 passenger trains and up to 15 diesel powered freight train pass the site per weekday.

The Queensland Rail Code of Practice – Railway Noise Management defines the single event maximum (SEM) sound pressure level as the arithmetic average of the highest 15 single maximum noise level events over a 24-hour period. Table 4 presents the highest 15 free-field L_{Amax} rail noise levels during the measured 24-hour period.

The calculated $L_{Aeq,24hr}$ is based on these measured L_{Aeq} results (logarithmic average) and number of trains over a 24 hour period, and is therefore a conservative approach. This approach is required as the proximity of road traffic and other extraneous noises, results in a significant portion of measured non-rail noise and it is not practical to identify and remove all non-rail event measurement data over each 24 hour period.

Table 5: Measured Rail Noise Levels (Highest 15 each day)

Date	Train Type*	Maximum Noise Level L_{MAX} dB(A)	Noise Level L_{eq} dB(A)	Warning Device
3rd – 4th April 2025 (12.00pm – 11.59am)	Passenger	97.8	83.4	No
	Freight	96.7	78.1	No

Date	Train Type*	Maximum Noise Level L_{MAX} dB(A)	Noise Level L_{eq} dB(A)	Warning Device
	Freight	96.7	90.3	No
	Freight	96.6	83.2	No
	Passenger	95.9	79.8	No
	Passenger	94.6	86.2	No
	Passenger	93.6	77.2	No
	Passenger	91.5	71.7	No
	Passenger	91.0	80.6	No
	Passenger	90.7	79.5	No
	Passenger	90.6	76.2	No
	Passenger	90.5	81.4	No
	Passenger	90.5	78.6	No
	Passenger	90.0	78.3	No
	Passenger	90.0	78.0	No
	Single event maximum noise level (SEM) dB(A)	**93.1**		
	Leq,24hour dB(A)		**70.2**	
4th – 5th April 2025 (12.00pm – 11.59am)	Freight	101.0	89.4	No
	Freight	98.5	85.0	No
	Passenger	97.3	82.9	No
	Freight	96.2	83.0	No
	Freight	95.2	81.2	No
	Freight	94.7	84.9	No
	Freight	93.4	80.2	No
	Passenger	92.7	80.5	No
	Passenger	92.7	79.6	No
	Freight	92.6	80.3	No
	Passenger	91.6	78.5	No
	Passenger	90.9	79.2	No
	Freight	90.6	79.3	No
	Passenger	89.6	77.0	No
	Passenger	89.4	74.9	No
	Single event maximum noise level (SEM) dB(A)	**93.8**		
	Leq,24hour dB(A)		**70.3**	

Date	Train Type*	Maximum Noise Level L_{MAX} dB(A)	Noise Level L_{eq} dB(A)	Warning Device
Maximum of both 24 hour periods	Single event maximum noise level (SEM) dB(A)	93.8		
	Leq,24hour dB(A)		70.3	

5 Noise Criteria

The applicable noise criteria codes for the site location are the Bowen Hills PDA Development Scheme December 2022 and Brisbane City Plan 2014.

5.1 Northshore Hamilton PDA Scheme

Bowen Hills PDA Development Scheme states in relation to noise criteria:

2.5.9.3 Noise – Transport noise corridors and entertainment venues

Development is oriented, designed and constructed to:

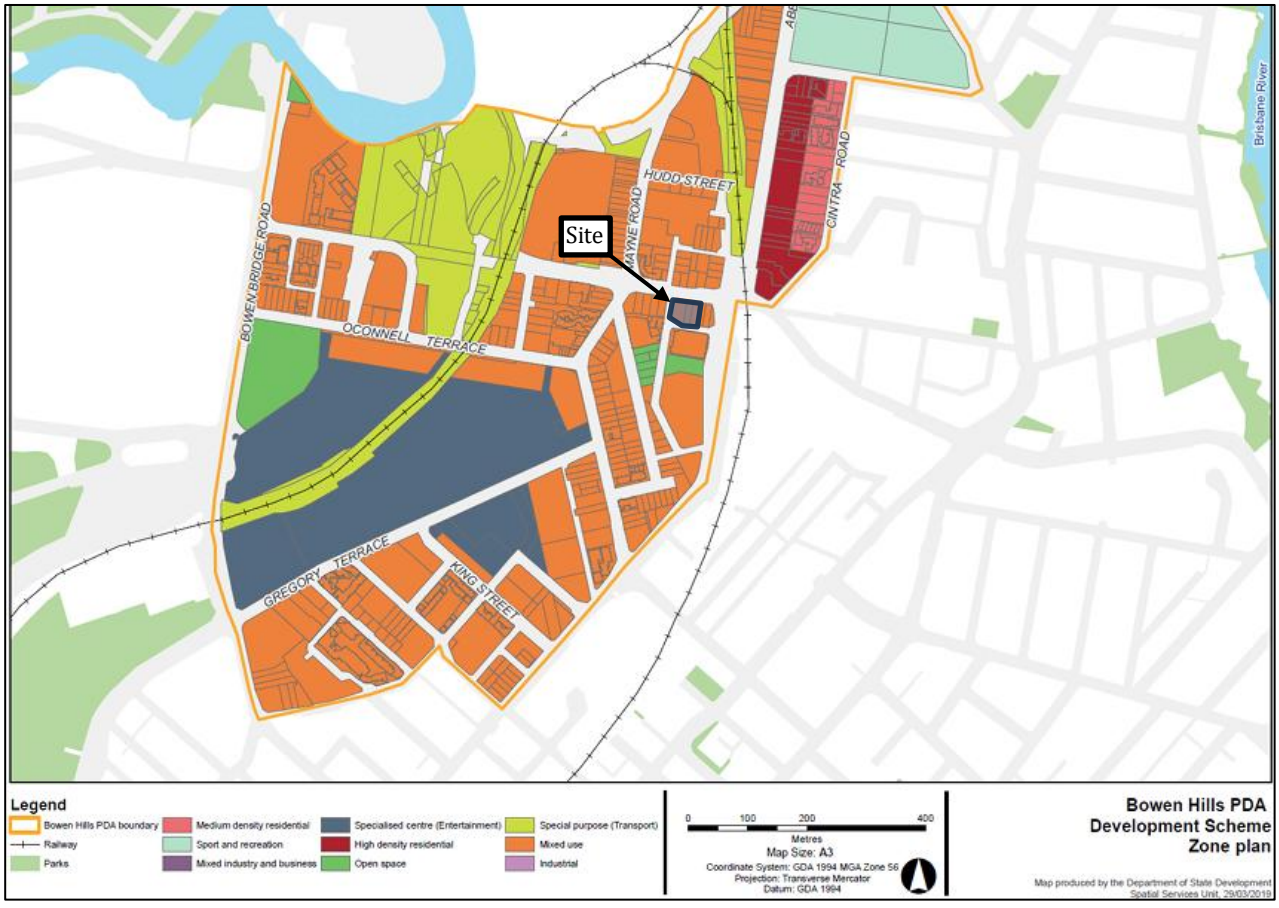
i. reduce exposure to noise impacts from designated transport noise corridors, and

ii. reduce the exposure of residential uses to noise impacts from lawfully operating entertainment venues.

Item i. refers to the Brisbane City Plan Transport Noise overlay map and the crtieria is outlined in Section 5.3.

Item ii. is regarding entertainment noise, the site is not located close to entertainment venues or the specialized centre (entertainment) zone as shown in Figure 1.

Figure 1: Bowen Hills PDA Development Scheme – Zone Plan



The PDA scheme provides only general noise requirements. The Brisbane City Council City Plan 2014 planning scheme provides more detail for noise assessments.

The Brisbane City Council *City Plan 2014* details site specific planning scheme zones, overlays and codes relevant to a site in the BCC local government area. Table 6 summarises the planning scheme requirements for the site which are relevant to the noise assessment.

Table 6: City Plan 2014 - Site Specific Acoustic Requirements

Zone	Code	Overlay Code
BCC - Emerging Community Zone	BCC - Multiple Dwelling Code	BCC - Transport Noise Corridor Overlay

5.2 Multiple Dwelling Code

The primarily performance outcomes relating to acoustics within the *Multiple Dwelling Code* are detailed in the following Tables.

Table 7: Multiple Dwelling Code

Performance Outcomes	Acceptable Outcomes
PO22 Development that includes mechanical plant (including air-conditioning plant, heat pumps and swimming pool pumps) ensures it is located, designed and attenuated to achieve the following criteria: $L_{Aeq,adj,T}$ emitted from mechanical plant is not greater than the rating background level plus 3 at a sensitive use not associated with the development. Note— Where T is • Day (7am to 6pm): 11hr, • Evening (6pm to 10pm): 4hr, • Night (10pm to 7am): 9hr. Where- $L_{Aeq,adj,T}$ is the A-weighted equivalent continuous sound pressure level during measurement time T, adjusted for tonal and impulsive noise characteristics, determined in accordance with the methodology described in the Noise impact assessment planning scheme policy. The rating background level is determined in accordance with the methodology described in the Noise impact assessment planning scheme policy. Note—A noise impact assessment report prepared in accordance with the Noise impact assessment planning scheme policy can assist in demonstrating achievement of this performance outcome.	**AO22** Development ensures mechanical plant is acoustically screened from nearby sensitive uses.

PO35	AO35.1
Development where not in a zone in the centre zones category or the Mixed use zone, ensures that car parking, hardstand or manoeuvring areas are: a. located to minimise noise and fumes disturbance on residents within and adjoining the site; b. acoustically and visually screened to: i. minimise the reflection of headlights into dwelling windows; ii. attenuate noise impacts; c. landscaped to: i. soften the visual appearance of at grade hardstand areas; ii. enhance pedestrian safety; iii. improve visual amenity for the streetscape and urban area; iv. provide shade for pedestrians and reduce the impact of glare and radiant heat from car parking areas. Note—where in a zone in the centre zones category or the Mixed use zone, the car parking provisions of the Centre or mixed use code apply.	Development where not in a zone in the centre zones category or the Mixed use zone, ensures that a hardstand or manoeuvring area situated at or above ground level is: a. located a minimum of 3 metres vertically and horizontally from any habitable window on site to minimise noise disturbance on residents; b. screened to prevent the reflection of car headlights onto dwelling windows adjoining or opposite the site.
	AO35.2 Development where not in a zone in the centre zones category or the Mixed use zone ensures any vehicle movement or vehicle parking areas along the side or rear boundary are: a. acoustically screened from adjoining dwellings to a minimum height of 1.8m; b. provided with a vegetated buffer next to any movement or parking areas: i. a minimum of 1m wide along the side boundary; ii. a minimum of 2m wide along the rear boundary; planted at a pot size and density sufficient to screen up to 1.5m above ground level at establishment.

To comply with *Performance Outcome PO22* it is recommended the development comply with *Acceptable Outcome AO22* by applying acoustic screening to exposed mechanical plant with the potential to impact adjacent noise sensitive receivers.

The majority of mechanical plant is expected to be located in an open air plant are on the lower and upper roof levels. This mechanical plant equipment is screened from all adjacent receivers by the building structure.

For any mechanical plant equipment that is not screened from the adjacent sensitive receivers, *PO42* outlines the criteria based on the measured ambient noise levels are summarised in Table 8.

Table 8: Mechanical Plant Criteria

Time Period	Measured RBL L_{90} dB(A)	Criteria $L_{Aeq,adj,T}$
Day (7am – 6pm)	55	58
Evening (6pm – 10pm)	50	53
Night (10pm – 7am)	40	43

The development complies with *Acceptable Outcome AO35*.1 as all habitable windows are screened by the building structure from all hardstand or manoeuvring areas.

The development complies with *Acceptable Outcome AO35*.2 as the building structure screens the adjoining sensitive commercial receiver (medical facility) to the east from the basement and podium level car parking.

5.3 Transport Noise Corridor Overlay Code

The Transport Noise Corridor Overlay of City Plan 2014 identifies the site as being situated within a transport noise corridor as specified by the Queensland Development Code MP4.4. Table 9 outlines the performance outcomes of the Transport Noise Corridor Overlay Code.

Table 9: Transport Noise Corridor Overlay Code outcomes, City Plan 2014

Performance Outcomes	Acceptable Outcomes
PO1 Development provides outdoor space for passive recreation in a manner where transport noise has been minimised.	**AO1** Development ensures that each dwelling: (a) has a balcony or outdoor recreation area shielded by the building from direct road traffic noise; or (b) with a balcony exposed to road traffic noise has a solid gap free balustrade

It will be recommended the development adopt *Acceptable Outcome AO1* where each balcony exposed to road traffic noise (QDC noise category 2 or higher) has a solid gap free balustrade.

5.4 Road Traffic Noise

The site is located in the Local government transport noise corridor of Campbell Street and Markwell Street which identifies the site to be affected by road traffic noise at the worst-case level of Queensland Development Code (QDC) MP4.4 Noise Category 3 (near the boundary). Details of the QDC MP4.4 requirements are included below.

5.4.1 Queensland Development Code MP4.4 – Road Traffic Noise

The *Queensland Development Code Part MP 4.4 - 'Buildings in a Transport Noise Corridor'* August 2015 (QDC) specifies Noise Categories to ensure that habitable rooms of residential buildings are adequately protected from transport noise over a 10-year planning horizon.

The Noise Categories list the minimum acoustic R_W ratings for each building component to comply with the indoor sound levels as outlined in Australian Standard AS2107[1]. Details regarding the noise categories and acceptable forms of construction can be found within Schedule 1 and 2 of the QDC document (see Appendix E). The triggers for each noise category are summarised in Table 10.

[1] AS NZS 2107:2016. Acoustics - Recommended design sound levels and reverberation times for building interiors

Table 10: Road Traffic Noise Category Levels – QDC MP4.4 (Schedule 3)

Noise Category	Level of Transport Noise* $L_{A10,18Hour}$ for State-Controlled Roads and Designated Local Government Roads
Category 4	≥ 73 dB(A)
Category 3	68 – 72 dB(A)
Category 2	63 – 67 dB(A)
Category 1	58 – 62 dB(A)
Category 0	≤ 57 dB(A)

*Measured at 1 metre from the façade of the proposed or existing building.

5.5 Rail Noise

The assessment of rail noise is considered under the Queensland Development Code criteria. Note. The site is not within 25m of the state-controlled railway corridor therefore State Development Assessment Provisions (SDAP) criteria do not apply to the site.

5.5.1 Queensland Development Code MP4.4 - Rail

The *Queensland Development Code Part MP 4.4 - 'Buildings in a Transport Noise Corridor* August 2015 (QDC) specifies Noise Categories to ensure that habitable rooms of residential buildings are adequately protected from transport noise over a 10-year planning horizon.

The Noise Categories list the minimum acoustic R_W ratings for each building component to comply with the indoor sound criteria. Details regarding the noise categories and acceptable forms of construction can be found within Schedule 1 and 2 of the QDC document. The triggers for each noise category are summarised in Table 11.

Table 11: Rail Noise Category Levels – QDC MP4.4 (Schedule 3)

Noise Category	Single event maximum noise* (L_{Amax}) for Railway Land
Category 4	≥ 85
Category 3	80 – 84
Category 2	75 – 79
Category 1	70 – 74
Category 0	≤ 69

* Measured at 1metre from the façade of the proposed or existing building.

5.6 Aircraft Noise

The assessment of aircraft noise is considered under the following criteria.

Australian Standard AS2021 states the indoor design sound levels are hypothesized values based on Australian experience. A design sound level is the maximum level from an aircraft flyover which, when heard inside a building by the average listener, will be judged as not intrusive or annoying by that listener while carrying out a specific activity. Owing to the variability of subject responses to aircraft noise, these values will not provide sufficiently low interior noise levels for occupants who have a sensitivity to aircraft noise.

Table 12 shows the internal noise levels applicable for residential buildings.

Table 12: Indoor Design Sound Levels for Determination of Aircraft Noise Reduction in Residential Buildings (AS2021)

Activity	Indoor design sound levels L_{max} (dBA)
Sleeping areas, dedicated lounges	50
Other habitable spaces	55
Bathroom, toilets, laundries	60

6 Road Traffic Noise Assessment

The site is located in the Local government transport noise corridor of Campbell Street and Markwell Street. An assessment of road traffic noise onto the proposed development was conducted to determine the acoustic treatment requirements.

6.1 Traffic Volumes

Existing traffic volumes and growth rate for Campbell Street and Markwell Street were obtained from TTM Traffic data. The traffic volumes used in the noise model are presented in Table 13.

Table 13: Traffic Volumes used in the Noise Model

Road	Traffic Volumes (AADT)			Heavy Vehicles (%)	Growth Rate (%)
	2017	2021	2035		
Campbell Street	13,495	15,858	27,815	3.2%	4.1%
Markwell Street	25,025	27,864	40,587	3.0%	2.7%

The 18 hour traffic volumes used in the noise model are taken to be 95% of the AADT (Annual average daily traffic).

6.2 Noise Model

6.2.1 Noise Modelling Parameters

Road traffic noise predictions were conducted using 'SoundPLAN v9.1', a CoRTN based modelling program. The basis of the 'SoundPLAN' model is presented in Table 14.

Table 14: Noise Modelling Parameters

Description	Value
Noise modelling standard	CoRTN (UK)
Grid spacing (noise maps)	2m
CoRTN correction for QLD roads (Except Pacific Motorway, Logan Motorway to Nerang)	-0.7dB(A) (free-field) -1.7dB(A) (1m in front of building façade)
Campbell Street Speed limit	60 km/h
Markwell Street Speed limit	60 km/h
Noise source height above grade	0.5m
Ground contours	DEM data 2015 1m (Source: ELVIS)
Floor heights	Ground: 4.75m, Level 1-2: 3.1m, Level 3: 4.6m Level 4 – 26: 3.1m, Level 27: 3.5m
Receiver heights	1.5m above ground/floor level
Façade correction	+2.5 dB(A)

6.2.2 Noise Model Verification

To verify the road traffic noise model, the $L_{A10,\ 18hour}$ noise levels were modelled and compared to the measured levels as presented in Table 15. As the noise monitor was in a free-field location, the predicted noise level is also shown as free-field.

Table 15: Comparison of Measured and Predicted Road Traffic Noise Levels

Road	Measured $L_{A10,\ 18\ hour}$	Predicted $L_{A10,\ 18\ hour}$
Campbell Street	68.9	69.8
Markwell Street	69.3	70.1

The modelled level is within the allowable tolerance of 2 dB(A) of the measured level, therefore no correction is required to the model.

6.3 Predicted Road Traffic Noise Levels

Modelling was conducted to determine road traffic noise levels at the development in the 10 year planning horizon (2035). Indicative road traffic noise contours at various heights above ground level (AGL) are presented in the following Figures. SoundPLAN receiver point results are shown in Appendix C. Note the noise contours shown are calculated at a fixed level above ground and due to ground level variation and façade corrections, are not representative of any one specific floor and should be considered indicative only.

Figure 4: Predicted Road Traffic Noise Levels at 20m AGL

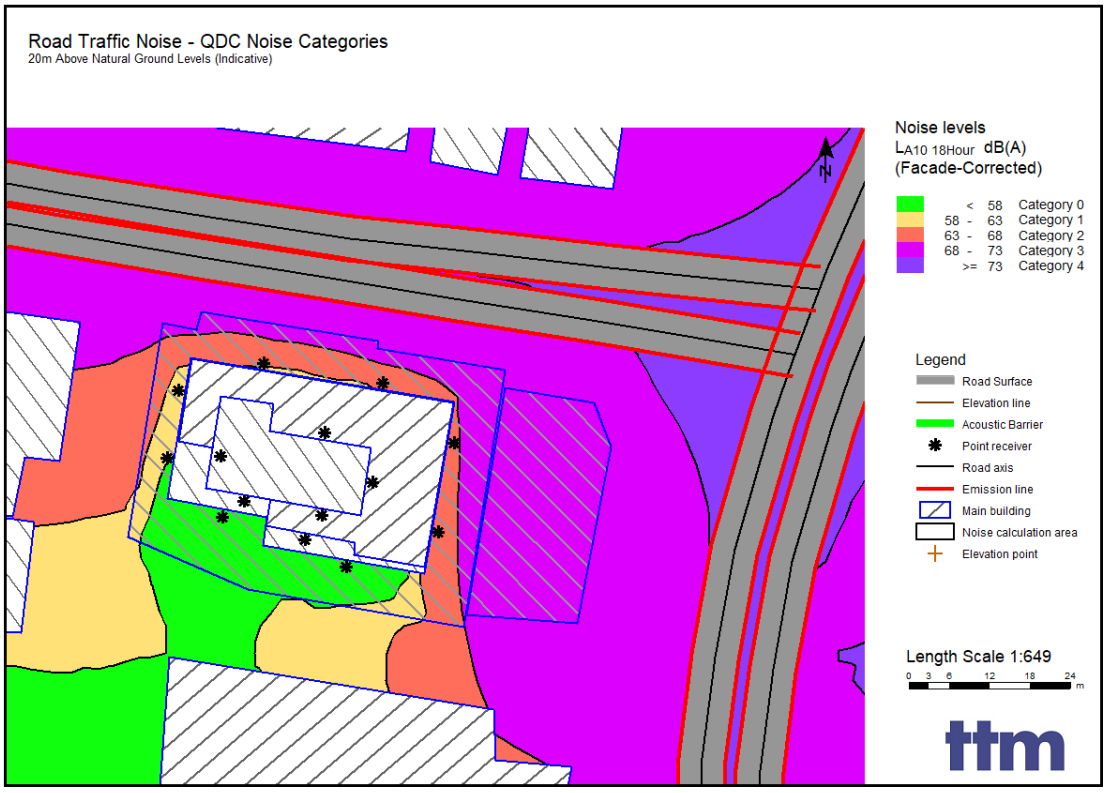
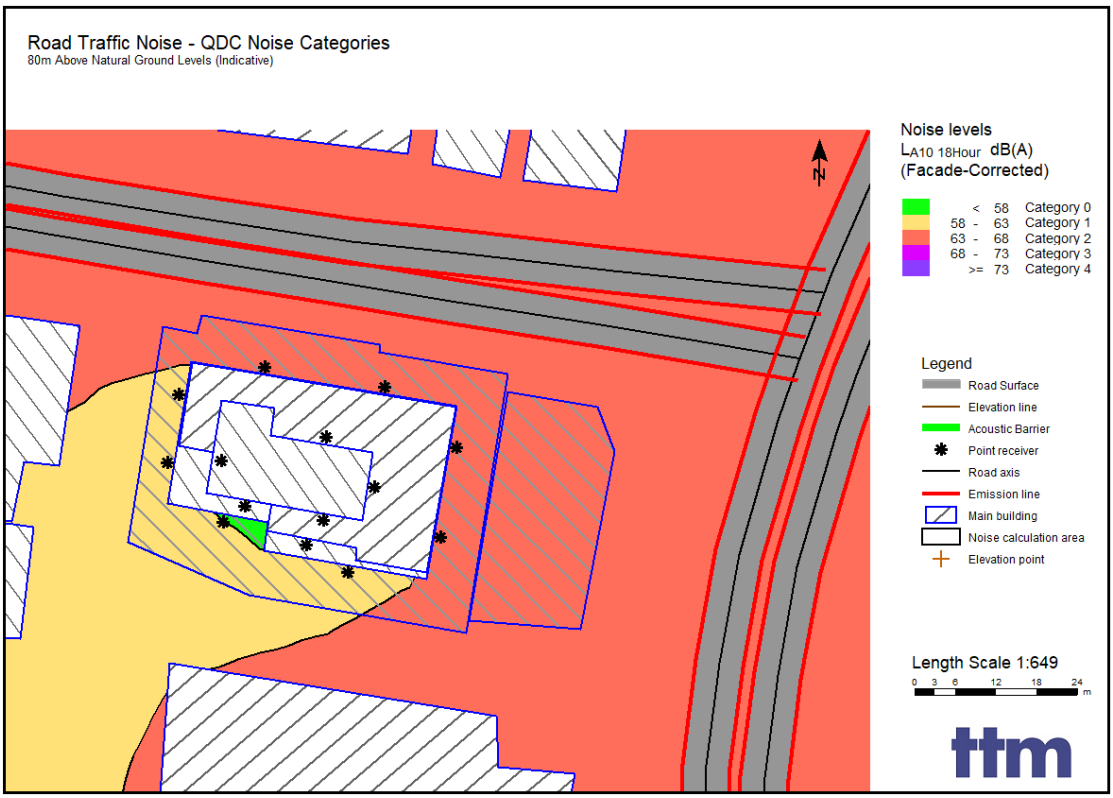


Figure 5: Predicted Road Traffic Noise Levels at 80m AGL



Based on the noise modelling results, the development is predicted to be impacted by road traffic noise ranging from QDC noise category 0 to 3. QDC noise categories and associated acoustic treatment requirements for each façade and floor level are detailed in Section 8.

7 Rail Noise Assessment

An assessment of rail noise on the proposed development was conducted to determine the acoustic treatment requirements for predicted compliance with the relevant criteria.

7.1 Rail Volumes

Rail timetables provided by Queensland Rail (QR) indicate a maximum of 850 passenger trains per day passed the site during the measurement period including approximately 19 diesel trains. QR advised that all services are subject to alteration, addition and cancellation which may vary the number of actual trains passing daily.

7.2 Noise Model

7.2.1 Noise Modelling Parameters

Rail noise predictions were conducted using 'SoundPLAN' v9.1. The parameters of the model are outlined in Table 16.

Table 16: Rail Noise Modelling Parameters

Description	Value
Prediction methodology	Nordic Rail Prediction (Kilde Rep. 130)
Grid spacing (noise maps)	2m
Train Frequency (daily) passenger / freight	City line: 850 / 19 (approximate) North Coast line: 488 / 15 (approximate)
Train speed	Passenger: 60km/h reduced at station Freight: 80km/h (standard reference speed)
Train length	Passenger: 144m Freight: 1000m Diesel engine: 36m (dual locomotive)
Rail track head height	0.6m above ground
Rail noise source height	0.5m (wheels) and 4.0m (diesel engine) above track head height (includes Kilde +0.5m addition)
L1 train type corrections	Passenger electric: -4.6dB Diesel engine: +4.4dB Freight wagons: -6.5dB
L2 correction (dLtype engine)	-100dB (removes contribution)
Rail noise measurement distance	City line: 11m from the nearest line North Coast line: 7m from the nearest line
Ground contours	DEM data 2015 1m (Source: ELVIS)
Floor heights	Ground: 4.75m, Level 1-2: 3.1m, Level 3: 4.6m Level 4 – 26: 3.1m, Level 27: 3.5m
Receiver heights	1.5m above ground/floor levels
Façade correction	+2.5 dB(A)

7.2.2 Noise Model Verification

The measured rail noise levels at the monitoring location were verified in the noise model prior to modelling noise impacts at the development. Table 17 presents the results of the rail noise model verification.

Table 17: Verification of the Rail Noise Model

Location	Descriptor	Measured dB(A)	Predicted dB(A)
City Line	L_{Amax}	90.4	91.1
	$L_{Aeq,24hr}$	58.6	60.6
North Coast Line	L_{Amax}	93.8	93.8
	$L_{Aeq,24hr}$	70.0	70.0

The predicted L_{max} rail noise level was within 2dB of the measured L_{max} level, therefore no correction was required. Corrections were applied to the $L_{Aeq,24hr}$ rail noise to bring the model to within approximately +2dB of the measured level $L_{Aeq,24hr}$ level. The over prediction is considered to possibly be caused by lower average train speeds in the area.

7.3 Predicted Noise Levels

Indicative rail noise contours at various heights above ground level (AGL) are presented in the following Figures. SoundPLAN receiver point results are shown in Appendix C. Note the noise contours shown are calculated at a fixed level above ground and due to ground level variation and façade corrections, are not representative of any one specific floor and should be considered indicative only.

Figure 6: Predicted Rail Noise Contour Map at 20m above ground level (Indicative)

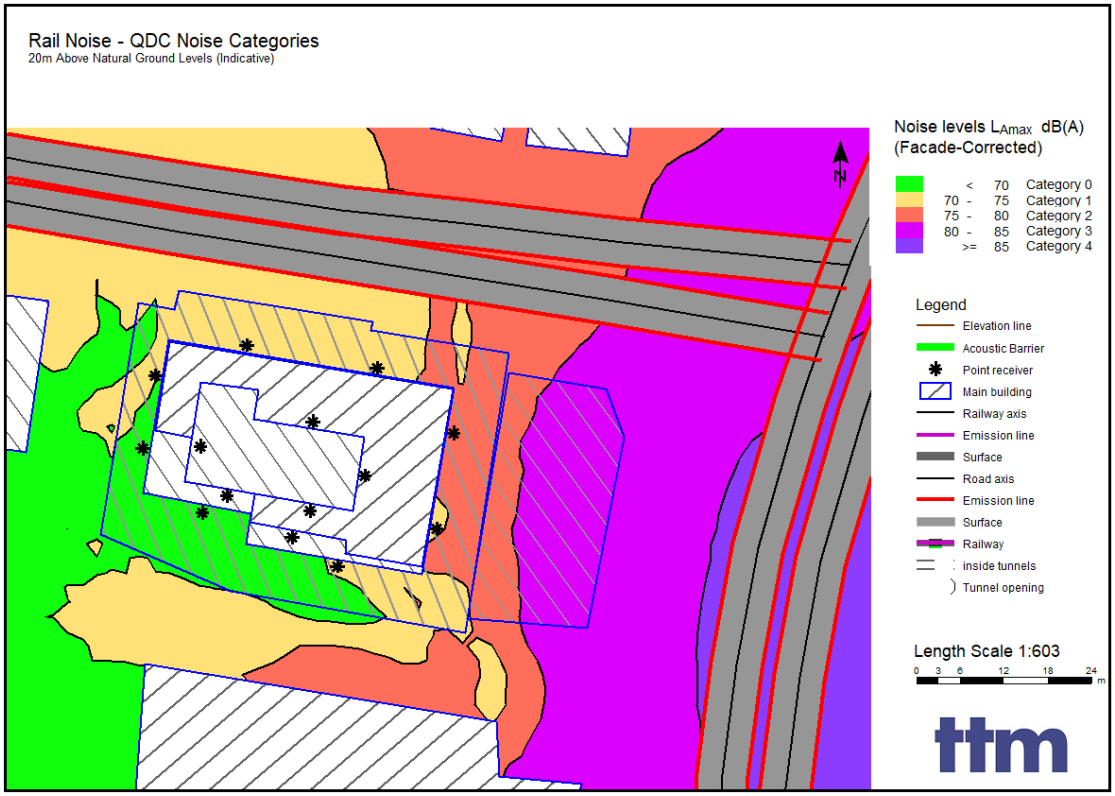
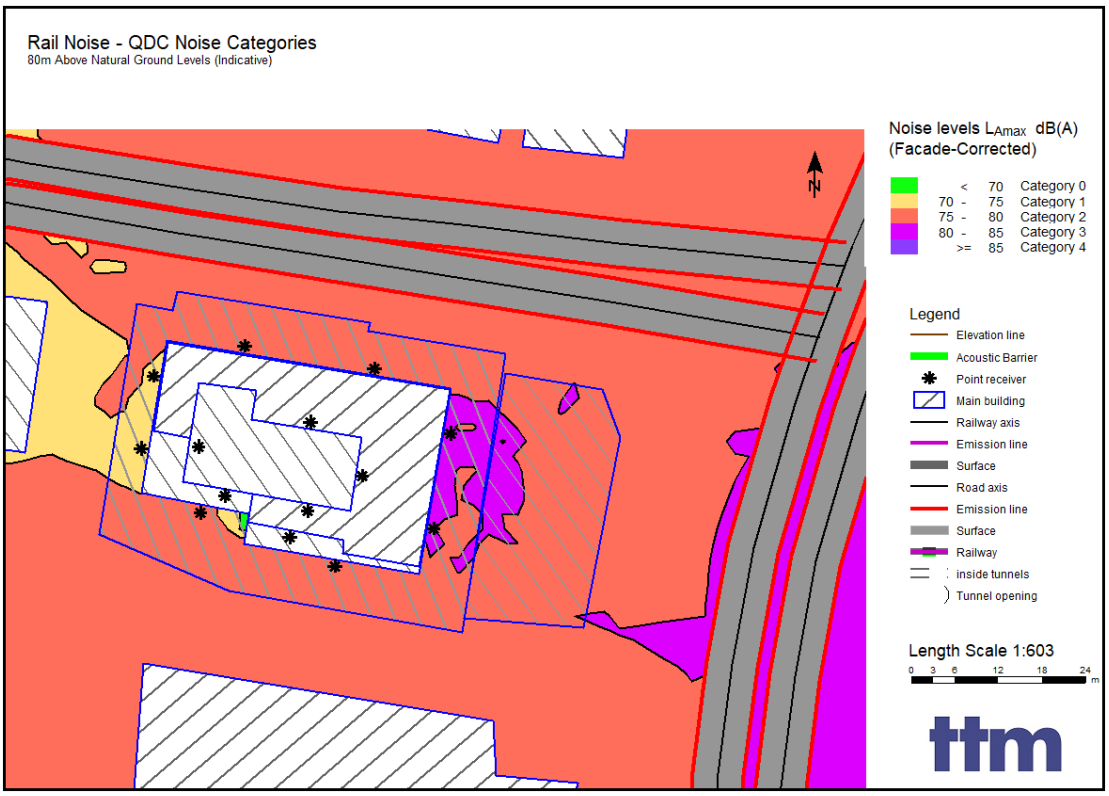


Figure 7: Predicted Rail Noise Contour Map at 80m above ground level (Indicative)



Based on the receiver point modelling results presented in Appendix C (noise contour maps are indictive only), the development is predicted to be impacted by rail noise ranging from noise category 0 to 3. Façade treatments are recommended to achieve internal noise criteria.

Noise categories and associated acoustic treatment requirements, for each façade and floor level, for compliance with internal criteria, are detailed in Section 6.

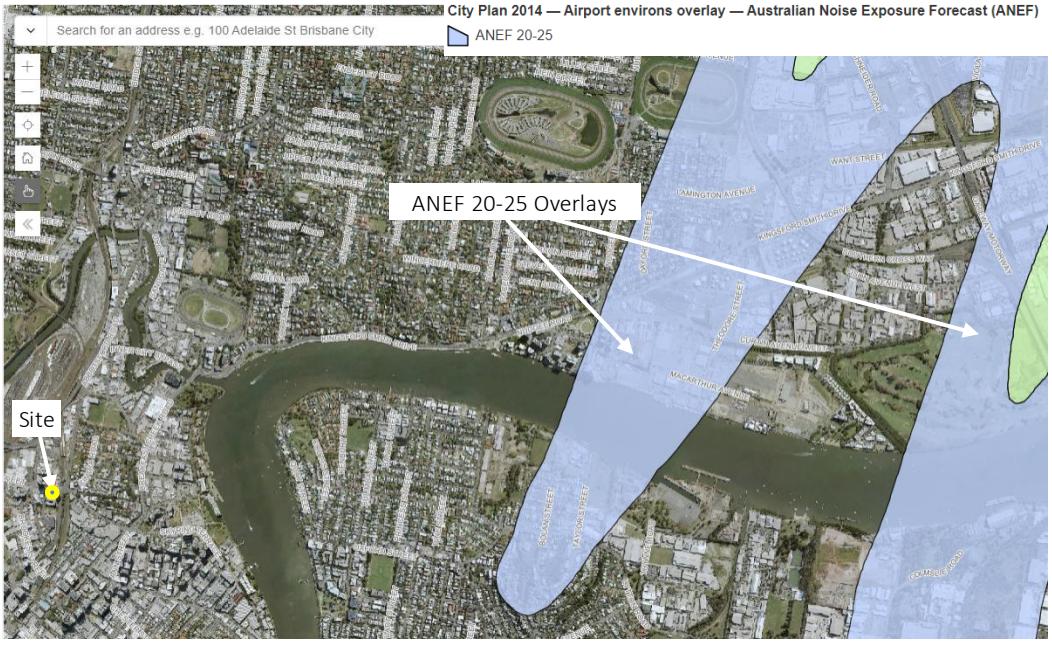
8 Aircraft Noise Assessment

An assessment of aircraft noise onto the proposed development was conducted. The development has residential units up to Level 26. This section will assess aircraft noise, specifically at higher floor levels. The assessment is based on analysis using the methodology from Australian Standard *AS2021:2015 Acoustics – Aircraft Noise Intrusion – Building Siting and Construction* (AS2021).

8.1 Australian Noise Exposure Forecast (ANEF) Zone

The site is approximately 2800m from the closest Australian Noise Exposure Forecast (ANEF) 20-25 noise overlay of Brisbane Airport as shown in Figure 9. An aircraft assessment for a site outside the ANEF 20-25 overlay is not usually a mandatory requirement but, in this instance, will be provided in response to previous requests for nearby locations from EDQ's.

Figure 8: BCC Mapping – ANEF Noise Contour Overlays



Australian Standard AS2021 states the indoor design sound level criteria and is presented in Section 5.6.

8.2 AS2021 - Predicted Aircraft Noise Levels

AS2021 provides an assessment method to determine the predicted aircraft noise level at the site location based on aircraft type and proximity to the airport runway. AS2021 provides aircraft noise levels based on long term average maximum values.

Aircraft types operating from Brisbane Airport were determined from the online service 'WebTrak' of Air Services Australia. The Aircraft Event Levels from Webtrak historical data (March 2024 – Feb 2025) for the nearest noise monitoring terminal (New Farm) are presented in Figure 9.

Figure 9: Aircraft Event Levels – New Farm Noise Monitoring Terminal (WebTrak)

Aircraft Type	Average Event Level	Event Counts			
		Total	Max/day	Min/day	Avg/day
A333	75	355	4	0	1
A332	74.7	541	8	0	1.5
B77W	73.2	208	5	0	0.6
B763	71.1	187	2	0	0.5
F100	70.6	1726	14	0	4.7
B738	70.4	4578	44	0	12.5
B789	70.2	175	4	0	0.5
A320	69.3	1772	13	0	4.9
A21N	69.3	526	4	0	1.4
E190	69.2	4062	36	0	11.1
F70	69	1903	19	0	5.2
A359	68.7	712	8	0	2
B788	68.6	375	3	0	1
B737	68.5	219	3	0	0.6
B38M	67.5	454	4	0	1.2

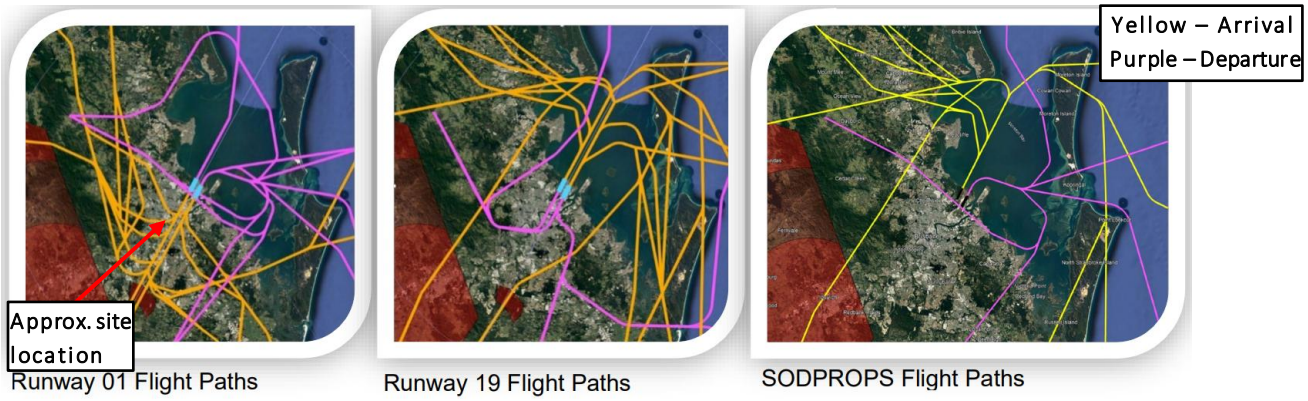
The aircraft types in Figure 9 are sorted in descending order of 'average event level' (noise level). Based on consideration of aircraft noise level and frequency of aircraft events, aircraft operating less than once per day were ignored.

In this instance, the following aircraft type were looked at this assessment:

- Boeing 737-800 (12.5 events per day)
- Airbus A330-300 (1.0 events per day)

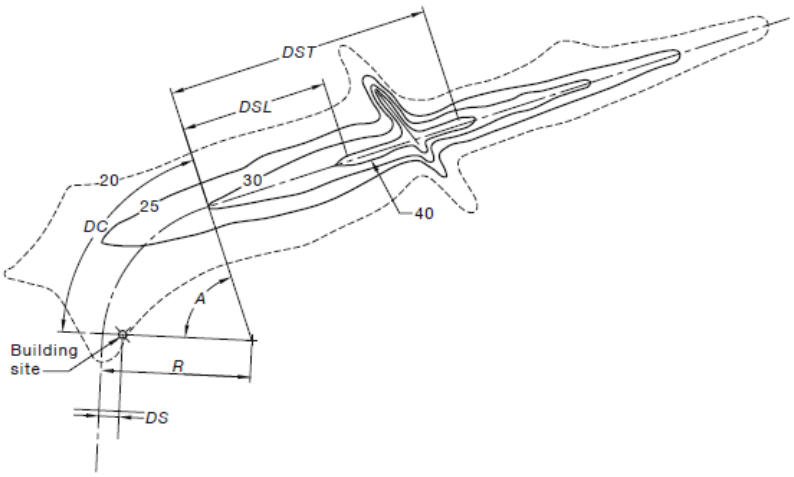
Information regarding flight paths could be found within an Air Services document (***Title: Brisbane New Parallel Runway Flight Paths Post Implementation Review (PIR) ver 1.0, dated 14 December 2022)***. The aircraft flight path maps shown in Figure 10 indicate that the site may be directly beneath one of the arrival flights during runway 01 flight path operation. The site appears to be over 2.5kms from departure flightpaths during runway 19 flight path operation, therefore the assessment will look at noise levels from arriving aircraft as a worst case assessment.

Figure 10: Flight paths from Airservices document (reference: Brisbane Airport Changes to Departure Flight Paths)



Based on the flight paths and in accordance with AS2021 as shown in Figure 11, the distance coordinates for the site location relative to the aerodrome runway are presented in Table 18.

Figure 11: AS2021: Determination of distance coordinates for curved flight paths



DIMENSIONS IN ANEF UNITS

FIGURE 3.2 DETERMINATION OF *DS*, *DL* AND *DT* FOR CURVED FLIGHT PATHS

Table 18: Distance Coordinates for Site Location as per AS2021

Distance Coordinate	Distance (m)
DL (DSL + DC)	11,800m
DT (DST + DC)	15,100m
DS	0m
Elevation difference (runway to site)	Minimum: 30m (Level 4) Maximum: 100m (Floor Level 26)

Based on the distance coordinates in Table 18, and Tables 3.15(A) and 3.7(A) of AS2021, the predicted highest aircraft noise level at the development location are presented in Table 19.

Table 19: AS2021 Aircraft Noise Level Predictions at the Site

Aircraft Type Floor Level	Aircraft Noise Level, Arrivals, dB(A) L_{max}	
	Boeing 737-800	Airbus A330-300
Level 4	70	71
Level 26	72	72

8.3 Internal Noise Attenuation Requirements

Table 20 presents the required aircraft noise attenuation for each habitable room for the aircraft noise impact level stated in Table 19, to achieve the specified internal noise levels from AS2021.

Table 20: Attenuation Requirements for Aircraft Noise

Room(s)	Aircraft Noise Impact Level (dBA)		Indoor design sound levels (dBA)	Assumed Orientation Correction	Required Aircraft Noise Reduction (ANR), dB	
	Level 4	Level 26			Level 4	Level 26
Sleeping areas, dedicated lounges	70	72	50	0*	**21**	**22**
Other habitable spaces			55		16	17
Bathroom, toilets, laundries			60		11	12

*The assumed orientation correction of 0 is used as a worst case assumption, as it is unclear exactly how the flight paths will be located relative to the development.

Based upon the analysis conducted to AS2021 and assuming a worst case arrival flight path over the development, the following conclusions can be made:

- Facades for sleeping areas and dedicated lounges are required to achieve up to a minimum noise reduction of 21 to 22dB.
- All other facades require 20dB or less noise reduction.
- Standard construction is expected to achieve a minimum noise reduction of 18-20dB.
- QDC Noise Category 1 construction is designed to provide up to 25dB noise reduction, therefore meeting the maximum requirements of 22dB.
- Recommendations have been made in Appendix C to incorporate minimum QDC Noise Category 1 façade attenuation requirements.

9 Recommendations

The recommended acoustic treatments are presented in the sections below to achieve predicted compliance with the relevant assessment criteria.

9.1 Façade Treatment

9.1.1 Road Traffic, Rail Noise and Aircraft Noise

9.1.1.1 Residential Accommodation

This section summarises the combined treatment required for habitable rooms for road traffic and rail noise to achieve compliance with the Queensland Development Code (QDC) MP4.4. For the purposes of the development application, the QDC provides a conservative design approach and is applied for this assessment.

In order to achieve the performance requirements of the QDC MP4.4, the external envelope of habitable rooms must comply with the minimum R_W for each building component specified in Schedule 1 to achieve a minimum transport noise reduction level for the relevant noise category by either one of the following:

a. Using materials specified in Schedule 2 of the QDC MP4.4;

OR

b. Using materials with manufacturer's specifications that achieve the minimum R_W value for the relevant building component and applicable noise category.

For application of Point (b), possible alternative constructions can be determined by the glazier (for glazing) and construction manuals such as 'The Red Book' by CSR (for walls and roof/ceiling).

The transport noise (rail, road traffic and aircraft) facade acoustic treatment requirements for habitable rooms are listed in Appendix C.

Details regarding noise categories and associated sound reduction (R_w) requirements for habitable rooms can be found within Schedule 1 of the QDC MP4.4. QDC Schedule 1 is reproduced in Table 21.

Table 21: Façade Acoustic Treatment Requirements

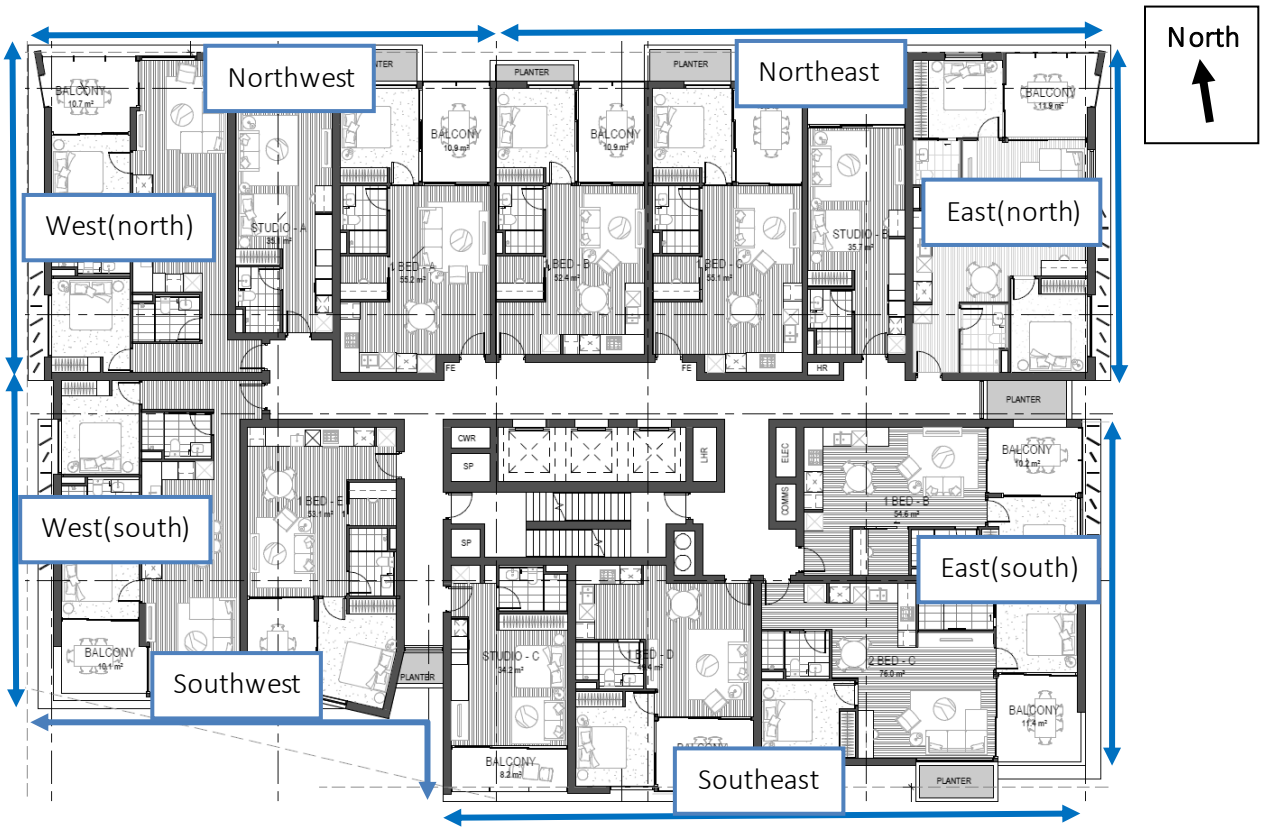
Noise Category	Required Sound Reduction Rating (R_w) for Habitable Rooms			
	Glazing > 1.8m²*	Glazing ≤ 1.8m²*	External Walls	Roof and Ceiling
Category 4	R_w 43	R_w 43	R_w 52	R_w 45
Category 3	R_w 38	R_w 35	R_w 47	R_w 41
Category 2	R_w 35	R_w 32	R_w 41	R_w 38
Category 1	R_w 27	R_w 24	R_w 35	R_w 35
Category 0	None			

*Total glazing area of the room not the area of a single piece of glazing.

Details regarding sound reduction ratings (R_w) and acceptable forms of construction can be found within QDC MP 4.4 Schedule 2. QDC Schedule 1 and 2 are provided in Appendix E of this report.

Receiver locations are shown in Figure 12.

Figure 12: Receiver Locations - Levels 4 - 26, Apartments



9.2 Solid Balustrades

To comply with *Performance Outcome PO1* of the *Transport Noise Corridor Overlay Code*, we recommend the adoption of *Acceptable Outcome AO1*:

> *Development ensures that each dwelling:*
>
> *a) has a balcony or outdoor recreation area shielded by the building from direct road traffic noise; or*
> *b) with a balcony exposed to road traffic noise has a solid gap free balustrade.*

Solid balustrades are recommended for all residential balconies and outdoor recreation areas with a road traffic or rail QDC noise category of 2 or higher (as detailed in Appendix C). Examples of possible construction materials for solid balustrading are masonry, glazing or other solid material with no gaps or holes. A gap at the bottom of the balustrade may be required for drainage purposes to comply with the Building Code of Australia.

9.3 Management Strategies

The following management strategies are recommended to minimise noise annoyance:

a. Car parking and manoeuvring areas to have a low wheel squeal surface finish.

b. Any grates or other protective covers in the car parks and access driveways must be rigidly fixed in position to eliminate clanging, and be maintained.

c. Speed bumps (if proposed) should be built into the finished surface of the car park / driveways and not be made of metal.

9.4 Mechanical Plant

As mechanical plant selections are not available at this stage, it is not possible to carry out a detailed examination of any ameliorative measures that may be required to achieve the noise criteria.

To comply with planning scheme acceptable outcomes for mechanical plant, we recommend the following for plant with the potential to adversely impact nearby sensitive receivers:

> *Development ensures mechanical plant is acoustically screened from nearby sensitive uses.*

The definition of 'acoustically screened' is provided in Table SC1.2.3.B of Brisbane City Plan 2014, Schedule 1 Definitions:

> *The source of noise is completely screened from view of habitable rooms (including balconies, patios, decks and verandas) of an adjoining sensitive use by solid, gap free material and construction e.g. acoustic fence, building, or enclosure.*
>
> *Acoustic barrier: Solid, gap free barrier with minimum surface density of 12.5kg/m^2*

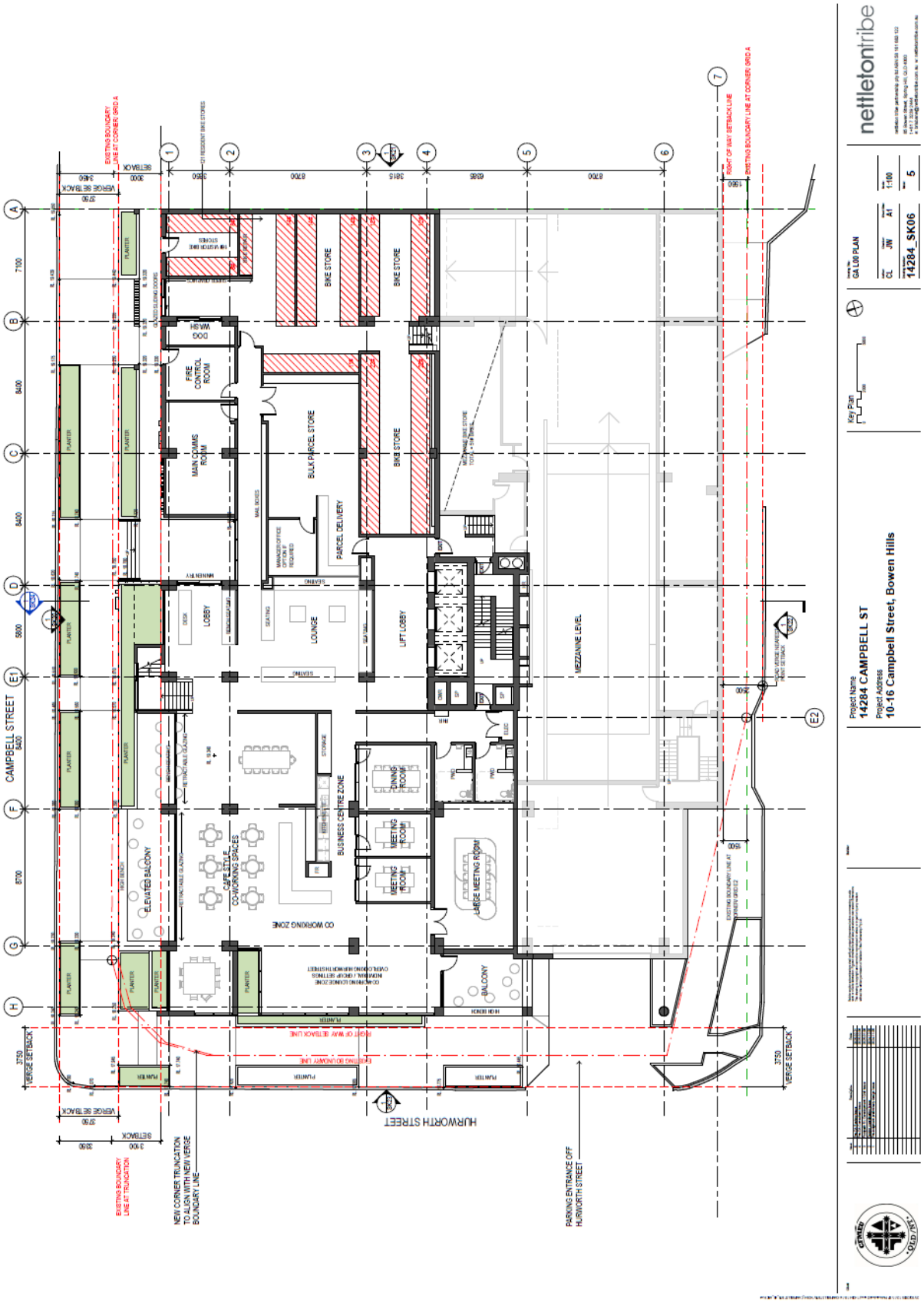
Furthermore, it is also recommended that a mechanical plant noise assessment is conducted once plant selections are finalised to ensure noise emissions comply with criteria.

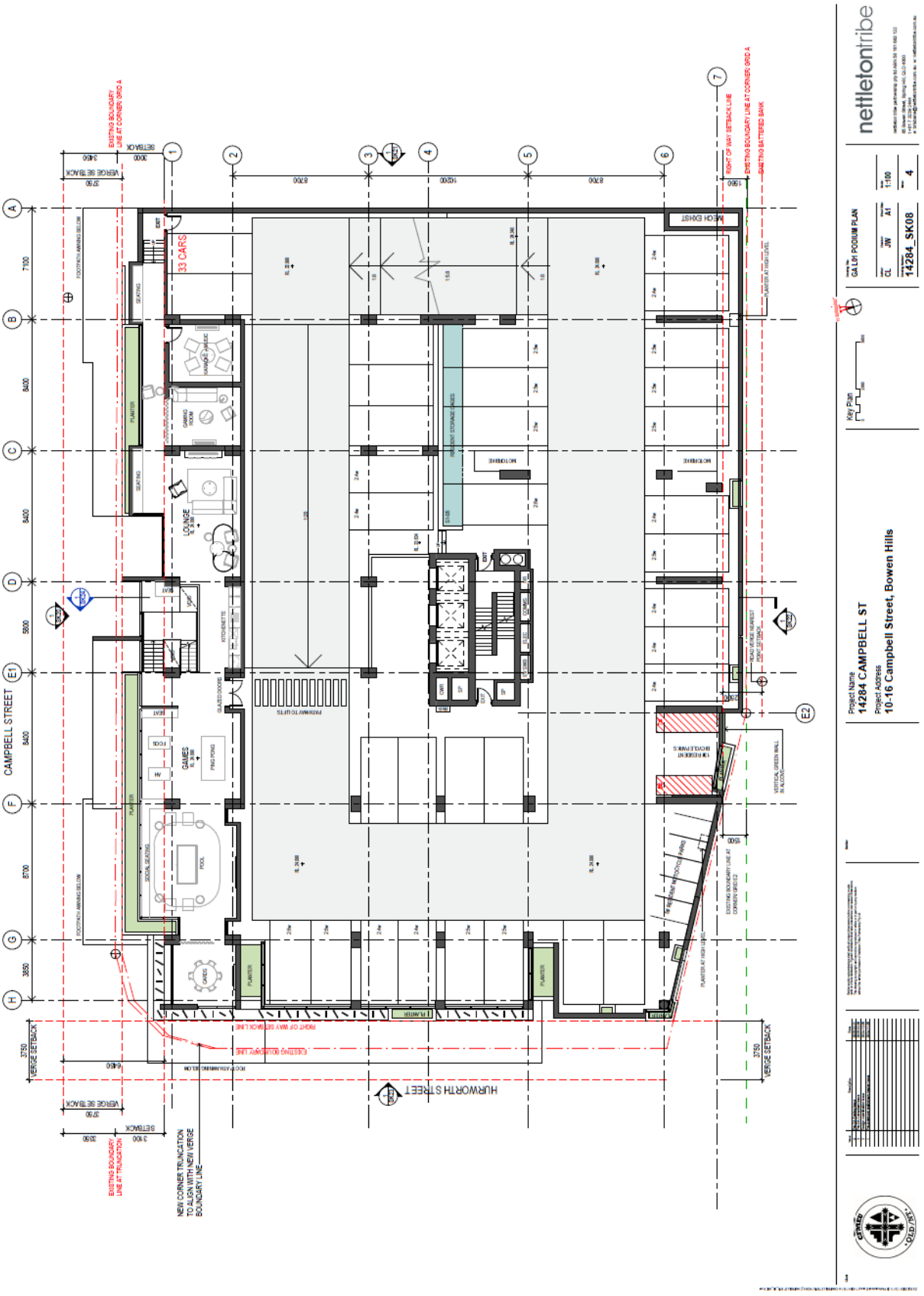
10 Conclusion

TTM was engaged by New Urban Villages to undertake an acoustic assessment for the proposed Build to Rent development located at 10-16 Campbell Street, Bowen Hills.

Compliance with the Brisbane City Council planning scheme and State code requirements is predicted based on the implementation of the recommendations outlined in Section 8 of this report.

Appendix A Development Plans


CAMPBELL STREET
HURWORTH STREET
BIKE STORE
BULK PARCEL STORE
PARCEL DELIVERY
FIRE CONTROL ROOM
MAIN COMMS ROOM
LOBBY
LOUNGE
LIFT LOBBY
MEZZANINE LEVEL
DINING ROOM
MEETING ROOM
LARGE MEETING Room
BUSINESS CENTRE ZONE
CO WORKING ZONE
ELEVATED BALCONY
BALCONY
VERGE SETBACK
NEW CORNER TRUNCATION TO ALIGN WITH NEW VERGE BOUNDARY LINE
PARKING ENTRANCE OFF HURWORTH STREET
nettletontribe
GA LOW PLAN
14284_SK06
Project Name
14284 CAMPBELL ST
Project Address
10-16 Campbell Street, Bowen Hills
Key Plan


CAMPBELL STREET
HURWORTH STREET
33 CARS
LOUNGE
GAMES
POOL
KITCHENETTE
GAMING ROOM
EXISTING BOUNDARY LINE AT CORNER GRID A
EXISTING BOUNDARY LINE AT TRUNCATION
NEW CORNER TRUNCATION TO ALIGN WITH NEW VERGE BOUNDARY LINE
VERGE SETBACK
SETBACK
RIGHT OF WAY SETBACK LINE
EXISTING BOUNDARY LINE AT CORNER GRID A
EXISTING BATTERED BANK
Project Name
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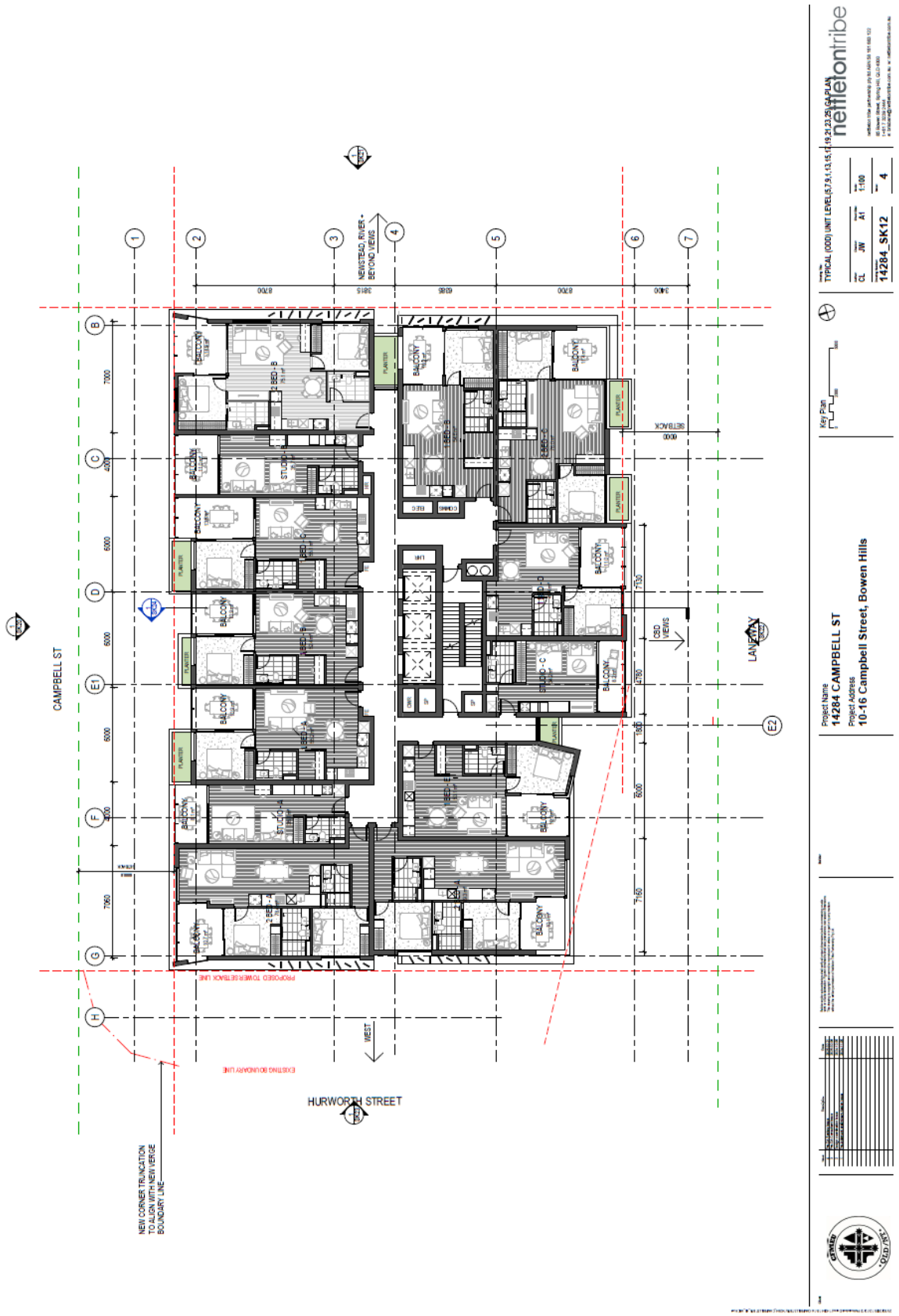
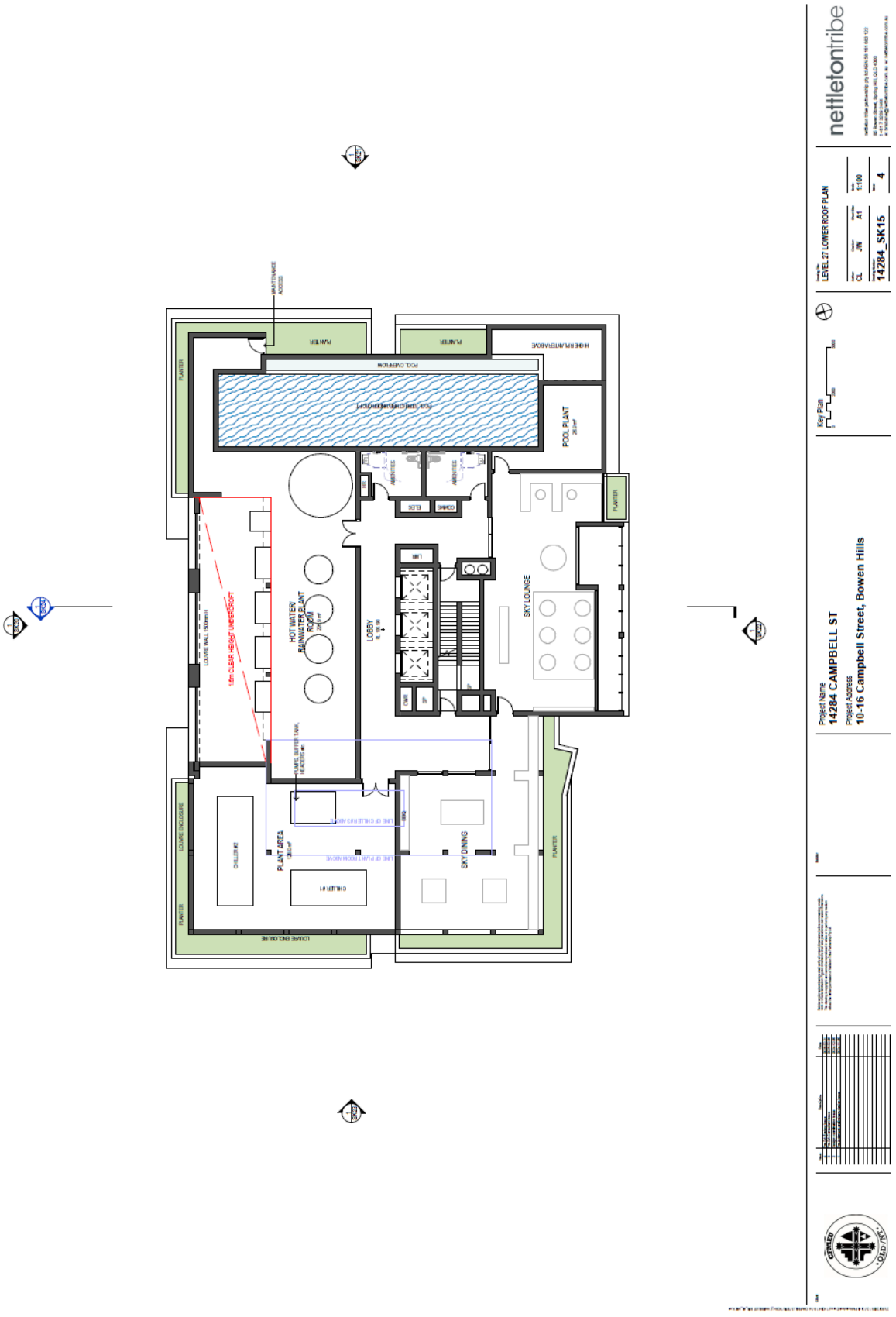
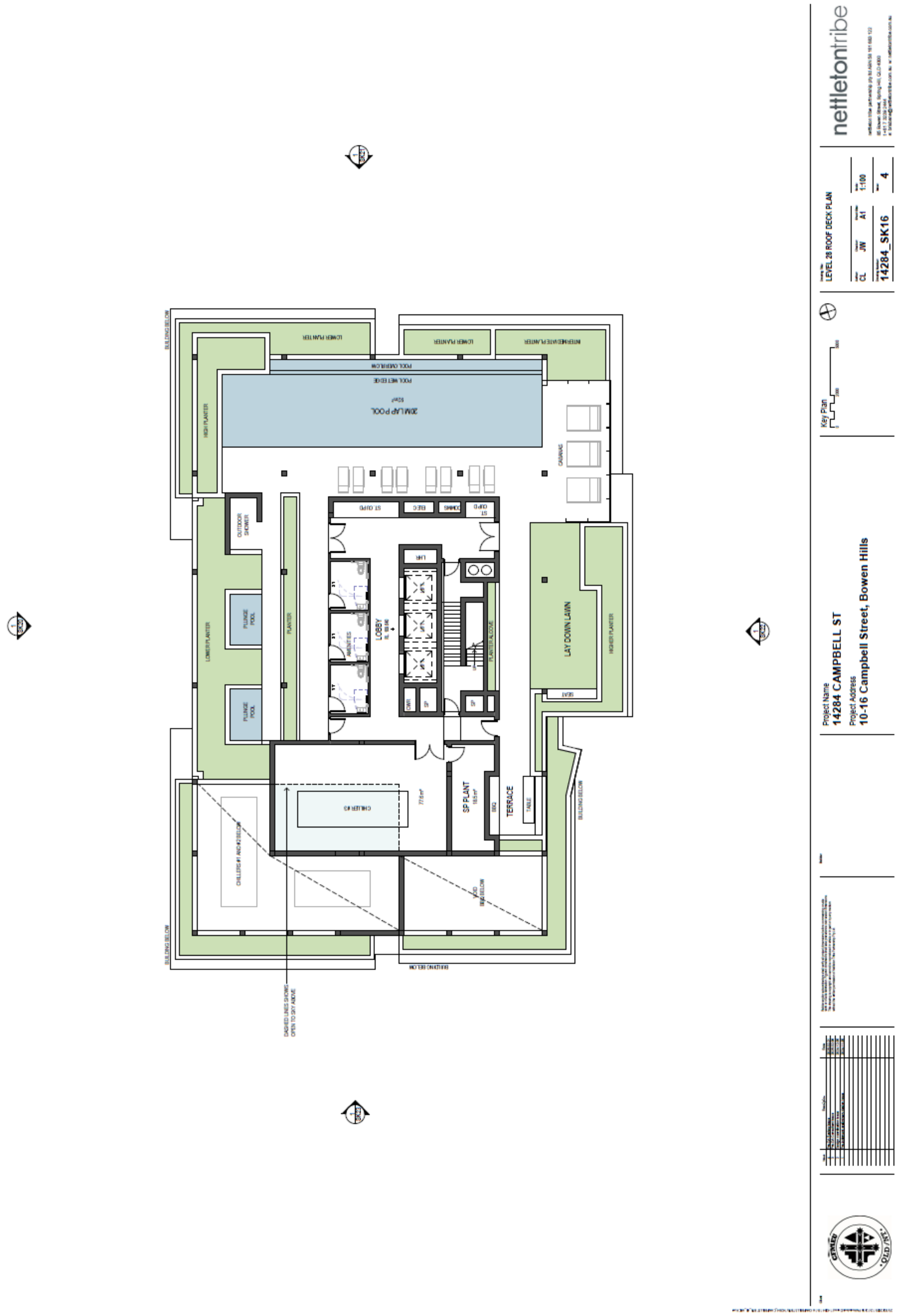
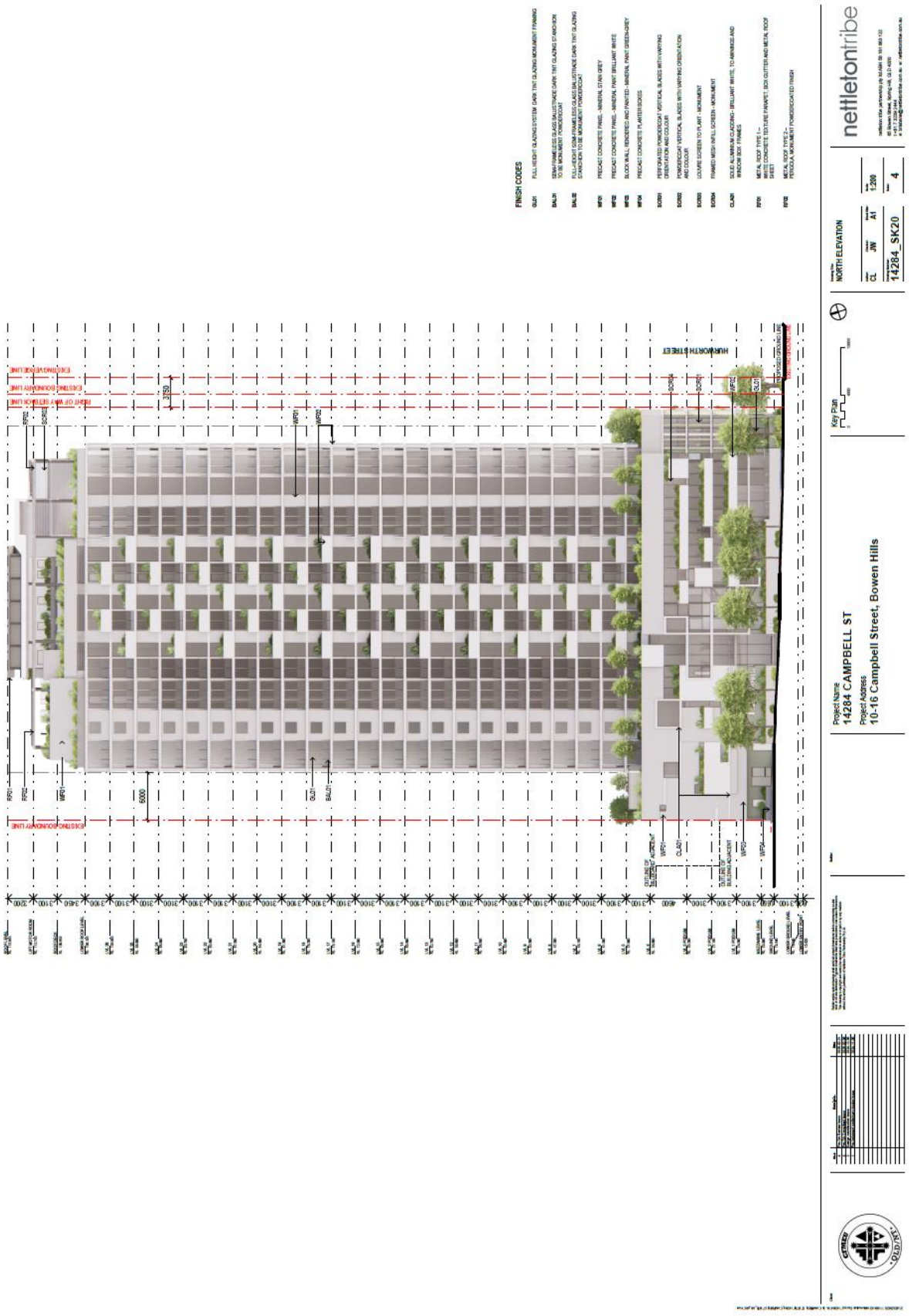
Project Address
10-16 Campbell Street, Bowen Hills
GA L04 PODIUM PLAN
14284_SK08
1:100
A1
4
nettletontribe


CAMPBELL ST
HURWORTH STREET
NEWSTEAD, RIVER + BEYOND VIEWS
CBD VIEWS
LANEWAY
WEST
SETBACK
PROPOSED TOWER SETBACK LINE
EXISTING BOUNDARY LINE
NEW CORNER TRUNCATION TO ALIGN WITH NEW VERGE BOUNDARY LINE
Project Name
14284 CAMPBELL ST
Project Address
10-16 Campbell Street, Bowen Hills
TYPICAL (ODD) UNIT LEVELS 7,9,11,13,15,17,19,21,23,25 GA PLAN
14284_SK12
Key Plan
nettletontribe


nettletontribe
LEVEL 27 LOWER ROOF PLAN
14284_SK15
Key Plan
Project Name
14284 CAMPBELL ST
Project Address
10-16 Campbell Street, Bowen Hills
POOL PLANT
SKY LOUNGE
SKY DINING
HOT WATER/ RAINWATER PLANT ROOM
PLANT AREA
LOBBY
PLANTER
LOUVRE ENCLOSURE
CHILLER #2

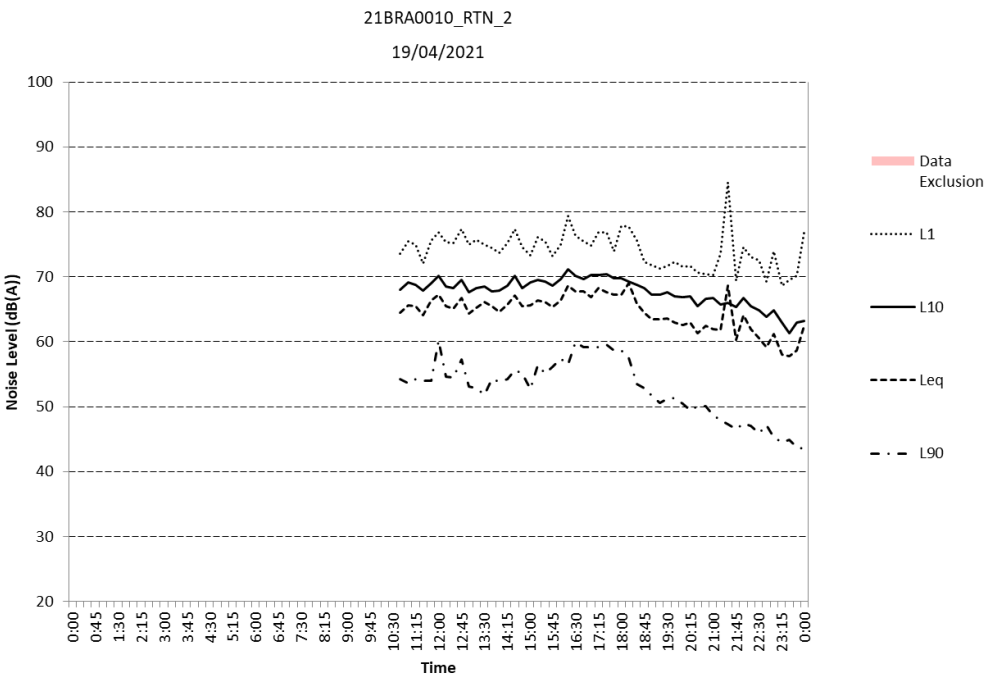


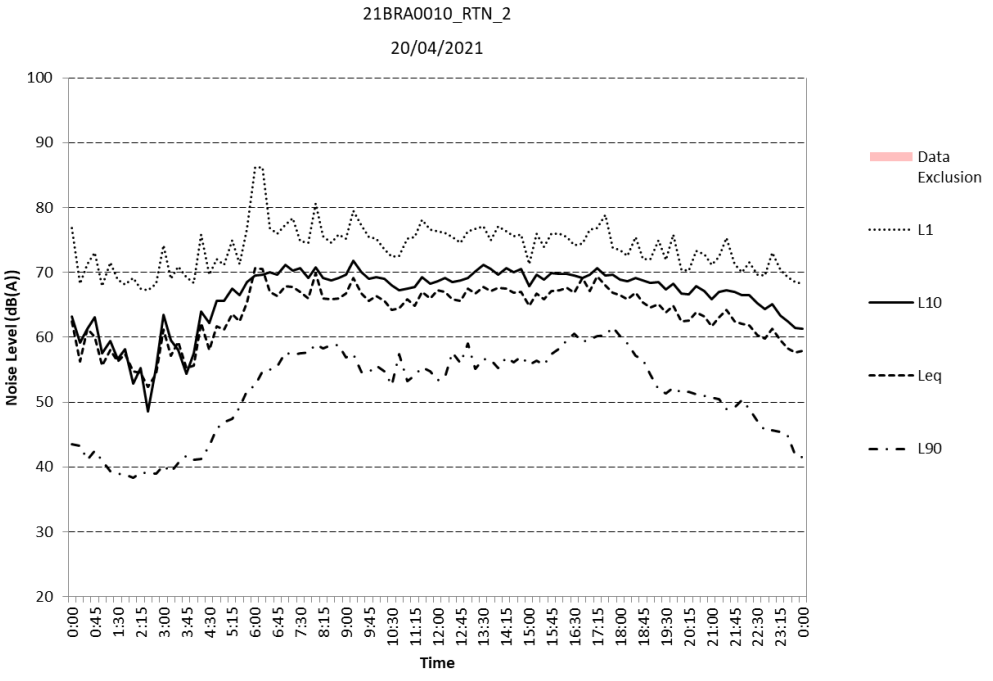
nettletontribe
LEVEL 28 ROOF DECK PLAN
14284_SK16
Project Name
14284 CAMPBELL ST
Project Address
10-16 Campbell Street, Bowen Hills
Key Plan
LAY DOWN LAWN
TERRACE
SP PLANT
LOBBY

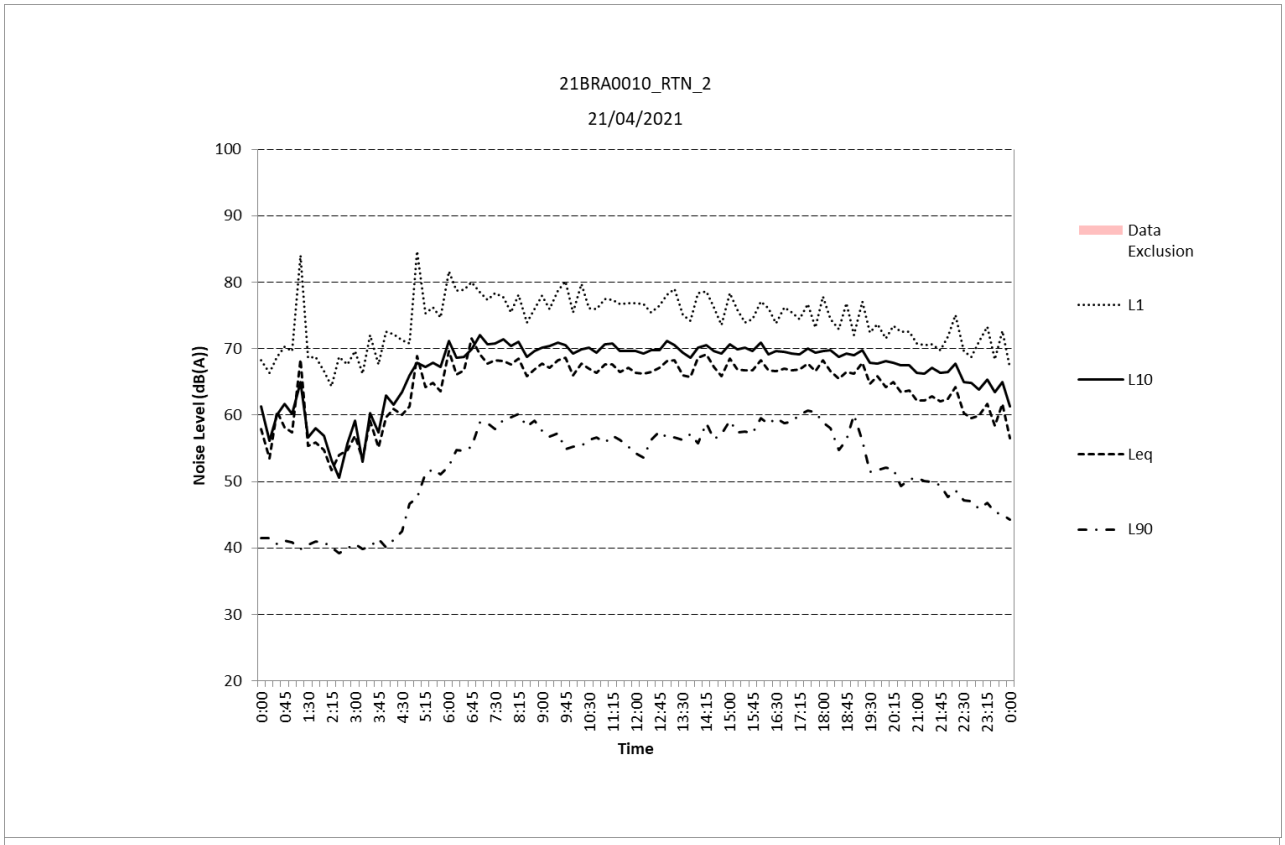

FINISH CODES
HUNWORTH STREET
Project Name
14284 CAMPBELL ST
Project Address
10-16 Campbell Street, Bowen Hills
Key Plan
NORTH ELEVATION
14284_SK20
nettletontribe

Appendix B Unattended Noise Monitoring Graphs

Ambient Noise Monitor and Road Traffic Noise Monitor - Campbell Street






21BRA0010_RTN_2
21/04/2021
Noise Level (dB(A))
100
90
80
70
60
50
40
30
20
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0:45
1:30
2:15
3:00
3:45
4:30
5:15
6:00
6:45
7:30
8:15
9:00
9:45
10:30
11:15
12:00
12:45
13:30
14:15
15:00
15:45
16:30
17:15
18:00
18:45
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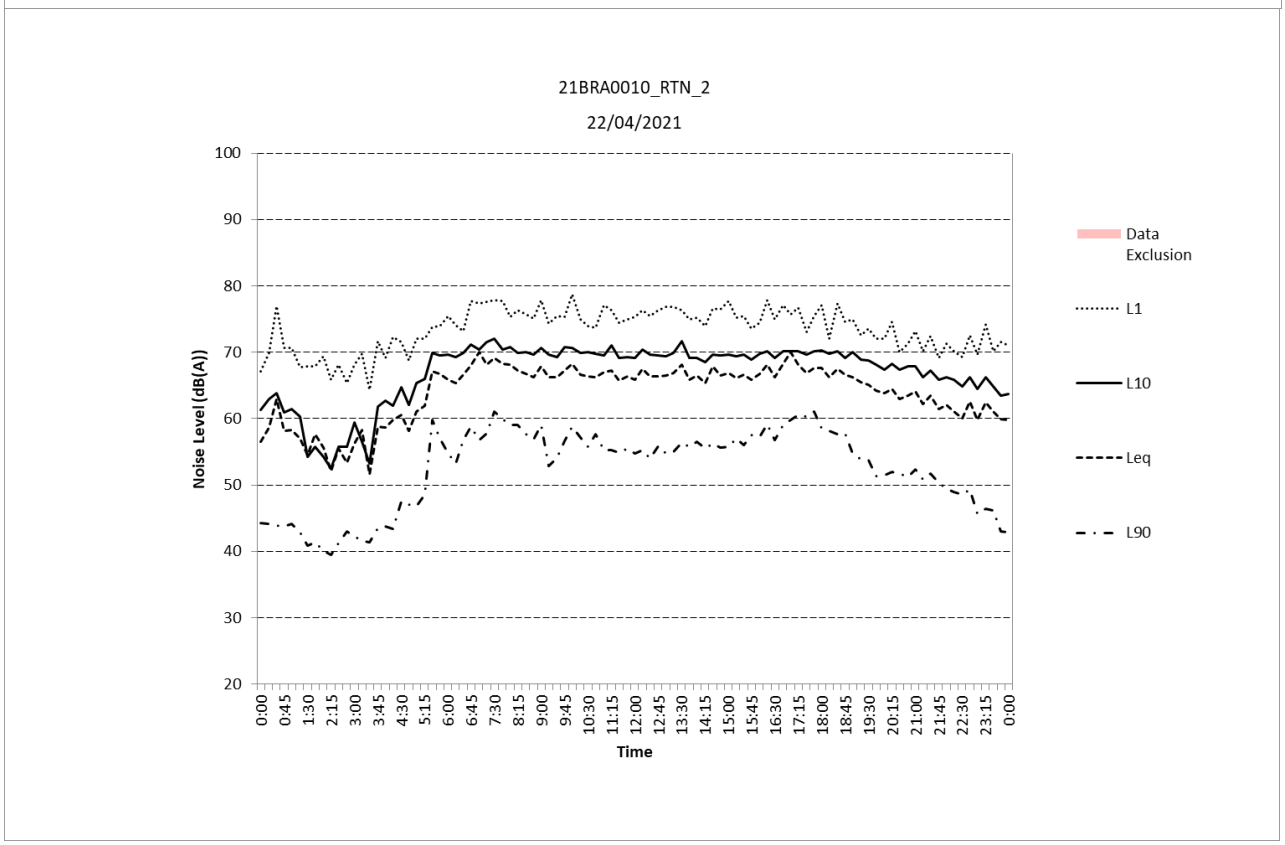
0:00
Time
Data Exclusion
L1
L10
Leq
L90


21BRA0010_RTN_2
22/04/2021
Noise Level (dB(A))
100
90
80
70
60
50
40
30
20
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0:45
1:30
2:15
3:00
3:45
4:30
5:15
6:00
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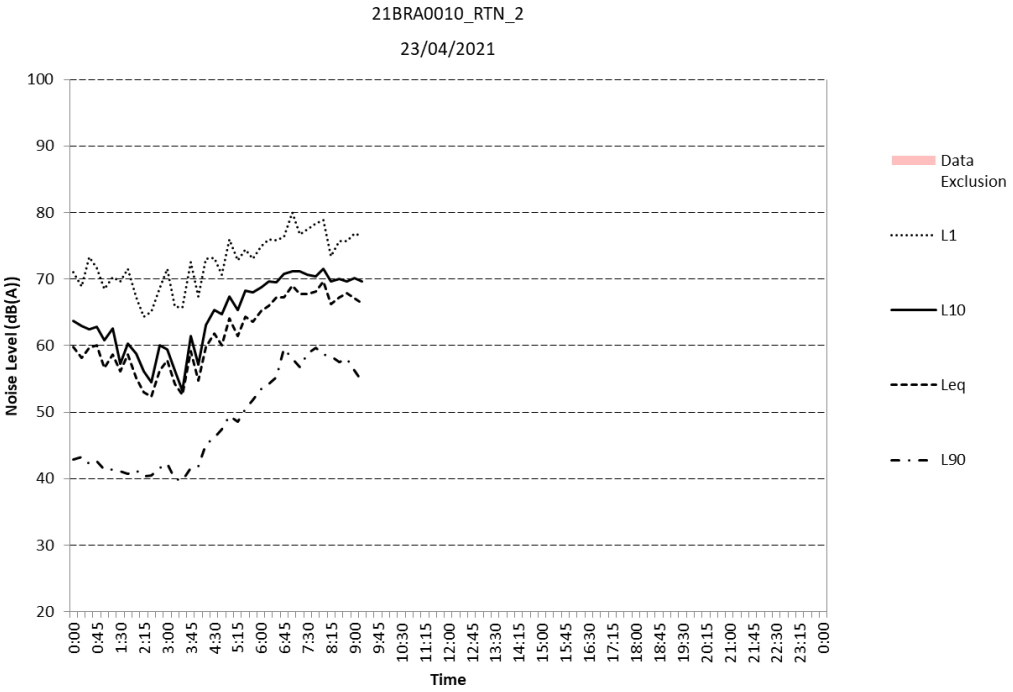
Time
Data Exclusion
L1
L10
Leq
L90


21BRA0010_RTN_2
23/04/2021
Noise Level (dB(A))
100
90
80
70
60
50
40
30
20
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3:45
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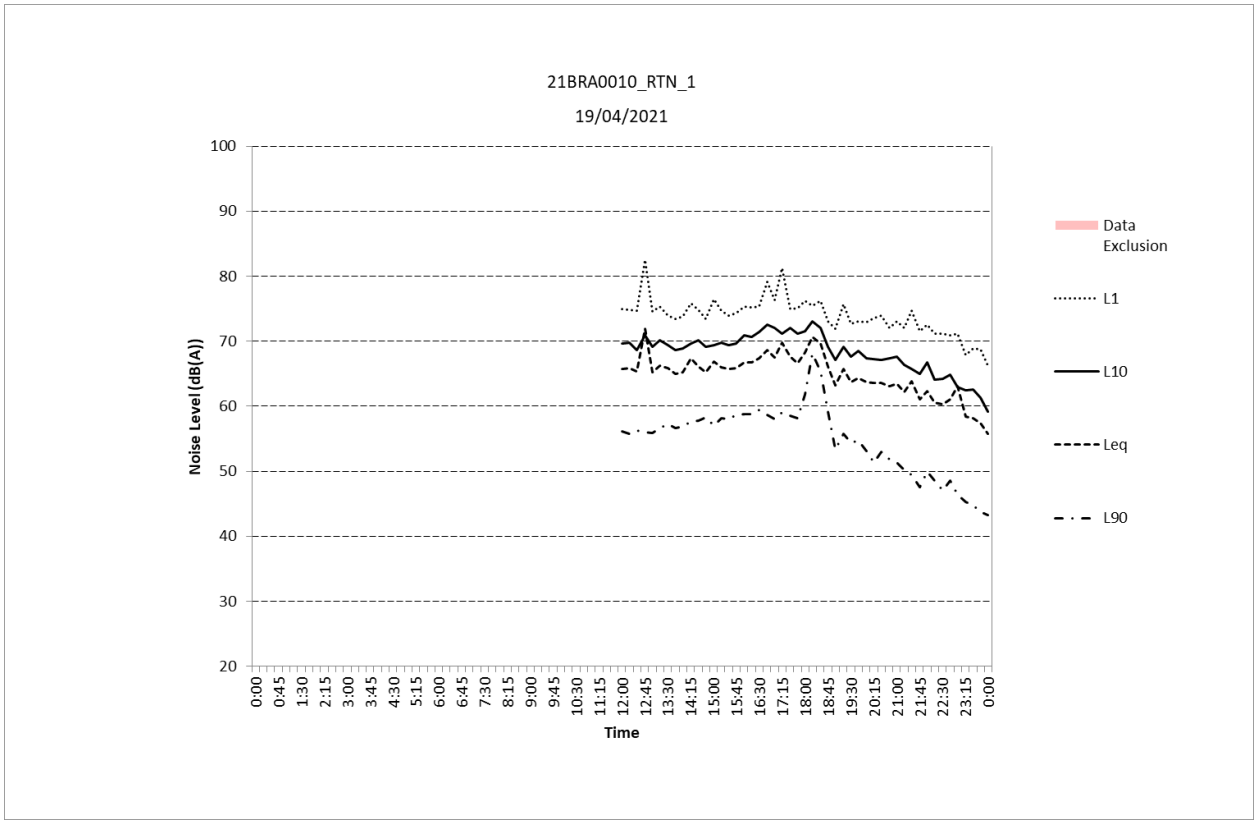
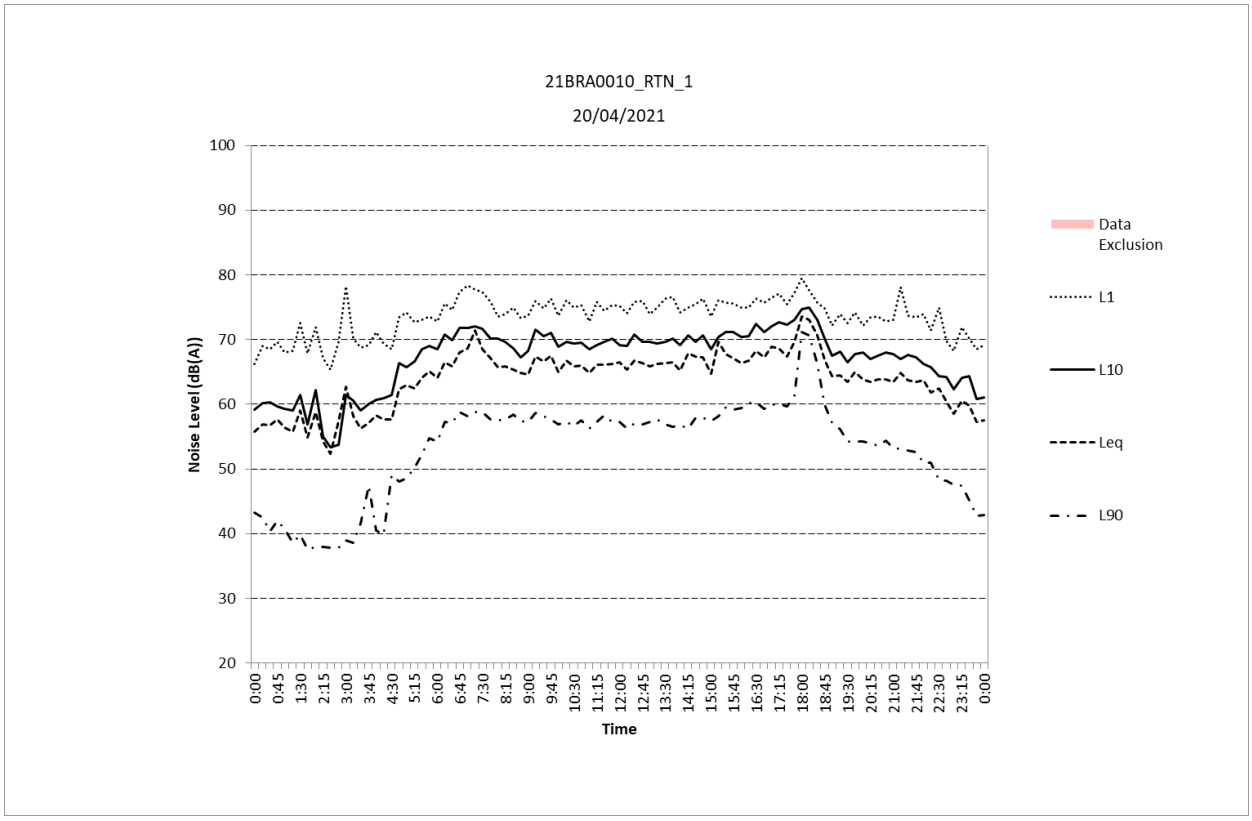
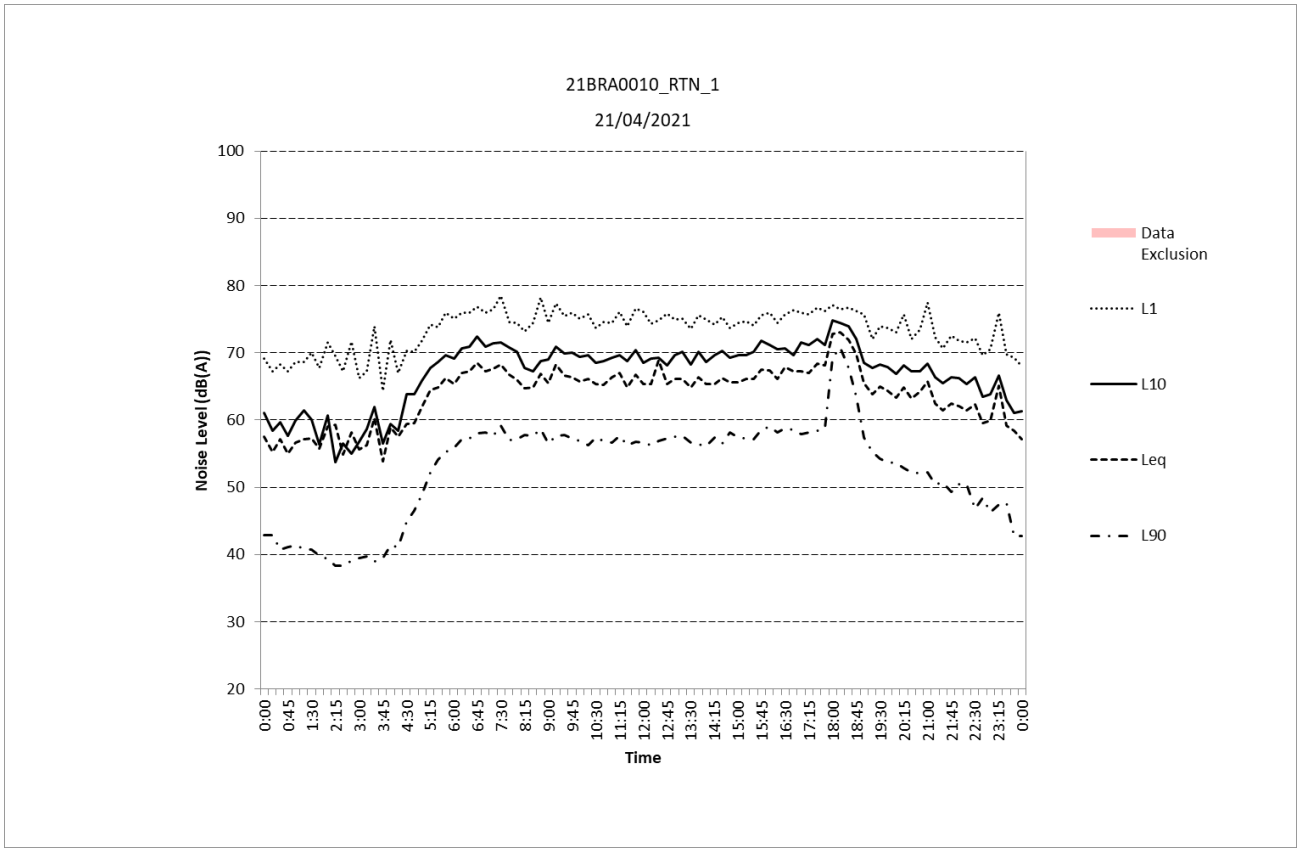
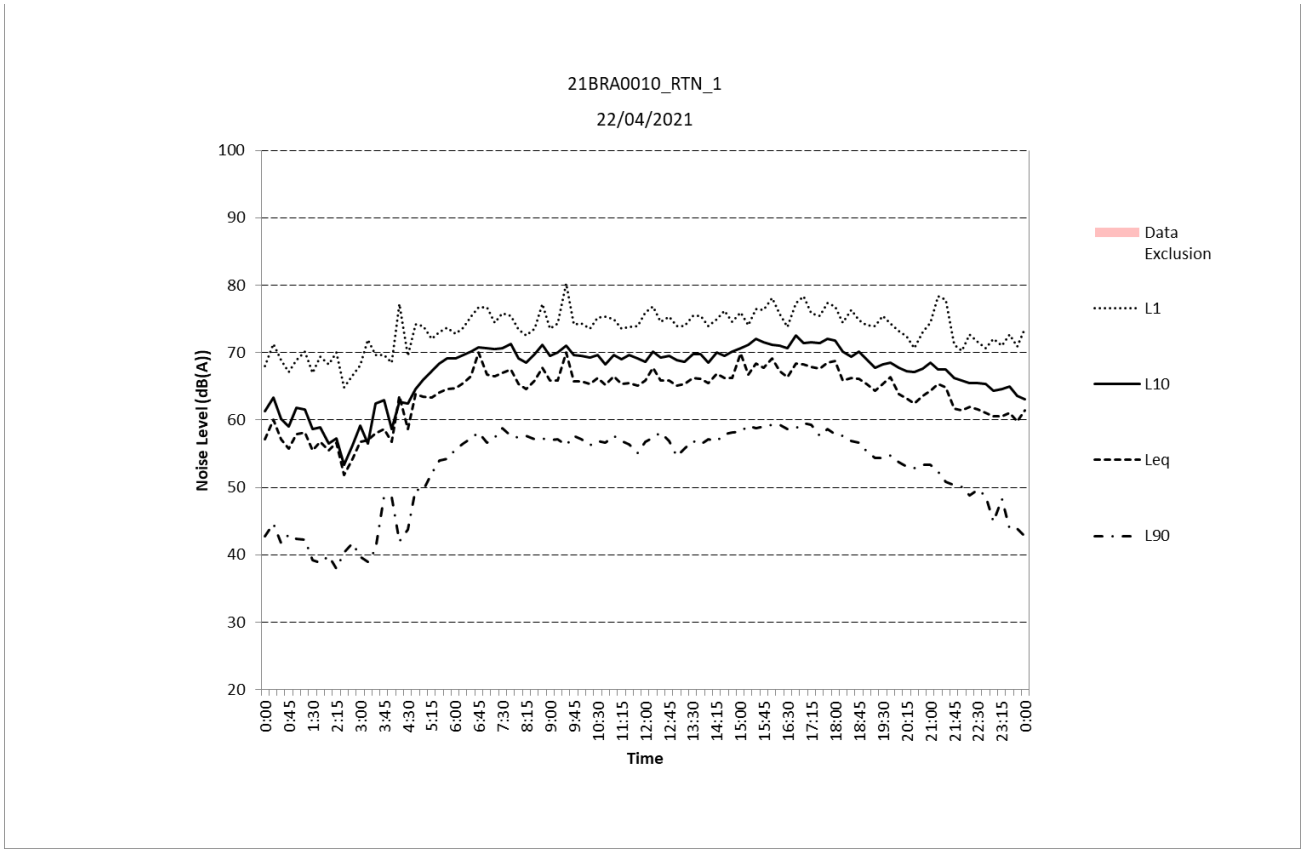
17:15
18:00
18:45
19:30
20:15
21:00
21:45
22:30
23:15
0:00
Time
Data Exclusion
L1
L10
Leq
L90

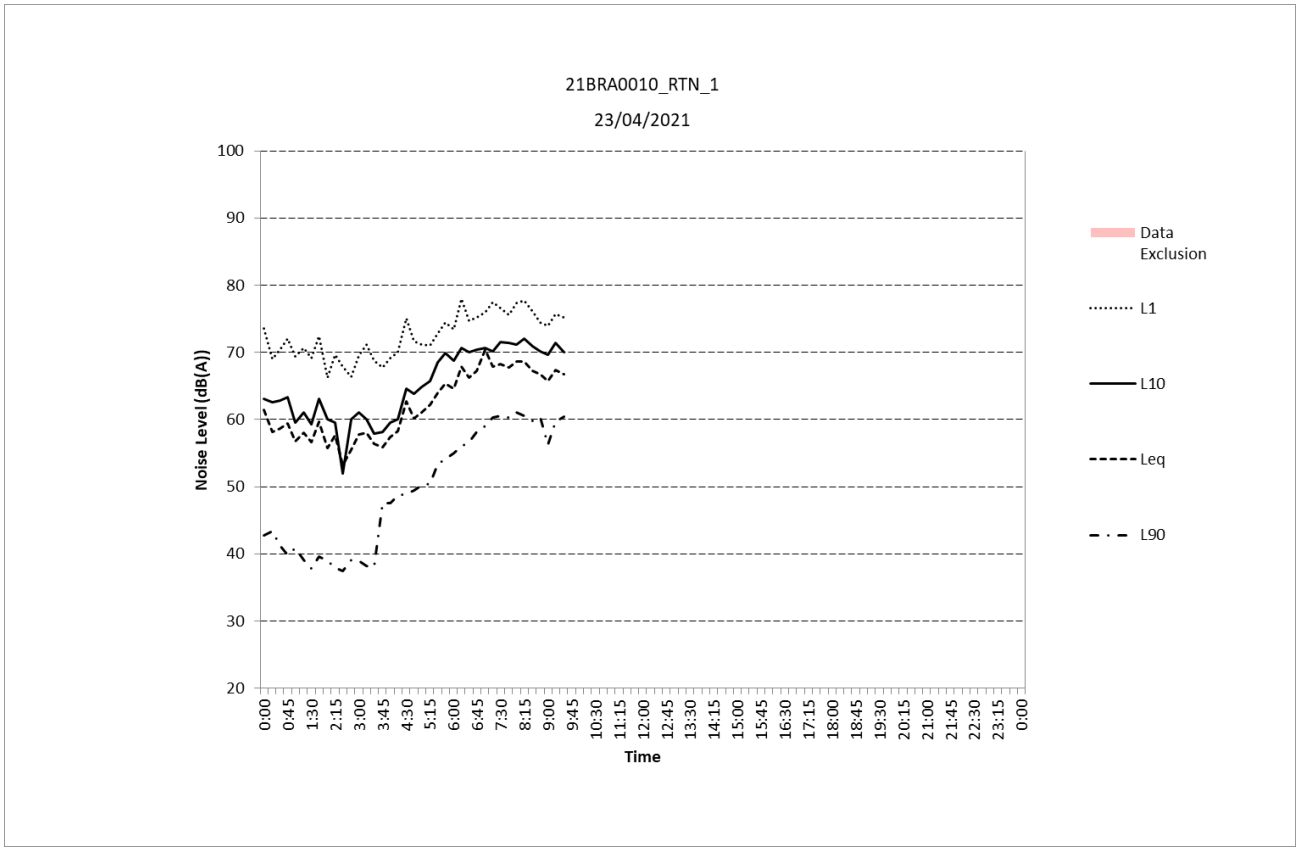
Road Traffic Noise Monitor - Markwell Street






21BRA0010_RTN_1
21/04/2021
Noise Level (dB(A))
Time
Data Exclusion
L1
L10
Leq
L90


21BRA0010_RTN_1
22/04/2021
Noise Level (dB(A))
Time
Data Exclusion
L1
L10
Leq
L90


21BRA0010_RTN_1
23/04/2021
Noise Level (dB(A))
100
90
80
70
60
50
40
30
20
0:00
0:45
1:30
2:15
3:00
3:45
4:30
5:15
6:00
6:45
7:30
8:15
9:00
9:45
10:30
11:15
12:00
12:45
13:30
14:15
15:00
15:45
16:30
17:15
18:00
18:45
19:30
20:15
21:00
21:45
22:30
23:15
0:00
Time
Data Exclusion
L1
L10
Leq
L90

Appendix C Road Traffic, Rail and Aircraft Noise Category Results

Receiver	Façade	Floor	QDC MP4.4 Noise Category			
			Road Traffic	Rail	Air	Maximum
East (North)	E	F 4	2	2	1	**2**
		F 5	3	2	1	**3**
		F 6	3	2	1	**3**
		F 7	3	3	1	**3**
		F 8	3	3	1	**3**
		F 9	3	3	1	**3**
		F 10	3	3	1	**3**
		F 11	3	3	1	**3**
		F 12	3	3	1	**3**
		F 13	3	3	1	**3**
		F 14	2	3	1	**3**
		F 15	2	3	1	**3**
		F 16	2	3	1	**3**
		F 17	2	3	1	**3**
		F 18	2	3	1	**3**
		F 19	2	3	1	**3**
		F 20	2	3	1	**3**
		F 21	2	2	1	**2**
		F 22	2	2	1	**2**
		F 23	2	2	1	**2**
		F 24	2	2	1	**2**
		F 25	2	2	1	**2**
		F 26	2	2	1	**2**
East (South)	E	F 4	2	2	1	**2**
		F 5	2	2	1	**2**
		F 6	2	2	1	**2**
		F 7	2	3	1	**3**
		F 8	2	3	1	**3**
		F 9	2	3	1	**3**
		F 10	2	3	1	**3**
		F 11	2	3	1	**3**
		F 12	2	3	1	**3**
		F 13	2	3	1	**3**
		F 14	2	3	1	**3**
		F 15	2	3	1	**3**
		F 16	2	3	1	**3**
		F 17	2	3	1	**3**
		F 18	2	3	1	**3**
		F 19	2	3	1	**3**
		F 20	2	3	1	**3**
		F 21	2	2	1	**2**
		F 22	2	2	1	**2**
		F 23	2	2	1	**2**
		F 24	2	2	1	**2**
		F 25	2	2	1	**2**
		F 26	2	2	1	**2**
Northeast	N	F 4	1	1	1	**1**
		F 5	2	1	1	**2**
		F 6	3	1	1	**3**
		F 7	3	2	1	**3**
		F 8	3	2	1	**3**
		F 9	3	2	1	**3**
		F 10	3	2	1	**3**
		F 11	3	2	1	**3**
		F 12	3	2	1	**3**
		F 13	3	2	1	**3**
		F 14	2	2	1	**2**
		F 15	2	2	1	**2**
		F 16	2	2	1	**2**
		F 17	2	2	1	**2**
		F 18	2	2	1	**2**
		F 19	2	2	1	**2**
		F 20	2	2	1	**2**
		F 21	2	2	1	**2**
		F 22	2	2	1	**2**
		F 23	2	2	1	**2**
		F 24	2	2	1	**2**
		F 25	2	2	1	**2**
		F 26	2	2	1	**2**

Receiver	Façade	Floor	QDC MP4.4 Noise Category			
			Road Traffic	Rail	Air	Maximum
Northwest	N	F 4	1	0	1	**1**
		F 5	2	1	1	**2**
		F 6	2	1	1	**2**
		F 7	3	1	1	**3**
		F 8	3	2	1	**3**
		F 9	3	2	1	**3**
		F 10	3	2	1	**3**
		F 11	3	2	1	**3**
		F 12	3	2	1	**3**
		F 13	2	2	1	**2**
		F 14	2	2	1	**2**
		F 15	2	2	1	**2**
		F 16	2	2	1	**2**
		F 17	2	2	1	**2**
		F 18	2	2	1	**2**
		F 19	2	2	1	**2**
		F 20	2	2	1	**2**
		F 21	2	2	1	**2**
		F 22	2	2	1	**2**
		F 23	2	2	1	**2**
		F 24	2	2	1	**2**
		F 25	2	2	1	**2**
		F 26	2	2	1	**2**
Southeast	S	F 4	0	0	1	**1**
		F 5	0	1	1	**1**
		F 6	1	1	1	**1**
		F 7	1	2	1	**2**
		F 8	1	2	1	**2**
		F 9	1	2	1	**2**
		F 10	1	2	1	**2**
		F 11	1	2	1	**2**
		F 12	1	2	1	**2**
		F 13	1	2	1	**2**
		F 14	1	2	1	**2**
		F 15	1	2	1	**2**
		F 16	1	2	1	**2**
		F 17	1	2	1	**2**
		F 18	1	2	1	**2**
		F 19	1	2	1	**2**
		F 20	1	2	1	**2**
		F 21	1	2	1	**2**
		F 22	1	2	1	**2**
		F 23	1	2	1	**2**
		F 24	1	2	1	**2**
		F 25	1	2	1	**2**
		F 26	1	2	1	**2**
Southwest	S	F 4	0	0	1	**1**
		F 5	0	0	1	**1**
		F 6	0	0	1	**1**
		F 7	0	0	1	**1**
		F 8	0	0	1	**1**
		F 9	0	1	1	**1**
		F 10	0	1	1	**1**
		F 11	0	1	1	**1**
		F 12	0	2	1	**2**
		F 13	0	2	1	**2**
		F 14	0	2	1	**2**
		F 15	0	2	1	**2**
		F 16	0	2	1	**2**
		F 17	0	2	1	**2**
		F 18	0	2	1	**2**
		F 19	1	2	1	**2**
		F 20	1	2	1	**2**
		F 21	1	2	1	**2**
		F 22	1	2	1	**2**
		F 23	1	1	1	**1**
		F 24	1	1	1	**1**
		F 25	1	1	1	**1**
		F 26	1	1	1	**1**

Receiver	Façade	Floor	QDC MP4.4 Noise Category			
			Road Traffic	Rail	Air	Maximum
West (North)	W	F 4	1	0	1	**1**
		F 5	2	0	1	**2**
		F 6	2	0	1	**2**
		F 7	2	0	1	**2**
		F 8	2	0	1	**2**
		F 9	2	1	1	**2**
		F 10	2	1	1	**2**
		F 11	2	1	1	**2**
		F 12	2	1	1	**2**
		F 13	2	1	1	**2**
		F 14	2	1	1	**2**
		F 15	2	1	1	**2**
		F 16	1	1	1	**1**
		F 17	1	1	1	**1**
		F 18	1	1	1	**1**
		F 19	1	1	1	**1**
		F 20	1	1	1	**1**
		F 21	1	1	1	**1**
		F 22	1	1	1	**1**
		F 23	1	1	1	**1**
		F 24	1	1	1	**1**
		F 25	1	1	1	**1**
		F 26	1	1	1	**1**
West (South)	W	F 4	1	0	1	**1**
		F 5	1	0	1	**1**
		F 6	2	0	1	**2**
		F 7	2	0	1	**2**
		F 8	2	0	1	**2**
		F 9	2	0	1	**2**
		F 10	2	0	1	**2**
		F 11	2	1	1	**2**
		F 12	1	1	1	**1**
		F 13	1	1	1	**1**
		F 14	1	1	1	**1**
		F 15	1	1	1	**1**
		F 16	1	1	1	**1**
		F 17	1	1	1	**1**
		F 18	1	1	1	**1**
		F 19	1	1	1	**1**
		F 20	1	1	1	**1**
		F 21	1	1	1	**1**
		F 22	1	1	1	**1**
		F 23	1	1	1	**1**
		F 24	1	1	1	**1**
		F 25	1	1	1	**1**
		F 26	1	1	1	**1**

Appendix D SoundPLAN Noise Modelling

10-16 Campbell Street, Bowen Hills
RTN Assessment
"Verification RTN.sit"

Receiver	Fl	L10(18h) Free Field dB(A)	
Logger Campbell Street (68.9dBA)	GF	69.8	
Logger Markwell Street (69.3dBA)	GF	70.1	

10-16 Campbell Street, Bowen Hills
"Verification Rail.sit"

Receiver	Floor Level	Lmax dB(A)	Leq,24hr dB(A)
Rail logger North Coast line (93.8dBA)	GF	93.8	70.0
Rail logger City line (90.4dBA)	GF	91.1	61.6

Receiver	Façade Direction	Floor	SoundPLAN Results - dB(A), façade corrected		
			Road Traffic	Rail	
			L10(18h)	LAmax	Laeq 24 hour
East (North)	E	F 4	63.8	74.9	43.0
East (North)	E	F 5	68.2	75.4	44.7
East (North)	E	F 6	68.5	78.9	46.1
East (North)	E	F 7	68.5	80.1	47.6
East (North)	E	F 8	68.6	80.2	49.4
East (North)	E	F 9	68.5	80.3	50.6
East (North)	E	F 10	68.4	80.6	51.3
East (North)	E	F 11	68.3	80.8	51.8
East (North)	E	F 12	68.2	80.7	52.1
East (North)	E	F 13	68.0	80.6	52.4
East (North)	E	F 14	67.7	80.4	52.6
East (North)	E	F 15	67.5	80.3	52.7
East (North)	E	F 16	67.3	80.1	52.8
East (North)	E	F 17	67.1	80.0	52.9
East (North)	E	F 18	66.9	79.8	53.0
East (North)	E	F 19	66.7	79.7	53.1
East (North)	E	F 20	66.5	79.5	53.2
East (North)	E	F 21	66.3	79.4	53.2
East (North)	E	F 22	66.1	79.2	53.2
East (North)	E	F 23	65.9	79.1	53.1
East (North)	E	F 24	65.7	78.9	53.1
East (North)	E	F 25	65.5	78.7	53.1
East (North)	E	F 26	65.3	78.6	53.1
East (South)	E	F 4	63.2	75.2	42.7
East (South)	E	F 5	67.7	74.9	44.4
East (South)	E	F 6	67.9	78.6	45.2
East (South)	E	F 7	67.9	80.3	47.1
East (South)	E	F 8	67.8	80.6	49.2
East (South)	E	F 9	67.8	80.7	50.9
East (South)	E	F 10	67.8	80.7	51.6
East (South)	E	F 11	67.8	80.7	52.3
East (South)	E	F 12	67.7	80.8	52.6
East (South)	E	F 13	67.6	80.6	52.8
East (South)	E	F 14	67.4	80.5	52.9
East (South)	E	F 15	67.2	80.4	53.0
East (South)	E	F 16	67.0	80.2	53.1
East (South)	E	F 17	66.8	80.1	53.2
East (South)	E	F 18	66.6	79.9	53.3
East (South)	E	F 19	66.5	79.8	53.4
East (South)	E	F 20	66.3	79.6	53.4
East (South)	E	F 21	66.1	79.4	53.5
East (South)	E	F 22	65.9	79.3	53.5
East (South)	E	F 23	65.7	79.1	53.5
East (South)	E	F 24	65.5	78.9	53.5
East (South)	E	F 25	65.4	78.8	53.5
East (South)	E	F 26	65.2	78.6	53.4
Northeast	N	F 4	61.1	69.9	44.1
Northeast	N	F 5	65.3	72.9	48.2
Northeast	N	F 6	68.0	74.4	40.3
Northeast	N	F 7	69.1	75.2	43.4
Northeast	N	F 8	69.3	76.0	44.3
Northeast	N	F 9	69.2	76.0	45.4
Northeast	N	F 10	69.0	76.3	46.4
Northeast	N	F 11	68.7	76.5	46.9
Northeast	N	F 12	68.5	76.6	47.4
Northeast	N	F 13	68.2	76.6	47.7
Northeast	N	F 14	67.9	76.6	48.3
Northeast	N	F 15	67.6	76.6	48.4
Northeast	N	F 16	67.3	76.5	48.8
Northeast	N	F 17	67.1	76.5	48.8
Northeast	N	F 18	66.8	76.5	48.9
Northeast	N	F 19	66.6	76.5	49.0
Northeast	N	F 20	66.3	76.5	49.1

Receiver	Façade Direction	Floor	SoundPLAN Results - dB(A), façade corrected		
			Road Traffic	Rail	
			L10(18h)	LAmax	Laeq 24 hour
Northeast	N	F 21	66.1	76.5	49.2
Northeast	N	F 22	65.9	76.6	49.2
Northeast	N	F 23	65.6	76.6	49.3
Northeast	N	F 24	65.4	76.6	49.3
Northeast	N	F 25	65.2	76.7	49.4
Northeast	N	F 26	65.0	76.7	49.5
Northwest	N	F 4	59.8	67.9	49.7
Northwest	N	F 5	64.3	69.9	49.7
Northwest	N	F 6	67.2	72.0	41.9
Northwest	N	F 7	68.4	74.2	42.4
Northwest	N	F 8	68.9	75.0	43.0
Northwest	N	F 9	68.9	75.3	43.8
Northwest	N	F 10	68.8	75.7	44.6
Northwest	N	F 11	68.5	76.0	45.4
Northwest	N	F 12	68.2	76.1	46.0
Northwest	N	F 13	67.9	76.2	46.9
Northwest	N	F 14	67.7	76.1	47.5
Northwest	N	F 15	67.4	76.1	47.8
Northwest	N	F 16	67.1	76.0	48.1
Northwest	N	F 17	66.8	76.0	48.4
Northwest	N	F 18	66.6	76.0	48.6
Northwest	N	F 19	66.3	76.0	48.6
Northwest	N	F 20	66.1	76.1	48.7
Northwest	N	F 21	65.9	76.2	48.7
Northwest	N	F 22	65.6	76.2	48.7
Northwest	N	F 23	65.4	76.3	48.7
Northwest	N	F 24	65.2	76.4	48.7
Northwest	N	F 25	65.0	76.3	48.7
Northwest	N	F 26	64.8	76.3	48.9
Southeast	S	F 4	52.3	67.7	49.0
Southeast	S	F 5	57.9	71.0	49.1
Southeast	S	F 6	60.5	73.3	38.2
Southeast	S	F 7	61.2	76.8	39.8
Southeast	S	F 8	61.2	79.2	39.0
Southeast	S	F 9	61.3	79.4	39.8
Southeast	S	F 10	61.4	79.4	41.9
Southeast	S	F 11	61.7	79.4	45.0
Southeast	S	F 12	62.1	79.3	48.0
Southeast	S	F 13	62.3	79.2	49.2
Southeast	S	F 14	62.5	79.1	50.0
Southeast	S	F 15	62.5	79.0	50.5
Southeast	S	F 16	62.5	78.8	50.7
Southeast	S	F 17	62.4	78.7	50.9
Southeast	S	F 18	62.2	78.6	51.0
Southeast	S	F 19	62.1	78.5	51.0
Southeast	S	F 20	61.9	78.4	51.1
Southeast	S	F 21	61.8	78.3	51.2
Southeast	S	F 22	61.6	78.2	51.3
Southeast	S	F 23	61.5	78.0	51.3
Southeast	S	F 24	61.3	77.9	51.4
Southeast	S	F 25	61.2	77.8	51.4
Southeast	S	F 26	61.0	77.7	51.5
Southwest	S	F 4	42.2	60.2	51.5
Southwest	S	F 5	44.1	61.1	51.7
Southwest	S	F 6	45.6	61.9	37.2
Southwest	S	F 7	46.4	62.8	37.3
Southwest	S	F 8	47.5	68.1	37.6
Southwest	S	F 9	49.3	72.0	38.2
Southwest	S	F 10	51.3	72.7	39.3
Southwest	S	F 11	52.8	73.4	41.3
Southwest	S	F 12	54.0	74.9	42.7
Southwest	S	F 13	54.9	74.9	44.3
Southwest	S	F 14	55.7	74.9	45.7

Receiver	Façade Direction	Floor	SoundPLAN Results - dB(A), façade corrected		
			Road Traffic	Rail	
			L10(18h)	LAmax	Laeq 24 hour
Southwest	S	F 15	56.5	74.8	46.8
Southwest	S	F 16	57.1	74.8	47.2
Southwest	S	F 17	57.6	74.7	47.7
Southwest	S	F 18	57.9	74.7	48.2
Southwest	S	F 19	58.1	74.7	48.5
Southwest	S	F 20	58.2	74.6	48.8
Southwest	S	F 21	58.3	74.6	49.1
Southwest	S	F 22	58.3	74.5	49.2
Southwest	S	F 23	58.3	74.4	49.3
Southwest	S	F 24	58.2	74.4	49.5
Southwest	S	F 25	58.1	74.3	49.6
Southwest	S	F 26	58.1	74.3	49.7
West (North)	W	F 4	60.1	67.5	49.8
West (North)	W	F 5	63.7	68.1	49.9
West (North)	W	F 6	64.5	68.6	46.0
West (North)	W	F 7	64.8	68.4	37.7
West (North)	W	F 8	64.8	69.0	37.0
West (North)	W	F 9	64.8	69.5	48.1
West (North)	W	F 10	64.5	69.9	42.2
West (North)	W	F 11	64.2	70.0	42.1
West (North)	W	F 12	63.9	70.3	42.1
West (North)	W	F 13	63.6	70.4	42.2
West (North)	W	F 14	63.3	70.5	42.4
West (North)	W	F 15	63.0	70.7	42.8
West (North)	W	F 16	62.6	70.6	43.3
West (North)	W	F 17	62.3	70.6	43.8
West (North)	W	F 18	62.0	70.7	44.3
West (North)	W	F 19	61.7	70.7	44.7
West (North)	W	F 20	61.5	70.7	45.1
West (North)	W	F 21	61.2	70.7	45.5
West (North)	W	F 22	60.9	70.7	45.7
West (North)	W	F 23	60.7	70.7	45.9
West (North)	W	F 24	60.4	70.7	46.0
West (North)	W	F 25	60.2	70.7	46.2
West (North)	W	F 26	59.9	70.7	46.4
West (South)	W	F 4	59.4	66.6	46.7
West (South)	W	F 5	62.8	67.1	47.0
West (South)	W	F 6	63.3	67.7	47.3
West (South)	W	F 7	63.4	68.5	47.5
West (South)	W	F 8	63.3	68.9	47.7
West (South)	W	F 9	63.2	69.3	47.9
West (South)	W	F 10	63.1	69.4	41.2
West (South)	W	F 11	63.0	69.8	41.3
West (South)	W	F 12	62.8	69.9	41.4
West (South)	W	F 13	62.6	70.1	41.7
West (South)	W	F 14	62.4	70.2	42.0
West (South)	W	F 15	62.2	70.2	42.5
West (South)	W	F 16	61.9	70.2	43.0
West (South)	W	F 17	61.7	70.1	43.6
West (South)	W	F 18	61.4	70.1	44.0
West (South)	W	F 19	61.2	70.1	44.3
West (South)	W	F 20	60.9	70.1	44.7
West (South)	W	F 21	60.7	70.0	45.2
West (South)	W	F 22	60.4	70.0	45.4
West (South)	W	F 23	60.2	70.0	45.6
West (South)	W	F 24	60.0	70.0	45.9
West (South)	W	F 25	59.7	69.9	46.1
West (South)	W	F 26	59.5	69.9	46.3
Lower Roof - Sky Dining	S	F 27	42.2	64.9	46.5
Lower Roof - Sky Lounge	S	F 27	53.6	72.6	46.6
Upper Roof - Lawn	S	F 28	49.6	70.8	46.6
Upper Roof - Plunge Pools	N	F 28	45.2	63.3	46.7
Upper Roof - Pool	E	F 28	45.6	60.3	46.9
Upper Roof - Terrace	S	F 28	53.1	72.3	47.1

Appendix E QDC MP4.4 Schedules 1 and 2

Schedule 1

Noise category	Minimum *transport noise reduction* (dB (A)) required for *habitable rooms*	Component of building's *external envelope*	Minimum R_w required for each component
Category 4	40	Glazing	43
		External walls	52
		Roof	45
		Floors	51
		Entry doors	35
Category 3	35	Glazing	38 (where total area of glazing for a *habitable room* is greater than 1.8m²)
			35 (where total area of glazing for a *habitable room* is less than or equal to 1.8m²)
		External walls	47
		Roof	41
		Floors	45
		Entry doors	33

Noise category	Minimum *transport noise reduction* (dB (A)) required for *habitable rooms*	Component of building's *external envelope*	Minimum R_w required for each component
Category 2	30	Glazing	35 (where total area of glazing for a *habitable room* is greater than 1.8m²)
			32 (where total area of glazing for a *habitable room* is less than or equal to 1.8m²)
		External walls	41
		Roof	38
		Floors	45
		Entry doors	33
Category 1	25	Glazing	27 (where total area of glazing for a *habitable room* is greater than 1.8m²)
			24 (where total area of glazing for a *habitable room* is less than or equal to 1.8m²)
		External walls	35
		Roof	35
		Entry Doors	28
Category 0	No additional acoustic treatment required – standard building assessment provisions apply.		

Schedule 2

Component of building's *external envelope*	Minimum R_w	Acceptable forms of construction
Glazing	43	Double glazing consisting of two panes of minimum 5mm thick glass with at least 100mm air gap and full perimeter *acoustically rated seals*.
	38	Minimum 14.38mm thick laminated glass, with full perimeter *acoustically rated seals*; OR Double glazing consisting of one pane of minimum 5mm thick glass and one pane of minimum 6mm thick glass with at least 44mm air gap, and full perimeter *acoustically rated seals*
	35	Minimum 10.38mm thick laminated glass, with full perimeter *acoustically rated seals*.
	32	Minimum 6.38mm thick laminated glass with full perimeter *acoustically rated seals*.
	27	Minimum 4mm thick glass with full perimeter *acoustically rated seals*
	24	Minimum 4mm thick glass with standard weather seals

Component of building's *external envelope*	Minimum R_w	Acceptable forms of construction
External walls	52	Two leaves of clay brick masonry, at least 270mm in total, with subfloor vents fitted with noise attenuators.
	47	Two leaves of clay brick masonry at least 110mm thick with: (i) cavity not less than 50mm between leaves; and (ii) 50mm thick mineral insulation or 50mm thick glass wool insulation with a density of 11kg/m³ or 50mm thick polyester insulation with a density of 20kg/m³ in the cavity. OR Two leaves of clay brick masonry at last 110mm thick with: (i) cavity not less than 50mm between leaves; and (ii) at least 13mm thick cement render on each face OR Single leaf of clay brick masonry at least 110mm thick with: (i) a row of at least 70mm x 35mm timber studs or 64mm steel studs at 600mm centres, spaced at least 20mm from the masonry wall; and (ii) Mineral insulation or glass wool insulation at least 50mm thick with a density of at least 11 kg/m³ positioned between studs; and (iii) One layer of plasterboard at least 13mm thick fixed to outside face of studs. OR Single leaf of minimum 150mm thick masonry of hollow, dense concrete blocks, with mortar joints laid to prevent moisture bridging.

Component of building's *external envelope*	Minimum R_w	Acceptable forms of construction
	41	Two leaves of clay brick masonry at least 110mm thick with cavity not less than 50mm between leaves OR Single leaf of clay brick masonry at last 110mm thick with: (i) a row of at least 70mm x 35mm timber studs or 64mm steel studs at 600mm centres, spaced at least 20mm from the masonry wall; and (ii) mineral insulation or glass wool insulation at least 50mm thick with a density of at least 11 kg/m³ positioned between studs; and (iii) One layer of plasterboard at least 10mm thick fixed to outside face of studs OR Single leaf of brick masonry at least 110mm thick with at least 13mm thick render on each face OR Concrete brickwork at least 110mm thick OR In-situ concrete at least 100mm thick OR Precast concrete at least 100mm thick and without joints.

Component of building's *external envelope*	Minimum R_w	Acceptable forms of construction
	35	Single leaf of clay brick masonry at least 110mm thick with: (i) a row of at least 70mm x 35mm timber studs or 64mm steel studs at 600mm centres, spaced at least 20mm from the masonry wall; and (ii) One layer of plasterboard at least 10mm thick fixed to outside face of studs OR Minimum 6mm thick fibre cement sheeting or weatherboards or plank cladding externally, minimum 90mm deep timber stud or 92mm metal stud, standard plasterboard at least 13mm thick internally.
Roof	45	Concrete or terracotta tile or sheet metal roof with sarking, *acoustically rated plasterboard* ceiling at least 13mm thick fixed to ceiling joists, cellulose fibre insulation at least 100mm thick with a density of at least 45kg/m³ in the cavity. OR Concrete or terracotta tile or sheet metal roof with sarking, 2 layers of *acoustically rated plasterboard* at least 16mm thick fixed to ceiling joists, glass wool insulation at least 50mm thick with a density of at least 11kg/m³ or polyester insulation at least 50mm thick with a density of at least 20kg/m³ in the cavity.
	41	Concrete or terracotta tile or metal sheet roof with sarking, plasterboard ceiling at least 10mm thick fixed to ceiling joists, glass wool insulation at least 50mm thick with a density of at least 11kg/m³ or polyester insulation at least 50mm thick with a density of at least 20kg/m³ in the cavity. OR Concrete suspended slab at least 100mm thick.
	38	Concrete or terracotta tile or metal sheet roof with sarking, plasterboard ceiling at least 10mm thick fixed to ceiling cavity, mineral insulation or glass wool insulation at least 50mm thick with a density of at least 11 kg/m³.

Component of building's *external envelope*	Minimum R_w	Acceptable forms of construction
	35	Concrete or terracotta tile or metal sheet roof with sarking, plasterboard ceiling at least 10mm thick fixed to ceiling cavity.
Floors	51	Concrete slab at least 150mm thick.
	45	Concrete slab at least 100mm thick OR Tongued and grooved boards at least 19mm thick with: (i) timber joists not less than 175mm x 50mm; and (ii) mineral insulation or glass wool insulation at least 75mm thick with a density of at least 11kg/m³ positioned between joists and laid on plasterboard at least 10mm thick fixed to underside of joists; and (iii) mineral insulation or glass wool insulation at least 25mm thick with a density of at least 11kg/m³ laid over entire floor, including tops of joists before flooring is laid; and (iv) secured to battens at least 75mm x 50mm; and (v) the assembled flooring laid over the joists, but not fixed to them, with battens lying between the joists.
Entry Doors	35	Solid core timber not less than 45mm thick, fixed so as to overlap the frame or rebate of the frame by not less than 10mm, with full perimeter *acoustically rated seals*.
	33	Fixed so as to overlap the frame or rebate of the frame by not less than 10mm, fitted with full perimeter *acoustically rated seals* and constructed of - (i) solid core, wood, particleboard or blockboard not less than 45mm thick; and/or (ii) acoustically laminated glass not less than 10.38mm thick.

Component of building's *external envelope*	Minimum R_w	Acceptable forms of construction
	28	Fixed so as to overlap the frame or rebate of the frame, constructed of - (i) Wood, particleboard or blockboard not less than 33mm thick; or (ii) Compressed fibre reinforced sheeting not less than 9mm thick; or (iii) Other suitable material with a mass per unit area not less than 24.4kg/m²; or (iv) Solid core timber door not less than 35mm thick fitted with full perimeter *acoustically rated seals*.