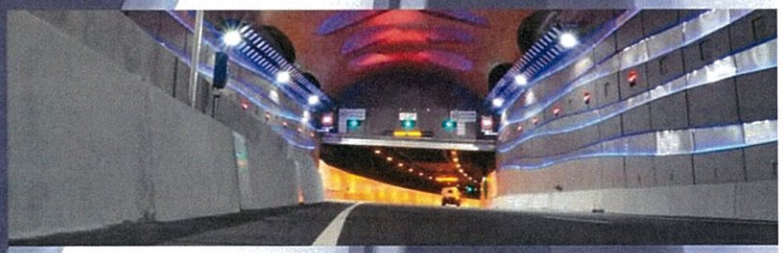
NOISE MEASUREMENT SERVICES

Noise Assessment Report
Proposed Residential Development
23 – 39 Abbotsford Road
Bowen Hills, QLD 4006

Report No 3007 ***1st December 2014***



PLANS AND DOCUMENTS
referred to in the PDA APPROVAL
- 9 APR 2015
MEDQ

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Revision No	Issue Date	Revision Description	Author	Review
0	1/12/2014	Draft Report for Consideration	MD	GR
1	3/12/2014	Plan changes, corrections	MD	MD

Copy No(s)	Rev No	Destination
1 pdf	0	HAL Architects
2	0	Noise Measurement Services

REPORT FOR **HAL Architects** *on behalf of* **Starhill Property Group**

CONTACT **Adam Lockhart (HAL Architects)**

Signed

Dr Bob Thorne
(Principal)

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Executive Summary

This Report is in response to a request from HAL Architects for a noise impact assessment report on a proposed residential development at 23 – 39 Abbotsford Road, Bowen Hills (lots 2, 3 & 6 on RP10087; lots 1 & 2 on RP10092; lot 1 on RP10091; and lot 17 on RP47816). The development is adjacent to Abbotsford Road, which is a designated Transport Noise Corridor under the Brisbane City Council (BCC) Cityplan 2014. The development is therefore subject to design requirements under the Queensland Development Code Mandatory Part 4.4. The default noise categories for the site are Category 2 and 3 at ground level.

The noise level criteria applicable to this development are contained in:

- Brisbane City Council – City Plan
- Brisbane City Council - Multiple Dwelling Code
- Queensland Development Code Mandatory Part 4.4 – Buildings in a Transport Noise Corridor

In addition the following are considered:

- Department of Environment and Heritage Protection – Environmental Protection Act 1994 (EPA 94)
- Department of State Development, Infrastructure and Planning, Module 1

Conclusions

It is concluded that-

- The development is subject to significant levels of road traffic noise from Abbotsford Road. Units overlooking Sandgate road are exposed to high levels of noise, and are forecast at QDC MP4.4 Categories 3 and 4. Other unit façades and townhouses will be screened from road traffic noise, and are predicted to fall within Categories 0, 1 and 2. Predictions by façade are presented in **Section 4**.

Recommendations

It is recommended that-

- The development be undertaken to achieve not less than the design considerations and acoustic treatments as outlined in **Section 4** of this Report.

1. Introduction

This Report is in response to a request from HAL Architects for a noise impact assessment report on a proposed residential development at 23 – 39 Abbotsford Road, Bowen Hills (lots 2, 3 & 6 on RP10087; lots 1 & 2 on RP10092; lot 1 on RP10091; and lot 17 on RP47816). The development is adjacent to Abbotsford Road, which is a designated Transport Noise Corridor under the Brisbane City Council (BCC) Cityplan 2014. The development is therefore subject to design requirements under the Queensland Development Code Mandatory Part 4.4. The default noise categories for the site are Category 2 and 3 at ground level.

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In addition the following are considered:

- Department of Environment and Heritage Protection – Environmental Protection Act 1994 (EPA 94)
- Department of State Development, Infrastructure and Planning, Module 1

The locality and development design is presented in the following **plates** and **photographs**.

Plate 1: Showing the site and locality (source: Google; Queensland Government).

Plate 2: Showing the site plan for the development (source: Google, Queensland Government, HAL Architects).

Plate 3: Default Noise Categories for the Development (Source: Brisbane City Council)

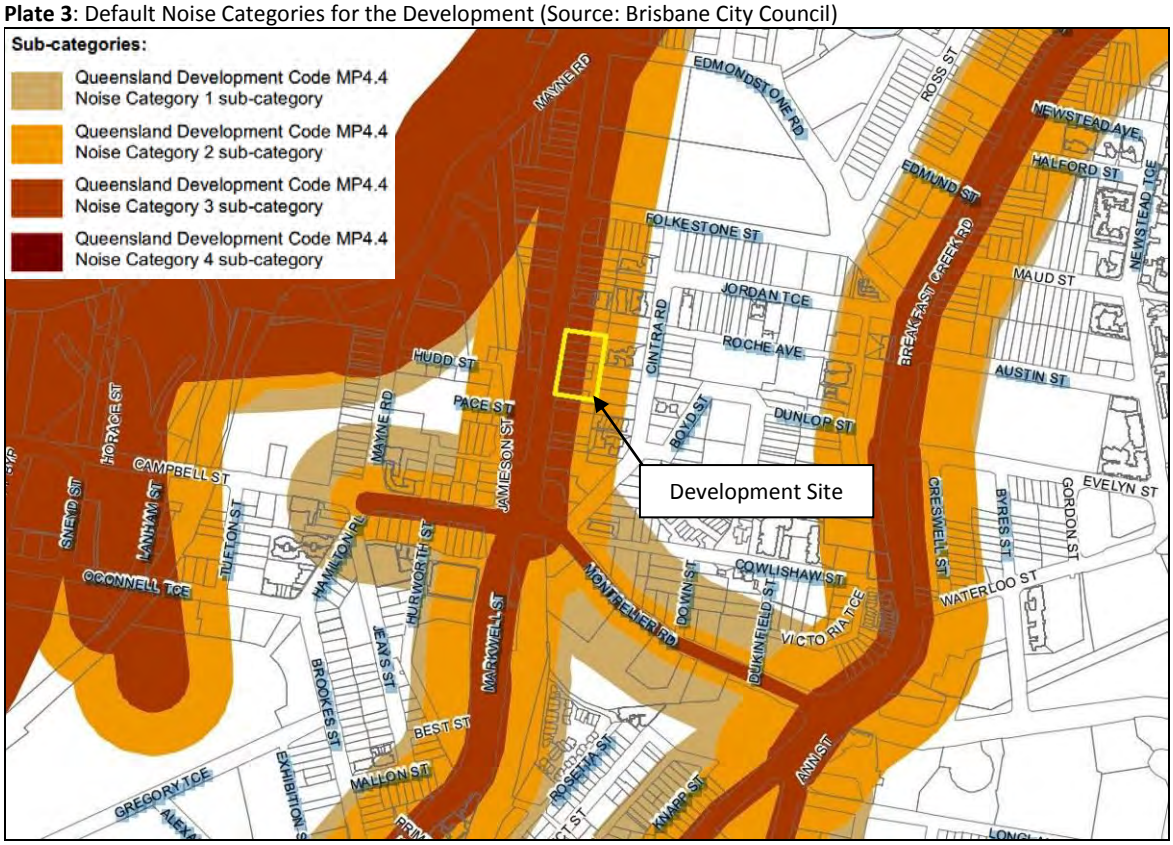


Plate 4: Zoning. The site is within an Emerging Community EC zone (Source: BCC)

Brisbane City Council - City Plan 2014 Property Report

Print Report

Property Address

23 Abbotsford Rd Bowen Hills 4006

Parcel Details

Lot No and Plan: Lot 3 on RP10087

Title Area*: 405 m2

Full Property Holding:
View property holding detail report
3 on RP10087

Ward: HAMILTON

PDF Maps GRID Reference: Map 20

* refer NOTES below.

City Plan 2014 Zones

Zone Name	Description
EC Emerging community	The purpose of the Emerging community zone code is to: (a) Identify land that is suitable for urban purposes and conserve land that may be suitable for urban development in the future. (b) Manage the timely conversion of non-urban land to urban purposes. (c) Prevent or discourage development that is likely to compromise appropriate longer term land use. Refer to Part 6 in the City Plan 2014 and the Factsheets.

Photo 1: Showing current view of the site, 23 Abbotsford Road to the right of photo (Source: Google)

2. Measurement of Ambient Noise Levels

2.1 Measurement Procedures

In order to assess the potential impact of noise from all sources of noise in the locale, an ambient noise survey was conducted on-site. The noise logger was located at 25 Abbotsford Road, 10m from Abbotsford Road and 3m south of the driveway at a height of 1.4m. The measurement location is identified as ML1 in this Report, and is presented in the following **plate** and **photos**.

Plate 5: The measurement location ML1 is marked (source: Google; Queensland Government).

Photo 2: Showing measurement location ML1, facing driveway of 25 Abbotsford Rd (Source: NMS)

Photo 3: Showing measurement location ML1, facing Abbotsford Road (Source: NMS)

The noise logger was field calibrated before and after each measurement session and was found to be within 0.3 dB(A) of the reference signal. All instrumentation used in this assessment hold a current calibration certificate from a certified NATA calibration laboratory. The following instruments were used to measure the ambient noise levels-

- Rion NL-21 type 2 environmental noise logger
- Rion NC-73 Calibrator

Ambient sound pressure levels were measured generally in accordance with Australian Standard AS1055.1:1997 - 'Acoustics-Description and measurement of environmental noise - Part 1: General procedures'. Ambient noise levels were recorded at 15 minute intervals from the 24th to the 27th of November 2014, and data from a "typical" day (25th November 2014) is presented in tabular form. The data is presented in **Figure 1** and **Table 1** below.

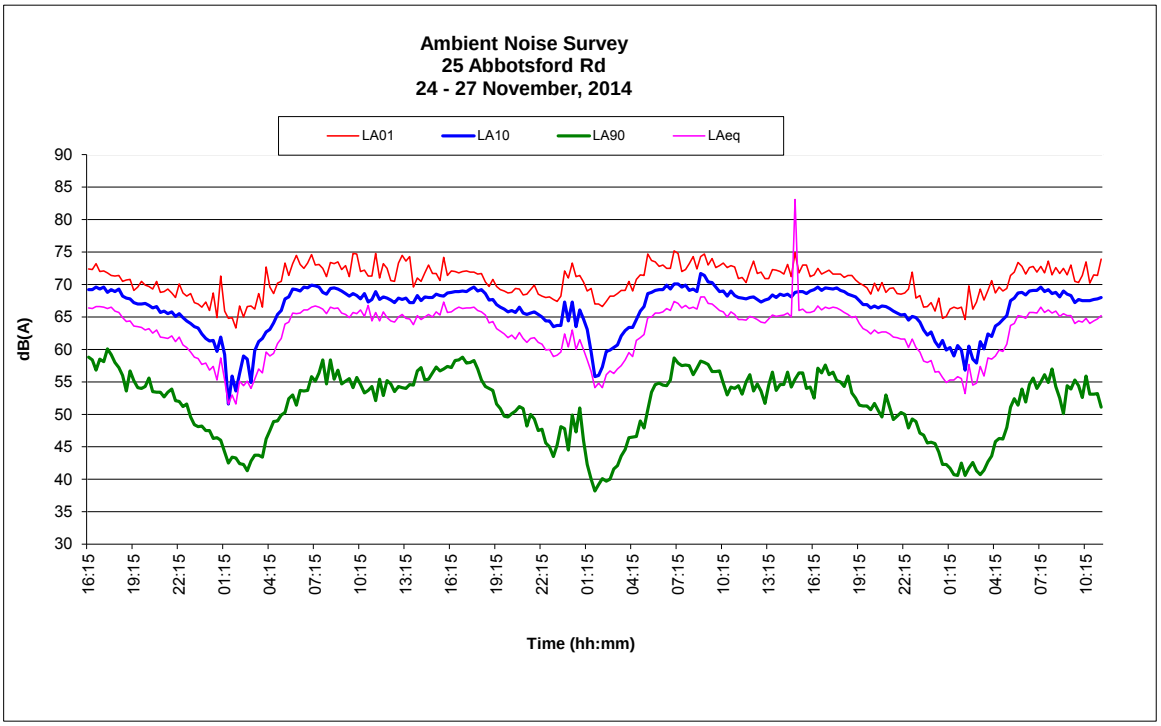
Table 1: Average ambient and background noise levels recorded at Location ML1 on Tuesday 25th November, 2014 (levels in dB(A), free-field).

Time	LA(01)	LA(10)	LA(90)	LAeq
Day 6am to 6pm	74.5	68.5	55.5	65.7
Evening 6pm to 10pm	71.2	66.8	51.6	63.3
Night 10pm to 6am	71.4	61.8	47.0	59.4
Day max 1-hr				66.5
Night max 1-hr (night to 6am)				64.1
CoRTN 6am to 12pm		67.7	53.7	
24 hour	73.5			64.0

The table above includes measured levels from all sources of noise including road traffic, residential and other local sources of noise. Road traffic noise from Abbotsford Road was observed to be the dominant noise source, and the data presented in **Figure 1** is consistent with an acoustic environment controlled by road traffic noise.

The recorded $L_{10,\ 18hr}$ was 70.2 dB(A), façade adjusted. This puts the location into QDC MP4.4 Noise **Category 3**.

Figure 1: Measured ambient noise levels at Location ML1.



Terms and definitions used in this Report are found in **Appendix E**.

3. Noise Criteria and Limits

3.1 BCC – City Plan

Under the BCC City Plan 2014, Abbotsford Road has been designed as a Transport Noise Corridor, and the development site is within Noise Categories 2 and 3 of the Abbotsford Road overlay presented on the Brisbane City Council website (see **plate 3**). As a multiple dwelling within an Emerging Community Zone, it is understood that the development is assessable against the Transport Noise Corridor Overlay Code, as set out in Table 5.10.23 of the City Plan, and reproduced in **Table 2** below.

Table 2: Brisbane City Plan 2014, Table 5.10.23 – Levels of assessment for Transport noise corridor overlay

Development	Level of assessment	Assessment criteria
All aspects of developments		
MCU, ROL, building work or operational work if prescribed exempt development	**Exempt**	Not applicable
MCU, ROL, building work or operational work if self-assessable development	**No change**	Not applicable
MCU		
MCU for a dual occupancy, multiple dwelling, residential care facility, retirement facility or rooming accommodation where accommodating 6 or more people, involving a new premises or an existing premises with an increase in gross floor area	**No change**	Transport noise corridor overlay code

It is concluded that there are mandated design requirements for mitigation of noise emissions from Abbotsford Road. Predictions of road traffic noise are set out in Section 4. QDC MP4.4 is considered in Section 3.3.

3.2 BCC – Residential Design – Multiple Dwelling Code

The Brisbane City Council (BCC) *City Plan 2014 Multiple Dwelling Code* provides performance requirements and acceptable solutions for noise issues when assessing a material change of use and/or building work for a multiple dwelling not within a centre zone category or mixed use zone. As discussed in Section 3.1 BCC has designated traffic noise corridors around certain Council roads, and the QDC MP4.4 methodology applies to acoustic assessment that may be required within these corridors. QDC MP4.4 is considered in Section 3.3.

Table 3: Performance criteria and acceptable solutions from BCC City Plan 2014 Section 9.3.14.3 Multiple Dwelling Code

Performance Criteria	Acceptable Outcome
PO21 Development….. provides car parking that minimises impacts on the quality of adjoining streetscapes or public spaces and the *amenity* of adjoining residents in terms of location, bulk, form and amenity impacts including noise, odour or light having regard to: (a) The proximity of *dwelling houses* or existing multiple dwellings on adjoining sites; *(c) setback* distances to mitigate impacts;	**AO21.1** Development….. provides car parking that is: (a) Located below ground; (b) Located at ground level or above ground only if: (i) Contained within the *development footprint* and located behind the main building line, except where visitor parking. (c) Set back from front, rear and side boundaries in accordance with a neighbourhood plan or if no neighbourhood plan applies or no requirements are specified in a neighbourhood plan, *Table 9.3.14.3.E* (d) Screened and landscaped
PO23 Development …… provides vehicle access and parking that must not impact on the *amenity* and privacy of residents within or adjoining the site.	**AO23.1** Development … ensures that a hardstand or manoeuvring area situated at *ground level* is: (a) Located to minimise noise disturbance: (b) Screened to: (i) Minimise the reflection of car headlights onto dwelling windows; (ii) Attenuate noise; (c) Separated from habitable windows to minimize noise and fumes disturbance;

Performance Criteria	Acceptable Solutions
	AO23.2 Development ….. (a) Ensures any vehicle movement or vehicle parking areas along the side or rear boundary are *acoustically screened* from adjoining dwellings; or (b) Provides a vegetated buffer next to any movement or parking areas of 1m wide along the side boundary and 2m wide along the rear boundary
PO34 Development provides front fencing and retaining walls that must: (a) Facilitate casual surveillance of the street and public space; (b) Enable use of private open space; (c) Assist in highlighting entrances to the property; (d) Provide a positive interface to the streetscape	**AO34.1** Development ensures that, where fencing is provided, the height of any new fence located on any common boundary to a street or public space is a maximum of: (a) 1.2m, where fence construction is solid or less than 50% transparent; (b) 1.5m where fence construction is at least 50% transparent; (c) 1.8m and solid only where the site is on an arterial road.
PO37 Development must provide good neighbour fencing to adjoining properties.	**AO37** Development with side and rear boundary fencing that is required to achieve or protect privacy or amenity, is: (a) A minimum of 1.8m in height; (b) A maximum of 1.2m in height where fence construction is solid or less than 50% transparent, or 1.5m where fence construction is at least 50% transparent, forward of the main building line to the front boundary except where it has a noise mitigation function.

Performance Criteria	Acceptable Solutions
PO42 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. Where T is • Day (7am to 6pm): 11hr, • Evening (6pm to 10pm): 4hr, • Night (10pm to 7am): 9 hr.	**AO42** Development ensures mechanical plant is *acoustically screened* from nearby sensitive uses.

3.3 QDC MP4.4 – Road Traffic Noise

QDC MP4.4 is intended to ensure that habitable rooms of residential buildings located in a transport noise corridor are designed and constructed to reduce transport noise from the gazetted or designated road or roads in question. Noise reduction requirements fall into categories, based on $L_{10,18hr}$ noise levels along the façades of the proposed development (see **Table 4**). Construction of the dwelling is then to "deemed to satisfy" solutions, see **Table 5**.

The proposed development sits within Noise Category 2 and 3 of the Transport Noise Corridor for Sandgate Road at ground level, based on the noise contours published by Brisbane City Council (see **Plate 3**). These are calculated rather than measured, and provision is made for a noise impact assessment to incorporate acoustic measurements to more accurately determine the relevant noise category for the dwelling.

Table 4: Noise levels associated with QDC MP4.4 Noise Categories

Noise Category	**Level of Transport Noise ($L_{A10,18hr}$) 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)

Table 5: Performance requirements of QDC MP4.4

Performance Requirements	**Acceptable Solutions**
Residential Buildings	
P1 Habitable rooms in residential buildings located in a transport noise corridor are adequately protected from transport noise to safeguard occupants' health and amenity.	**A1** The external envelope of habitable rooms in a residential building located in a transport noise corridor complies 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: a) Using materials specified in Schedule 2; **OR** b) Using materials with manufacturer's specifications that, in combination, achieve the minimum R_w value for the relevant building component and acceptable noise category.

The revised categories are set out in **Section 4.** The default Deemed to Satisfy building solutions for these Categories, for use at Building Approval stage, are set out in **Appendix C**.

3.4 Air Conditioning - Noise Emissions

Alternative ventilation, such as air-conditioning, may be installed. State requirements are set out under the Environmental Protection Act 1994; in that Act noise from air conditioning must not exceed the following noise levels when measured as the LA90 dB(A) level over a period of 15 minutes at an affected building:

- Between 10pm and 7am: 3 dB(A) above the background level
- From 7am to 10pm: 5 dB(A) above the background level

It is considered that achieving the emission criteria set out in PO42 of the BCC Multiple Dwelling Code also achieves the less strict requirements of the EPA 1994. Noise mitigation for potential air conditioning is not within the scope of this report.

3.5 Environmental Protection (Noise) Policy 2008

The Environmental Protection Noise Policy 2008 establishes acoustic quality objectives to protect or enhance stated environmental values. The environmental values to be enhanced or protected under the policy are the qualities of the acoustic environment that are conducive to protecting the health and biodiversity of ecosystems; and the qualities of the acoustic environment that are conducive to human health and well-being, including ensuring a suitable acoustic environment for individual's to sleep, study and learn, to be involved in recreation including relaxation and conversation; and the qualities of the acoustic environment that are conducive to protecting the amenity of the community. The values are generally protected by meeting the acoustic quality objectives.

The ambient observations for this Report indicate that the dominant noise character of the environment, apart from residential and commercial neighbour activity, is noise from "ordinary" road traffic. It is therefore concluded that the policy objectives for the environmental values of an individual are applied as part of this development approval by meeting the requirements of QDC MP4.4.

3.6 State Development Assessment Provisions – Module 1 Community Noise

Module 1 was developed with the active participation of the Department of Main Roads and Transport and it is therefore concluded that meeting the noise criteria under Module 1 (Table 1.1.1, PO1, presented in part in **Table 6** below) achieves the recommendations contained in the various DTMR traffic noise codes of practice, NIAPSP, AS3671 and AS2107.

Table 6: SARA Module 1

Performance outcomes	Acceptable outcomes
Residential buildings near a state-controlled road or type 1 multi modal corridor	
PO1 Development involving an accommodation activity that is a residential building achieves acceptable noise levels for residents and visitors by mitigating adverse impacts on the development from noise generated by a state-controlled road or type 1 multi-modal corridor.	**AO1.1** All facades of a residential building exposed to noise from a state-controlled road or type 1 multi-modal corridor meet the following external noise criteria^#: (1) ≤60 dB(A) L_{10} (18 hour) facade corrected (measured L_{90} (8 hour) free field between 10 pm and 6 am ≤40 dB(A)) (2) ≤63 dB(A) L_{10} (18 hour) facade corrected (measured L_{90} (8 hour) free field between 10 pm and 6 am >40 dB(A)). AND
	AO1.4 For a residential building, not located in a transport noise corridor, every habitable room is designed, sited and constructed to meet the following internal noise criteria^#: (1) ≤35 dB(A) L_{eq} (1 hour) (maximum hour over 24 hours). AND
	AO1.5 A residential building not located in a transport noise corridor, is designed, sited and constructed to incorporate noise attenuation treatments in accordance with *AS3671–1989 Acoustics – Road traffic noise intrusion – building siting and construction.* Note: Noise levels from a state-controlled road or type 1 multi-modal corridor are to be measured in accordance with *AS1055.1–1997 Acoustics – Description and measurement of environmental noise.* Editor's note: Habitable rooms of residential buildings located within a transport noise corridor must comply with t*he Queensland Development Code MP4.4 Buildings in a transport noise corridor*, Queensland Government, 2010. Transport noise corridors are mapped on the Department of Housing and Public Works website.

Note: It is not clear how or why PO1 applies to A01.4 and A01.5 as there does not appear to legislative authority for the provisions. Acceptable Solution AO1.4 conflicts with the provisions of Schedule 1 of the Environmental Protection (Noise) Policy 2008. It is concluded, however, that meeting the requirements of QDC MP4.4 will also meet the requirements of Module 1, PO1, above.

3.7 Railway Noise

The development site is located approximately 50m from Bowen Hills station, and is exposed to noise from railway passes-by. It is noted that Brisbane City Council no longer has a railway noise policy, and that DSDIP provisions are not mandated as the site is understood to be further than 25m from railway land.

It is also noted that the site is exposed to road traffic noise, and is subject to design requirements under QDC MP4.4. Façades that are most exposed to railway noise are also the most exposed to road traffic noise, which was considered to be the dominant noise source during the ambient noise survey. It is therefore considered that construction that achieves the design requirements of MP4.4 for road traffic noise will also mitigate noise from railway passes-by.

4. Noise Impact Assessment

4.1 Brisbane City Council – Multiple Dwelling Code

4.1.1 Car Parking and Vehicle Movements

The development plans show parking areas to be located below ground, in concurrence with Acceptable Outcome **AO21.1-(a)**.

4.1.2 Air- Conditioners

It is expected that dwellings within the development will incorporate some form of air-conditioning. However the layout and plant selection is not known at this stage. The layout and selection of air-conditioning plant should be considered so that noise emission from the units does not exceed the noise emission criteria required by the BCC Multiple Dwelling Code, as presented in **Table 7** below. RBL calculations were made in accordance to the BCC Noise Impact Assessment Planning Scheme Policy.

Table 7: BCC Multiple Dwelling Code noise emission criteria, levels in dB(A)

	PO42 criteria	Measured RBL	Maximum emission to nearby sensitive use
Day	RBL + 3	54	57
Evening	RBL + 3	50	53
Night	RBL + 3	42	45

There is also an ongoing responsibility to comply with the requirements of the State of Queensland under the Environmental Protection Act 1994. The appropriate criteria to be met is set out in **Section 3.4**.

4.2 QDC MP4.4

New dwellings subject to Queensland Development Code Mandatory Part 4.4 – Buildings in a Transport Noise Corridor ("QDC MP4.4") are built to the Category calculated on the basis of the $L_{10,\ 18hr}$ at its façade (this is height dependant, so different levels may have different Categories). This Code relates to the Habitable Rooms of a dwelling, and bedrooms are not differentiated from living rooms.

The transport noise corridor overlay defines this property as being in Category 2 and 3 at ground level. This has been reconsidered in this report which is prepared in accordance with the Department of Transport and Main Roads' *Code of Practice.*

The nearest major road is Abbotsford Road, which is adjacent to site. Future road traffic noise from Abbotsford Road has been calculated into the 10 year design horizon. Details of the road traffic noise model are presented in **Appendix B**.

It is understood that the design of the balcony areas are to be largely "enclosed"; that is, the wing-walls and floor of solid construction. A 'solid' design has been shown to reduce noise within the centre of the balcony area, with a measured 3.5 dB(A) noise reduction over the façade level if solid balustrades are also included. It is noted that if wing-walls and balustrades are of solid and gap-free construction, noise levels behind balconies would be expected to be around 3 dB(A) lower than model predictions.

Forecast QDC Noise Categories for the proposed development depend on façade height, direction and screening. Results from the traffic noise model are presenting in **Tables 8 - 11** below. "Deemed to satisfy" building solutions for QDC MP4.4 Categories are presented in **Appendix C.**

Table 8: Forecast QDC MP4.4 Categories, Level 1

Unit & Façade	Forecast $L_{10,\ 18hr}$ (dB(A))	QDC Noise Category
101 South	69	3
102 South	73	4
102 West	74	4
103 West	74	4
104 West	74	4
104 North	72	3
105 North	70	3
106 North	68	3
107 North	68	3
107 East	60	1
108 East	52	0
109 East	52	0
109 Nouth	66	2
110 South	68	3
111 North	58	1
111 East	43	0
112 West	61	1
112 East	43	0
113 West	61	1
113 East	44	0
114 West	60	1
114 East	43	0
115 East	44	0
116 East	46	0
116 South	58	1
117 South	62	1
118 South	66	2
119 South	69	3
119 West	73	4
120 West	75	4
120 North	70	3
121 North	69	3

T**able 9:** Forecast QDC MP4.4 Categories, Level 2

Unit & Façade	**Forecast $L_{10,\ 18hr}$ (dB(A))**	**QDC Noise Category**
201 South	67	2
202 South	72	3
202 West	76	4
203 West	76	4
204 West	76	4
204 North	72	3
205 North	63	2
206 North	61	1
207 North	59	1
207 East	51	0
208 East	44	0
209 East	43	0
209 South	61	1
210 South	63	2
211 North	60	1
211 East	44	0
212 West	62	1
212 East	44	0
213 West	63	2
213 East	45	0
214 West	62	1
214 East	44	0
215 East	44	0
216 East	48	0
216 South	61	1
217 South	64	2
218 South	68	3
219 South	72	3
219 West	76	4
220 West	76	4
220 North	72	3
221 North	66	2

Table 10: Forecast QDC MP4.4 Categories, Level 3

Unit & Façade	Forecast $L_{10,\ 18hr}$ (dB(A))	QDC Noise Category
301 South	67	2
302 South	72	3
302 West	75	4
303 West	76	4
304 West	75	4
304 North	72	3
305 North	67	2
306 North	64	2
307 North	62	1
307 East	55	0
308 East	45	0
309 East	44	0
309 South	62	1
310 South	64	2
311 North	61	1
311 East	45	0
312 West	63	2
312 East	45	0
313 West	64	2
313 East	46	0
314 West	63	2
314 East	45	0
315 East	46	0
316 East	52	0
316 South	63	2
317 South	67	2
318 South	69	3
319 South	72	3
319 West	75	4
320 West	75	4
320 North	72	3
321 North	67	2

Table 11: Forecast QDC MP4.4 Categories, Level 4

Unit & Façade	Forecast $L_{10,\ 18hr}$ (dB(A))	QDC Noise Category
401 South	68	3
402 South	72	3
402 West	75	4
403 West	75	4
404 West	75	4
404 North	72	3
405 North	70	3
406 North	67	2
407 North	65	2
407 East	58	1
408 East	47	0
409 East	46	0
409 South	63	2
410 South	65	2
411 North	62	1
411 East	47	0
412 West	64	2
412 East	48	0
413 West	64	2
413 East	48	0
414 West	64	2
414 East	47	0
415 East	48	0
416 East	58	1
416 South	65	2
417 South	68	3
418 South	70	3
419 South	72	3
419 West	75	4
420 West	75	4
420 North	72	3
421 North	67	2

Table 12: Forecast QDC MP4.4 Categories, Level 5

Unit & Façade	Forecast $L_{10,\ 18hr}$ (dB(A))	QDC Noise Category
501 South	70	3
502 South	72	3
502 West	75	4
503 West	75	4
504 West	75	4
504 North	71	3
505 North	70	3
506 North	68	3
507 North	67	2
507 East	60	1
508 East	48	0
509 East	48	0
509 South	63	2
510 South	66	2
511 North	62	1
511 East	48	0
512 West	65	2
512 East	49	0
513 West	65	2
513 East	49	0
514 West	64	2
514 East	49	0
515 East	49	0
516 East	59	1
516 South	67	2
517 South	69	3
518 South	70	3
519 South	71	3
519 West	75	4
520 West	74	4
520 North	71	3
521 North	67	2

Table 13: Forecast QDC MP4.4 Categories, Level 6

Unit & Façade	Forecast $L_{10,\ 18hr}$ (dB(A))	QDC Noise Category
601 South	69	3
602 South	72	3
602 West	74	4
603 West	74	4
604 West	74	4
604 North	71	3
605 North	69	3
606 North	68	3
607 North	68	3
607 East	61	1
608 East	50	0
609 East	50	0
609 South	64	2
610 South	67	2
611 North	62	1
611 East	50	0
612 West	67	2
612 East	50	0
613 West	67	2
613 East	50	0
614 West	65	2
614 East	50	0
615 East	50	0
616 East	60	1
616 South	68	3
617 South	69	3
618 South	70	3
619 South	71	3
619 West	74	4
620 West	74	4
620 North	71	3
621 North	68	3

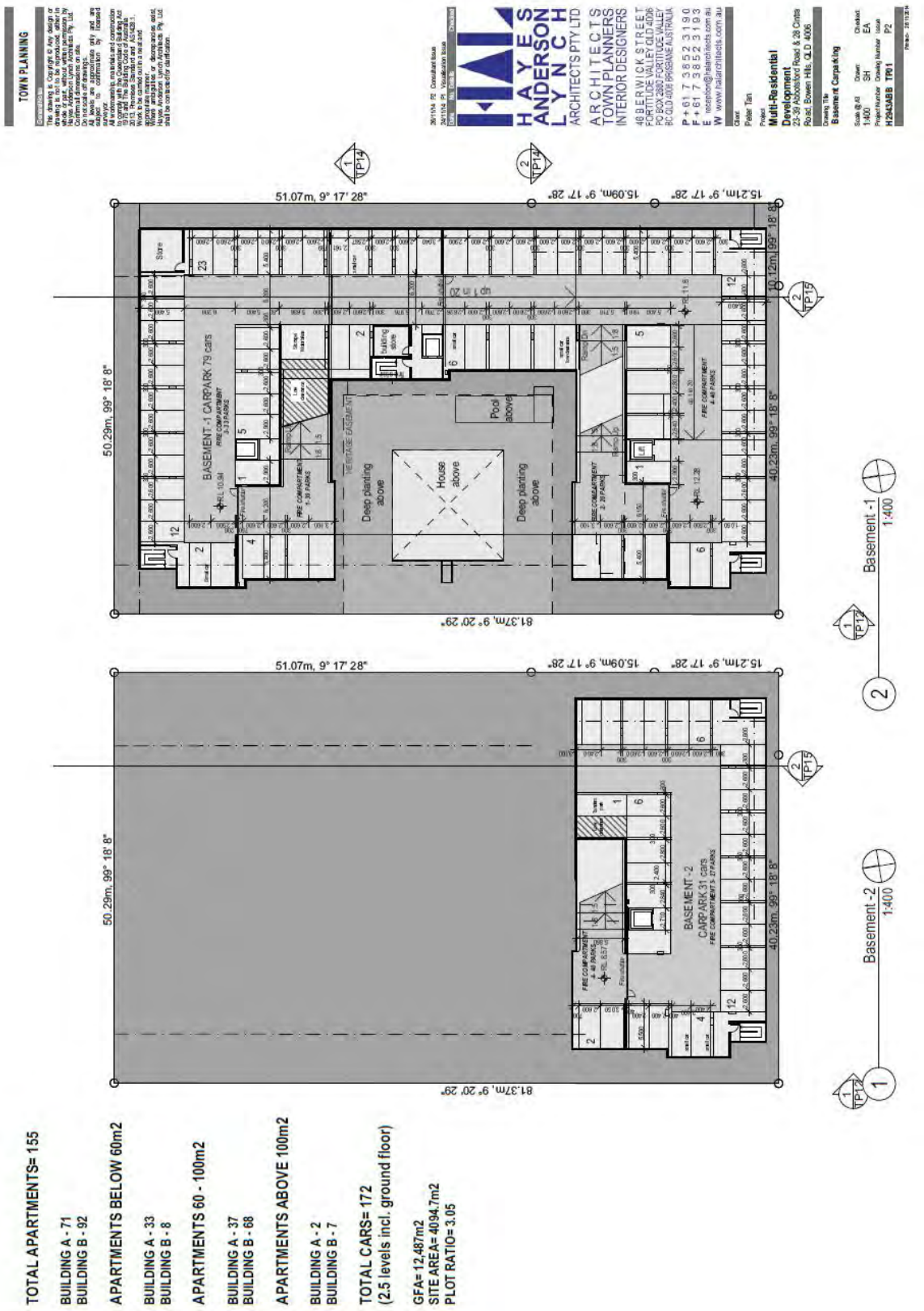
Table 14: Forecast QDC MP4.4 Categories, Level 7

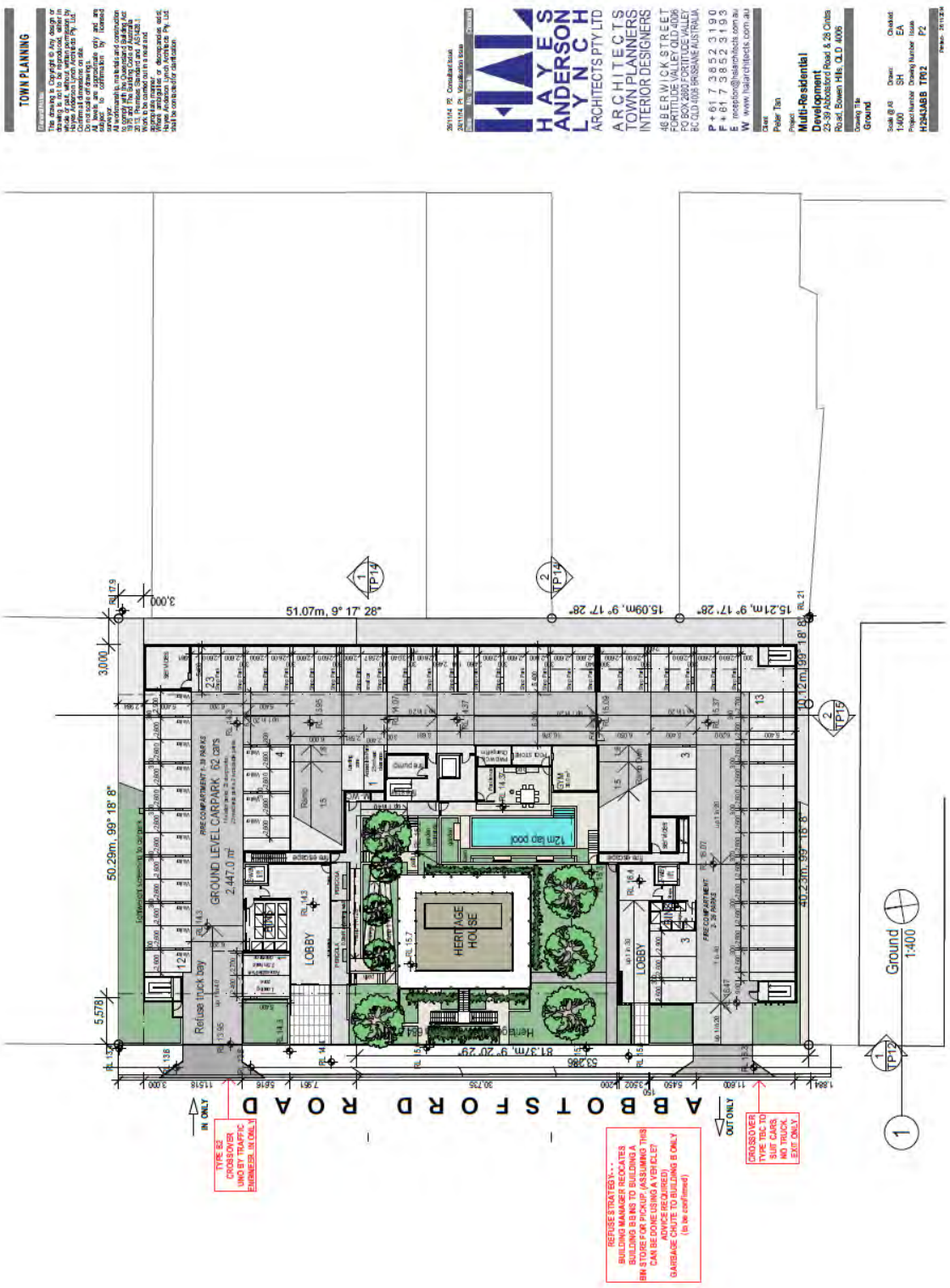
Unit & Façade	Forecast $L_{10,\ 18hr}$ (dB(A))	QDC Noise Category
701 South	69	3
702 South	71	3
702 West	74	4
703 West	74	4
704 West	74	4
704 North	71	3
705 North	69	3
706 North	68	3
707 North	68	3
707 East	61	1
708 East	51	0
709 East	51	0
709 South	65	2
710 South	68	3
711 North	62	1
711 East	52	0
712 West	67	2
712 East	51	0
713 West	66	2
713 East	52	0
714 West	64	2
714 East	51	0
715 East	60	1
715 South	68	3
716 South	69	3
717 South	69	3
718 South	71	3
718 West	74	4
719 West	74	4
719 North	71	3
720 North	68	3

Table 15: Forecast QDC MP4.4 Categories, Level 8

Unit & Façade	Forecast $L_{10,\ 18hr}$ (dB(A))	QDC Noise Category
801 West	54	0
801 North	68	3
801 East	61	1
802 East	53	0
803 East	53	0
803 South	67	2
803 West	56	0
804 North	61	1
804 West	67	2
804 East	53	0
805 West	67	2
805 East	53	0
806 West	67	2
806 East	53	0
807 West	66	2
807 East	53	0
808 East	57	0
808 South	67	2
809 South	68	3
809 West	55	0
810 West	56	0
810 North	68	3

Appendix A: Plans

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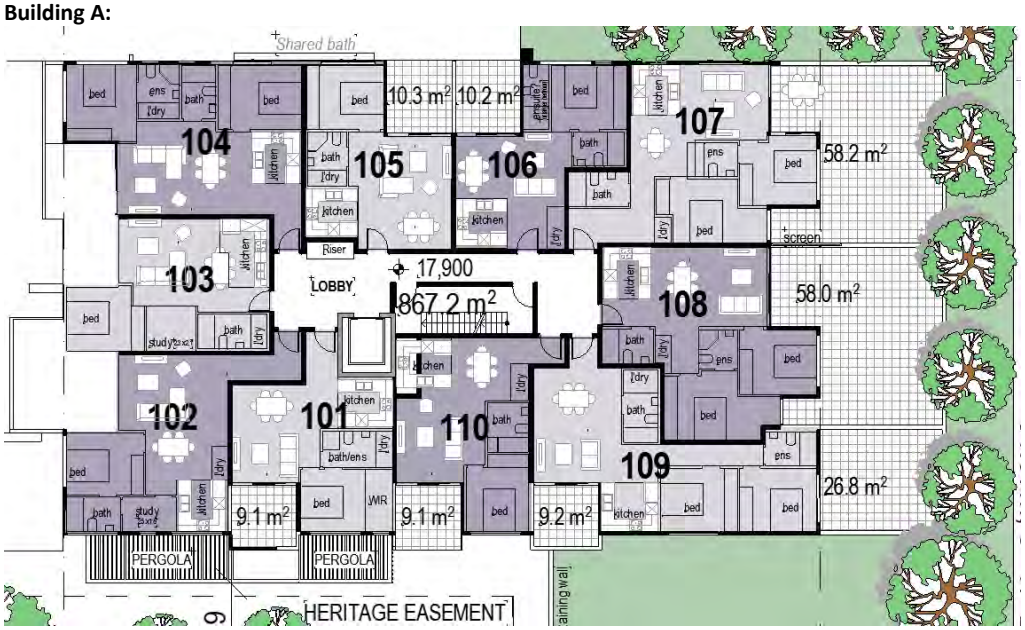
ARCHITECTS
TOWN PLANNERS
INTERIOR DESIGNERS
Multi-Residential Development
23-39 Abbotsford Road & 26 Childs Road, Bowen Hills, QLD 4006
Ground
GROUND LEVEL CARPARK 62 cars
2,447.0 m²
HERITAGE HOUSE
LOBBY
Refuse truck bay
12m lap pool
ABBOTSFORD ROAD
IN ONLY
OUT ONLY
51.07m, 9° 17' 28"
15.09m, 9° 17' 28"
15.21m, 9° 17' 28"
50.29m, 99° 18' 8"
40.23m, 99° 18' 8"
81.37m, 9° 20' 29"
Ground
1:400

Level 1 Plans (Updated 3/12/2014)

Building A:



Building B: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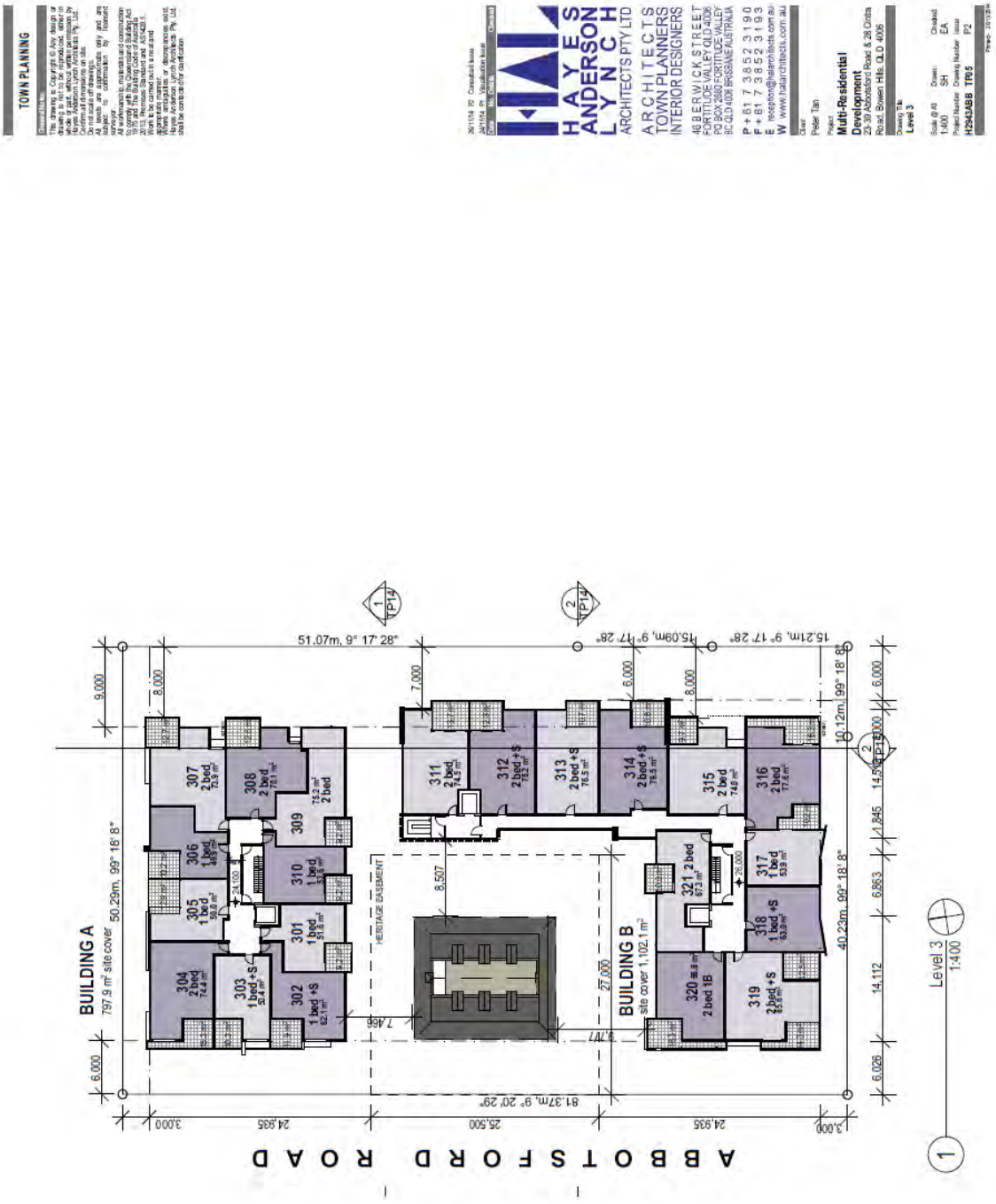
Level 2
BUILDING A
796.3 m² site cover
BUILDING B
site cover 1,108.8 m²
HERITAGE HOUSE
84 m²
HERITAGE EASEMENT
ABBOTSFORD ROAD
51.07m, 9° 17' 28"
152.1m, 99° 18' 8"
Level 2
1:400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Level 3
BUILDING A
797.9 m² site cover
BUILDING B
site cover 1,102.1 m²
HERITAGE EASEMENT
ABBOTSFORD ROAD
Level 3
1:400


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Level 4
Scale @ A3 1:400
Drawn SH
Checked EA
Project Number H2643ABB
Drawing Number TP05
Issue P2
BUILDING A
797.9 m² site cover
BUILDING B
site cover 1,102.1 m²
HERITAGE EASEMENT
ABBOTSFORD ROAD
Level 4
1:400


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Level 5
BUILDING A
797.9 m² site cover
BUILDING B
site cover 1,102.1 m²
HERITAGE EASEMENT
ABBOTSFORD ROAD
Level 5
1:400


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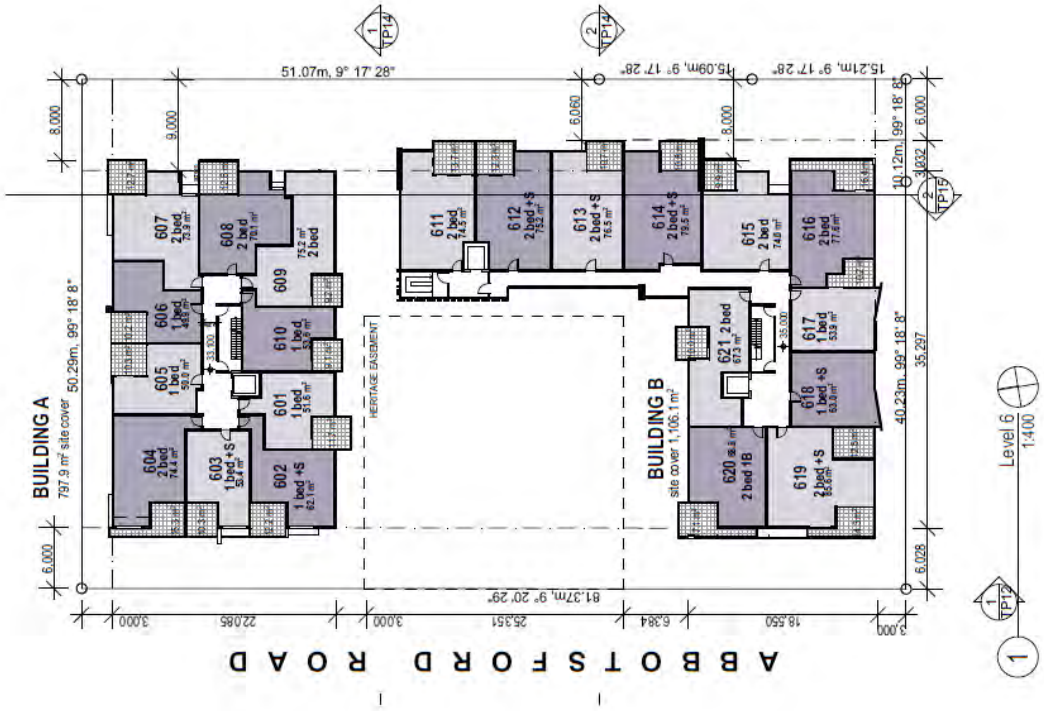
23-39 Abbotsford Road & 28 Cribb Street, Bowen Hills, QLD 4006
Drawing Title
Level 6
Scale @ A3
1:400
Drawn
SH
Checked
EA
Project Number
H2843AB
Drawing Number
TP8
Issue
P2


BUILDING A
797.9 m² site cover
BUILDING B
site cover 1,106.1 m²
HERITAGE EASEMENT
ABBOTSFORD ROAD
51.07m, 9° 17' 28"
15.09m, 9° 17' 28"
15.21m, 9° 17' 28"
81.37m, 9° 20' 29"
50.29m, 99° 18' 8"
40.23m, 99° 18' 8"
10.12m, 99° 18' 8"
Level 6
1:400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Road, Bowen Hills, QLD 4006
Drawing Title
Level 7
Scale @ A3
1:400
Drawn
SH
Checked
EA
Project Number
H2443ABB
Drawing Number
TP09
Issue
P2
BUILDING A
797.9 m² site cover
BUILDING B
site cover 1,111.8 m²
HERITAGE EASEMENT
ABBOTSFORD ROAD
Level 7
1:400


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Drawing Title
Level 8
Scale @ A3
1:400
Drawn
SH
Checked
EA
Project Number
H2943ABB
Drawing Number
TP10
Issue
P2
ABBOTSFORD ROAD
BUILDING A
Site cover 561.0 m²
BUILDING B
Site cover 1,019.2 m²
HERITAGE EASEMENT
801 3 bed
802 2 bed
803 3 bed + s
804 3 bed
805 3 bed
806 1 bed
807 1 bed +S
808 3 bed
809 3 bed
810 2 bed
Roof Deck
Roof Deck
Level 8
1:400


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Level 8
BUILDING A
site cover 561.0 m²
BUILDING B
site cover 1,019.2 m²
HERITAGE EASEMENT
Roof Deck
801 3 bed
802 2 bed
803 3 bed + s
804 3 bed
805 3 bed
806 1 bed
807 1 bed +S
808 3 bed
809 3 bed
810 2 bed
ABBOTSFORD ROAD
Level 8
1:400


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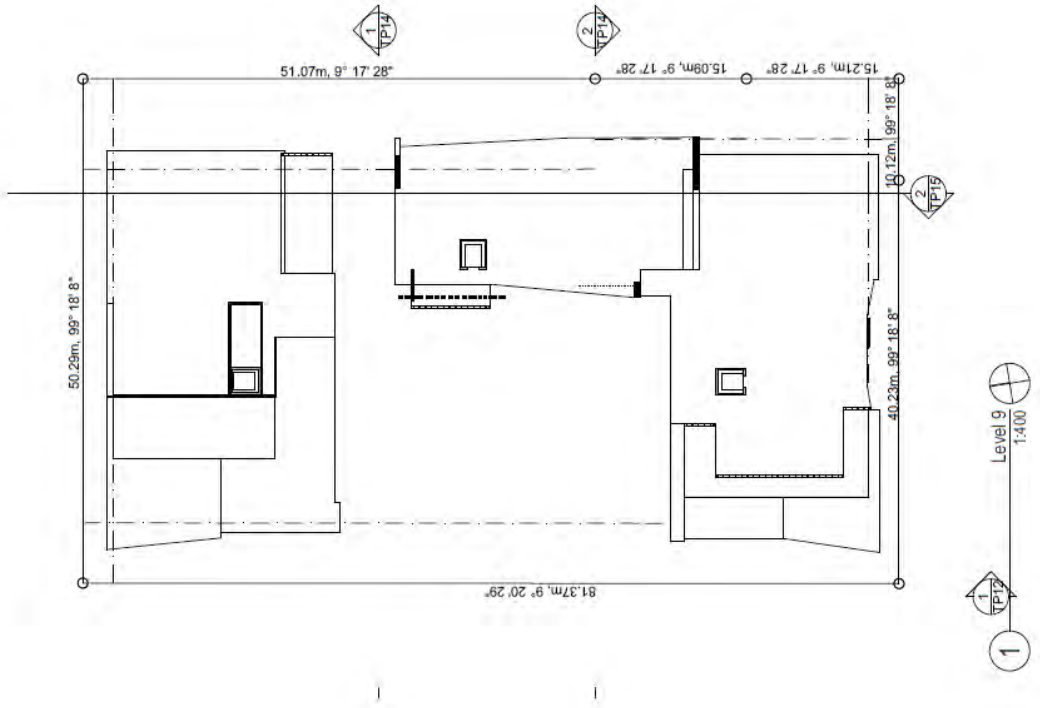
Road, Bowen Hills, QLD 4006
Drawing Title
Roof
Scale @ A3
1:400
Drawn
SH
Checked
EA
Project Number
H2943488
Drawing Number
TP11
Issue
P2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15.09m, 9° 17' 28"
15.21m, 9° 17' 28"
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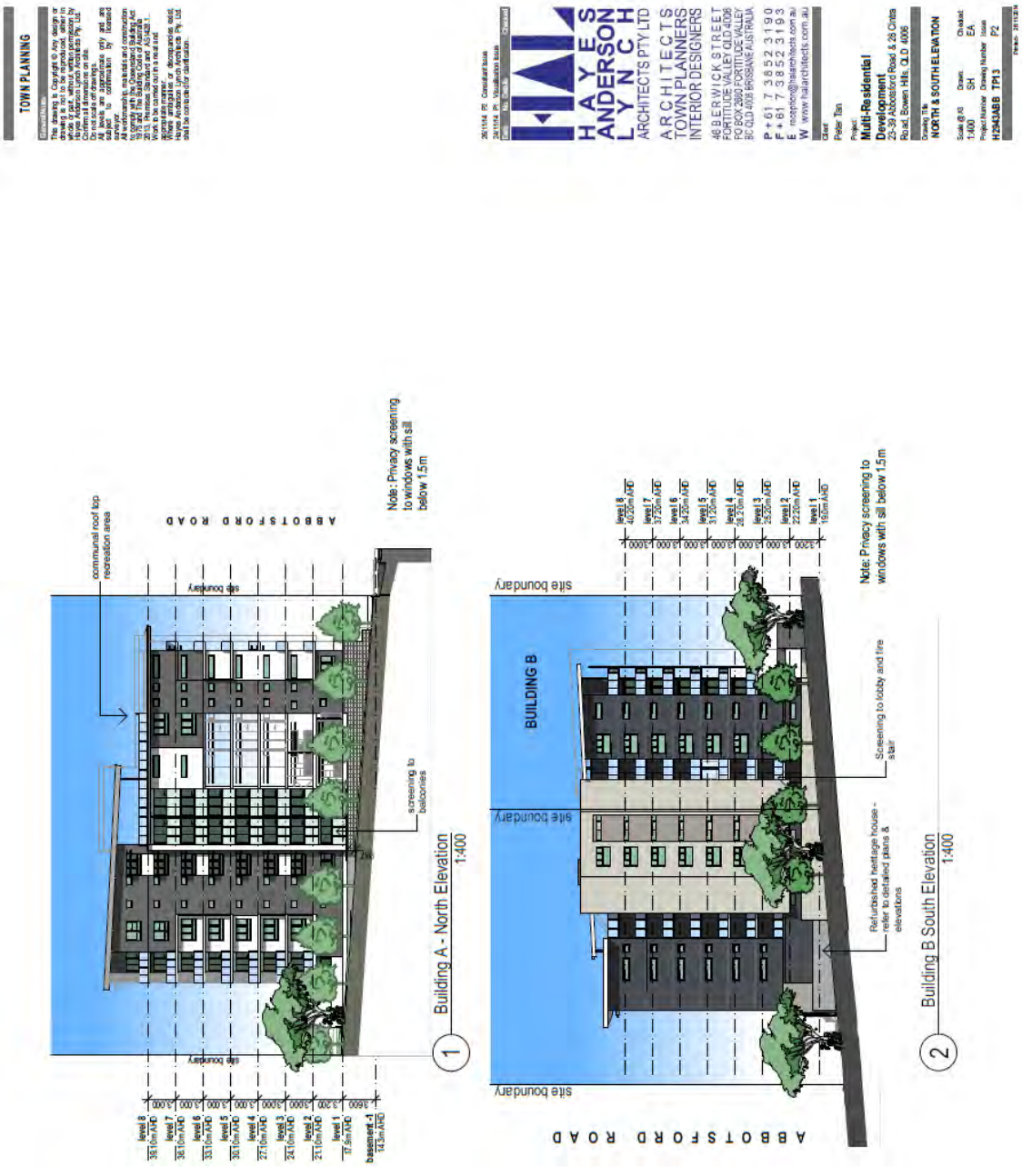
50.29m, 99° 18' 8"
40.23m, 99° 18' 8"
81.37m, 9° 20' 29"
TP14
TP14
TP15
TP12
Level 9
1:400


BUILDING A
BUILDING B
site boundary
site boundary
site boundary
SITE BOUNDARY
SITE BOUNDARY
West Elevation
1:400
East Elevation
1:400
1
2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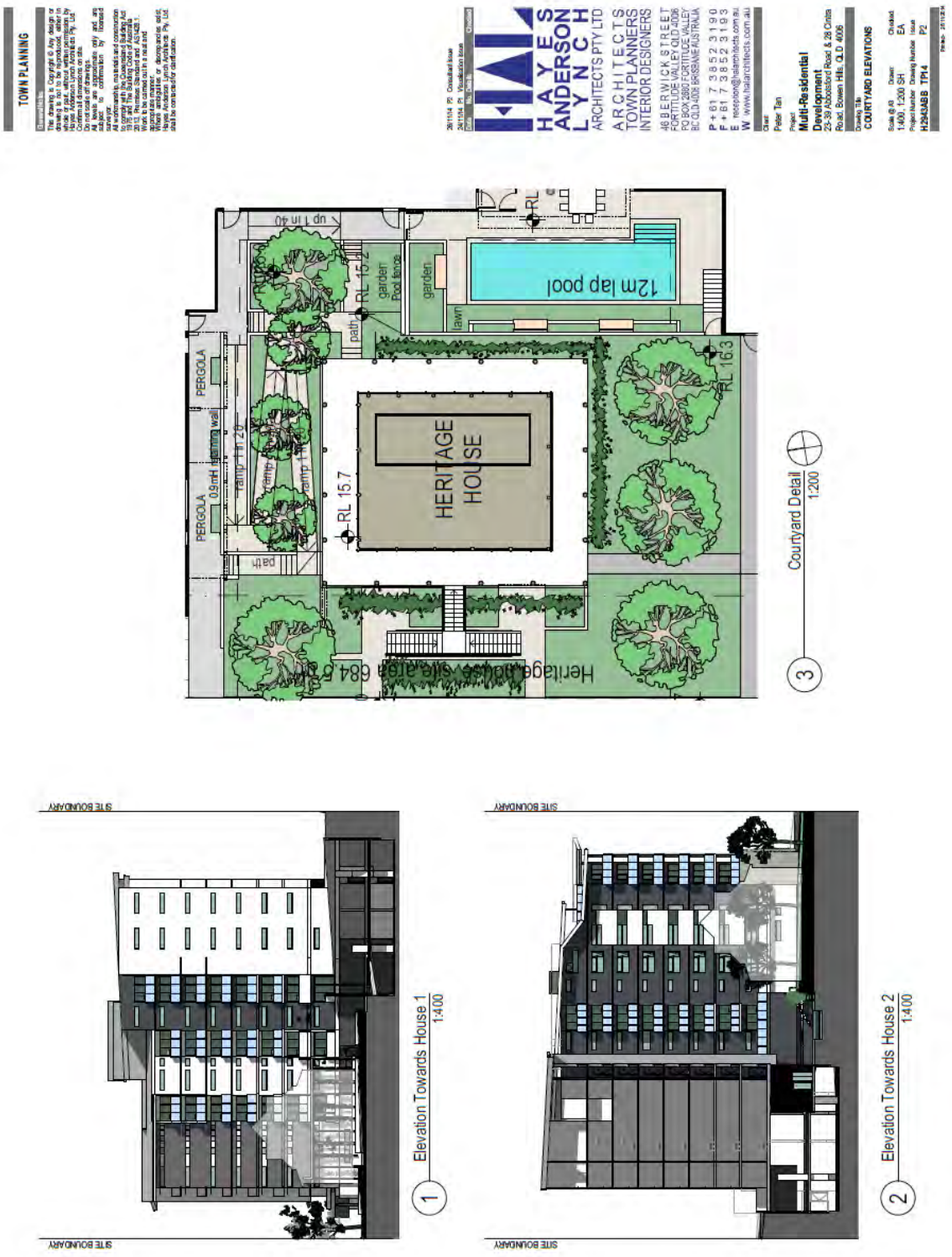
NORTH & SOUTH ELEVATION
H2943ABB TP13
ABBOTSFORD ROAD
site boundary
communal roof top recreation area
Note: Privacy screening to windows with sill below 1.5m
screening to balconies
Building A - North Elevation
1:400
BUILDING B
Screening to lobby and fire stair
Refurbished heritage house - refer to detailed plans & elevations
Note: Privacy screening to windows with sill below 1.5m
Building B South Elevation
1:400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COURTYARD ELEVATIONS
H2943ABB TP14
HERITAGE HOUSE
12m lap pool
garden
Pool fence
lawn
path
PERGOLA
RL 15.7
RL 16.3
RL 15.2
Courtyard Detail
1:200
SITE BOUNDARY
Elevation Towards House 1
1:400
Elevation Towards House 2
1:400


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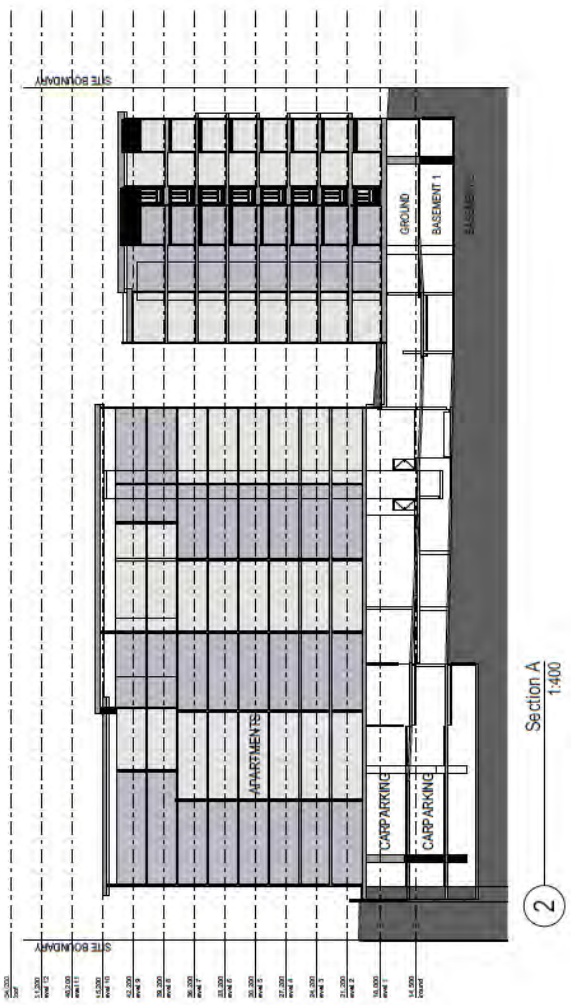
Drawing Title
SECTION A
Scale @ A4
1:400
Drawn
SH
Checked
EA
Project Number
H2043ABB
Drawing Number
TP15
Issue
P2


SITE BOUNDARY
GROUND
BASEMENT 1
APARTMENTS
CARPARKING
CARPARKING
SITE BOUNDARY
Section A
1:400
2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Drawing Title
HERITAGE HOUSE IN CONTEXT
Scale @ A3 1:250
Drawn SH
Checked EA
Project Number H2643ABB
Drawing Number TP16
Issue P2
House in Context 1
TREES NOT SHOWN FOR CLARITY
House in Context 2
House in Context 3
TREES NOT SHOWN FOR CLARITY
House in Context 4


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Multi-Residential Development
51.07m, 9° 17' 28"
BUILDING A
HERITAGE EASEMENT
HERITAGE HOUSE
LOBBY
Refuse Truck
PERGOLA
Retaining wall
9,000
6,000
22,085
2,851
4,918
5,519
3,000
17,900

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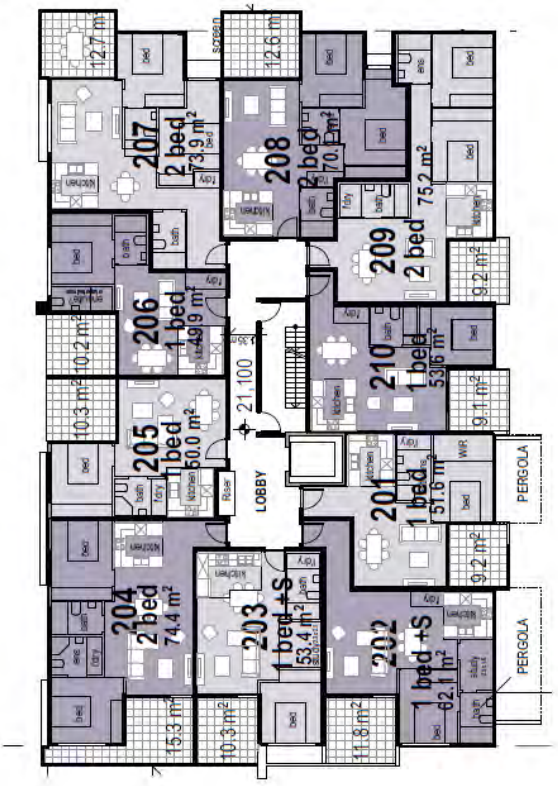
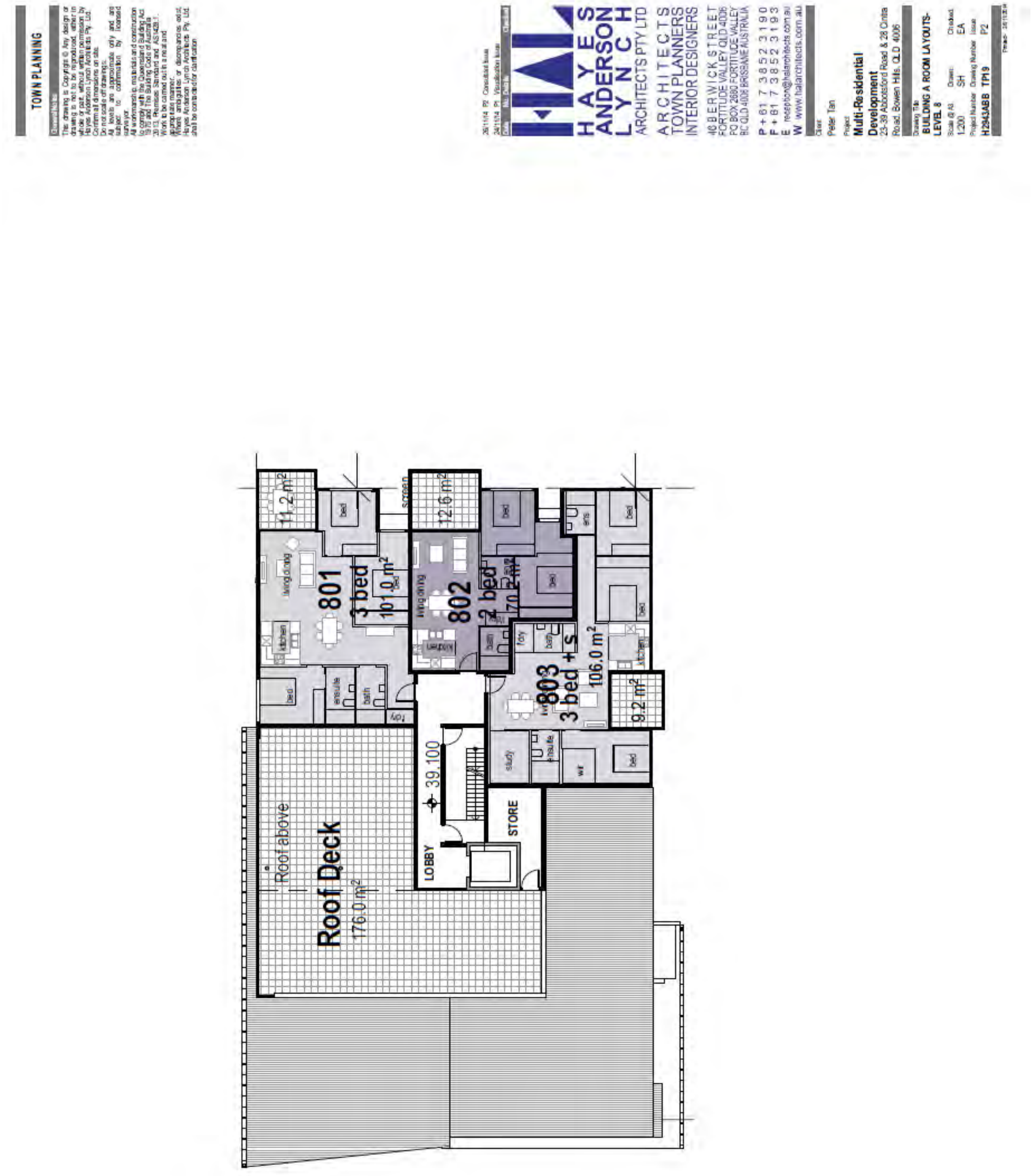
Drawn Title
BUILDING A ROOM LAYOUTS-LEVEL 2-7 TYPICAL FLOOR

Scale @ A3: 1:200 | Drawn: SH | Checked: EA
Project Number: H2443ABB | Drawing Number: TP18 | Issue: P2




TOWN PLANNING
HAYES ANDERSON LYNCH
ARCHITECTS PTY LTD
ARCHITECTS
TOWN PLANNERS
INTERIOR DESIGNERS
801
3 bed
802
2 bed
803
3 bed + s
106.0 m2
Roof Deck
176.0 m2
Roof above
LOBBY
STORE
39.100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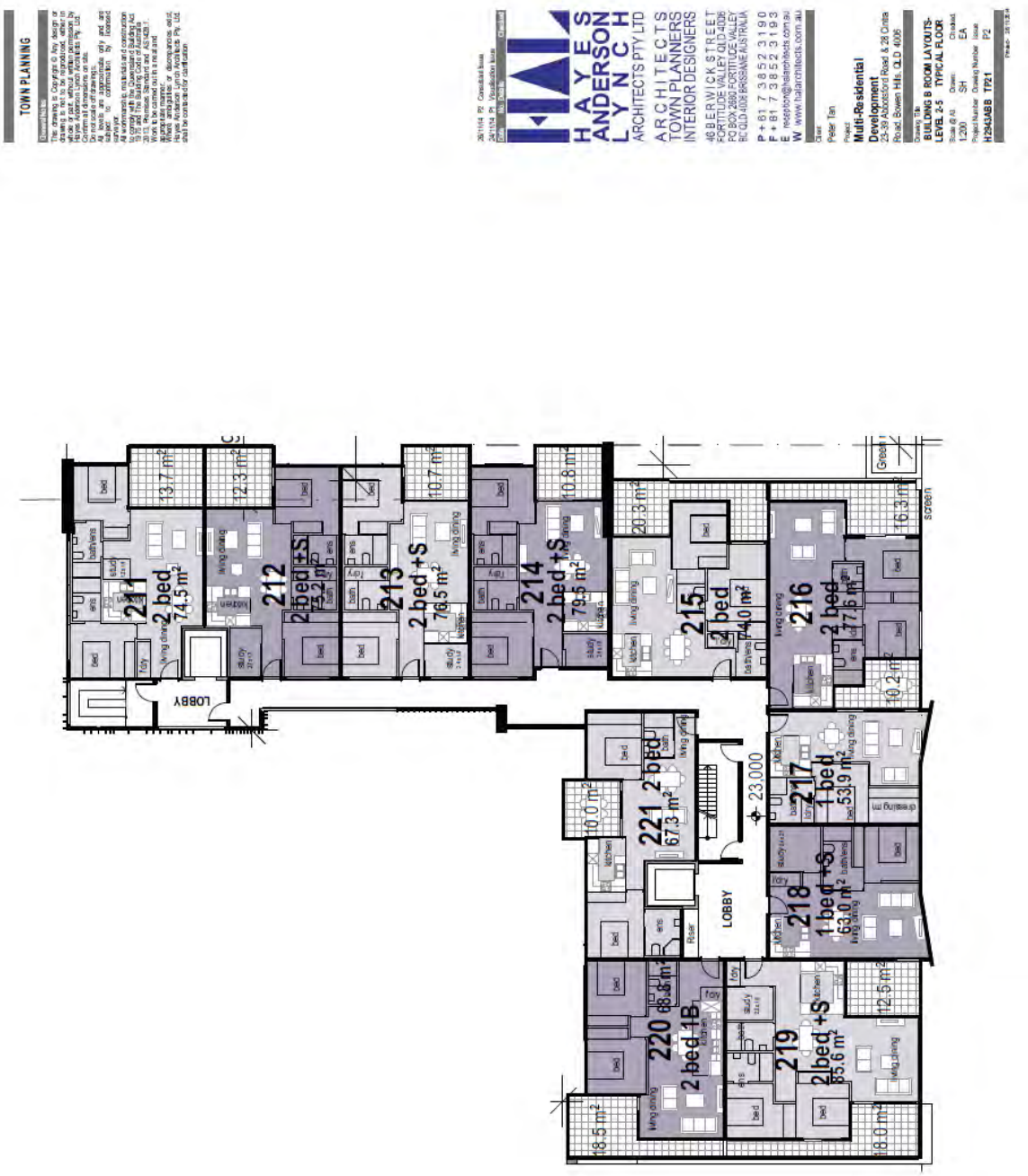
ARCHITECTS PTY LTD
ARCHITECTS
TOWN PLANNERS
INTERIOR DESIGNERS
BUILDING B
site cover 1,247.9 m2
HERITAGE HOUSE
103.9 m2
pool below
entry below
LOBBY
81.37m, 9° 20' 29"
40.23m, 99° 18' 8"
15.21m, 9° 17' 28"
15.09m, 9° 17' 28"
4,918
15,731
4,851
6,384
21,551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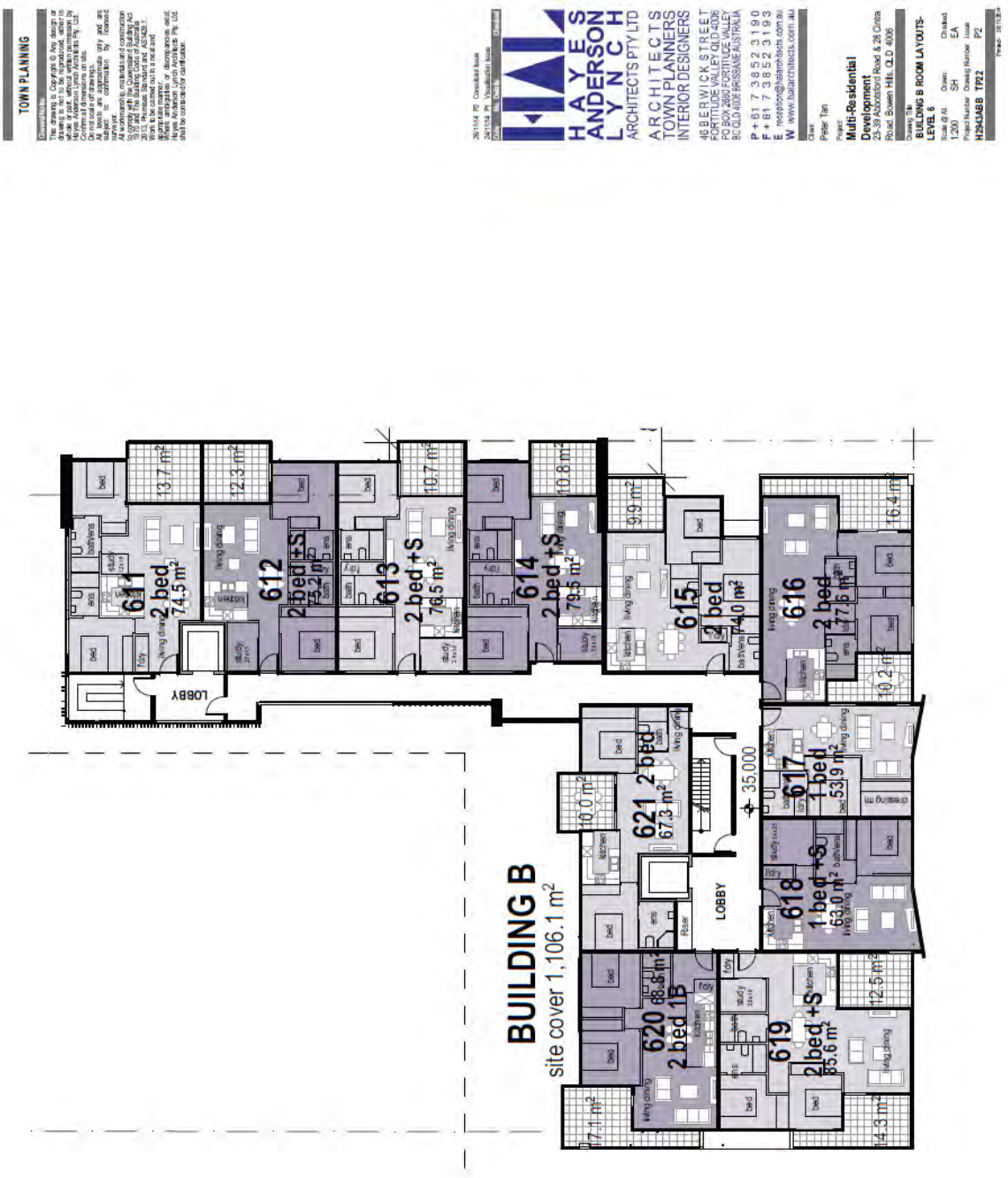
ARCHITECTS
TOWN PLANNERS
INTERIOR DESIGNERS
Peter Tan
Multi-Residential Development
BUILDING B ROOM LAYOUTS-LEVEL 2-5 TYPICAL FLOOR
LOBBY
2 bed 74.5 m²
212
2 bed +S
213
2 bed +S
76.5 m²
214
2 bed +S
79.5 m²
215
2 bed
74.0 m²
216
2 bed
77.6 m²
Screen
221
2 bed
67.3 m²
217
1 bed
53.9 m²
218
1 bed +S
63.0 m²
220
2 bed 1B
219
2 bed +S
85.6 m²
LOBBY
23,000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ARCHITECTS PTY LTD
ARCHITECTS
TOWN PLANNERS
INTERIOR DESIGNERS
Client
Peter Tan
Project
Multi-Residential Development
Drawing Title
BUILDING B ROOM LAYOUTS-LEVEL 6
BUILDING B
site cover 1,106.1 m²
LOBBY
611 2 bed 74.5 m²
612 2 bed +S 75.2 m²
613 2 bed +S 76.5 m²
614 2 bed +S 79.5 m²
615 2 bed 74.0 m²
616 2 bed 77.6 m²
617 1 bed 53.9 m²
618 1 bed +S 63.0 m²
619 2 bed +S 85.6 m²
620 2 bed 1B 68.6 m²
621 2 bed 67.3 m²
35.000


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BUILDING B ROOM LAYOUTS-LEVEL 7
BUILDING B
site cover 1,111.8 m²
LOBBY
711 3 bed 106.7 m²
712 3 bed 107.2 m²
713 1 bed 65.9 m²
714 1 bed +S 62.8 m²
715 3 bed 105.2 m²
716 1 bed 54.1 m²
717 1 bed +S 62.0 m²
718 2 bed +S 85.7 m²
719 2 bed 1B 68.9 m²
720 2 bed 67.3 m²


804
3 bed
106.6 m²
805
3 bed
807
1 bed + S
808
3 bed
809
3 bed
810
2 bed
BUILDING B
site cover 1,019.2 m²
LOBBY
Roof Deck
Roof above
155.4 m²
41.000

Appendix B: Traffic Noise Calculations

The 10-year design levels for traffic noise are calculated for the proposed development. Calculations are performed in accordance with Australian Standard AS2702-1984 Acoustics-Methods for the measurement of road traffic noise and 'Calculation of Road Traffic Noise', 1975-1988. Predicted levels for this report have been calculated using CRTN prediction models PEN3D2000 and are façade-adjusted. Traffic data was sourced from Veitch Lister, a professional transport planning consultancy. The assumptions that were made for the calculations included-

- Abbotsford Road 2014 33,352 vehicles / 24hr
- Abbotsford Road 2024 36,386 vehicles / 24hr
- Abbotsford Road Heavy Vehicles 8.7%
- Abbotsford Road Growth 0.1% pa
- Montpelier Road 2014 9266 vehicles / 24hr
- Montpelier Road 2024 9740 vehicles / 24hr
- Montpelier Road Heavy Vehicles 4.1%
- Montpelier Road Growth 0.05% pa
- 18hr traffic flow is 94% of 24hr
- Traffic speed 60 km/hr (posted)
- source height 0.5m
- a bitumen road surface with 1 mm texture depth
- Predicted design level for ML1, 2014, 70.3 dB(A) L10, 18hr façade adjusted
- Measured level at ML1, 2014, 70.2 dB(A) L10, 18hr façade adjusted including noise from all sources

Table B1: Model Validation (façade adjusted $L_{10\ (18hr)}$ values, dB(A))

Location	Survey	PEN3D	Difference
ML1	70.2	70.3	0.1

Note: The levels above give what is considered to be a good standard of fit between the road traffic model and measured levels. Results from the traffic noise model are presented in the following **figures, plates** and **tables**.

Figure B1: Receiver point locations, Level 1

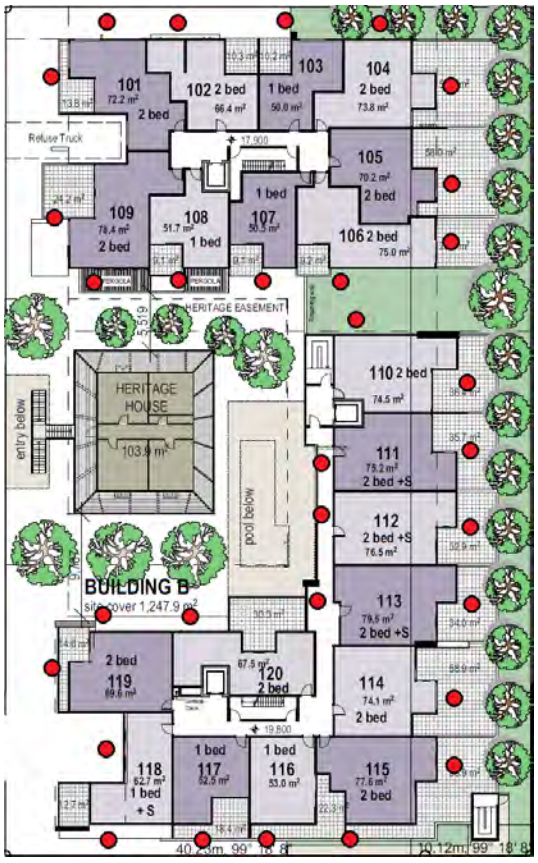

Figure B2: Receiver point locations, Level 2 - 6

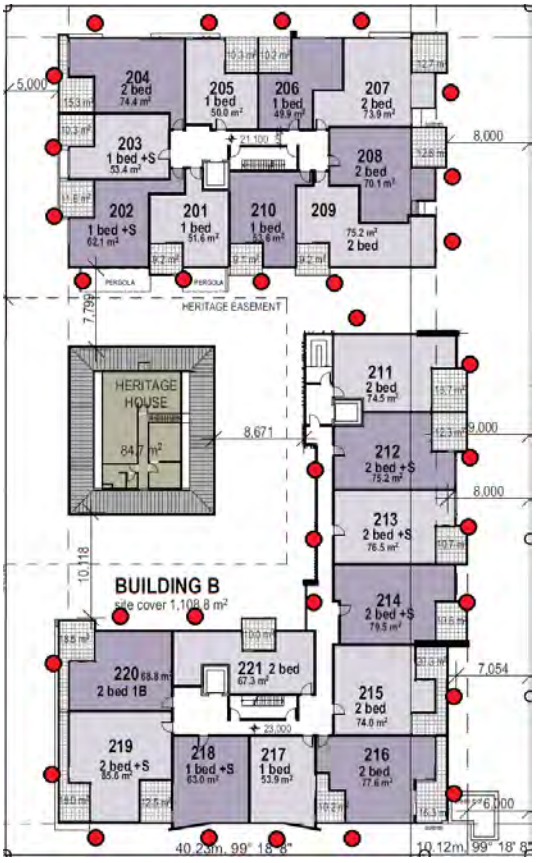

Figure B3: Receiver point locations, Level 7

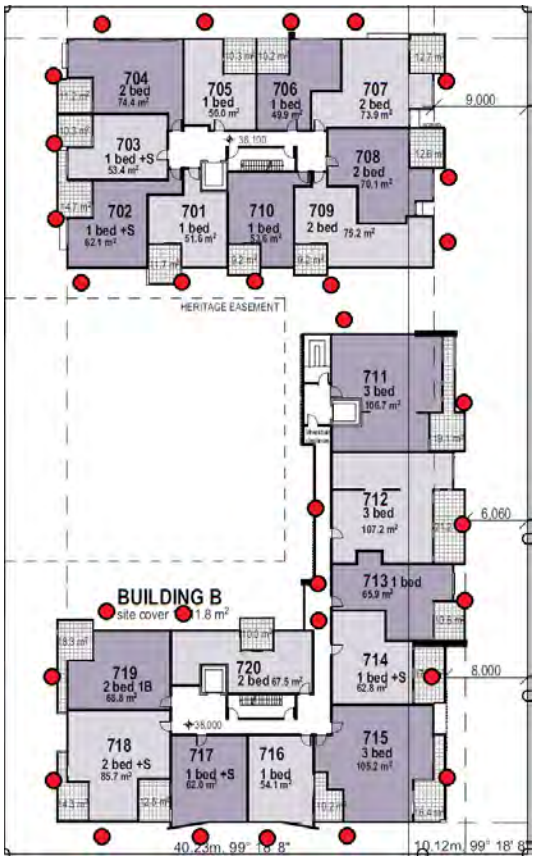

Figure B4: Receiver point locations, Level 8

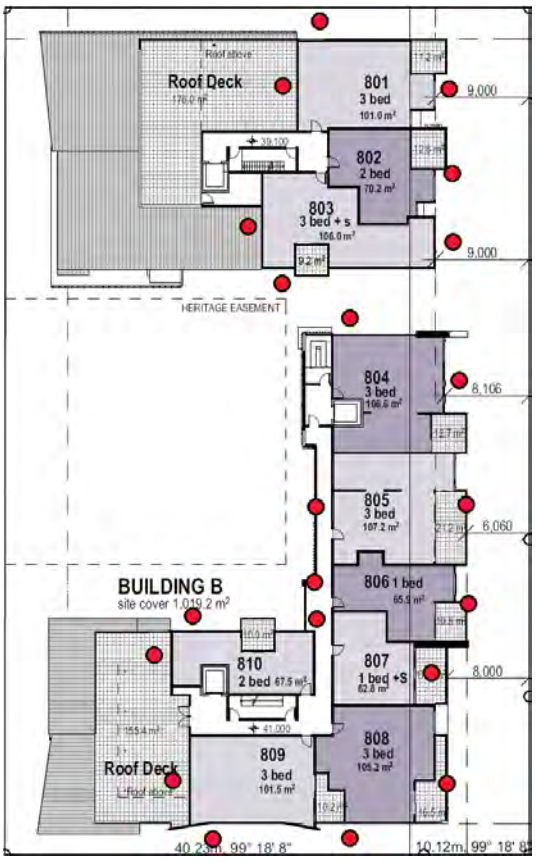

Plate B1: Traffic noise contours at Level 1, 2024 L10 (18hr) façade adjusted

Table B2: Receiver point calculations, Level 1, 2024 L10 (18hr) façade adjusted

POINT CALCULATIONS

Pen3D2000 V 1.9.32
Project Code:3007
Project Description: 23-39 Abbotsford and 28 Cintra Rd Bowen Hills

File:Z:\Projects 3000 - 3049\3007 23 -39 Abbotsford Road, Bowen Hills & 28 Cintra Road, Bowen Hills - Residential\Model\3007 CRTN 23-39 Abbotsford, Bowen Hills - 2024 Level 1.PEN

File Description: Level 1

Thursday 27 Nov, 2014 at 11:00:17
CoRTN Calculations
All road segments included. Segmentation angle: 10degrees. Road elevations apply.

Receptor	X Posn (m)	Y Posn (m)	Height (m)	L10(18hour) (dB(A))
101 West	120	327	19.4	74.2
101 North	125.8	330.9	19.4	71.1
102 North	133.2	329.8	19.4	69.6
103 North	143.5	328	19.4	68.1
104 North	150.6	326.8	19.4	67.6
104 East	156.3	319.9	19.4	58.4
105 East	155.1	312	19.4	51.9
106 East	153.9	305.6	19.4	51.7
106 South	146.6	303.6	19.4	64.6
107 South	136.3	304.9	19.4	68.0
108 South	129.9	306.1	19.4	68.9
109 South	121.5	307.6	19.4	71.5
109 West	117.8	312.6	19.4	74.2
110 North	146.9	298.8	20.5	62.3
110 East	153.9	293	20.5	51.8
111 West	139.3	287	20.5	67.3
111 East	152.8	285.6	20.5	51.6
112 West	138.3	280.3	20.5	66.6
112 East	151.4	277.6	20.5	52.1
113 West	137.3	273.2	20.5	65.9
113 East	150.4	271.2	20.5	52.1
114 East	147.2	263.4	20.5	52.0
115 East	146.3	255.5	20.5	60.7
115 South	138.8	250.7	20.5	67.6
116 South	129.6	252.3	20.5	68.5
117 South	122.6	253.3	20.5	69.3
118 South	115.8	254.3	20.5	70.1
118 West	111.4	259	20.5	72.5
119 West	111	270	20.5	73.8
119 North	118.5	274.4	20.5	70.6
120 North	126.6	273.3	20.5	68.4

Plate B2: Traffic noise contours at Level 2, 2024 L10 (18hr) façade adjusted

Table B3: Receiver point calculations, Level 2, 2024 L10 (18hr) façade affected

POINT CALCULATIONS

Pen3D2000 V 1.9.32
Project Code:3007
Project Description: 23-39 Abbotsford and 28 Cintra Rd Bowen Hills

File:Z:\Projects 3000 - 3049\3007 23 -39 Abbotsford Road, Bowen Hills & 28 Cintra Road, Bowen Hills - Residential\Model\3007 CRTN 23-39 Abbotsford, Bowen Hills - 2024 Level 2.PEN

File Description: Level 2

Thursday 27 Nov, 2014 at 11:02:44
CoRTN Calculations
All road segments included. Segmentation angle: 10degrees. Road elevations apply.

Receptor	X Posn (m)	Y Posn (m)	Height (m)	L10(18hour) (dB(A))
201 South	129.6	306.1	22.6	66.7
202 South	121.9	307.3	22.6	72.1
202 West	117.6	313	22.6	75.7
203 West	118	319.5	22.6	75.8
204 West	119.6	327.6	22.6	75.7
204 North	126.9	331.1	22.6	71.6
205 North	136.2	329.6	22.6	62.6
206 North	143.4	328.4	22.6	60.8
207 North	150.8	327.2	22.6	59.4
207 East	156.9	320.1	22.6	51.0
208 East	155.3	311.2	22.6	43.9
209 East	154.9	305.7	22.6	43.1
209 South	146.4	303	22.6	61.1
210 South	136.9	304.9	22.6	62.9
211 North	146.9	299.1	23.7	60.2
211 East	154.2	293	23.7	43.5
212 West	138.9	286.6	23.7	62.4
212 East	153	283.9	23.7	43.8
213 West	137.8	280.1	23.7	62.8
213 East	152	278.2	23.7	45.1
214 West	136.8	273.2	23.7	62.4
214 East	150.2	270.5	23.7	44.0
215 East	147.5	261.5	23.7	44.3
216 East	146.4	255.3	23.7	48.1
216 South	138.4	250.2	23.7	60.9
217 South	129.6	251.6	23.7	64.4
218 South	122.6	252.9	23.7	67.7
219 South	113.9	254.1	23.7	71.7
219 West	108.9	262.4	23.7	75.6
220 West	110.4	270.7	23.7	75.5
220 North	118.2	274.8	23.7	71.5
221 North	128.4	273	23.7	65.8

Plate B3: Traffic noise contours at Level 3, 2024 L10 (18hr) façade adjusted

Table B4: Receiver point calculations, Level 3, 2024 L10 (18hr) façade affected

POINT CALCULATIONS

Pen3D2000 V 1.9.32
Project Code:3007
Project Description: 23-39 Abbotsford and 28 Cintra Rd Bowen Hills

File:Z:\Projects 3000 - 3049\3007 23 -39 Abbotsford Road, Bowen Hills & 28 Cintra Road, Bowen Hills - Residential\Model\3007 CRTN 23-39 Abbotsford, Bowen Hills - 2024 Level 3.PEN

File Description: Level 3

Thursday 27 Nov, 2014 at 11:07:43
CoRTN Calculations
All road segments included. Segmentation angle: 10degrees. Road elevations apply.

Receptor	X Posn (m)	Y Posn (m)	Height (m)	L10(18hour) (dB(A))
301 South	129.6	306.1	25.6	67.4
302 South	121.9	307.3	25.6	72.1
302 West	117.6	313	25.6	75.4
303 West	118	319.5	25.6	75.5
304 West	119.6	327.6	25.6	75.4
304 North	126.9	331.1	25.6	71.7
305 North	136.2	329.6	25.6	67.3
306 North	143.4	328.4	25.6	64.4
307 North	150.8	327.2	25.6	61.5
307 East	156.9	320.1	25.6	54.5
308 East	155.3	311.2	25.6	45.0
309 East	154.9	305.7	25.6	44.1
309 South	146.4	303	25.6	62.1
310 South	136.9	304.9	25.6	63.8
311 North	146.9	299.1	26.7	61.1
311 East	154.2	293	26.7	44.7
312 West	138.9	286.6	26.7	63.2
312 East	153	283.9	26.7	44.9
313 West	137.8	280.1	26.7	63.7
313 East	152	278.2	26.7	46.4
314 West	136.8	273.2	26.7	63.3
314 East	150.2	270.5	26.7	45.0
315 East	147.5	261.5	26.7	45.6
316 East	146.4	255.3	26.7	51.5
316 South	138.4	250.2	26.7	62.7
317 South	129.6	251.6	26.7	66.5
318 South	122.6	252.9	26.7	69.2
319 South	113.9	254.1	26.7	71.8
319 West	108.9	262.4	26.7	75.3
320 West	110.4	270.7	26.7	75.2
320 North	118.2	274.8	26.7	71.6
321 North	128.4	273	26.7	66.5

Plate B4: Traffic noise contours at Level 4, 2024 L10 (18hr) façade adjusted

Table B5: Receiver point calculations, Level 4, 2024 L10 (18hr) façade affected

POINT CALCULATIONS

Pen3D2000 V 1.9.32
Project Code:3007
Project Description: 23-39 Abbotsford and 28 Cintra Rd Bowen Hills

File:Z:\Projects 3000 - 3049\3007 23 -39 Abbotsford Road, Bowen Hills & 28 Cintra Road, Bowen Hills - Residential\Model\3007 CRTN 23-39 Abbotsford, Bowen Hills - 2024 Level 4.PEN

File Description: Level 4

Thursday 27 Nov, 2014 at 11:09:11
CoRTN Calculations
All road segments included. Segmentation angle: 10degrees. Road elevations apply.

Receptor	X Posn (m)	Y Posn (m)	Height (m)	L10(18hour) (dB(A))
401 South	129.6	306.1	28.6	67.9
402 South	121.9	307.3	28.6	72.0
402 West	117.6	313	28.6	75.0
403 West	118	319.5	28.6	75.1
404 West	119.6	327.6	28.6	75.0
404 North	126.9	331.1	28.6	71.5
405 North	136.2	329.6	28.6	69.5
406 North	143.4	328.4	28.6	66.8
407 North	150.8	327.2	28.6	64.8
407 East	156.9	320.1	28.6	58.0
408 East	155.3	311.2	28.6	46.6
409 East	154.9	305.7	28.6	45.8
409 South	146.4	303	28.6	62.7
410 South	136.9	304.9	28.6	64.5
411 North	146.9	299.1	29.7	61.6
411 East	154.2	293	29.7	47.1
412 West	138.9	286.6	29.7	63.9
412 East	153	283.9	29.7	47.6
413 West	137.8	280.1	29.7	64.2
413 East	152	278.2	29.7	48.2
414 West	136.8	273.2	29.7	63.8
414 East	150.2	270.5	29.7	47.4
415 East	147.5	261.5	29.7	48.3
416 East	146.4	255.3	29.7	57.9
416 South	138.4	250.2	29.7	65.3
417 South	129.6	251.6	29.7	68.0
418 South	122.6	252.9	29.7	69.7
419 South	113.9	254.1	29.7	71.6
419 West	108.9	262.4	29.7	74.9
420 West	110.4	270.7	29.7	74.8
420 North	118.2	274.8	29.7	71.6
421 North	128.4	273	29.7	67.0

Plate B5: Traffic noise contours at Level 5, 2024 L10 (18hr) façade adjusted

Table B6: Receiver point calculations, Level 5, 2024 L10 (18hr) façade affected

POINT CALCULATIONS

Pen3D2000 V 1.9.32
Project Code:3007
Project Description: 23-39 Abbotsford and 28 Cintra Rd Bowen Hills

File:Z:\Projects 3000 - 3049\3007 23 -39 Abbotsford Road, Bowen Hills & 28 Cintra Road, Bowen Hills - Residential\Model\3007 CRTN 23-39 Abbotsford, Bowen Hills - 2024 Level 5.PEN

File Description: Level 5

Thursday 27 Nov, 2014 at 11:10:45
CoRTN Calculations
All road segments included. Segmentation angle: 10degrees. Road elevations apply.

Receptor	X Posn (m)	Y Posn (m)	Height (m)	L10(18hour) (dB(A))
501 South	129.6	306.1	31.6	69.5
502 South	121.9	307.3	31.6	71.7
502 West	117.6	313	31.6	74.6
503 West	118	319.5	31.6	74.7
504 West	119.6	327.6	31.6	74.6
504 North	126.9	331.1	31.6	71.2
505 North	136.2	329.6	31.6	69.5
506 North	143.4	328.4	31.6	68.2
507 North	150.8	327.2	31.6	66.6
507 East	156.9	320.1	31.6	59.5
508 East	155.3	311.2	31.6	48.2
509 East	154.9	305.7	31.6	47.5
509 South	146.4	303	31.6	63.1
510 South	136.9	304.9	31.6	66.0
511 North	146.9	299.1	32.7	62.0
511 East	154.2	293	32.7	48.3
512 West	138.9	286.6	32.7	65.0
512 East	153	283.9	32.7	48.7
513 West	137.8	280.1	32.7	64.8
513 East	152	278.2	32.7	49.2
514 West	136.8	273.2	32.7	64.2
514 East	150.2	270.5	32.7	48.8
515 East	147.5	261.5	32.7	49.2
516 East	146.4	255.3	32.7	58.5
516 South	138.4	250.2	32.7	66.6
517 South	129.6	251.6	32.7	68.7
518 South	122.6	252.9	32.7	69.7
519 South	113.9	254.1	32.7	71.3
519 West	108.9	262.4	32.7	74.5
520 West	110.4	270.7	32.7	74.4
520 North	118.2	274.8	32.7	71.3
521 North	128.4	273	32.7	67.4

Plate B6: Traffic noise contours at Level 6, 2024 L10 (18hr) façade adjusted

Table B7: Receiver point calculations, Level 6, 2024 L10 (18hr) façade affected

POINT CALCULATIONS

Pen3D2000 V 1.9.32
Project Code:3007
Project Description: 23-39 Abbotsford and 28 Cintra Rd Bowen Hills

File:Z:\Projects 3000 - 3049\3007 23 -39 Abbotsford Road, Bowen Hills & 28 Cintra Road, Bowen Hills - Residential\Model\3007 CRTN 23-39 Abbotsford, Bowen Hills - 2024 Level 6.PEN

File Description: Level 6

Thursday 27 Nov, 2014 at 11:11:35
CoRTN Calculations
All road segments included. Segmentation angle: 10degrees. Road elevations apply.

Receptor	X Posn (m)	Y Posn (m)	Height (m)	L10(18hour) (dB(A))
601 South	129.6	306.1	34.6	69.3
602 South	121.9	307.3	34.6	71.5
602 West	117.6	313	34.6	74.3
603 West	118	319.5	34.6	74.3
604 West	119.6	327.6	34.6	74.3
604 North	126.9	331.1	34.6	71.0
605 North	136.2	329.6	34.6	69.3
606 North	143.4	328.4	34.6	68.2
607 North	150.8	327.2	34.6	67.6
607 East	156.9	320.1	34.6	60.5
608 East	155.3	311.2	34.6	49.8
609 East	154.9	305.7	34.6	49.5
609 South	146.4	303	34.6	63.5
610 South	136.9	304.9	34.6	67.0
611 North	146.9	299.1	35.7	62.2
611 East	154.2	293	35.7	49.9
612 West	138.9	286.6	35.7	66.8
612 East	153	283.9	35.7	49.8
613 West	137.8	280.1	35.7	66.5
613 East	152	278.2	35.7	50.2
614 West	136.8	273.2	35.7	64.7
614 East	150.2	270.5	35.7	50.2
615 East	147.5	261.5	35.7	50.2
616 East	146.4	255.3	35.7	59.9
616 South	138.4	250.2	35.7	67.5
617 South	129.6	251.6	35.7	68.7
618 South	122.6	252.9	35.7	69.5
619 South	113.9	254.1	35.7	71.0
619 West	108.9	262.4	35.7	74.1
620 West	110.4	270.7	35.7	74.1
620 North	118.2	274.8	35.7	71.0
621 North	128.4	273	35.7	68.3

Plate B7: Traffic noise contours at Level 7, 2024 L10 (18hr) façade adjusted

Table B8: Receiver point calculations, Level 7, 2024 L10 (18hr) façade affected

POINT CALCULATIONS

Pen3D2000 V 1.9.32
Project Code:3007
Project Description: 23-39 Abbotsford and 28 Cintra Rd Bowen Hills

File:Z:\Projects 3000 - 3049\3007 23 -39 Abbotsford Road, Bowen Hills & 28 Cintra Road, Bowen Hills - Residential\Model\3007 CRTN 23-39 Abbotsford, Bowen Hills - 2024 Level 7.PEN

File Description: Level 7

Thursday 27 Nov, 2014 at 11:17:12
CoRTN Calculations
All road segments included. Segmentation angle: 10degrees. Road elevations apply.

Receptor	X Posn (m)	Y Posn (m)	Height (m)	L10(18hour) (dB(A))
701 South	129.6	306.1	37.6	69.1
702 South	121.9	307.3	37.6	71.2
702 West	117.6	313	37.6	73.9
703 West	118	319.5	37.6	73.9
704 West	119.6	327.6	37.6	73.9
704 North	126.9	331.1	37.6	70.7
705 North	136.2	329.6	37.6	69.1
706 North	143.4	328.4	37.6	68.1
707 North	150.8	327.2	37.6	67.6
707 East	156.9	320.1	37.6	60.6
708 East	155.3	311.2	37.6	51.4
709 East	154.9	305.7	37.6	50.8
709 South	146.4	303	37.6	64.6
710 South	136.9	304.9	37.6	67.8
711 North	146.9	299.1	38.7	62.4
711 East	153.1	291.6	38.7	51.6
712 West	138.4	282.4	38.7	66.5
712 East	150.3	278.9	38.7	51.3
713 West	137.1	274.3	38.7	66.4
713 East	150.7	271.7	38.7	51.6
714 West	136.7	270.5	38.7	64.3
714 East	146	264.9	38.7	50.7
715 East	146.4	255.3	38.7	60.4
715 South	138.4	250.2	38.7	67.7
716 South	129.6	251.6	38.7	68.5
717 South	122.6	252.9	38.7	69.3
718 South	113.9	254.1	38.7	70.8
718 West	108.9	262.4	38.7	73.7
719 West	110.4	270.7	38.7	73.7
719 North	118.2	274.8	38.7	70.8
720 North	128.4	273	38.7	68.2

Plate B8: Traffic noise contours at Level 8, 2024 L10 (18hr) façade adjusted

Table B9: Receiver point calculations, Level 8, 2024 L10 (18hr) façade affected

POINT CALCULATIONS

Pen3D2000 V 1.9.32
Project Code:3007
Project Description: 23-39 Abbotsford and 28 Cintra Rd Bowen Hills

File:Z:\Projects 3000 - 3049\3007 23 -39 Abbotsford Road, Bowen Hills & 28 Cintra Road, Bowen Hills - Residential\Model\3007 CRTN 23-39 Abbotsford, Bowen Hills - 2024 Level 8.PEN

File Description: Level 8

Thursday 27 Nov, 2014 at 11:18:14
CoRTN Calculations
All road segments included. Segmentation angle: 10degrees. Road elevations apply.

Receptor	X Posn (m)	Y Posn (m)	Height (m)	L10(18hour) (dB(A))
801 West	141.8	322.8	40.6	68.0
801 North	149.6	327	40.6	67.8
801 East	156.6	320	40.6	66.6
802 East	155.3	311.2	40.6	66.5
803 East	154.1	305.2	40.6	66.9
803 South	144.2	303.7	40.6	67.8
803 West	136.5	310.3	40.6	68.0
804 North	146.7	298.7	41.7	66.9
804 West	139.4	288.5	41.7	67.8
804 East	153	291.6	41.7	66.7
805 West	138.2	281.9	41.7	67.8
805 East	150.2	278.8	41.7	66.9
806 West	137.3	274.3	41.7	68.0
806 East	149.9	270.1	41.7	66.7
807 West	136.8	270.5	41.7	67.8
807 East	145.9	265.3	41.7	67.3
808 East	146.5	256.9	41.7	67.3
808 South	139	250.6	41.7	67.8
809 South	126.6	252.5	41.7	68.4
809 West	120.6	258.9	41.7	69.8
810 West	121.2	270.7	41.7	70.0
810 North	127.4	273	41.7	69.0

Appendix C: Building Construction – QDC MP4.4

This Annex is based on the building construction guidelines of 'Queensland Development Code Mandatory Part 4.4 – Buildings in Transport Noise Corridors'. The Code provides information for new houses, townhouses, units, hotel and motels (Class 1-4 buildings) as well as renovations at any existing Class 1 to 4 buildings achieve certain levels of noise mitigation through the use of appropriate materials for floors, walls, roofs, windows and doors for the relevant noise category presented in **Section 4** of this Report.

Under the Department of Local Government and Planning criteria the site is considered to be in the following Categories based on the measured or calculated L10, 18hr value or distance from the road, depending on the property definition given by QDC. The relationships are set out in **Table C1**:

Table C1: Noise Categories, related to L10, 18hr values.

Noise Category	Level of transport noise * (LA10, 18hr) for State-controlled roads and designated local government roads	Single event maximum noise* (LAmax) for railway land
Category 4	≥ 73 dB(A)	≥ 85 dB(A)
Category 3	68 - 72 dB(A)	80 – 84 dB(A)
Category 2	63 – 67 dB(A)	75 – 79 dB(A)
Category 1	58 - 62 dB(A)	70 - 74 dB(A)
Category 0	≤ 57 dB(A)	≤ 69 dB(A)

Note* the sound levels are measured at 1 metre from the façade.

Performance Requirements	**Acceptable Solutions**
Residential Buildings	
P1 Habitable rooms in residential buildings located in a transport noise corridor are adequately protected from transport noise to safeguard occupants' health and amenity.	**A1** The external envelope of habitable rooms in a residential building located in a transport noise corridor complies 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: c) Using materials specified in **Schedule 2**; **OR** d) Using materials with manufacturer's specifications that, in combination, achieve the minimum R_w value for the relevant building component and acceptable noise category.

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 1.8m^2)
			35 (where total area of glazing for a habitable room is less than or equal to 1.8m^2)
		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 1.8m^2)
			32 (where total area of glazing for a habitable room is less than or equal to 1.8m^2)
		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 1.8m^2)
			24 (where total area of glazing for a habitable room is less than or equal to 1.8m^2)
		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 constructions
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 constructions
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/m^3 or 50mm thick polyester insulation with a density of 20kg/m^3 in the cavity. **OR** Two leaves of clay brick masonry at least 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 11kg/m^3 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 constructions
External walls	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 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 11kg/m^3 positioned between studs; and (ii) 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.
	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 the 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.

Component of building's external envelope	Minimum R_w	Acceptable forms of constructions
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/m^3 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/m^3 or polyester insulation at least 50mm thick with a density of at least 20kg/m^3 in the cavity.
	41	Concrete or terracotta tile or sheet metal 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/m^3 or polyester insulation at least 50mm thick with a density of at least 20kg/m^3 in the cavity **OR** Concrete suspended slab at least 100mm thick.
	38	Concrete or terracotta tile or sheet metal 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 11kg/m^3
	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/m^3 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/m^3 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.

Component of building's external envelope	Minimum R_w	Acceptable forms of constructions
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
	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/m^2, or (iv) Solid core timber door not less than 35mm thick fitted with full perimeter *acoustically rated seals.*

Appendix D: Statement of Qualifications

The Signatory to this Report is Robert (Bob) Thorne, Principal, Noise Measurement Services Pty Ltd, Brisbane

Statement of Qualifications as a 'Suitably Qualified Person' pursuant to Part 5 of the Building Regulation 2006.

Bob is the principal of Noise Measurement Services Pty Ltd, an environmental consultancy based in Brisbane. He is an experienced expert witness and has wide professional and work experience in environmental noise investigations and risk assessment, developing environmental noise management systems and land use planning.

Academic background:

- PhD in Health Science ('Assessing intrusive noise and low amplitude sound', Massey University, 2007)
- New Zealand Diploma in Science (Noise Management, 1985)
- Diploma in Acoustics and Noise Control (UK Institute of Acoustics 1985; specialist subjects: Architectural Acoustics, Law & Administration)
- Royal Society for the Promotion of Health Diploma in Health Engineering (1981)
- Royal Society of Health Diploma in Air Pollution Control (1978)

Experience Summary:

Bob's work undertaken for Noise Measurement Services Pty Ltd involves specialised acoustical and psychoacoustical investigations for public authority, commercial and industrial clients. Current technical research work involves using 'smart' technology for intrusive noise assessment and environmental monitoring systems with simplified data analysis and information retrieval protocols. A specific application is personalised sound reinforcement for hearing assistive devices. Current psychoacoustic research involves investigation into sleep disturbance and adverse health effects experienced by individuals exposed to low amplitude intrusive sound. General acoustical work includes environmental noise surveys, social surveys and analysis, health impact assessment and noise impact prediction modeling as follows.

- Presenting evidence as an expert witness in noise assessment
- Assessment of noise from industrial and mining activities onto noise sensitive places
- Mine site, blasting and drilling assessments
- Environmental noise impact assessment and prediction modeling for residential estates and residential developments
- Traffic noise impact assessments for residential developments
- Airport noise assessments in New Zealand, Australia and Thailand
- Remote telemetry systems for noise monitoring
- Industrial noise impact assessments and associated noise management plans
- Industrial surveys for occupational noise assessment
- Vehicle noise compliance (ADR)
- Research investigations into the effects of various noise sources on sensitive and non-sensitive communities
- Preparation and presentation of training courses in community and individual noise impact analysis
- Intrusive noise: its definition, measurement and assessment
- Wind farm noise assessment
- Development of personalized sound reinforcement and sound quality instrumentation and protocols

Appendix E: Glossary

Event maximum sound pressure level (LA%,adj,T), L01

The L01 level is calculated as the noise level equalled and exceeded for 1% of the measurement time, for example 9 seconds in any 15 minute interval. L01 is an appropriate level to characterise single events, such as from train bypass.

In this Report, the measured L01 levels for day/evening/night are not averaged but are arranged from low to high in the relevant day/evening/night interval and the value that is found at the 90th percentile (L10 of L01 sample) in the interval is recorded as its "L01" level.

Average maximum sound pressure level (LA%,adj, T), L10

The "L10" level is an indicator of "steady-state" noise or intrusive noise conditions from traffic, music and other relatively non-impulsive noise sources. The L10 level is calculated as the noise level equalled and exceeded for 10% the measurement time, for example 90 seconds in any 15 minute interval. The measured L10 time-intervals for day/evening/night are arithmetically averaged to present the "average maximum" levels of the environment for day/evening/night. The level can be adjusted for tonality or impulsiveness.

Background sound pressure level (LA90,T), L90

Commonly called the "L90" or "background" level and is an indicator of the quietest times of day, evening or night. The L90 level is calculated as the noise level equalled and exceeded for 90% the measurement time. The measured L90 time-intervals are arithmetically averaged to present the "average background" levels of the environment for day/evening/night. The level is recorded in the absence of any noise under investigation. The level is not adjusted for tonality or impulsiveness.

Equivalent Continuous or time average sound pressure level (LAeq,T), Leq

Commonly called the "Leq" level it is the logarithmic average noise level from all sources far and near. The maximum 1-hour levels within the day/evening/night time intervals are referenced for building design. The level can be adjusted for tonality.

Façade-adjusted level

A sound level that is measured at a distance of 1.0 metre from a wall or facade. The level is nominally 2.5 dB higher than the free-field level.

Free-field level

A sound level that is measured at a distance of more than 3.5 metres from a wall or facade.

Weighted Sound Reduction Index, Rw

A single number value used to compare the sound reduction index of building elements. Similar to the Sound Transmission Class (STC) rating that is still in common use. Rw and STC are not identical though may be considered, for most applications, as being interchangeable. A high Rw indicates high sound reduction.