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Proposed Mixed-Use Development
37 Mayne Road, Bowen Hills

ENVIRONMENTAL NOISE IMPACT ASSESSMENT

Prepared For:

Metro (Bowen Hills No.3) Pty Ltd

Date Prepared:

3rd December, 2010

ttmref: 27242 R02 37 Mayne Road Bowen Hills RTN ENV RAIL

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1. INTRODUCTION

The following report is in response to a request by Metro (Bowen Hills No.3) Pty Ltd to prepare an environmental noise impact assessment for the proposed mixed-use development located at 37 Mayne Road, Bowen Hills. This report will form part of the development application for consideration by ULDA (Urban Land Development Authority).

In undertaking this assessment, the following noise data was recorded:

- Unattended road traffic noise monitoring,
- Unattended ambient noise monitoring,
- Attended train passby measurements,
- Observations of offsite activity,
- Attended noise measurements of offsite mechanical plant/activities.

Through modelling, predictions of noise impacts were produced. Based upon the predicted noise levels, recommendations regarding acoustic treatments and management controls are specified.

2. SITE DESCRIPTION

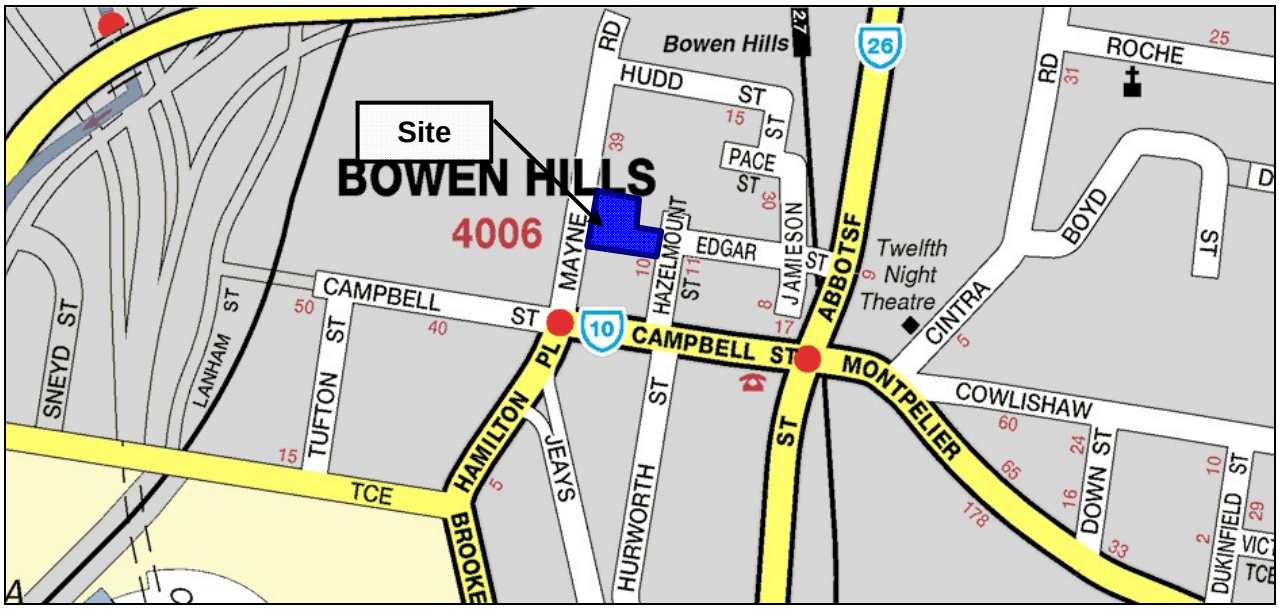
2.1. Site Location

The site is described by the following:

37 Mayne Road, Bowen Hills,
Lot 1 on RP110079.

Refer to Figure 1 for the site location.

Figure 1: Site Location (Not to Scale).



A comprehensive site survey was conducted on the 16th of July, 2010. The survey identified the following:

- Located west across Mayne Road is *"The Courier Mail, Sunday Mail and The Australian"* newspaper printing building separating the development from the Exhibition railway line (and depot), the *"Clem7"* tunnel and *Inner City Bypass*.
- A proposed 30 storey commercial/residential building is located adjacent the southern boundary separating the site from Campbell Street and a mixture of single and two storey commercial premises.
- A car park is located adjacent the eastern boundary separating the site from commercial premises and the Bowen Hills railway station (a passenger train line only).
- Located adjacent the northern boundary are light industry (warehousing) premises including a bathroom supply shop, *"Cyclone Shower Screens"* and furniture wholesalers.

2.2. Proposal

The proposed development consists of the following:

- A total of 467sqm of retail space located on the ground and first floor levels including the manager's office.
- 180 tenant and visitor parking spaces (including motorcycles) are located over 5 levels.
- Levels 3 – 26 contain a total of 242 residential apartments.
- Communal recreation areas are located on levels 5 and 25.
- Designated waste collection and loading bay areas are located on level 1.

Site access is proposed via Hazelmount Street and Mayne Road.

As hours of operation for the development are not known, this assessment has assumed 24 hours/7days.

2.3. Description of Surrounding Environment

The site is primarily affected by road traffic noise associated with the surrounding road network and the railway lines to the west and east. Commercial office and retail/light industry (warehousing) premises in all directions may also affect the acoustic amenity. Activities associated with these premises are addressed in this assessment with results presented in Section 6.

A night time survey was conducted on the 18th of May, 2010 between 11pm and 11:30pm to determine the potential noise impacts from offsite mechanical plant. During the survey, mechanical plant associated with the commercial buildings in all directions was inaudible at the site and were not considered in this assessment.

2.4. Affected Receivers

The area surrounding the site comprises a mixture of uses including light industrial, commercial office/retail premises and residential land uses. This assessment will focus on the nearest residential receivers described as follows:

Receiver 1: Located to the south at 29 Campbell Street is a proposed 30 storey mixed-use development (levels 3 – 30 are residential). A distance of approximately 10 metres separates the apartments from the nearest site boundary.

Receiver 2: Located to the north east at Hudd Street is a single storey highset dwelling. A distance of approximately 110metres separates the development from the nearest façade of the dwelling.

Refer to Figure 2 for the location of the nearest receivers in relation to the site.

Figure 2: Nearest Affected Noise Sensitive Receivers.

If compliance can be achieved at receivers 1 and 2, all remaining locations are predicted to comply.

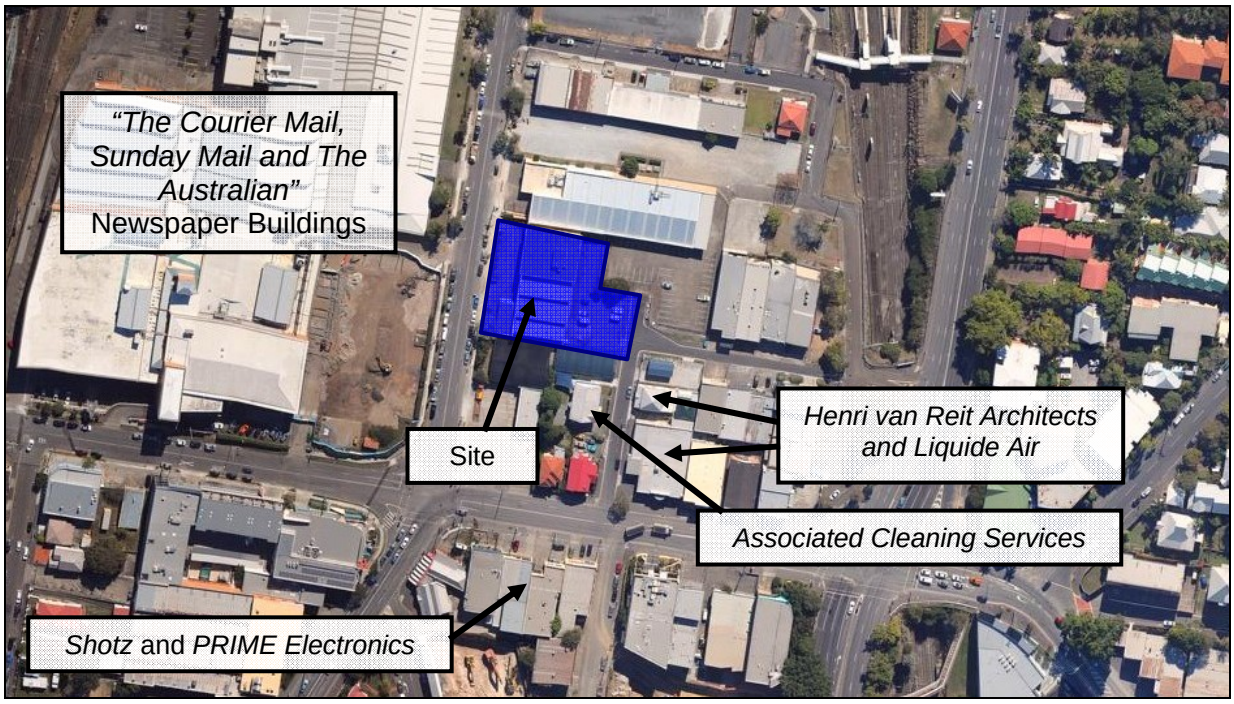
2.5. Offsite Commercial Activities

To adequately assess the site, consideration must be given to the activities associated with commercial office/retail and light industry (warehousing) premises located in the vicinity of the development. During the site survey, the following offsite premises were identified as having the potential to impact the acoustic amenity:

- *Associated Cleaning Services*; operating hours range from 7am to 6pm Monday to Sunday.
- *"The Courier Mail, Sunday Mail and The Australian"* Newspaper; operating hours are 24 hours 7 days.
- *Shotz and PRIME Electronics;* operating hours range from 8am to 5pm Monday to Saturday.

Refer to Figure 3 for the location of the nearest commercial premises.

Figure 3: Nearest Commercial Premises.



An assessment of the offsite activities which have the potential to impact the site was conducted with the results of the analysis presented in Section 6.3.

3. EQUIPMENT

The following equipment was used to record road traffic and ambient noise levels including train passby measurements in the vicinity of the site:

- Three ARL EL316 Environmental Noise Monitors (SN# 16-707-016, 16-707-040 and 16-207-011);
- BSWA Technology Co.Ltd CA106 Acoustical Calibrator (SN # 44095);
- RION NA-28 Sound Level Meter (SLM) (SN# 01060055); and
- RION NA-74 Sound Calibrator (SN# 35073393).

The environmental noise monitors and sound level meter hold current NATA Laboratory Certification and were field calibrated before and after the monitoring sessions with no significant drift from the reference signal.

4. METHODOLOGY

4.1. Unattended Road Traffic and Ambient Noise Monitoring

ARL EL316 environmental noise monitors were placed at the following locations to measure road traffic and ambient noise levels:

- In the front yard of 16 Hamilton Place in a free field position 4.5metres from the road;
- On the corner of 1 Abbotsford Road within 2 metres of a façade 7.5metres from the road; and
- Adjacent the Inner City Bypass (northern end of Mayne Road) in a free field position 7metres from the nearest lane of the ICB.

The monitors were set to record road traffic and ambient noise from the 8th to the 16th of June and 16th to the 27th of July, 2010 as follows:

- "A" weighting,
- "Fast" response, and
- 15 minute statistical interval.

The statistical interval was chosen to allow application of AS/NZS 2107:2000 *'Acoustics – Recommended Design Sound Level and Reverberation Times for Building Interiors'*.

Road traffic noise monitoring was conducted generally in accordance with Australian Standard AS2702:1984 *'Acoustics - Methods for the measurement of road traffic noise'*.

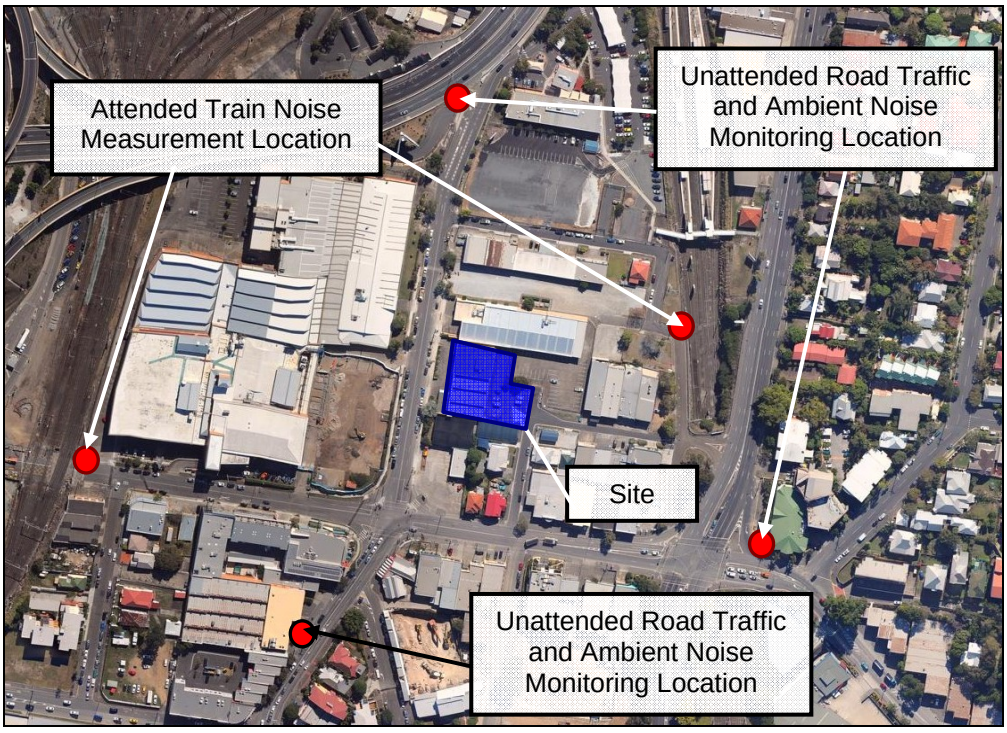
Rainfall was recorded on the 20th and 26th of July, 2010. The data collected on these days was omitted from the analysis. Weather conditions for the remaining days were generally fine with light wind speeds.

4.2. Onsite/Offsite Activity Noise Measurements

Typical noise levels associated with onsite and offsite activities were taken from similar investigations conducted by TTM Acoustics. All measurements were conducted generally in accordance with Australian Standard AS1055:1997 *"Acoustics – Description & Measurement of Environmental Noise"*.

Refer to Figure 4 for the location of the unattended noise monitors.

Figure 4: Unattended Noise Monitoring Locations.



4.3. Attended Train Noise Monitoring

Attended noise measurements of train passes were conducted on the 18th of May and the 24th of November, 2010. The SLM was positioned in the vicinity of the site to record train noise levels with direct line of sight to the line. The SLM was positioned at the following locations:

- Approximately 7 metres from the nearest Exhibition railway line and 1.2metres above ground level.
- Approximately 3 metres from the nearest Bowen Hills railway line and 10metres above the track level.

Noise measurements were conducted as follows:

- "A" weighting;
- "Fast" response; and
- 1 – 5 minute statistical interval
- Statistics recorded: L_{Amax}, SEL (L_{AE}), L_{AEQ}

Note: the SEL or L_{AE} is the sound exposure level. A parameter closely related to L_{Aeq} for assessment of train events that have similar characteristics but are of different duration. The L_{AE} value contains the same amount of acoustic energy over a 'normalised' one second period as the actual noise event under consideration.

Based on the measured L_{AE} level, calculations are conducted utilising the number of trains per day to determine the $L_{Aeq,24hr}$ noise impact at proposed residential receivers.

The measurements were conducted generally in accordance with Australian Standard AS 2377:2002 *'Acoustics – Methods for the Measurement of Railbound Vehicle Noise'*.

5. NOISE ASSESSMENT CRITERIA

As the Urban Land Development Authority (ULDA) does not have specific noise criteria assessment procedures, we are recommending the application of the Brisbane City Council and Queensland Transport assessment requirements. The criteria applied to the site is divided into 4 sections (5.1 – 5.4) and details the relevant assessment methods for road traffic, onsite/offsite activities, rail noise and mechanical plant.

5.1. Road Traffic Noise – Brisbane City Council

The road traffic noise criteria applied to the proposed development is pursuant to the Brisbane City Council's (BCC) City Plan 2000 *"Noise Impact Assessment Planning Scheme Policy"* (NIAPSP). The assessment methodology requires that road traffic noise is investigated for the planning horizon. This assessment has considered road traffic for the year 2021. Road traffic noise levels are assessed as an outdoor level in recreation areas, as internal noise levels for living, work and sleeping areas.

The internal noise limits are the recommended design sound levels from Australian/New Zealand Standard AS/NZS2107:2000 and are presented in Table 1.

Since AS/NZS2107:2000 does not include limits for outdoor recreation areas, the BCC City Plan Noise Impact Assessment Planning Policy states that the L_{eq} averaged over a 24 hour period should not exceed 55 dB(A). The maximum $L_{Aeq\ 1hr}$ for any hour should not exceed 60 dB(A).

Table 1: Internal Noise Limits for Residential Dwellings from AS/NZS 2107:2000.

Type of Occupancy / Activity	**Recommended Design Sound Level, L_{Aeq} dB(A)**
7. RESIDENTIAL BUILDINGS	
Houses and apartments near major roads –	
Living areas	35 – 45
Sleeping areas	30 – 40
Work areas	35 – 45

Table 2 outlines the assessment criteria based upon achieving the noise level objectives for Brisbane City Council.

Table 2: Road Traffic Noise Assessment Criteria.

Description	**Predicted SPL dB(A)**
Communal Recreational Areas	55dB(A) $L_{Aeq\ (24hour)}$ (Free Field)
Private Recreational Areas	55dB(A) $L_{Aeq\ (24hour)}$ (Façade Corrected)
External façade	60dB(A) $L_{Aeq\ (1hour)}$ (Façade Corrected)
Internal noise limits	As per Table 1

5.2. Onsite and Offsite Activity Noise – Brisbane City Council

Brisbane City Council require onsite activities (i.e. vehicle movements excluding mechanical plant) be assessed in accordance with NIAPSP. The assessment should detail the location, extent and construction specifications for proposed attenuation measures including all assumptions and methodologies used.

Noise criteria associated with the proposed site activities are pursuant to the NIAPSP. In essence, NIAPSP requires the following:

- Assessment of immission[1] and emission[2].

  Assessment of immission and emission levels are grouped into 3 fundamental methodologies:

  1) **Comparison of like parameters or descriptors** – Comparison, using a suitable sound descriptor, of the ambient sound character of an area without the development to that resulting with the development.
  2) **Application of AS/NZ2107** – Comparison with a defined set of sound pressure levels, for specified indoor areas occupied by people set out in Table 1 of AS/NZ2107:1997.
  3) **Sleep awakenings** – Comparison with sleep levels. This type of assessment can be conducted using sound exposure levels (L_{AE}) to compare to the FICAN 1997 SEL(L_{AE})/percentage awakening curve

We recommend applying the comparison of like parameters for assessment of noise from all noise sources associated with the development as follows:

- L_{A10}[3] V^{s} L_{A10} for transient noise sources (i.e. waste collection, car parking and loading dock). NIAPSP allows the existing L_{A10} level to be exceeded by 3 dB by any proposed activities (taking into account the number of discreet noise events, character of the noise and time of occurrence);
- Application of AS/NZS2107:2000 for control of mechanical plant noise.

The use of L_{A10} levels is recommended as it reflects the average maximum level of noise associated with a source. The use of average maximum is referenced as an acceptable assessment method of transient noise sources in the "Noise Measurement Manual" produced by the Queensland Department of Environment & Heritage (2nd Edition, 1995). For short duration noise events, the application of AS/NZS2107:2000 (see point (2) above) is not considered appropriate, as it applies to continuous noise, such as mechanical plant.

Based on the above assessment requirements, the assessment criteria for residential receivers in the vicinity of the site are detailed in Table 3.

Table 3: Assessment Criteria for Residential Receivers.

Time Period	**Criteria L_{A10} dB(A)**
Daytime (7am – 6pm)	**75** (L_{A10} +3dB(A))
Evening (6pm – 10pm)	**72** (L_{A10} +3dB(A))
Night time (10pm – 7am)	**69** (L_{A10} +3dB(A))

Refer to **Appendix B** for graphical representation of measured noise levels.

[1] Immission is the noise received by the development when it is immersed in an ambient sound environment.
[2] Emission is the noise emitted by activities within the development.
[3] L10 level is the level exceeded for 10% of the measurement time, and often termed the "average maximum"

Sleep Disturbance Criteria

Criteria for sleep disturbance is addressed under the is addressed in the User's Guide to the Environmental Protection (Noise) Policy, and states the following:

> *'In the case of fluctuating noise, the maximum level is correlated to sleep disturbance, rather than the ambient level. For good sleep, maximum noise levels of 45 dB(A) to 50 dB(A) should not be heard in a bedroom more than 10 to 15 times a night.*
>
> *'Where noise is continuous, the ambient level during the sleeping period should not exceed 30 – 35 dB(A) indoors in a bedroom.'*

The research concerning the effect of maximum noise levels of 45 to 50 dB(A) and the number of events is not complete and there is still a lot of discussion about their application. This is because people are extremely variable in their reactions to noise and how well they acclimatise to new activities. The maximum level does not mean a person is awakened at these levels, but sleep may be disturbed.

Intrusiveness Criteria

Further to the above, we recommend applying a limit of L_{Amax} 45dB(A) inside dwellings for fluctuating noise as the World Health Organisation's Guidelines for Community Noise 1999 states that *"speech in relaxed conversation"* can be *"understood fairly well in background levels of 45dBA"*. The L_{Amax} level is therefore considered unlikely to interfere with normal speech levels, watching television and other typical household activities.

5.3. Mechanical Plant – Brisbane City Council

Application of AS/NZ2107 for control of mechanical plant noise is in accordance with NIAPSP, and takes into account the acceptable R category for potentially affected premises as defined in Australian Standard AS1055.2 1997 "*Acoustics – Description & Measurement of Environmental Noise"*. By categorising the dwellings adjacent to the development as being R4 *"areas with dense transportation or some commerce or industry"*, the noise design target level defined in AS/NZ2107 for dwellings near major roads is 40dB(A) $L_{eq\ (15\ min)}$ in sleeping areas.

Further to this, to prevent background creep, plant must be designed to not exceed the measured background noise levels. These various criteria equate to a design target for mechanical plant of the following levels:

Table 4: Mechanical Plant Assessment Criteria for Residential Receivers.

Time Period	**Criteria L_{90} dB(A)**
Daytime (7am – 6pm)	**59**
Evening (6pm – 10pm)	**56**
Night time (10pm – 7am)	**42**

Refer to **Appendix B** for graphical representation of measured noise levels

The above levels are quoted as a measured level, not a component level; hence, all plant proposed must be included in assessment. By designing plant noise to a measured level rather than a component level, the additive effect of multiple plant is taken into account.

5.4. Rail Noise

The criteria applied to the site for rail noise is divided into two sections and details the noise limits required for both Brisbane City Council and Queensland Transport (QT).

5.4.1. Queensland Transport

The site is located in the vicinity of a railway line controlled by Queensland Transport. The design criteria applicable to the proposed development is detailed below:

- *External design levels of $L_{Aeq,24hr}$ 65dB(A), assessed at outdoor recreation areas.*
- *L_{Amax} 87dB(A), assessed at outdoor recreation areas.*
- *Indoor design level for bedrooms and living areas of L_{Amax} 50dB(A) average maximum sound level between 10pm and 6am.*

The indoor design level is set in Queensland Transport's 'Interest in Planning Schemes No.3'; and the external design levels are set out in the Environmental Protection (Noise) Policy 1997.

From time to time, passing trains will blow a horn to warn people of its presence. It should be noted however that Queensland Rails' "Code of Practice, Railway Noise Management" (December 1999), states the following in relation to noise impacts from horns and other safety devices:

8. "HORNS AND OTHER WARNING DEVICES"

Horns and sirens are used within QR as warning devices to protect the safety of both employees and the public. Unfortunately, noise from these devices may cause annoyance to some residents from time to time.

In general, public and employee safety must be satisfactorily protected and hence it is not appropriate to apply any particular noise criteria to these warning devices (including the QR nominated interim levels and the EPP Noise planning levels). Where specific complaints are received, however, responsible Managers will consider whether there is sufficient justification to change standing orders on the use of horns or to nominate alternative warning devices.

In considering what constitutes "sufficient justification", responsible Managers will have regard to any relevant QR Safety Management Systems.

QR shall ensure driver training will include appropriate use of horns and warning devices.

5.4.2. Brisbane City Council

A criteria for rail noise impacting the site is detailed in Brisbane City Council's "*Noise Methodology Guidelines"* (June 2002) under City Plan 2000 – "*Noise Impact Assessment Planning Scheme Policy"*. The criteria applicable to the site is detailed as follows:

"D.2.2 Trains
The noise due to trains should not exceed the following:

Design all proposed residential units affected by rail noise to achieve the following criteria:

Residential Dwelling Outdoor Noise:
- *– $L_{Aeq,24hour}$ 55 dB(A)*
- *– L_{Apmax} (maximum peak noise level of a passby) 80 dB(A)*

Residential Dwelling Indoor Noise:
- *– Relaxing and sleeping areas L_{Apmax} 50 dB(A)*
- *– Normal Domestic L_{Apmax} 50 dB(A)"*

5.4.3. Combined Rail Noise Limits

Based on the criteria stated in Sections 5.4.1 and 5.4.2, Table 5 presents the more stringent noise limits from BCC and QT.

Table 5: Combined rail noise limits

Description	**Sound Level dB(A)**
Private Recreational Areas	55dB(A) $L_{Aeq, (24\ hour)}$
	80dB(A) L_{Amax}
Bedrooms	50dB(A) L_{Amax}
Living areas	50dB(A) L_{Amax}

6. ANALYSIS AND RESULTS

The results of the assessment are divided into four sections, 6.1 – 6.4 and present the results of modelling for road traffic, onsite/offsite activity and mechanical plant noise.

6.1. Road Traffic Noise

6.1.1. Measured Levels

Table 6 presents the measured road traffic noise levels recorded at the unattended monitoring locations.

Table 6: Measured Road Traffic Noise Levels.

Location/Date	Road Traffic Noise Descriptor	Time Period	Measured Level dB(A)
Hamilton Place – June, 2010	$L_{A10,18Hour}$	6am to midnight	73
	Noisiest day-time $L_{Aeq,1Hour}$		73
	Noisiest night-time $L_{Aeq,1Hour}$		69
	$L_{Aeq,24Hour}$	Midnight to midnight	70
Inner City Bypass – July, 2010	$L_{A10,18Hour}$	6am to midnight	76
	Noisiest day-time $L_{Aeq,1Hour}$		75
	Noisiest night-time $L_{Aeq,1Hour}$		73
	$L_{Aeq,24Hour}$	Midnight to midnight	73
Abbotsford Road – July, 2010	$L_{A10,18Hour}$	6am to midnight	72
	Noisiest day-time $L_{Aeq,1Hour}$		72
	Noisiest night-time $L_{Aeq,1Hour}$		67
	$L_{Aeq,24Hour}$	Midnight to midnight	69

Graphical presentation of the measured road traffic noise levels are presented in **Appendix B**.

6.1.2. Traffic Volumes

The traffic volumes and percentage of heavy vehicles for the surrounding road network were obtained from TTM Data Division, Veitch Lister Consulting and *"Airport Link Phase 2 – Detailed Feasibility Study"* (October 2006) prepared by SKM & Connell Wagner.

Due to the high level of development expected for the surrounding area, predicted volumes presented in Table 7 and are based on worst case scenario traffic volumes, as supplied by Veitch Lister Consulting, SKM & Connell Wagner and TTM Consulting.

Table 7: Road Traffic Volumes for the Surrounding Road Network.

Description (Location):	Traffic Volume (AADT)			Heavy Vehicles % AADT	Growth Rate (%p.a.)
	2006	2010	2020		
Hamilton Place	7,816	9,757	17,942	16.0	5.7
O'Connell Terrace	11,780	11,922	12,211	5.0	0.3
Campbell Street	-	9,960	32,200	6.4	-
Mayne Road	-	2,765	4,673	5.0	-
Abbotsford Road	-	26,320	35,835	3.9	2.8
Markwell Street	-	15,950	21,116	3.9	2.8
Montpelier Road	-	11,950	37,400	4.5	-
Inner City Bypass	-	52,958	58,807	5.0	-
Clem 7 Bypass	-	-	93,100	5.0	-

The CoRTN methodology requires the input of 18 hour traffic volumes and is approximated as 95% of the Average Annual Daily Traffic.

6.1.3. Predicted Road Traffic Noise Levels – Existing

Road traffic noise predictions were conducted using *"SoundPLAN v6.5"*, a CoRTN based noise modelling program. To verify the road traffic noise model, the $L_{A10,18hour}$ noise levels were calculated and compared to the measured levels as presented in Table 8.

Table 8: Comparison of Measured and Predicted Road Traffic Noise Levels.

Location	Measured $L_{A10,18Hour}$	Predicted $L_{A10,18Hour}$	Required Correction
Abbotsford Road	71.5	71.7	0
Inner City Bypass	75.9	76.4	0

The CoRTN methodology allows a maximum deviation of 2 dB(A) from measured levels. The model has predicted slightly higher traffic noise levels than the measured but is within the ±2dB(A) tolerance. Therefore no correction factor is required.

6.1.4. Predicted Road Traffic Noise Levels – Year 2020

Predicted road traffic noise impacts for the 10 year planning horizon (presented in Figures 5 – 8) were calculated using *SoundPLAN v6.5* and are based on the following assumptions:

- The layout used for the modelling is based on the plans provided by *"Bureau Proberts"*. (refer to **Appendix A**)
- Contour levels surrounding the site were obtained from *Brisbane City Council*.
- Screening from the surrounding commercial buildings were incorporated in the modelling.
- Finished floor levels presented on elevation plans provided by *"Bureau Proberts"* were utilised in the modelling (refer to **Appendix A**).
- All roads were considered to be 60km/hour with the exception of the Clem 7 tunnel which was 60-80km/hr.
- The façade correction factor of +2.5dB(A) was considered in the calculations.

SoundPLAN outputs predicted $L_{A10,18hour}$ road traffic noise levels and are presented in Figures 5 – 8. These levels were converted into $L_{Aeq,1Hour}$ and $L_{Aeq,24Hour}$ levels to compare with the BCC assessment criteria.

Figure 5: Noise Contour Map $L_{A10,18hour}$ – Ground Level.

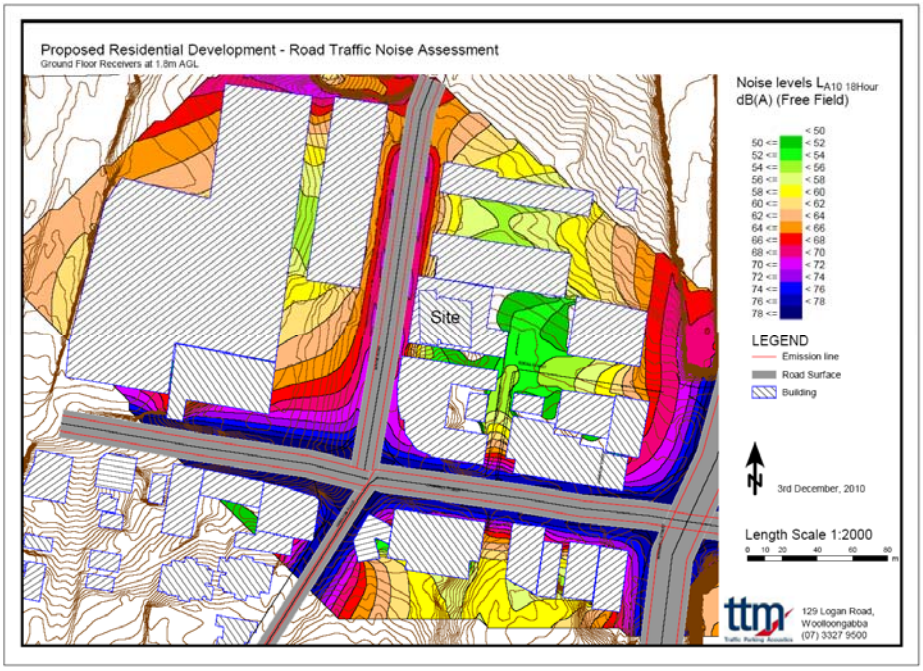


Figure 6: Noise Contour Map $L_{A10,18hour}$ – Level 4.

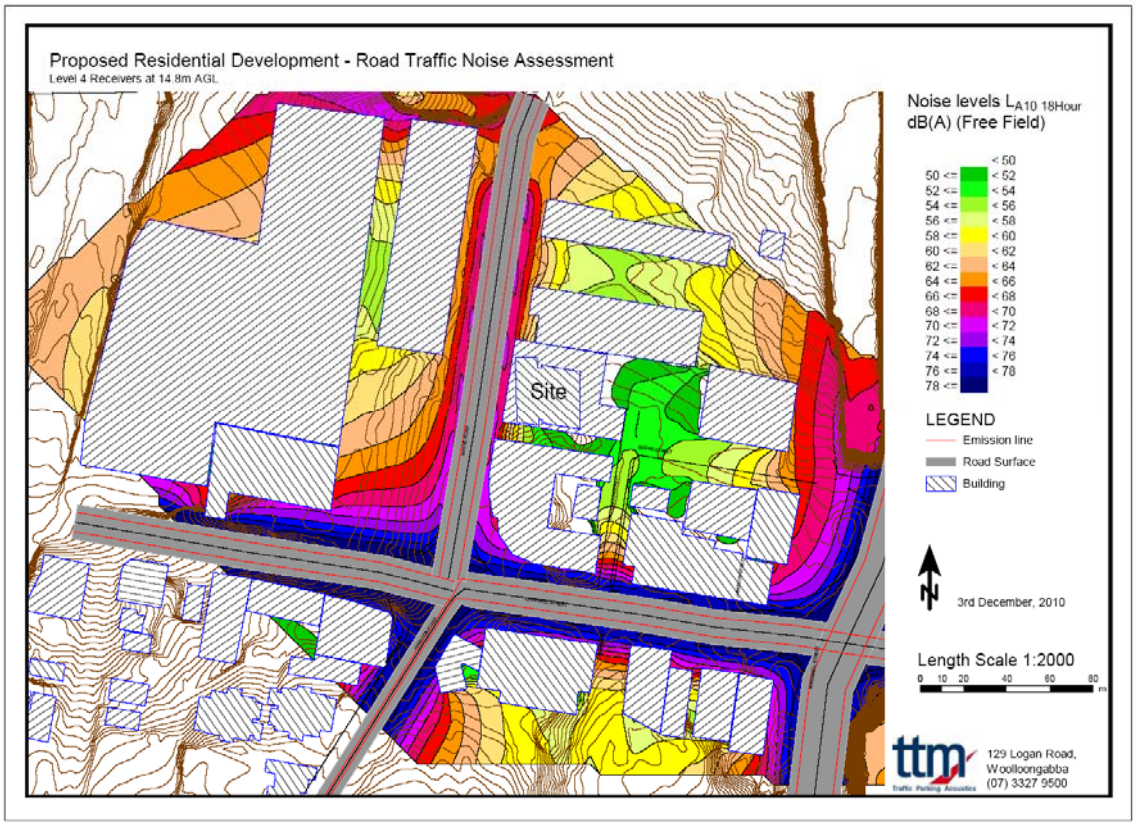


Figure 7: Noise Contour Map $L_{A10,18hour}$ – Level 15.

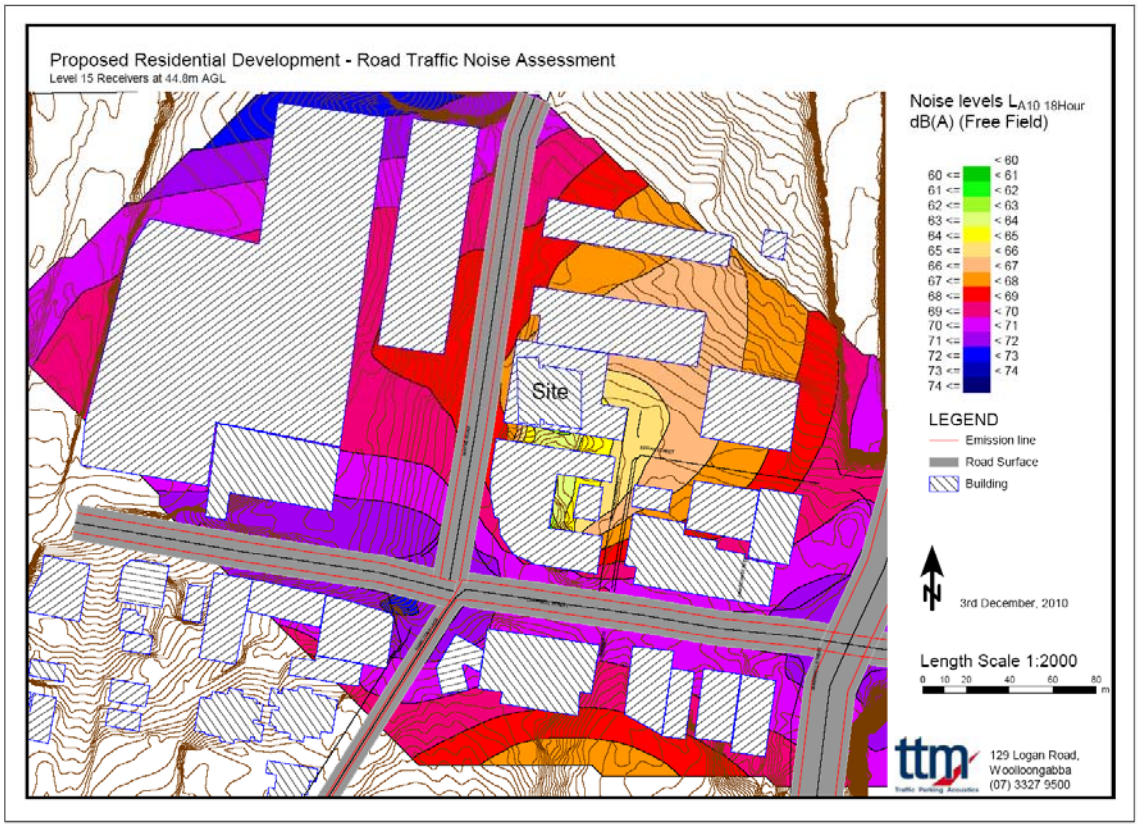
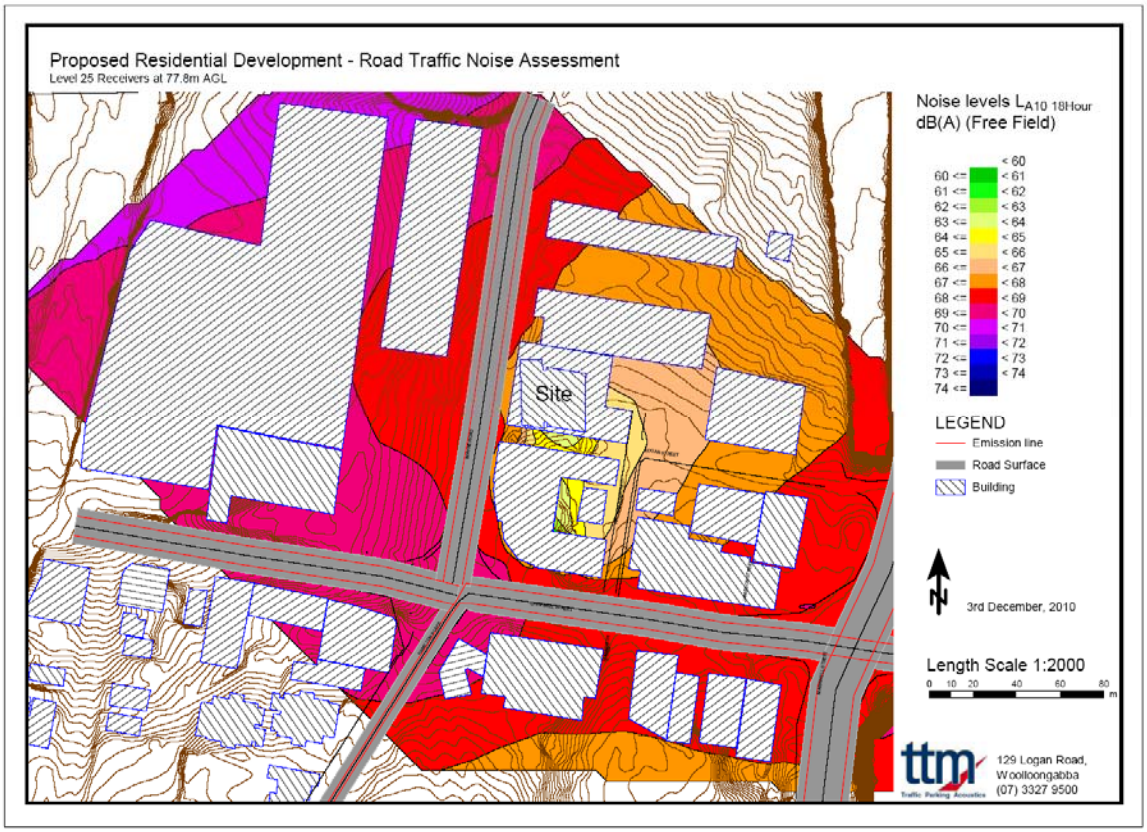


Figure 8: Noise Contour Map $L_{A10,18hour}$ – Level 25.



Based on the predicted noise impacts, Levels 3 – 26 are predicted to exceed the external criteria requiring further assessment to ensure compliance with the internal noise limits detailed in Section 7.

Table 9 presents the predicted road traffic noise impacts at the communal recreation area located on level 4.

Table 9: Predicted Road Traffic Impacts at Communal Recreation Area.

Location:	**Predicted SPL (dB(A)) in 2020 (Free field)**	
	$L_{A10,18hour}$	**$L_{Aeq,24hour}$**
Level 5 Pool Area – West	59	54

Based on the modelled levels in Table 9, the communal area is predicted to comply without additional acoustic treatments.

For ease of reference, all SoundPLAN calculations are presented in **Appendix B**.

6.2. Onsite Activity Noise

The average maximum levels associated with onsite activities are presented in Table 10 and were selected as they represent the likely activities that have the potential to impact the nearest residential receivers.

Table 10: Average Maximum Noise Levels from Typical Site Activity.

Noise Source:	**Measured Level L_{Amax} (dB(A))**	**Correction Factor dB(A)***	**Corrected Level L_{Amax} (dB(A))**
Car door closure	78	+ 5 (impulsive)	83
Car starting	75	N/A	75
Car bypass @ 5 km/h	77	N/A	77
Goods Delivery	85	N/A	85
Waste collection	92	+ 5 (impulsive)	97
Conversation	75	N/A	75
Alfresco Dining	80	N/A	80

*Correction due to tonality and impulsiveness as per AS1055:1997.

Tables 11 and 12 present predicted noise levels (based on the noise source levels in Table 10) from the development impacting the nearest residential receivers.

Table 11: Predicted Noise Impact Levels from Onsite Activities to Receiver 1.

Noise Source:	**Predicted Level L_{Amax} dB(A)**		**Assessment Criteria Complies (Yes/No)**		
	Façade	**Internal**	**Day 75dB(A)**	**Evening 72dB(A)**	**Sleep 45dB(A)**
Car door closure – Level 1	45	40	Yes	Yes	Yes
Car starting – Level 1	37	32	Yes	Yes	Yes
Car bypass @ 5 km/h – Level 1	43	38	Yes	Yes	Yes
Goods Delivery – Ground Level	55	50	Yes	Yes	Yes
Waste collection – Ground Level	43	38	Yes	Yes	Yes
Conversation – Level 4 Communal Area	43	38	Yes	Yes	Yes
Alfresco Dining – Ground Level	57	52	Yes	Yes	Yes

Table 12: Predicted Noise Impact Levels from Onsite Activities to Receiver 2.

Noise Source:	**Predicted Level L_{Amax} dB(A)**		**Assessment Criteria Complies (Yes/No)**		
	Façade	**Internal**	**Day 75dB(A)**	**Evening 72dB(A)**	**Sleep 45dB(A)**
Car door closure – Level 1	45	40	Yes	Yes	Yes
Car starting – Level 1	37	32	Yes	Yes	Yes
Car bypass @ 5 km/h – Level 1	39	34	Yes	Yes	Yes
Goods Delivery – Ground Level	44	39	Yes	Yes	Yes
Waste collection – Ground Level	32	27	Yes	Yes	Yes
Conversation – Level 4 Communal Area	32	27	Yes	Yes	Yes
Alfresco Dining – Ground Level	27	22	Yes	Yes	Yes

The predicted noise levels presented in Tables 11 and 12 are based upon the noise source being at the nearest position to the receivers, and assumes direct line of sight where applicable.

All onsite activities are predicted to comply with the day, evening and sleep disturbance criteria at the nearest residential receivers due to sufficient separation distance and building screening.

6.3. Offsite Activity Noise

There is the potential for activities associated with the offsite commercial premises surrounding the development to impact the residential component of the site. The noise sources associated with offsite commercial activities were based on similar investigations and are presented in Table 13. The noise sources were selected as they represent the likely activities that have the potential to impact the onsite receivers.

Note, offsite commercial activities were assessed based on their respective hours of operation as discussed in Section 2.5.

Table 13: Average Maximum Noise Levels from Offsite Activities.

Noise Source:	**Measured Level L_{Amax} (dB(A))**	**Correction Factor dB(A)***	**Corrected Level L_{Amax} (dB(A))**
Car door closure	78	+ 5 (impulsive)	83
Car starting	75	N/A	75
Car bypass @ 5 km/h	77	N/A	77
Waste collection	92	+ 5 (impulsive)	97
Goods Deliveries	85	N/A	85
Conversation	70	N/A	70

*Correction due to tonality and impulsiveness as per AS1055:1997.

Table 14 presents predicted noise levels (based on the noise source levels in Table 13) from the commercial premises impacting the nearest residential receivers on site.

Table 14: Predicted Noise Impact Levels from Offsite Activities to the Site.

Noise Source:	**Predicted Level L_{Amax} dB(A)**		**Assessment Criteria Complies (Yes/No)**		
	Façade	**Internal**	**Day 75dB(A)**	**Evening 72dB(A)**	**Sleep 45dB(A)**
Car door closure – ACS*	55	-	Yes	Yes	-
Car door closure – Newspaper	53	43*	Yes	Yes	Yes
Car starting – ACS	47	-	Yes	Yes	-
Car starting – Newspaper	45	40	Yes	Yes	Yes
Car bypass @ 5 km/h – ACS	49	-	Yes	Yes	-
Car bypass @ 5 km/h – Newspaper	47	42	Yes	Yes	Yes
Goods Delivery – ACS	57	-	Yes	Yes	-
Goods Delivery – Newspaper	48	43	Yes	Yes	Yes
Waste collection – ACS	69	-	Yes	Yes	-
Waste collection – Newspaper	60	-	Yes	Yes	-
Conversation – ACS	42	-	Yes	Yes	-
Conversation – Newspaper	40	35	Yes	Yes	Yes

* ACS implies Associated Cleaning Services.

The predicted noise levels presented in Table 14 are based upon the noise source being at the nearest position to the receivers, and assumes direct line of sight to the development.

With the exception of car door closure, all offsite activities are predicted to comply with the criteria based on current operating hours. Note(*); It is predicted road traffic/rail noise treatments will

provide sufficient attenuation to achieve internal compliance, provided windows and doors are closed.

6.4. Rail Noise

6.4.1. Measured Noise Levels

Measurements of 25 train passbys were recorded on the 18th of May and the 24th of November, 2010, and are presented in Tables 15 and 16.

Table 15: Measured Noise Levels from Passing Trains on the Exhibition Railway Line.

Date/Location	Train Type	Separation Distance (m)	Instantaneous Noise Level SEL dB(A)	Maximum Noise Level L_{AMAX} dB(A)	Horn / Warning Device
Exhibition Railway Line 18th May, 2010	Passenger	7	83	71	No
	Freight	7	108	97	No
	Passenger	19	81	75	No
	Passenger	7	103	95	No
	Passenger	19	83	76	No
	Passenger	19	78	70	No
	Passenger	19	90	81	No
	Passenger	7	98	92	No
	Passenger	19	84	77	No
	Passenger	19	83	73	No

Table 16: Measured Noise Levels from Passing Trains on the Bowen Hills Railway Line.

Date/Location	Train Type	Separation Distance (m)	Instantaneous Noise Level SEL dB(A)	Maximum Noise Level L_{AMAX} dB(A)	Horn / Warning Device
Bowen Hills Railway Line 24th of November, 2010	Passenger	17	96	94	No
	Passenger	8	97	95	No
	Passenger	8	92	86	No
	Passenger	3	90	88	No
	Passenger	8	95	92	No
	Passenger	12	84	84	No
	Passenger	17	91	85	No
	Passenger	17	84	74	No
	Passenger	12	88	85	No
	Passenger	17	93	90	No
	Passenger	3	93	88	No
	Passenger	17	84	76	No
	Passenger	12	82	74	No
	Passenger	3	81	73	No
	Passenger	8	94	90	No

An increase in rail traffic does not increase the maximum L_{Amax} noise levels; however it does increase the frequency of such occurrences and will increase the $L_{Aeq,24hour}$ noise level.

Note: The SEL or L_{AE} is the sound exposure level. A parameter closely related to L_{Aeq} for assessment of train events that have similar characteristics but are of different duration. The L_{AE} value contains the same amount of acoustic energy over a 'normalised' one second period as the actual noise event under consideration. Based on the measured L_{AE} level, calculations are

conducted utilising the number of trains per day to determine the $L_{eq,\ 24hr}$ noise impact at proposed residential receivers.

6.4.2. Rail Volumes

Train timetables provided by Queensland Rail indicate the following number of trains daily in the vicinity of the site:

- On the Exhibition Railway Line an average of 28 Freight and 150 passenger trains; and
- On the Bowen Hills Railway Line an average of 600 passenger trains.

We were advised by QR that all services are subject to alteration, addition and cancellation which may vary the number of actual trains passing on a daily basis.

During a phone conversation with QR, TTM Consulting was advised that due to confidentiality QR was unable to provide details of any future plans to duplicate the rail lines or of the ultimate rail traffic volumes.

6.4.3. Predicted Noise Levels

The predicted maximum noise levels presented in Figures 9 – 12 are based on the following assumptions:

- Finished floor levels based on plans provided by *"Bureau Proberts"* (refer to **Appendix A**).
- The calculations were conducted in free field (no façade correction factor was applied).
- The maximum noise level of a train passby was utilised for each respective rail line.
- Existing buildings were incorporated in the model.

Figure 9: Noise Contour Map L_{AMax} – Ground Level.

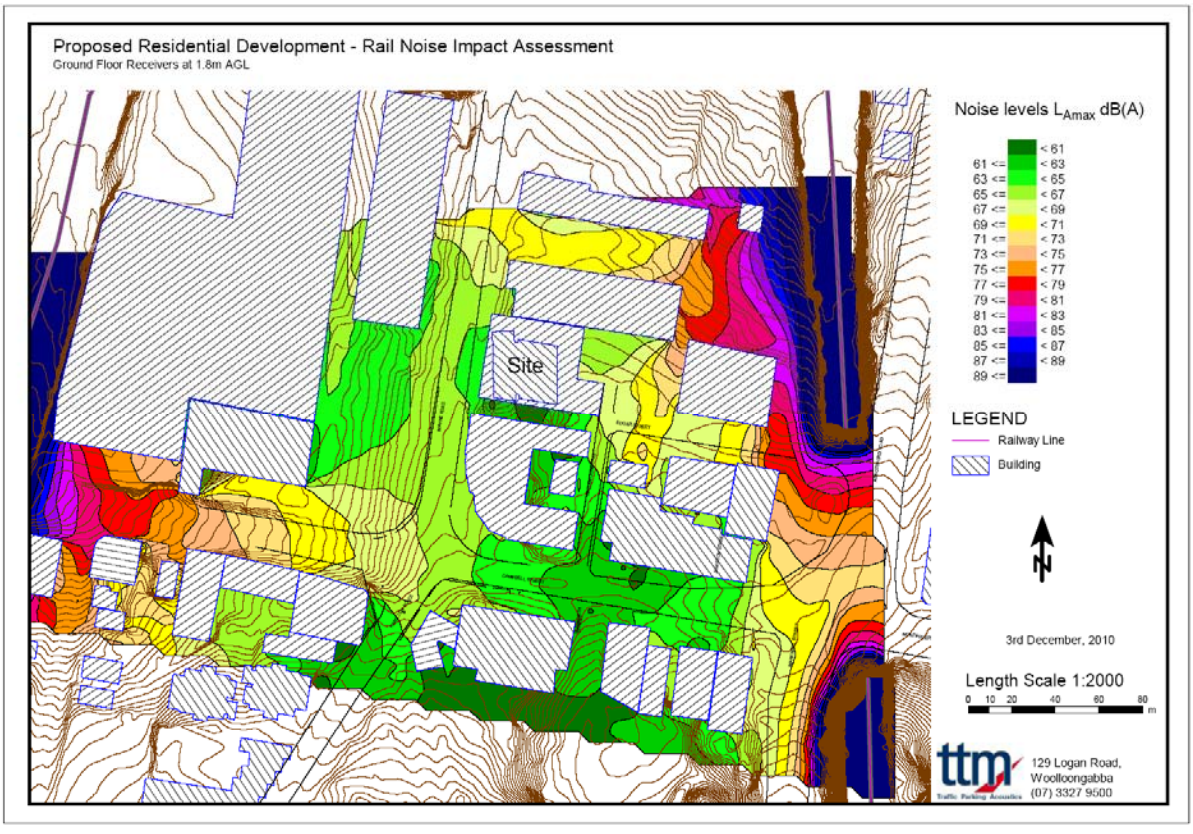


Figure 10: Noise Contour Map L_{AMax} – Level 4.

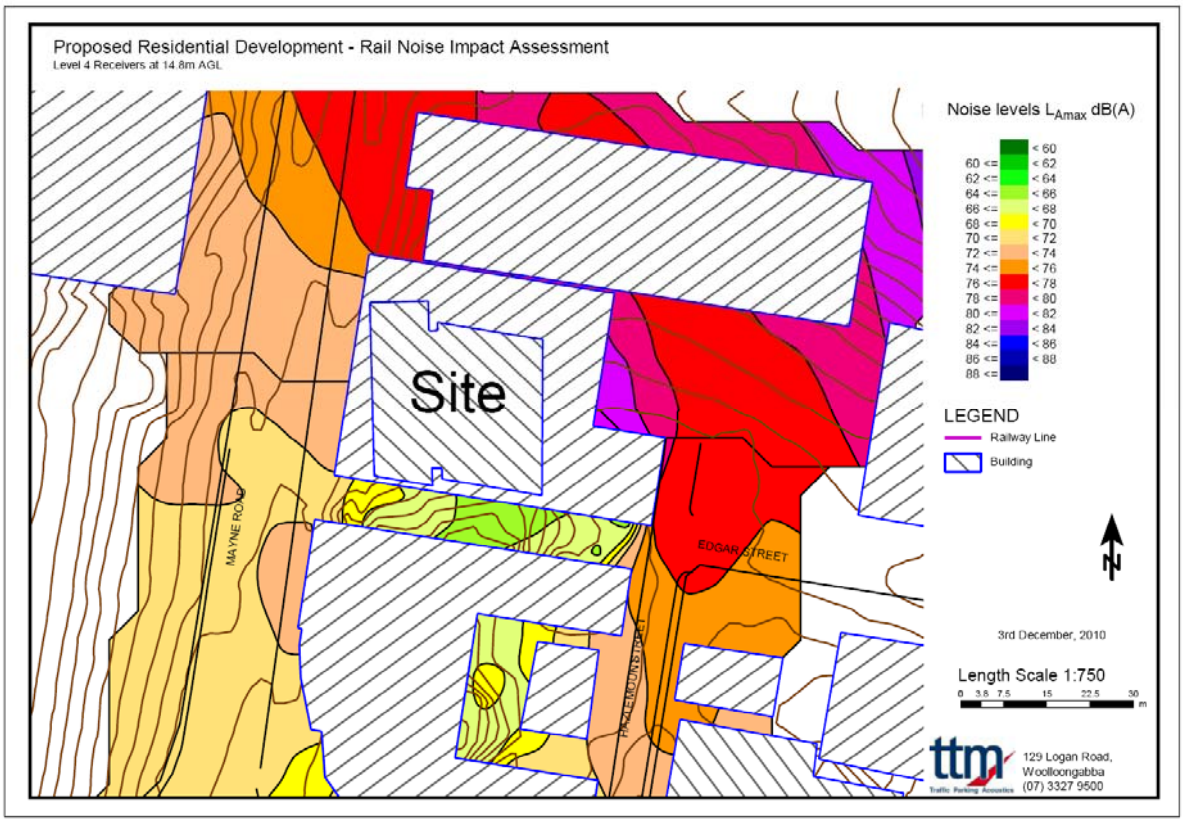


Figure 11: Noise Contour Map L_{AMax} – Level 15.

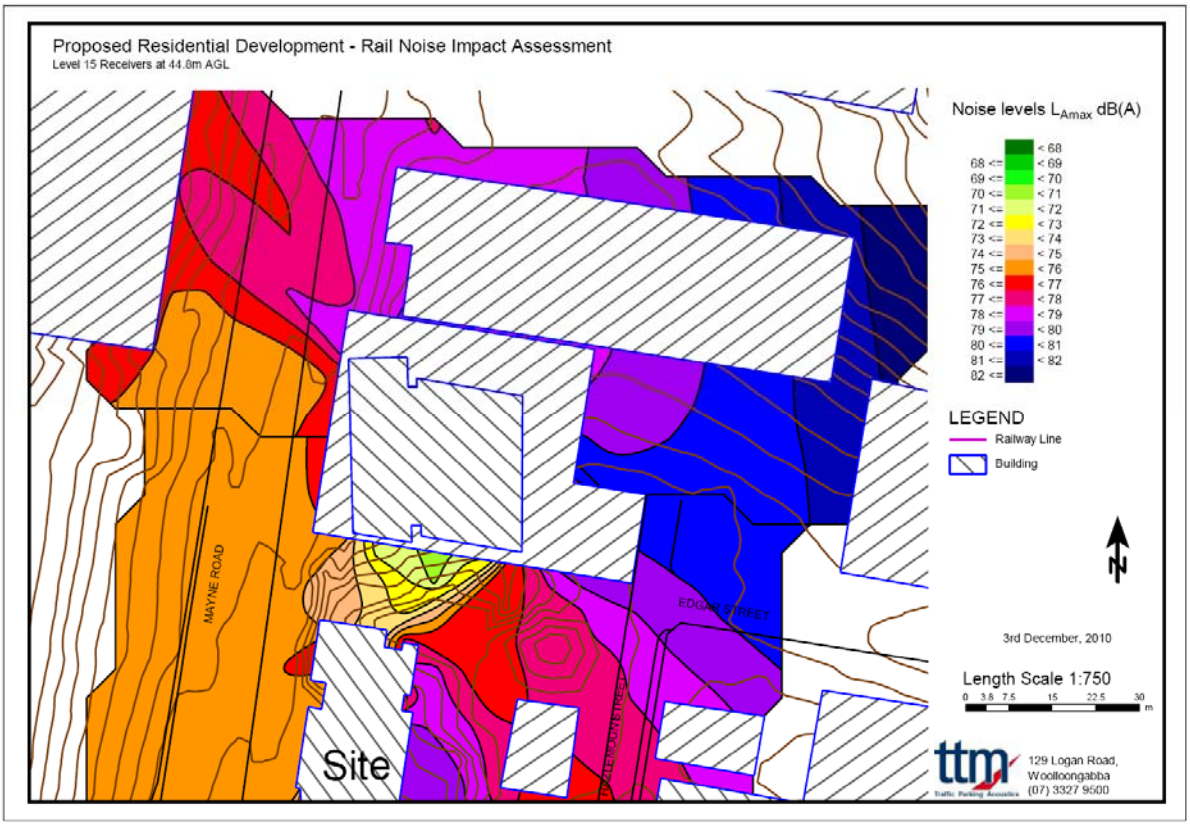
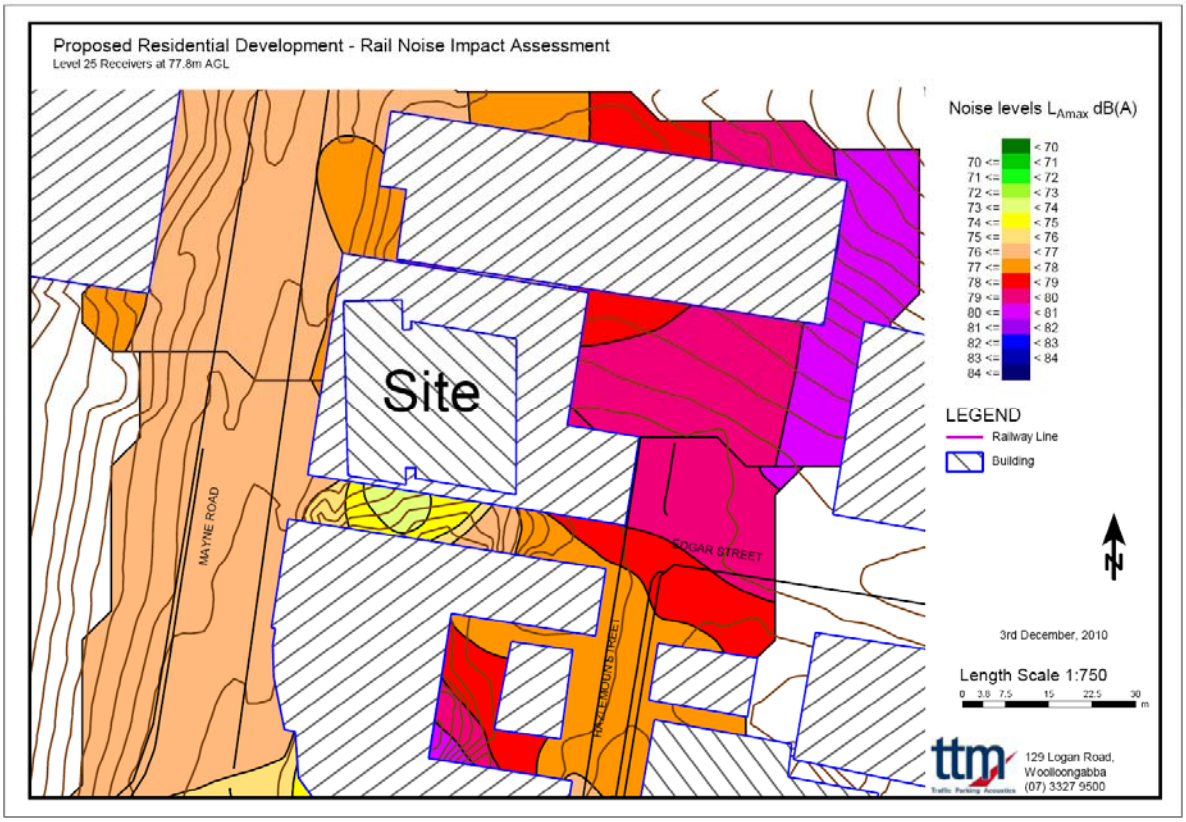


Figure 12: Noise Contour Map L_{AMax} – Level 25.



Based upon the modelled noise levels, all units are predicted to comply with the L_{Amax} 80dB(A) criteria due to sufficient separation distance and screening from the existing buildings.

All units located on levels 3 – 26 require further assessment to ensure compliance with the internal criteria of L_{Amax} 50dB(A). Refer to section 7 for the minimum acoustic treatments.

Based on the measured L_{AE} levels, calculations were conducted utilising the number of trains per day to determine the $L_{Aeq,24Hour}$ noise levels for private recreation areas. Table 18 presents the predicted $L_{Aeq,24Hour}$ noise level at the private recreation areas.

Table 17: Predicted Average Noise Levels from Passing Trains.

Assessment Location:	**Distance from Rail Line (m)**	**Average Noise Level dB(A) $L_{Aeq,24hr}$ (Free field)**	**Criteria dB(A) $L_{Aeq,24hr}$**	**Complies?**
Communal Pool Area Level 5	140	48	55	Yes

It is predicted that all private recreation areas on the ground floor will comply with the BCC criteria of $L_{Aeq,24Hour}$ 55(A) due to sufficient screening and separation distance.

7. RECOMMENDATIONS

The recommended acoustic treatments are presented in four sections, 7.1 – 7.4 and are required to ensure compliance with the relevant assessment criteria.

7.1. Road Traffic and Rail Noise

Compliance is predicted with the rail and road traffic assessment criteria on the condition the following treatments are implemented:

- To ensure compliance with the internal noise limits as specified in Sections 5.1 and 5.4.3 individual assessment of all units located on levels 3 – 26 is required.

All communal recreation areas are predicted to comply without additional treatments.

Building treatments were determined by using the calculation methods detailed in Australian Standard AS3671:1989 *'Road Traffic Noise Intrusion – Building Siting and Construction'*.

Note glazing treatments were based upon the worst-case impact from road traffic or rail noise.

Calculations were based on drawings numbered *10053_101E – 108E, 115C, 128C, 129B, 401D & 402D* issued by *Bureau Proberts*.

7.1.1. Glazing Treatments

Table 18 presents the minimum glazing required based on calculations conducted in accordance with AS3671:1989 for both road traffic and rail noise. Note that the minimum thickness of the glass as specified in Table 18 shall not be reduced regardless of the R_W/STC rating of the glazing system. The installed glazing may be equal or thicker to the specified glass only. Glazing specified with acoustic seals requires a Q-Lon seal to be installed or an equivalent product. Mohair seals are not acceptable.

Table 18: Glazing Treatments for Proposed Units.

Unit	Floor Level	Room	Building Component	Glazing thickness	Acoustic Seals
PA	3 & 4	Kit/Liv/Dining	Sliding Door	5mm Toughened	Yes
		Bedroom 1	Windows	6mm Float	Yes
PB		Kit/Liv/Dining	Sliding Door	5mm Toughened	Yes
		Bedroom 1	Windows	10mm Float	Yes
PC		Kit/Liv/Dining	Sliding Door	6.38mm Laminated	Yes
			Windows	6.38mm Laminated	Yes
		Bedroom 1	Windows	6mm Float	Yes
		Bedroom 2	Windows	4mm Float	Yes
Type A	5	Kit/Liv/Dining	Sliding Door/Window	6.38mm Laminated	Yes
		Bedroom 1	Windows	10.38mm Laminated	Yes
		Bedroom 2	Windows	11.52mm Laminated	Yes
Type B, C & D		Kit/Liv/Dining	Sliding Door	5mm Toughened	Yes
		Bedroom 1	Windows	10mm Float	Yes
Type E		Kit/Liv/Dining	Sliding Door/Window	10mm Toughened	Yes
		Bedroom 1	Windows	6.38mm Laminated	Yes
Type F		Kit/Liv/Dining	Sliding Door	10mm Toughened	Yes
		Bedroom 1	Windows	10mm Float	Yes

Unit	Floor Level	Room	Building Component	Glazing thickness	Acoustic Seals
Type G	5	Kit/Liv/Dining	Sliding Door	10mm Toughened	Yes
		Bedroom 1	Windows	10.38mm Laminated	Yes
		Bedroom 2	Windows	11.52mm Laminated	Yes
Type H		Studio	Sliding Door	5mm Toughened	Yes
Type J		Kit/Liv/Dining	Sliding Door	6.38mm Laminated	Yes
		Bedroom 1	Windows	10mm Float	Yes
Type K		Kit/Liv/Dining	Sliding Door	5mm Toughened	Yes
		Bedroom 1	Windows	10.38mm Laminated	Yes
		Bedroom 2	Windows	4mm Float	Yes
Type L		Kit/Liv/Dining	Sliding Door	5mm Toughened	Yes
		Bedroom 1	Windows	4mm Float	Yes
Type A (Nth)	6 – 24	Kit/Liv/Dining	Sliding Door	10mm Toughened	Yes
			Windows	10mm Float	Yes
		Bedroom 1	Windows	10.38mm Laminated	Yes
		Bedroom 2	Windows	6mm Float	Yes
Type B, C & D		Kit/Liv/Dining	Sliding Door	6.38mm Laminated	Yes
		Bedroom 1	Windows	10.38mm Laminated	Yes
Type A (Sth)		Kit/Liv/Dining	Sliding Door	5mm Toughened	Yes
		Bedroom 1	Windows	4mm Float	Yes
		Bedroom 2	Windows	6.38mm Laminated	Yes
Type F		Kit/Liv/Dining	Sliding Door	10.38mm Laminated	Yes
		Bedroom 1	Windows	10.38mm Laminated	Yes
Type G		Kit/Liv/Dining	Sliding Door	10mm Toughened	Yes
		Bedroom 1	Windows	11.52mm Laminated	Yes
		Bedroom 2	Windows	11.52mm Laminated	Yes
Type J (x2)		Kit/Liv/Dining	Sliding Door	10mm Float	Yes
		Bedroom 1	Windows	6.38mm Laminated	Yes
Type K		Kit/Liv/Dining	Sliding Door	10mm Toughened	Yes
		Bedroom 1	Windows	11.52mm Laminated	Yes
		Bedroom 2	Windows	6mm Float	Yes
Type L		Kit/Liv/Dining	Sliding Door	5mm Toughened	Yes
		Bedroom 1	Windows	6mm Float	Yes
Type A	25 & 26	Kit/Liv/Dining	Sliding Door	10mm Toughened	Yes
		Bedroom 1	Windows	10.38mm Laminated	Yes
		Bedroom 2	Windows	11.52mm Laminated	Yes
Type B, C & D		Kit/Liv/Dining	Sliding Door	6.38mm Laminated	Yes
		Bedroom 1	Windows	10.38mm Laminated	Yes
Type E		Kit/Liv/Dining	Sliding Door	5mm Toughened	Yes
		Bedroom 1	Windows	6.38mm Laminated	Yes
		Bedroom 2	Windows	6.38mm Laminated	Yes

All remaining locations on site not specified within Table 18 will require a minimum of 4mm float for windows (STC/R_W 22) and 5mm toughened ((STC/R_W 23) for sliding doors.

To assist in the assessment, a summary of the R_W glazing ratings are presented in Table 19.

Table 19: Minimum STC/R_W Rating Requirements.

Glass thickness	STC/R_W	Acoustic seals (yes/no)
4mm Float	22	No
5mm Toughened	23	No
4mm Float	27	Yes
5mm Toughened	28	Yes
6mm Float	29	Yes
6.38mm Laminated	30	Yes
10mm Float	32	Yes
10mm Toughened	33	Yes
10.38mm Laminated	35	Yes
11.52mm Laminated	37	Yes

7.1.2. Wall Treatments

All walls constructed of masonry blockwork or pre-cast panels do not require additional treatments to achieve the required R_W.

In all rooms, penetrations through the wall should be adequately sealed so as not reduce the overall acoustic rating of the wall system installed.

7.1.3. Recommended Ceiling Treatments

The roof system of all units on the top floor levels shall be constructed of reinforced concrete and achieves an R_W of 55.

Any penetrations through the ceiling, such as light fittings or duct penetration shall be acoustically treated so the rating require of the installed ceiling is maintained.

7.1.4. Provision of Mechanical Ventilation

To achieve the required internal noise levels of habitable rooms, doors and windows should be closed, hence, all habitable rooms requiring glazing treatments (as nominated in Table 18), will require the provision of an alternative ventilation system like mechanical ventilation or air-conditioning. The design and installation of the plant should not reduce the overall acoustic performance of the building shell.

7.2. Onsite Activity Noise

This assessment has investigated the 'worst case scenario', by considering potential noise impacts from onsite activities associated with the proposed development to the nearest residential receivers in vicinity of the site. Based upon the calculated levels, all onsite activities are predicted to comply with the daytime, evening and sleep disturbance criteria due to sufficient separation distance.

7.3. Offsite Activity Noise

Based on the modelled levels, all offsite activities are predicted to comply with the criteria based on current operation hours of the surrounding commercial and retail businesses.

7.4. Mechanical Plant Noise

Because detailed plant selections are not available at this stage, it is not possible to carry out a detailed examination of the ameliorative measures that may be required to achieve the noise targets. Plant will be acoustically treated to achieve the criteria detailed in Section 5.3 to prevent noise emissions from adversely impacting the surrounding properties. This may include selecting the quietest plant possible, or treating the plant equipment with enclosures, barriers, duct lining and silencers, etc if required to comply with the assessment criteria.

Experience with similar projects indicates that it would be possible to achieve the Council requirement with appropriate treatment of the plant. This treatment would be determined at the Building Approval/Construction Certificate stage.

A mechanical plant noise assessment should be conducted by a suitably qualified acoustic person once plant selections are finalised; and compliance tests conducted after the equipment is installed to ensure compliance with the criteria. Such measures should also be conditioned in the Development Approval.

8. CONCLUSIONS

A full assessment was conducted of the proposed mixed-use development located at 37 Mayne Road, Bowen Hills. This assessment has investigated the impacts from road traffic, rail, onsite and offsite activity noise. Provided the treatment recommendations and management controls presented in Section 7 are implemented, the development is predicted to comply with the assessment criteria.

If you should have any further questions, please do not hesitate to contact us.

Report Compiled by:

EDWARD O'CALLAGHAN
Acoustic Consultant

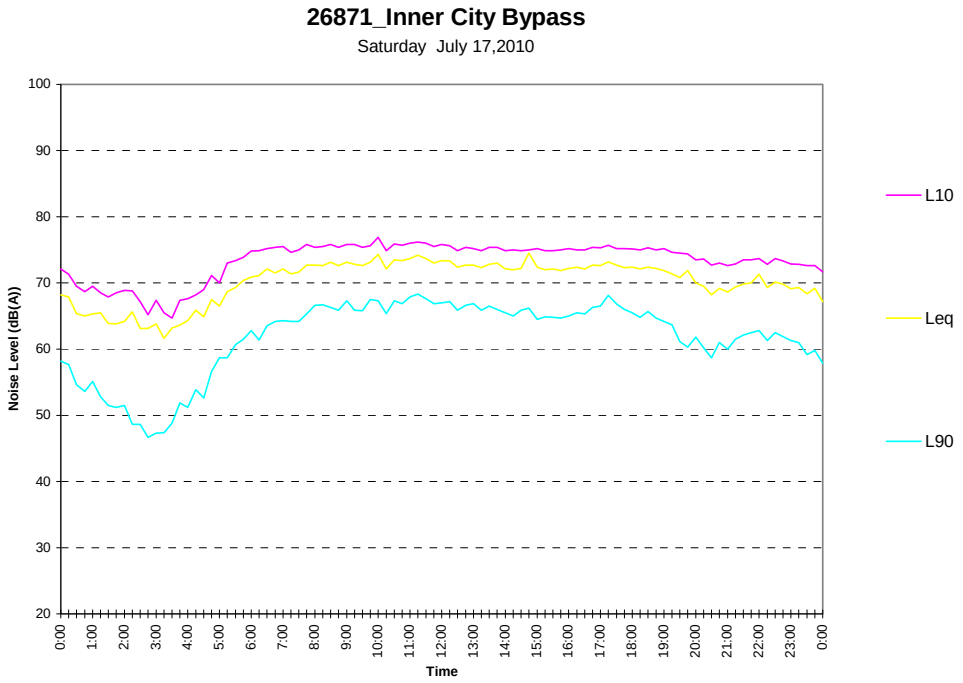
Report Checked by:

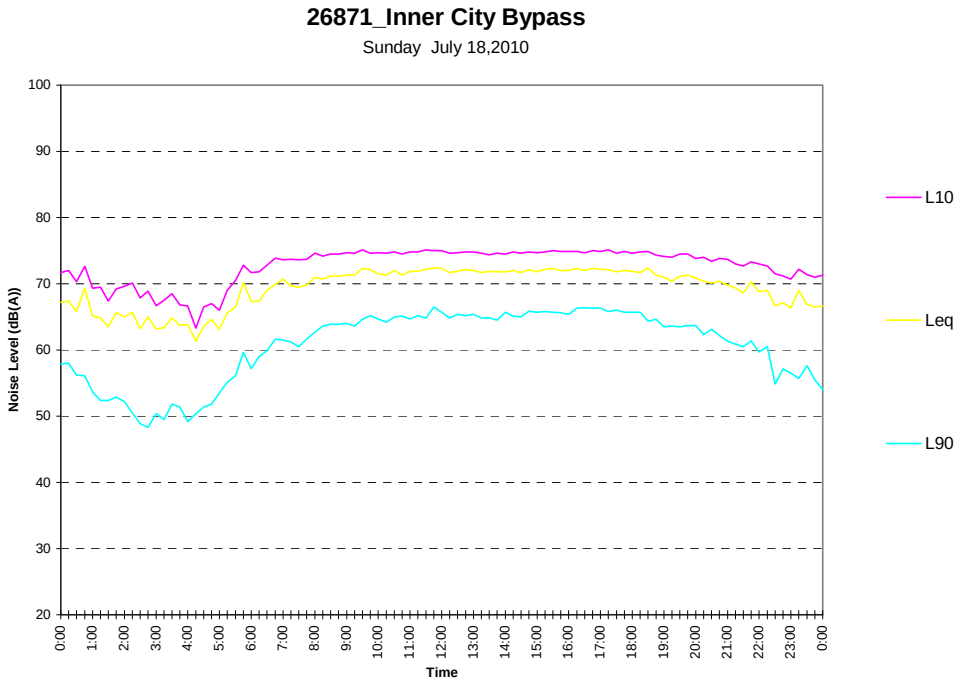
GREG PEARCE B.Eng (Mech)
Associate Director

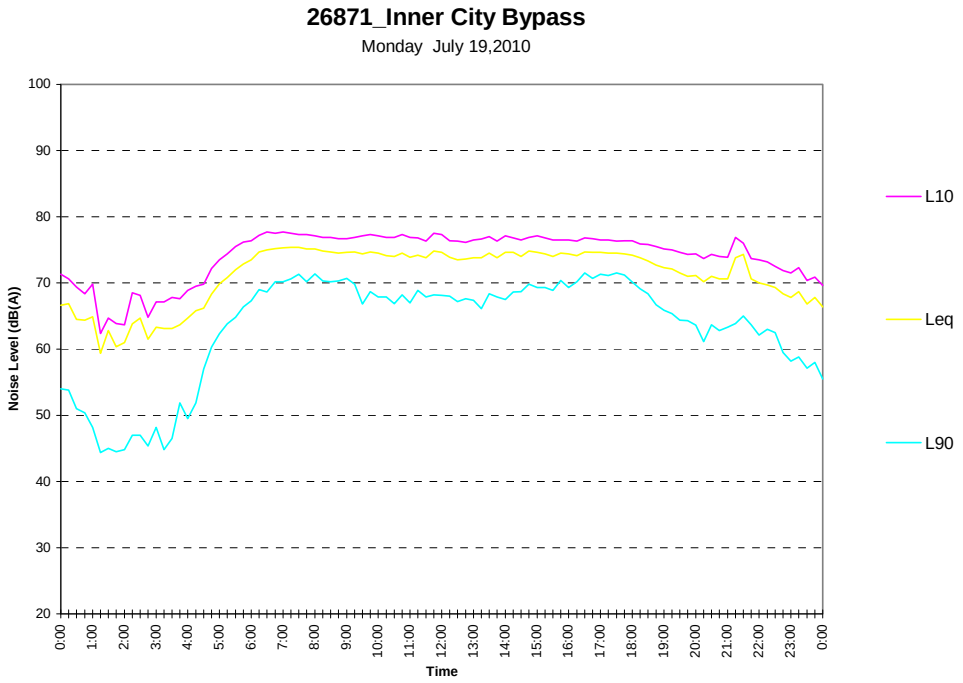
9. APPENDICES

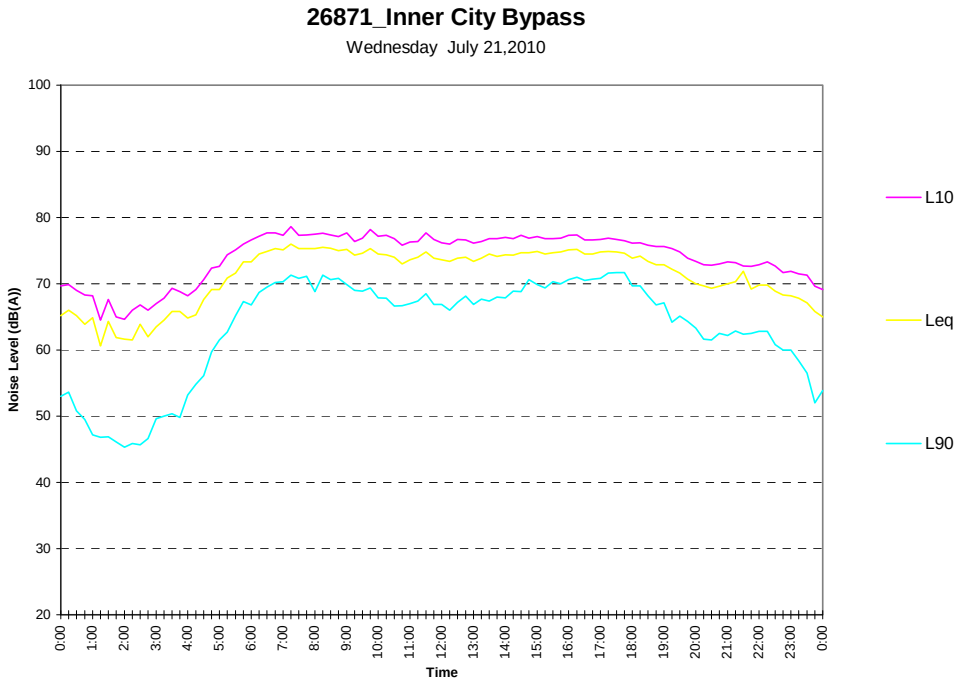
Appendix A

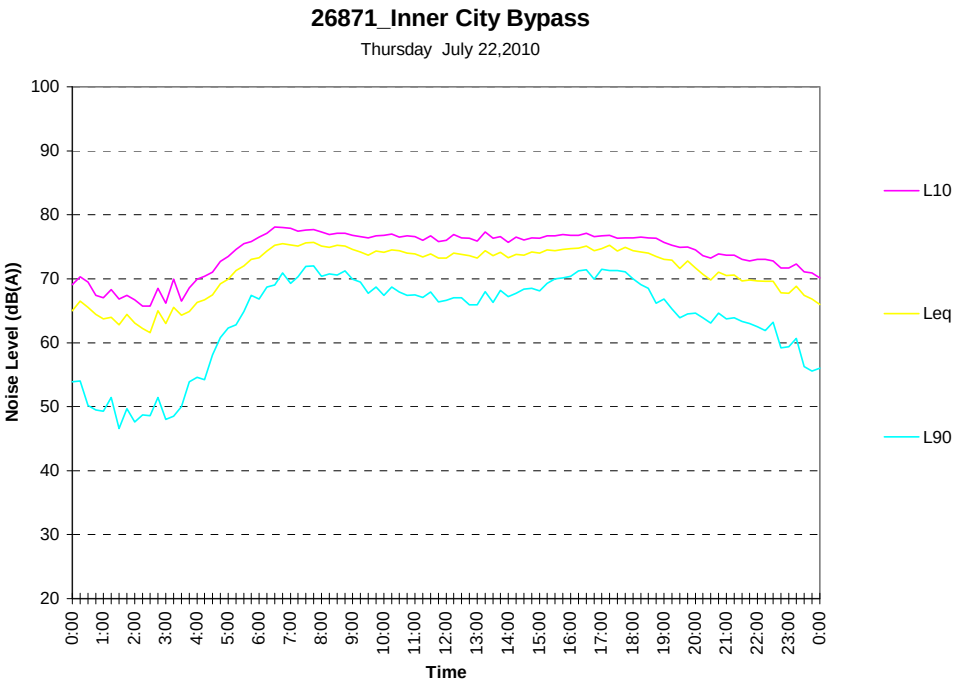
Noise Monitoring Graphs

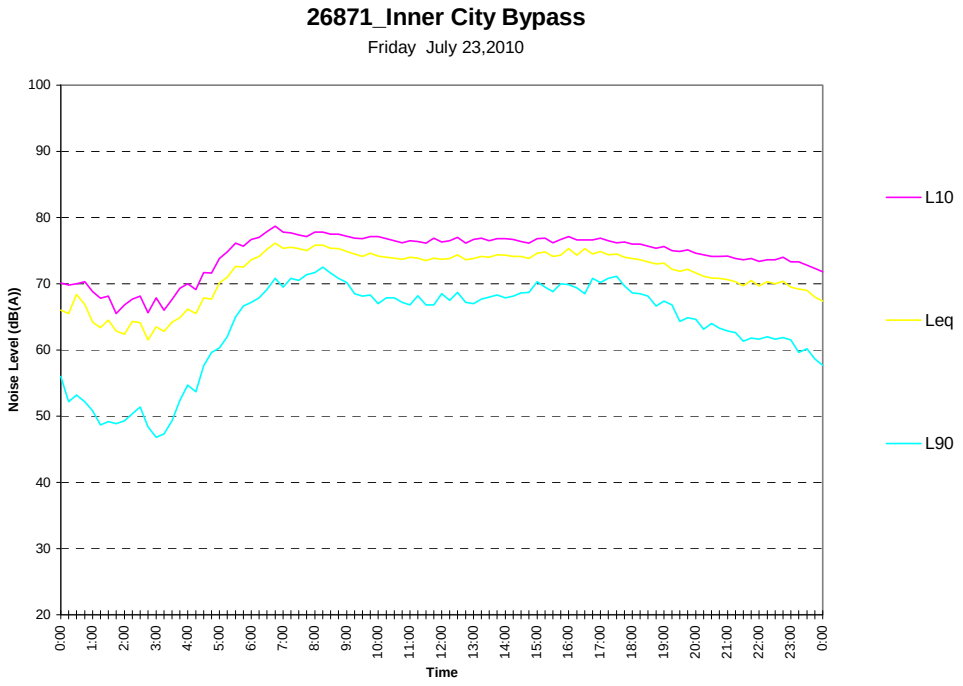






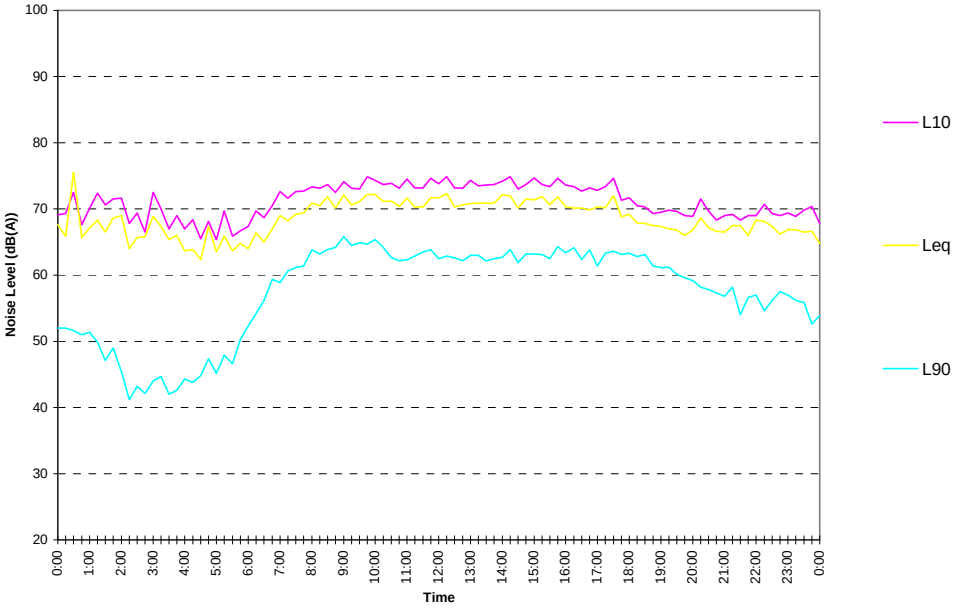






26871_Abbotsford Road

Tuesday July 20,2010



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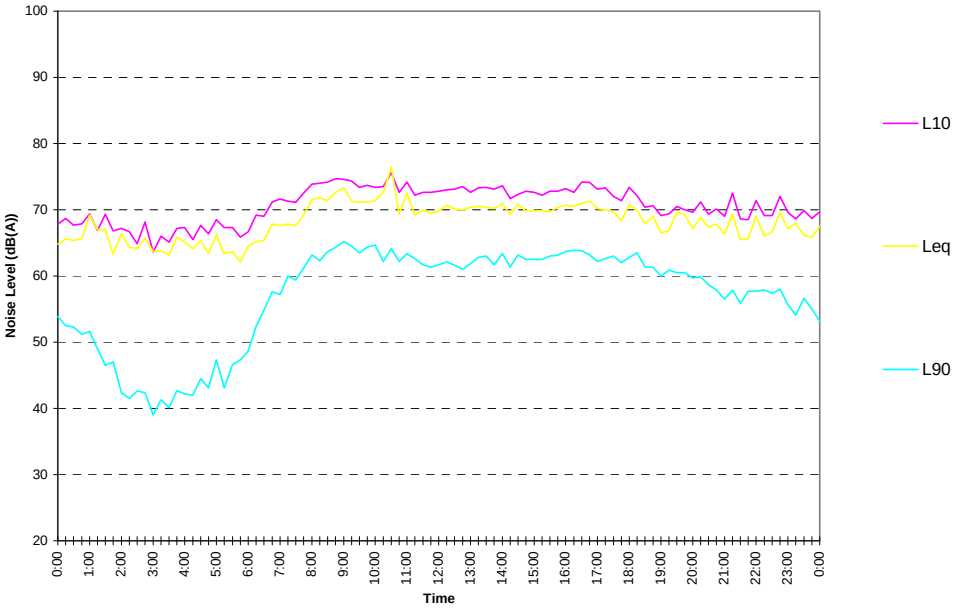

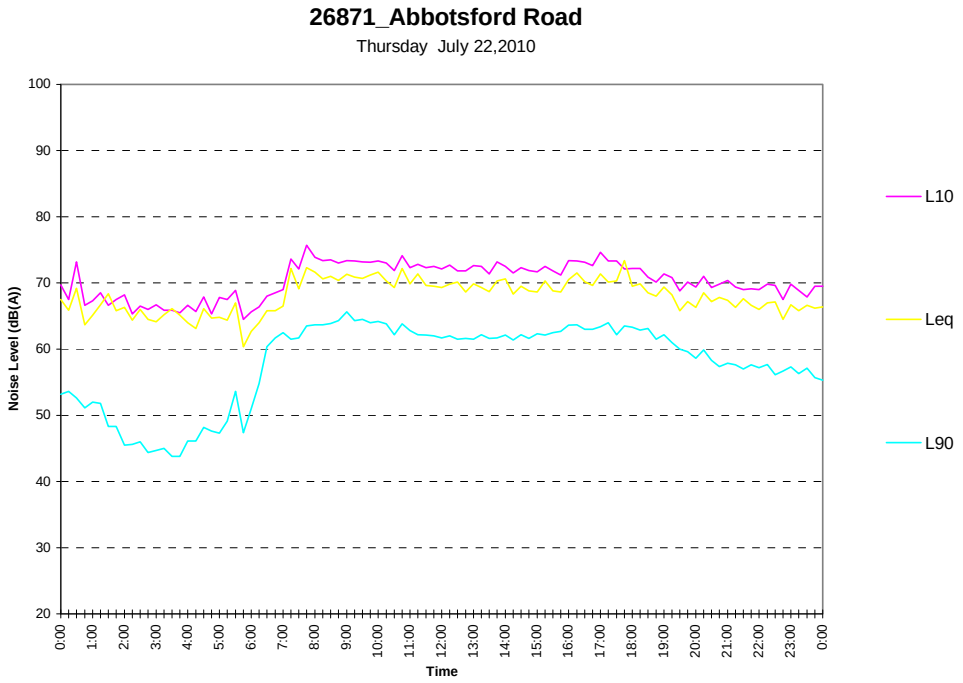

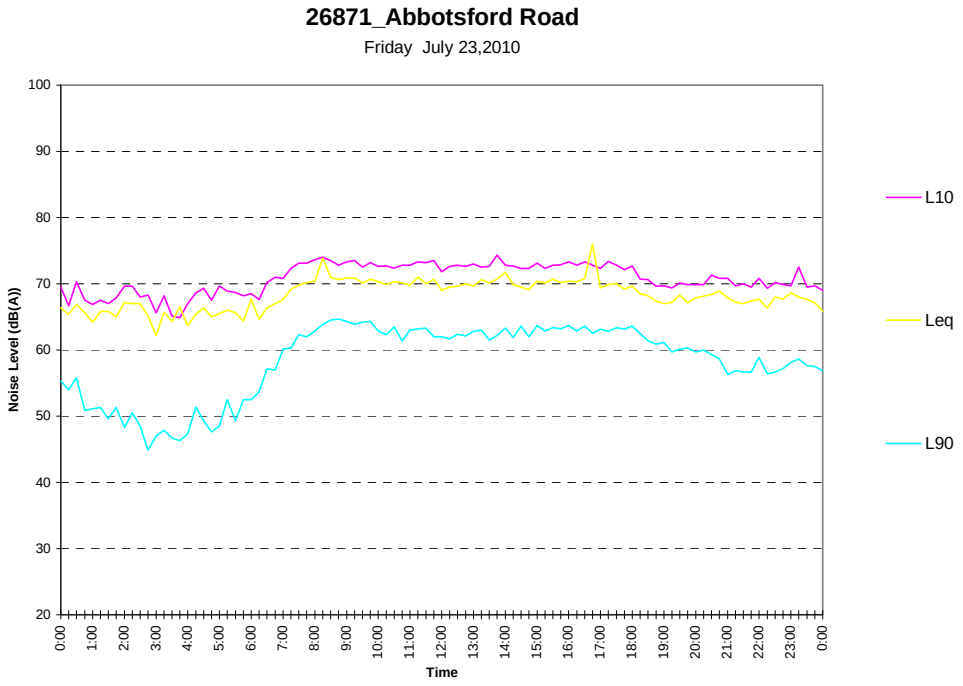

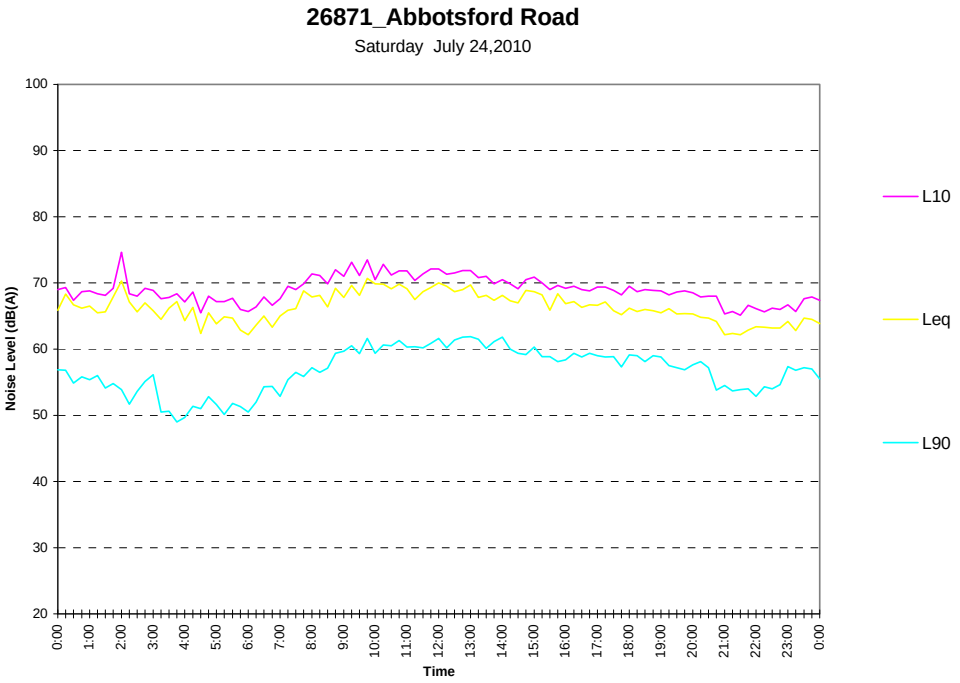

Appendix B

SoundPLAN Calculations

Proposed Mixed-Use Development
Road Traffic Noise Assessment- RTN Planning Horizon 2021

Location	Building Facade	Floor Level	L10(18h) (Facade Corrected) dB(A)
Levels G - 4	N	Level 1	66.1
Levels G - 4	N	Level 2	66.4
Levels G - 4	N	Level 3	66.6
Levels G - 4	N	Level 4	66.7
Levels G - 4	W	Level 1	71.6
Levels G - 4	W	Level 2	71.1
Levels G - 4	W	Level 3	70.6
Levels G - 4	W	Level 4	70.2
Levels G - 4	S	Level 1	52.7
Levels G - 4	S	Level 2	54.3
Levels G - 4	S	Level 3	55.4
Levels G - 4	S	Level 4	56.5
Levels 5 - 26	E	Level 1	59.9
Levels 5 - 26	E	Level 2	63.2
Levels 5 - 26	E	Level 3	63.9
Levels 5 - 26	E	Level 4	64.4
Levels 5 - 26	E	Level 5	64.8
Levels 5 - 26	E	Level 6	65.1
Levels 5 - 26	E	Level 7	65.3
Levels 5 - 26	E	Level 8	65.5
Levels 5 - 26	E	Level 9	65.7
Levels 5 - 26	E	Level 10	65.8
Levels 5 - 26	E	Level 11	65.9
Levels 5 - 26	E	Level 12	66.0
Levels 5 - 26	E	Level 13	66.1
Levels 5 - 26	E	Level 14	66.2
Levels 5 - 26	E	Level 15	66.2
Levels 5 - 26	E	Level 16	66.3
Levels 5 - 26	E	Level 17	66.3
Levels 5 - 26	E	Level 18	66.4
Levels 5 - 26	E	Level 19	66.4
Levels 5 - 26	E	Level 20	66.4
Levels 5 - 26	E	Level 21	66.4
Levels 5 - 26	E	Level 22	66.4
Levels 5 - 26	N	Level 1	61.3
Levels 5 - 26	N	Level 2	64.4
Levels 5 - 26	N	Level 3	65.0
Levels 5 - 26	N	Level 4	65.4
Levels 5 - 26	N	Level 5	65.8
Levels 5 - 26	N	Level 6	66.1
Levels 5 - 26	N	Level 7	66.4
Levels 5 - 26	N	Level 8	66.6
Levels 5 - 26	N	Level 9	66.8

Proposed Mixed-Use Development
Road Traffic Noise Assessment- RTN Planning Horizon 2021

Location	Building Facade	Floor Level	L10(18h) (Facade Corrected) dB(A)
Levels 5 - 26	N	Level 10	67.0
Levels 5 - 26	N	Level 11	67.2
Levels 5 - 26	N	Level 12	67.4
Levels 5 - 26	N	Level 13	67.5
Levels 5 - 26	N	Level 14	67.6
Levels 5 - 26	N	Level 15	67.6
Levels 5 - 26	N	Level 16	67.7
Levels 5 - 26	N	Level 17	67.7
Levels 5 - 26	N	Level 18	67.7
Levels 5 - 26	N	Level 19	67.7
Levels 5 - 26	N	Level 20	67.7
Levels 5 - 26	N	Level 21	67.6
Levels 5 - 26	N	Level 22	67.6
Levels 5 - 26	N	Level 1	64.2
Levels 5 - 26	N	Level 2	65.6
Levels 5 - 26	N	Level 3	66.3
Levels 5 - 26	N	Level 4	66.7
Levels 5 - 26	N	Level 5	67.0
Levels 5 - 26	N	Level 6	67.4
Levels 5 - 26	N	Level 7	67.7
Levels 5 - 26	N	Level 8	67.9
Levels 5 - 26	N	Level 9	68.0
Levels 5 - 26	N	Level 10	68.1
Levels 5 - 26	N	Level 11	68.3
Levels 5 - 26	N	Level 12	68.4
Levels 5 - 26	N	Level 13	68.5
Levels 5 - 26	N	Level 14	68.6
Levels 5 - 26	N	Level 15	68.6
Levels 5 - 26	N	Level 16	68.6
Levels 5 - 26	N	Level 17	68.6
Levels 5 - 26	N	Level 18	68.6
Levels 5 - 26	N	Level 19	68.6
Levels 5 - 26	N	Level 20	68.6
Levels 5 - 26	N	Level 21	68.6
Levels 5 - 26	N	Level 22	68.6
Levels 5 - 26	W	Level 1	64.6
Levels 5 - 26	W	Level 2	67.2
Levels 5 - 26	W	Level 3	67.9
Levels 5 - 26	W	Level 4	68.4
Levels 5 - 26	W	Level 5	68.7
Levels 5 - 26	W	Level 6	69.0
Levels 5 - 26	W	Level 7	69.3
Levels 5 - 26	W	Level 8	69.4

Proposed Mixed-Use Development
Road Traffic Noise Assessment- RTN Planning Horizon 2021

Location	Building Facade	Floor Level	L10(18h) (Facade Corrected) dB(A)
Levels 5 - 26	W	Level 9	69.5
Levels 5 - 26	W	Level 10	69.6
Levels 5 - 26	W	Level 11	69.7
Levels 5 - 26	W	Level 12	69.7
Levels 5 - 26	W	Level 13	69.7
Levels 5 - 26	W	Level 14	69.7
Levels 5 - 26	W	Level 15	69.7
Levels 5 - 26	W	Level 16	69.6
Levels 5 - 26	W	Level 17	69.6
Levels 5 - 26	W	Level 18	69.6
Levels 5 - 26	W	Level 19	69.5
Levels 5 - 26	W	Level 20	69.5
Levels 5 - 26	W	Level 21	69.4
Levels 5 - 26	W	Level 22	69.4
Levels 5 - 26 (SW)	S	Level 1	59.2
Levels 5 - 26 (SW)	S	Level 2	59.9
Levels 5 - 26 (SW)	S	Level 3	62.5
Levels 5 - 26 (SW)	S	Level 4	64.6
Levels 5 - 26 (SW)	S	Level 5	65.6
Levels 5 - 26 (SW)	S	Level 6	66.0
Levels 5 - 26 (SW)	S	Level 7	66.2
Levels 5 - 26 (SW)	S	Level 8	66.4
Levels 5 - 26 (SW)	S	Level 9	66.5
Levels 5 - 26 (SW)	S	Level 10	66.6
Levels 5 - 26 (SW)	S	Level 11	66.7
Levels 5 - 26 (SW)	S	Level 12	66.8
Levels 5 - 26 (SW)	S	Level 13	66.8
Levels 5 - 26 (SW)	S	Level 14	66.9
Levels 5 - 26 (SW)	S	Level 15	66.9
Levels 5 - 26 (SW)	S	Level 16	66.9
Levels 5 - 26 (SW)	S	Level 17	67.0
Levels 5 - 26 (SW)	S	Level 18	67.0
Levels 5 - 26 (SW)	S	Level 19	67.0
Levels 5 - 26 (SW)	S	Level 20	67.0
Levels 5 - 26 (SW)	S	Level 21	67.0
Levels 5 - 26 (SW)	S	Level 22	67.0
Levels 5 - 26	S	Level 1	58.8
Levels 5 - 26	S	Level 2	61.4
Levels 5 - 26	S	Level 3	62.8
Levels 5 - 26	S	Level 4	63.4
Levels 5 - 26	S	Level 5	63.9
Levels 5 - 26	S	Level 6	64.2
Levels 5 - 26	S	Level 7	64.5

Proposed Mixed-Use Development
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Location	Building Facade	Floor Level	L10(18h) (Facade Corrected) dB(A)
Levels 5 - 26	S	Level 8	64.7
Levels 5 - 26	S	Level 9	64.9
Levels 5 - 26	S	Level 10	65.0
Levels 5 - 26	S	Level 11	65.1
Levels 5 - 26	S	Level 12	65.2
Levels 5 - 26	S	Level 13	65.3
Levels 5 - 26	S	Level 14	65.3
Levels 5 - 26	S	Level 15	65.4
Levels 5 - 26	S	Level 16	65.4
Levels 5 - 26	S	Level 17	65.4
Levels 5 - 26	S	Level 18	65.4
Levels 5 - 26	S	Level 19	65.4
Levels 5 - 26	S	Level 20	65.5
Levels 5 - 26	S	Level 21	65.5
Levels 5 - 26	S	Level 22	65.5
Recreation Area		Level 1	59.4

Proposed Mixed-Use Development
Rail Noise

Name	Building Facade	Floor Level	LAmax dB(A)
Levels G - 4	N	Level 1	70.0
Levels G - 4	N	Level 2	71.0
Levels G - 4	N	Level 3	74.4
Levels G - 4	N	Level 4	76.7
Levels G - 4	W	Level 1	68.3
Levels G - 4	W	Level 2	70.0
Levels G - 4	W	Level 3	70.9
Levels G - 4	W	Level 4	72.5
Levels G - 4	S	Level 1	61.4
Levels G - 4	S	Level 2	61.6
Levels G - 4	S	Level 3	62.6
Levels G - 4	S	Level 4	63.5
Levels 5 - 26	E	Level 1	75.6
Levels 5 - 26	E	Level 2	78.8
Levels 5 - 26	E	Level 3	78.4
Levels 5 - 26	E	Level 4	78.6
Levels 5 - 26	E	Level 5	78.9
Levels 5 - 26	E	Level 6	79.2
Levels 5 - 26	E	Level 7	79.6
Levels 5 - 26	E	Level 8	79.7
Levels 5 - 26	E	Level 9	79.8
Levels 5 - 26	E	Level 10	79.8
Levels 5 - 26	E	Level 11	79.9
Levels 5 - 26	E	Level 12	80.1
Levels 5 - 26	E	Level 13	80.1
Levels 5 - 26	E	Level 14	80.1
Levels 5 - 26	E	Level 15	80.1
Levels 5 - 26	E	Level 16	80.1
Levels 5 - 26	E	Level 17	80.0
Levels 5 - 26	E	Level 18	79.9
Levels 5 - 26	E	Level 19	79.9
Levels 5 - 26	E	Level 20	79.8
Levels 5 - 26	E	Level 21	79.7
Levels 5 - 26	E	Level 22	79.6
Levels 5 - 26	N	Level 1	77.5
Levels 5 - 26	N	Level 2	78.8
Levels 5 - 26	N	Level 3	79.3
Levels 5 - 26	N	Level 4	79.5
Levels 5 - 26	N	Level 5	79.8
Levels 5 - 26	N	Level 6	80.0
Levels 5 - 26	N	Level 7	80.3
Levels 5 - 26	N	Level 8	80.6
Levels 5 - 26	N	Level 9	80.8

Proposed Mixed-Use Development
Rail Noise

Name	Building Facade	Floor Level	LAmax dB(A)
Levels 5 - 26	N	Level 10	80.8
Levels 5 - 26	N	Level 11	80.7
Levels 5 - 26	N	Level 12	80.8
Levels 5 - 26	N	Level 13	80.7
Levels 5 - 26	N	Level 14	80.7
Levels 5 - 26	N	Level 15	80.6
Levels 5 - 26	N	Level 16	80.5
Levels 5 - 26	N	Level 17	80.5
Levels 5 - 26	N	Level 18	80.4
Levels 5 - 26	N	Level 19	80.3
Levels 5 - 26	N	Level 20	80.3
Levels 5 - 26	N	Level 21	80.2
Levels 5 - 26	N	Level 22	80.1
Levels 5 - 26	N	Level 1	78.0
Levels 5 - 26	N	Level 2	78.4
Levels 5 - 26	N	Level 3	78.6
Levels 5 - 26	N	Level 4	78.7
Levels 5 - 26	N	Level 5	78.7
Levels 5 - 26	N	Level 6	78.8
Levels 5 - 26	N	Level 7	78.9
Levels 5 - 26	N	Level 8	78.9
Levels 5 - 26	N	Level 9	78.9
Levels 5 - 26	N	Level 10	79.1
Levels 5 - 26	N	Level 11	79.2
Levels 5 - 26	N	Level 12	79.0
Levels 5 - 26	N	Level 13	78.8
Levels 5 - 26	N	Level 14	78.8
Levels 5 - 26	N	Level 15	78.6
Levels 5 - 26	N	Level 16	78.6
Levels 5 - 26	N	Level 17	78.2
Levels 5 - 26	N	Level 18	78.1
Levels 5 - 26	N	Level 19	78.0
Levels 5 - 26	N	Level 20	78.0
Levels 5 - 26	N	Level 21	77.9
Levels 5 - 26	N	Level 22	77.9
Levels 5 - 26	W	Level 1	74.6
Levels 5 - 26	W	Level 2	75.1
Levels 5 - 26	W	Level 3	75.4
Levels 5 - 26	W	Level 4	75.7
Levels 5 - 26	W	Level 5	75.8
Levels 5 - 26	W	Level 6	76.0
Levels 5 - 26	W	Level 7	76.1
Levels 5 - 26	W	Level 8	76.2

Proposed Mixed-Use Development
Rail Noise

Name	Building Facade	Floor Level	LAmax dB(A)
Levels 5 - 26	W	Level 9	76.3
Levels 5 - 26	W	Level 10	76.4
Levels 5 - 26	W	Level 11	76.4
Levels 5 - 26	W	Level 12	76.4
Levels 5 - 26	W	Level 13	76.5
Levels 5 - 26	W	Level 14	76.6
Levels 5 - 26	W	Level 15	76.7
Levels 5 - 26	W	Level 16	76.8
Levels 5 - 26	W	Level 17	76.8
Levels 5 - 26	W	Level 18	76.9
Levels 5 - 26	W	Level 19	76.9
Levels 5 - 26	W	Level 20	77.0
Levels 5 - 26	W	Level 21	77.1
Levels 5 - 26	W	Level 22	77.2
Levels 5 - 26 (SW)	S	Level 1	67.3
Levels 5 - 26 (SW)	S	Level 2	69.6
Levels 5 - 26 (SW)	S	Level 3	69.3
Levels 5 - 26 (SW)	S	Level 4	69.6
Levels 5 - 26 (SW)	S	Level 5	70.2
Levels 5 - 26 (SW)	S	Level 6	70.4
Levels 5 - 26 (SW)	S	Level 7	70.6
Levels 5 - 26 (SW)	S	Level 8	70.8
Levels 5 - 26 (SW)	S	Level 9	71.0
Levels 5 - 26 (SW)	S	Level 10	71.2
Levels 5 - 26 (SW)	S	Level 11	71.4
Levels 5 - 26 (SW)	S	Level 12	71.4
Levels 5 - 26 (SW)	S	Level 13	71.6
Levels 5 - 26 (SW)	S	Level 14	71.7
Levels 5 - 26 (SW)	S	Level 15	71.9
Levels 5 - 26 (SW)	S	Level 16	72.2
Levels 5 - 26 (SW)	S	Level 17	72.4
Levels 5 - 26 (SW)	S	Level 18	72.6
Levels 5 - 26 (SW)	S	Level 19	72.9
Levels 5 - 26 (SW)	S	Level 20	73.1
Levels 5 - 26 (SW)	S	Level 21	73.3
Levels 5 - 26 (SW)	S	Level 22	73.4
Levels 5 - 26	S	Level 1	69.0
Levels 5 - 26	S	Level 2	69.2
Levels 5 - 26	S	Level 3	70.0
Levels 5 - 26	S	Level 4	70.6
Levels 5 - 26	S	Level 5	71.0
Levels 5 - 26	S	Level 6	71.2
Levels 5 - 26	S	Level 7	71.5

Proposed Mixed-Use Development
Rail Noise

Name	Building Facade	Floor Level	LAmax dB(A)
Levels 5 - 26	S	Level 8	71.6
Levels 5 - 26	S	Level 9	71.6
Levels 5 - 26	S	Level 10	71.8
Levels 5 - 26	S	Level 11	71.8
Levels 5 - 26	S	Level 12	71.9
Levels 5 - 26	S	Level 13	72.0
Levels 5 - 26	S	Level 14	72.1
Levels 5 - 26	S	Level 15	72.3
Levels 5 - 26	S	Level 16	72.5
Levels 5 - 26	S	Level 17	72.7
Levels 5 - 26	S	Level 18	72.8
Levels 5 - 26	S	Level 19	72.9
Levels 5 - 26	S	Level 20	73.0
Levels 5 - 26	S	Level 21	73.9
Levels 5 - 26	S	Level 22	74.4
Recreation Area		Level 1	75.8