

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 7 presents the measured road traffic noise levels recorded at the unattended monitoring location.

Table 7: Measured Road Traffic Noise Levels.

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

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

6.1.2. Traffic Volumes

The existing 2006 traffic volumes and percentage of heavy vehicles for the surrounding road network were obtained from Veitch Lister Consulting. Predicted 2010 and 2021 volumes are presented in Table 8 and are based on the corresponding growth rates as advised by Veitch Lister Consulting.

Table 8: Road Traffic Volumes for the Surrounding Road Network.

Description (Location):	Traffic Volume (AADT)			Heavy Vehicles % AADT	Growth Rate (%p.a.)
	2006	2010	2021		
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

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 $L_{A10,18\text{hr}}$ noise levels were calculated and compared to the measured levels as presented in Table 9.

Table 9: Comparison of Measured and Predicted Road Traffic Noise Levels.

Measured $L_{A10,18\text{Hour}}$	Predicted $L_{A10,18\text{Hour}}$	Required Correction
72.9	73	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 $\pm 2\text{dB(A)}$ tolerance. Therefore no correction factor is required.

6.1.4. Predicted Road Traffic Noise Levels – Year 2021

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 “ML Design”. (refer to **Appendix A**)
- Contour levels surrounding the site were obtained from *Brisbane City Council*.
- Screening from the adjacent commercial buildings was considered in the modelling.
- Finished floor levels presented on elevation plans provided by “ML Design” were utilised in the modelling (refer to **Appendix A**).
- The speed limit on Hamilton Place and O’Connell Terrace is 60km/h.
- The façade correction factor of +2.5dB(A) was considered in the calculations.

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

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

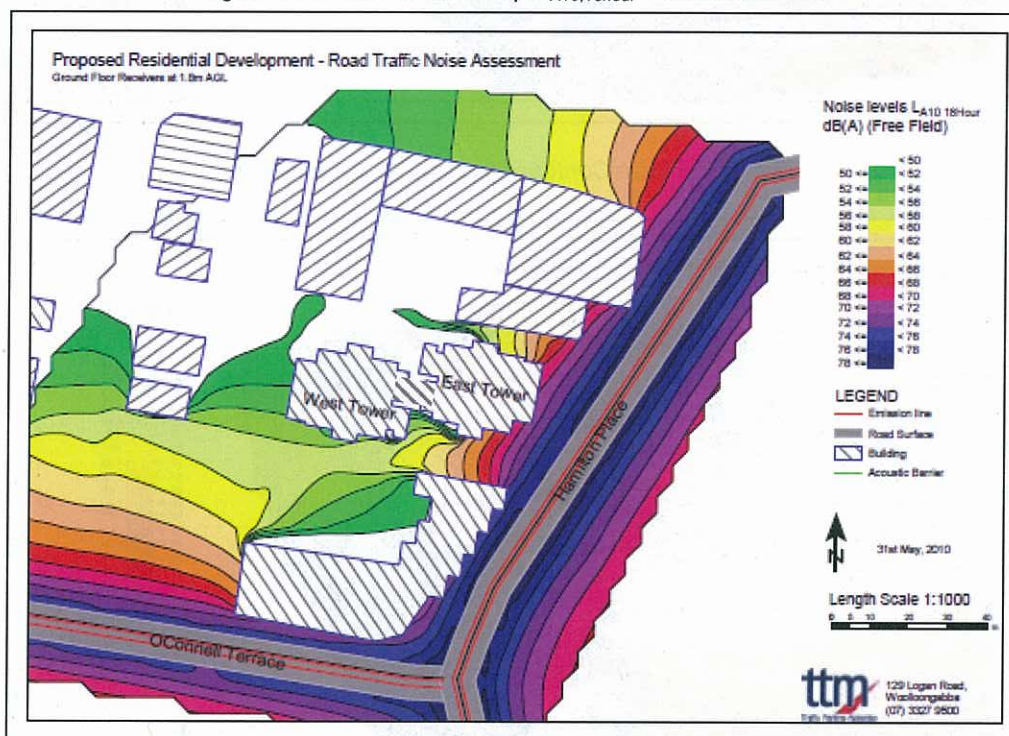


Figure 6: Noise Contour Map $L_{A10,18\text{hour}}$ – Level 5.

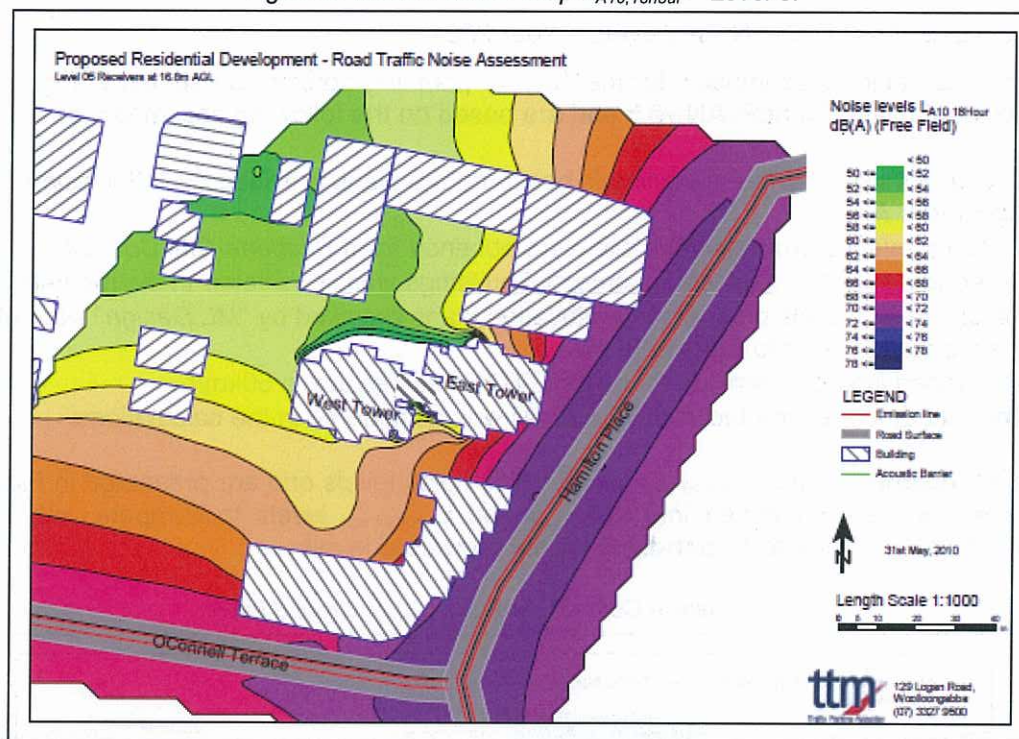


Figure 7: Noise Contour Map $L_{A10,18\text{hour}}$ – Level 10.

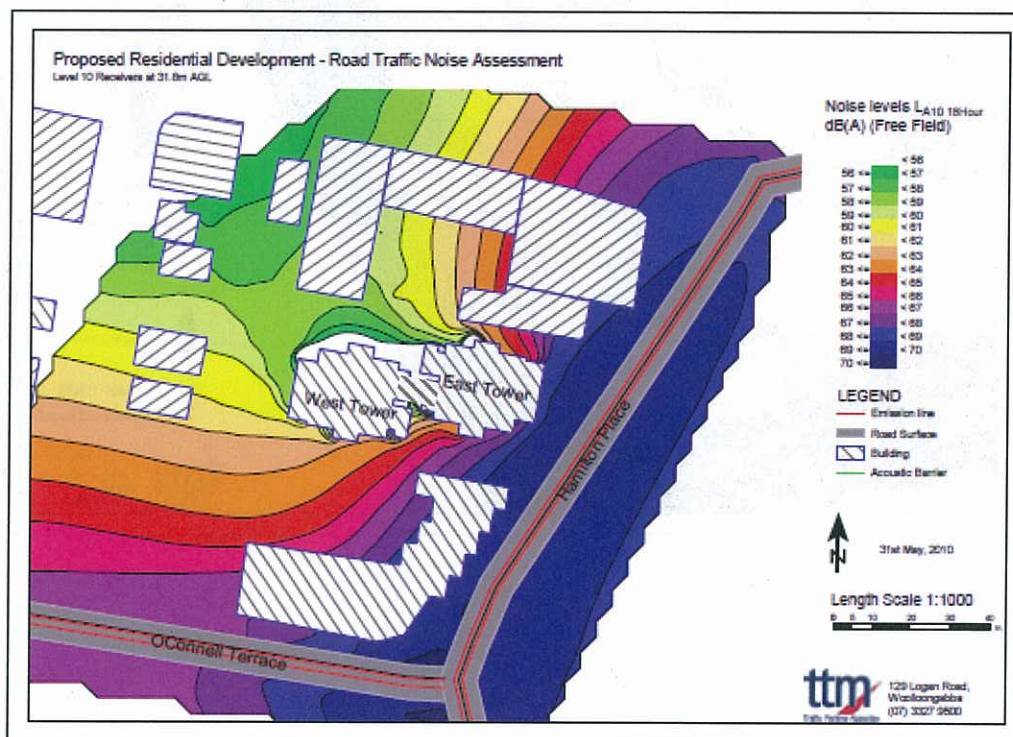
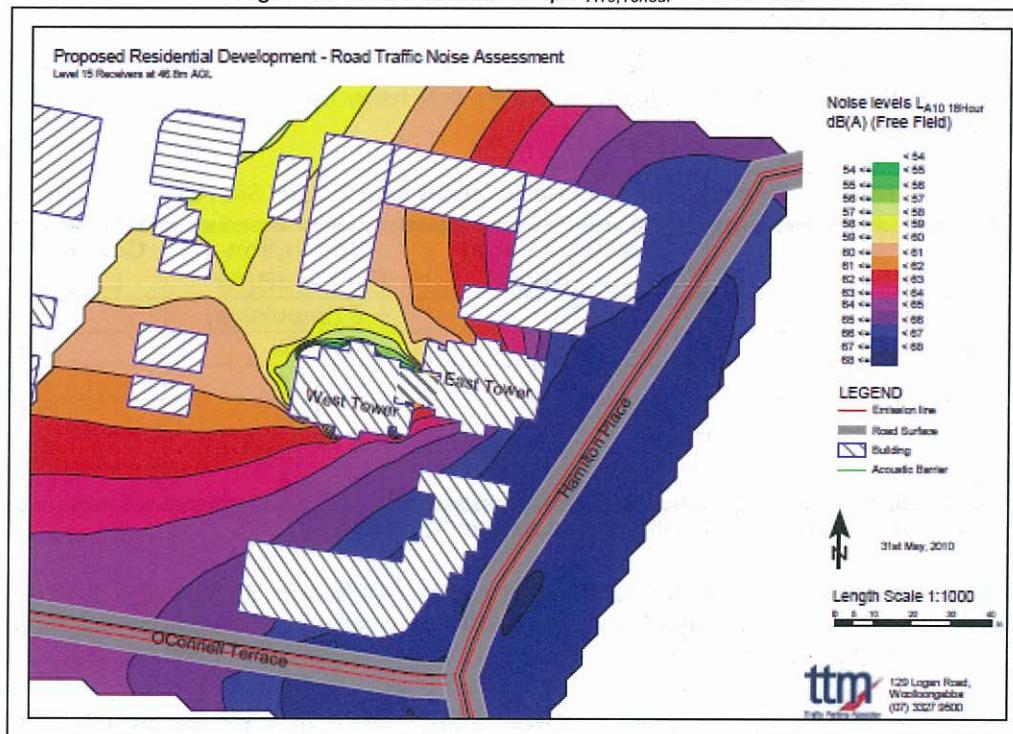


Figure 8: Noise Contour Map $L_{A10,18\text{hour}}$ – Level 15.



Based on the modelled levels, the following locations are predicted to exceed the external criteria requiring further assessment to ensure compliance with the internal noise limits detailed in Section 7:

- Eastern Tower, all facades;
- Western Tower, western, southern, eastern and northern façade,

Table 10 presents the modelled noise levels at the communal recreation areas and includes screening from the recommended acoustic barriers as detailed in Section 7.

Table 10: Predicted Road Traffic Impacts at Communal Recreation Areas.

Location:	Predicted SPL (dB(A)) in 2021 (Free field)	
	$L_{A10,18\text{hour}}$	$L_{Aeq,24\text{hour}}$
Ground Floor Pool Area	50	47
Sky Terrace – Level 9	56	53

Based on the modelled levels in Table 10, the communal areas are predicted to comply without addition acoustic treatments.

Note if the layout is changed or if the nominated finished pad levels as stipulated in **Appendix A** are raised in excess of 200mm, further assessment will be required.

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

6.2. Onsite Activity Noise

The average maximum levels associated with onsite activities are presented in Table 11 and were selected as they represent the likely activities that have the potential to impact the nearest residential receivers.

Table 11: 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

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

The nearest noise sensitive receivers to the site were identified in Section 2.4. Tables 12 – 14 present predicted noise levels (based on the above noise source levels) from the development impacting the nearest residential receivers.

Table 12: Predicted Noise Impact Levels from Onsite Activities to Receiver 1.

Noise Source:	Predicted Level L _{Amax} dB(A)		Assessment Criteria Complies (Yes/No)		
			Day 71dB(A)	Evening 66dB(A)	Sleep 45dB(A)
	Façade	Internal			
Car door closure	24	19	Yes	Yes	Yes
Car starting	16	11	Yes	Yes	Yes
Car bypass @ 5 km/h	18	13	Yes	Yes	Yes
Goods Delivery	26	21	Yes	Yes	Yes
Waste collection	38	33	Yes	Yes	Yes
Conversation	47	42	Yes	Yes	Yes

Table 13: Predicted Noise Impact Levels from Onsite Activities to Receiver 2.

Noise Source:	Predicted Level L _{Amax} dB(A)		Assessment Criteria Complies (Yes/No)		
			Day 58dB(A)	Evening 54dB(A)	Sleep 45dB(A)
	Façade	Internal			
Car door closure	32	27	Yes	Yes	Yes
Car starting	24	19	Yes	Yes	Yes
Car bypass @ 5 km/h	50	45	Yes	Yes	Yes
Goods Delivery	58	53	Yes	No	No
Waste collection	70	65	No	No	No
Conversation	45	40	Yes	Yes	Yes

Table 14: Predicted Noise Impact Levels from Onsite Activities to Receiver 3.

Noise Source:	Predicted Level L _{Amax} dB(A)		Assessment Criteria Complies (Yes/No)		
	Façade	Internal	Day 58dB(A)	Evening 54dB(A)	Sleep 45dB(A)
Car door closure	24	19	Yes	Yes	Yes
Car starting	16	11	Yes	Yes	Yes
Car bypass @ 5 km/h	28	23	Yes	Yes	Yes
Goods Delivery	33	28	Yes	Yes	Yes
Waste collection	45	40	Yes	Yes	Yes
Conversation	24	19	Yes	Yes	Yes

The predicted noise levels presented in Tables 12 – 14 are based upon the noise source being at the nearest position to the receivers, and assumes direct line of sight when applicable.

Waste collection is predicted to exceed the criteria at receiver 2. Noise impacts from waste collection are unlikely to be a cause of annoyance, given that they are generally and infrequent occurrence (i.e. once or twice per week) and are of short duration. To minimise annoyance from such activities we recommend that waste collection be limited to the daytime period between 7am and 6pm.

It is predicted goods deliveries will exceed the evening and sleep disturbance criteria at receiver 2. To minimise impacts from such activities it is recommended all goods deliveries be limited to the day time period (7am – 6pm).

All remaining onsite activities are predicted to comply with the day, evening and sleep disturbance criteria at the nearest residential receivers on the condition the recommendations in section 7 are implemented.

6.3. Offsite Activity Noise

There is the potential for offsite activities associated with the commercial premises to the south and north to impact the residential component of the development. The predicted impacts are divided into four sections (6.4.1 – 6.4.4) detailing the results of modelling for offsite commercial activities and were assessed based on their respective hours of operation as discussed in Section 2.5.

6.3.1. General Commercial Activity Noise

This section has assessed the vehicle movements, goods deliveries and waste collection for the commercial premises adjacent the southern boundary. The noise sources associated with general offsite commercial activities were based on similar investigations and are presented in Table 15. The noise sources were selected as they represent the likely activities that have the potential to impact the onsite receivers.

Table 15: 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 16 presents predicted noise levels (based on the above noise source levels) from the commercial premises impacting the nearest residential receivers on site for the existing operation hours of 7am to 5pm.

Table 16: Predicted Noise Impact Levels from Offsite Activities to the Site.

Noise Source:	Predicted Level L_{Amax} dB(A)	Assessment Criteria Complies (Yes/No)
	Façade	Day 58dB(A)
Car door closure	56	Yes
Car starting	48	Yes
Car bypass @ 5 km/h	53	Yes
Waste collection	56	Yes
Goods Deliveries	52	Yes
Conversation	51	Yes

The predicted noise levels presented in Table 16 are based upon the noise source being at the nearest position to the receivers, and assumes screening from existing buildings. All offsite activities are predicted to comply with the criteria based on current operating hours.

6.4. Rail Noise

6.4.1. Measured Noise Levels

Measurements of 10 train passbys were recorded on the 18th of May, 2010, and are presented in Table 17.

Table 17: Measured Noise Levels from Passing Trains.

Train Type	Separation Distance (m)	Instantaneous Noise Level SEL dB(A)	Maximum Noise Level L _{AMAX} dB(A)	Horn / Warning Device
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

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.

It was observed during the attended measurements that during certain train passbys the horn was utilised. Note as in accordance with the assessment requirements of Queensland Transport, all measurements containing horn noise were excluded.

6.4.2. Rail Volumes

Train timetables provided by Queensland Rail indicate an average of 28 Freight and 150 passenger trains passing the site daily. 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 “ML Design” (refer to **Appendix A**).
- The calculations were conducted in free field (no façade correction factor was applied).
- An average of 28 freight and 150 passenger trains per day traverse west of the site.
- The existing 3 metre high barrier located on the rail line boundary was utilised.

Figure 9: Noise Contour Map $L_{A\text{Max}}$ – Ground Level.

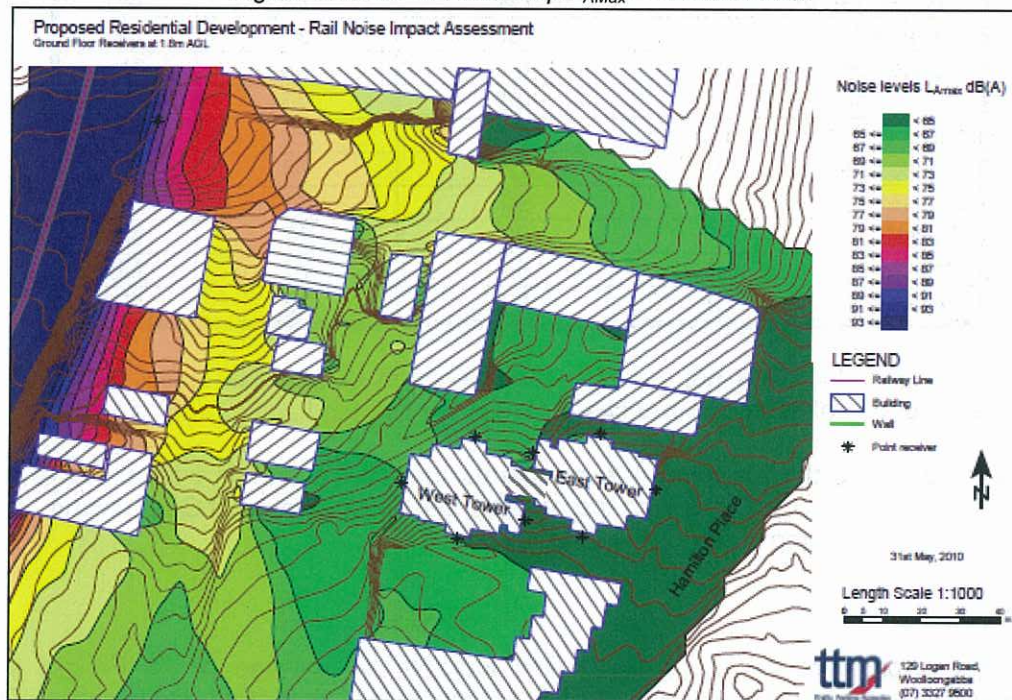


Figure 10: Noise Contour Map $L_{A\text{Max}}$ – Level 5.

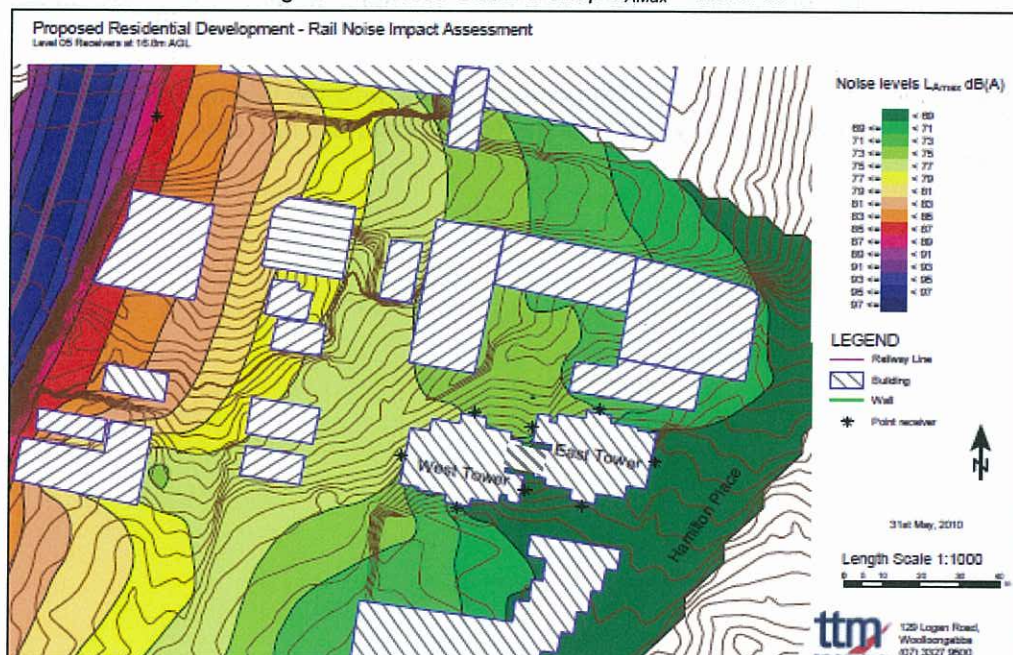


Figure 11: Noise Contour Map L_{Amax} – Level 10.

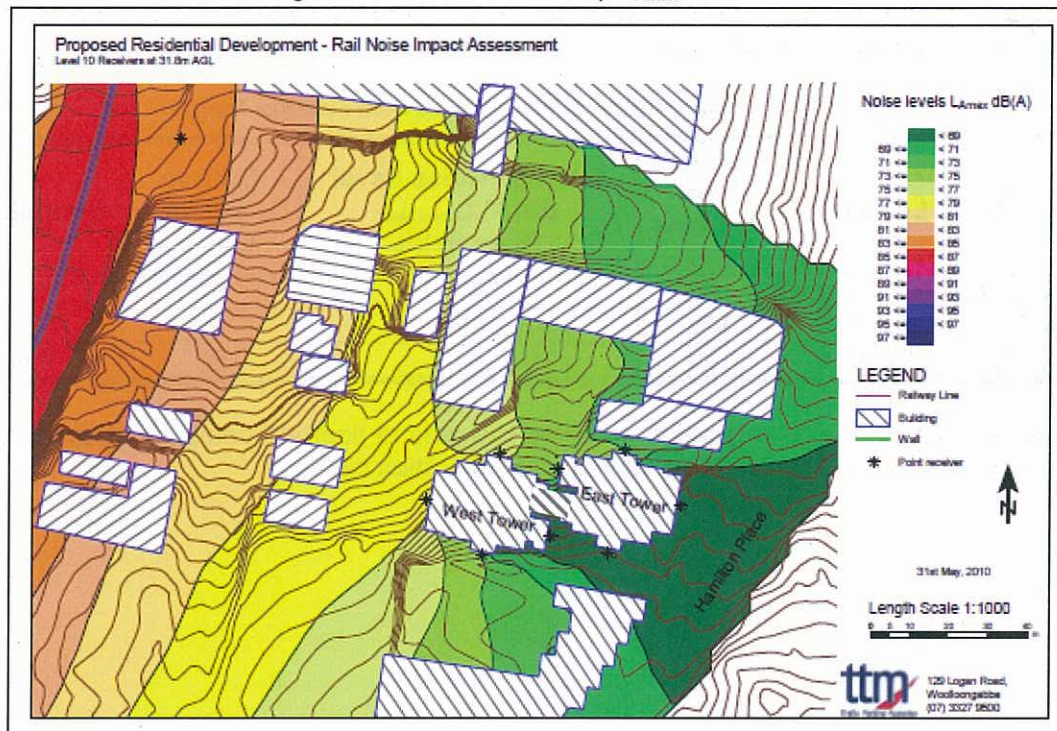
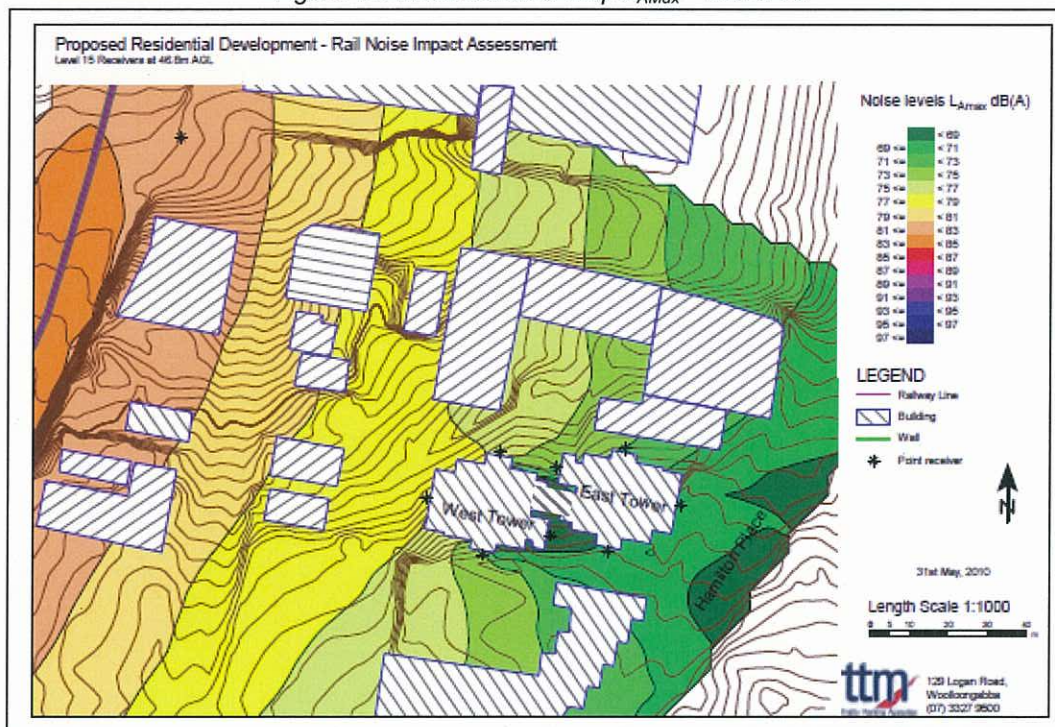


Figure 12: Noise Contour Map L_{Amax} – Level 15.



Based upon the modelled noise levels, all units are predicted to comply with the L_{Amax} 87dB(A) criteria due to sufficient separation distance and screening from the existing barrier.

All units shall require a 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 18: 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	100	57	65	Yes
Sky Terrace – Level 9	126	49	65	Yes
Sky Terrace – Level 10	160	44	65	Yes

It is predicted that all private recreation areas on the ground floor will comply with the criteria of $L_{Aeq,24Hour}$ 65dB(A) due to significant screening and separation distance.

7. RECOMMENDATIONS

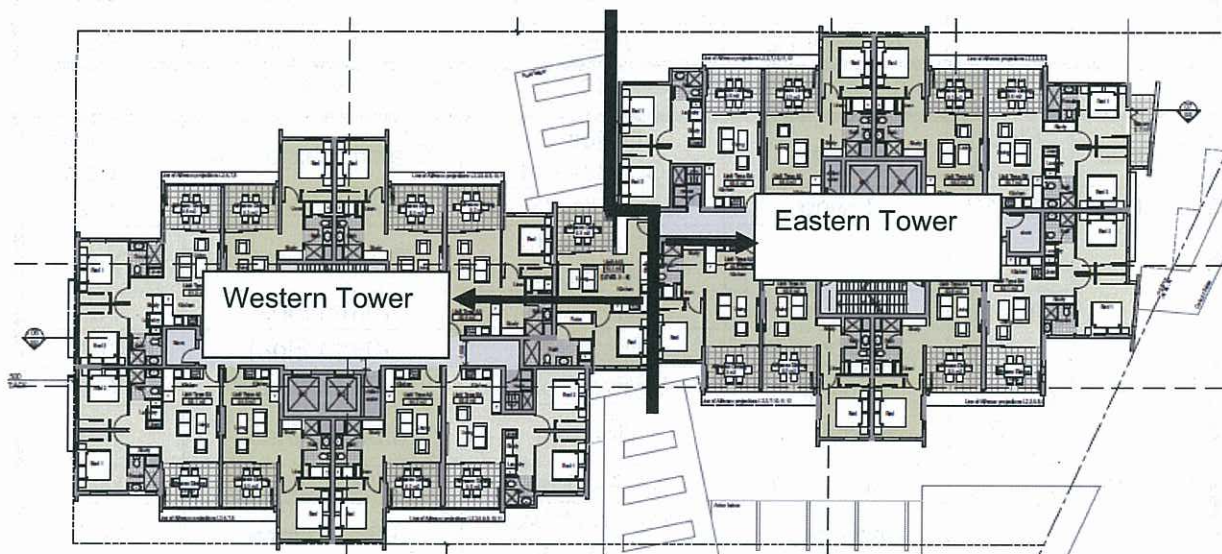
The recommended acoustic treatments are presented in five sections, 7.1 – 7.5 and are required to ensure compliance with the relevant assessment criteria.

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 Table 9 individual assessment of the following units is required:
 - East Tower;
 - Western Tower.

Figure 13: Building Split for Assessment.



All communal recreations areas are predicted to comply without any 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'.

Calculations were based on drawings numbered DA000 to DA031 issued by ML Design revision A.

Note if there is a revision of the layout or if the nominated finished floor RL levels as stipulated in the site layout (refer to **Appendix A**) are raised in excess of 200mm, a further assessment is required.

7.1.1. Glazing Treatments

Tables 19 – 20 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 Tables 19 & 20 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 19: Glazing Treatments for Proposed Units Western Tower & Link.

Façade	Floor Levels	Room	Building Component	Glazing thickness	Acoustic Seals
Western	8-11	Living	Windows	10.38mm Laminate	Yes
	Ground -8	Bedroom 1	Windows	6.38 laminate	Yes
		Bedroom 2	Windows	6.38 laminate	Yes
Northern & Southern	8-11	Living	Sliding Door	10mm Toughened or 10.38mm Laminate	Yes
	Ground -8	Living	Sliding Door	10mm Toughened or 10.38mm Laminate	Yes
	Ground -11	Bedroom	Windows	6.38 laminate	Yes
Eastern	Ground -11	Bedroom 1	Windows	6.38 laminate	Yes
		Bedroom 2	Windows	6.38 laminate	Yes

Table 20: Glazing Treatments for Proposed Units Eastern Tower.

Façade	Floor Levels	Room	Building Component	Glazing thickness	Acoustic Seals
Eastern	10 - 12	Living	East Windows	6.38 laminate	Yes
			South/north Sliding door	6.38 laminate	Yes
	Ground -9	Bedroom 1	Windows	10mm Float	Yes
		Bedroom 2	Windows	10mm Float	Yes
Northern & Southern	Ground -12	Living	Sliding Door	6.38 laminate	Yes
		Bedroom	Windows	6.38 laminate	Yes
Western	Ground -12	Bedroom 1	All Windows	6.38 laminate	Yes
		Bedroom 1	North/south/west Windows	6.38 laminate	Yes
		Bedroom 2	North/south/west Windows	6.38 laminate	Yes

All remaining locations on site not specified within Tables 31 – 33 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 21.

Table 21: 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

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 Tables 19 and 20), 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 adjacent the site. Based upon the assumed noise source levels and criteria (refer to Section 5.2); our assessment shows that further acoustic treatments are required as follows:

- Construction of a 2.4 metre barrier as marked in red on the figure below for the driveway access to the carpark. The barrier is to be of solid construction with no gaps and may use a material that achieves 11kg/m^2 surface density. Materials may include 6mm toughened or laminated glass, blockwork or 9mm FC



In addition to the acoustic treatments we recommend the following management controls to minimise annoyance from waste collection and ensure compliance of goods deliveries:

- All waste collection activities be limited to the daytime periods between 7am and 6pm.
- Goods deliveries shall be limited to the day time period (7am – 6pm).

All remaining onsite activities are predicted to comply with the daytime, evening and sleep disturbance criteria due to increased 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 5.4 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 residential development located at 16 Hamilton Place, Bowen Hills. On the condition 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:



GREG PEARCE B.Eng (Mech)
Associate Director

9. APPENDICES

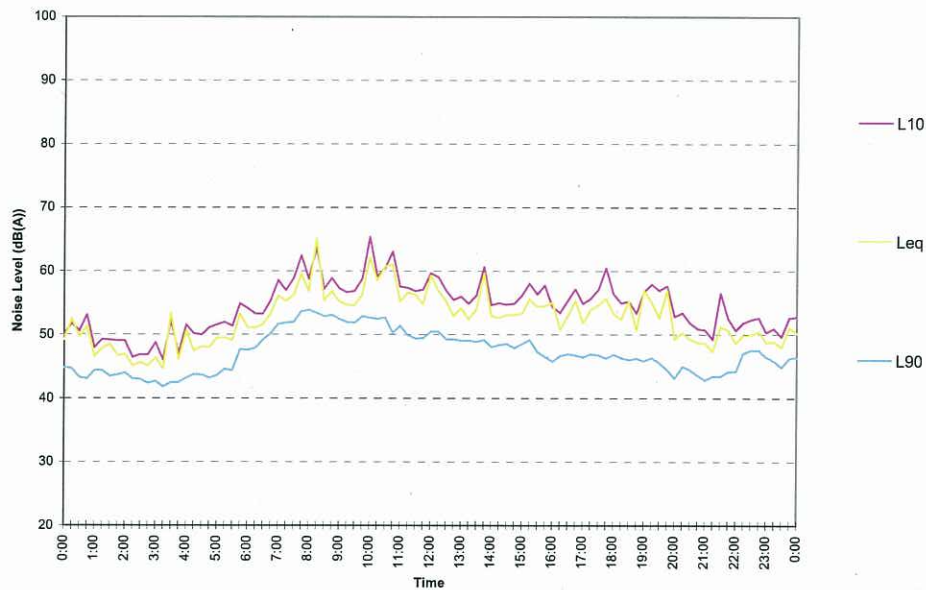
Appendix A

Noise Monitoring Graphs

26615ENV
 18/05/2010



26615ENV
 19/05/2010



26615ENV

20/05/2010



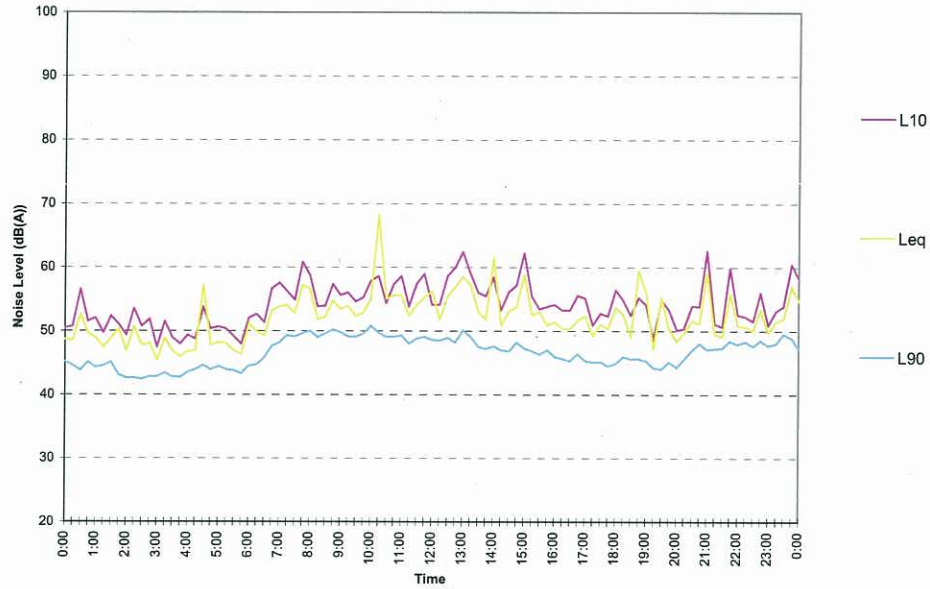
26615ENV

21/05/2010



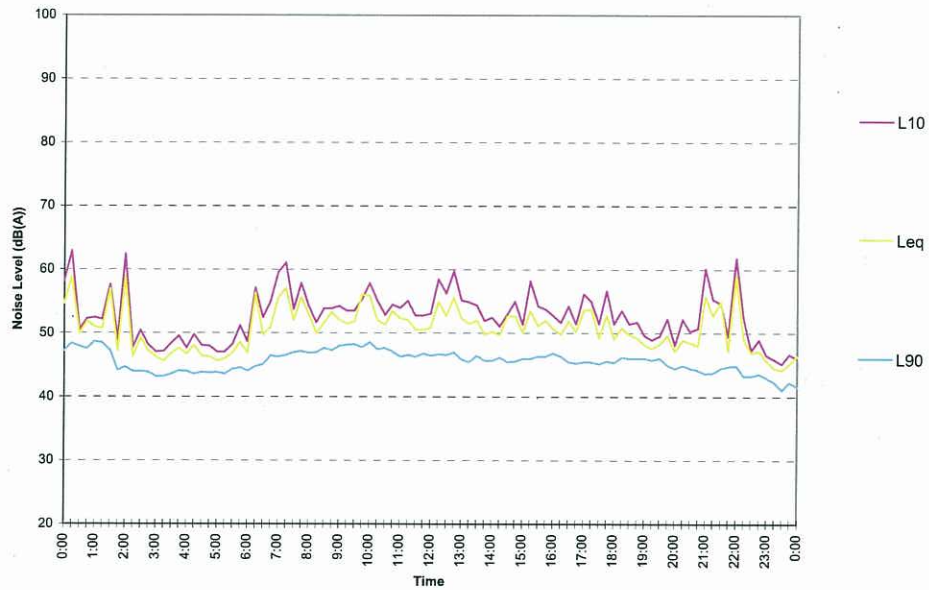
26615ENV

22/05/2010



26615ENV

23/05/2010



26615ENV

24/05/2010



9 Tufton St, Bowen Hills - ENV

Tuesday May 18, 2010



9 Tufton St, Bowen Hills - ENV

Wednesday May 19, 2010



9 Tufton St, Bowen Hills - ENV

Thursday May 20, 2010



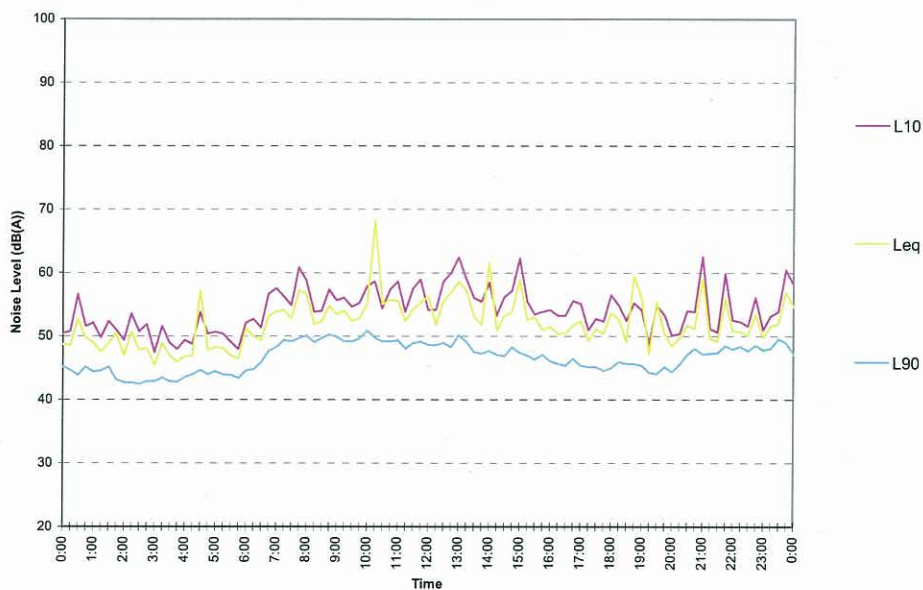
9 Tufton St, Bowen Hills - ENV

Friday May 21, 2010



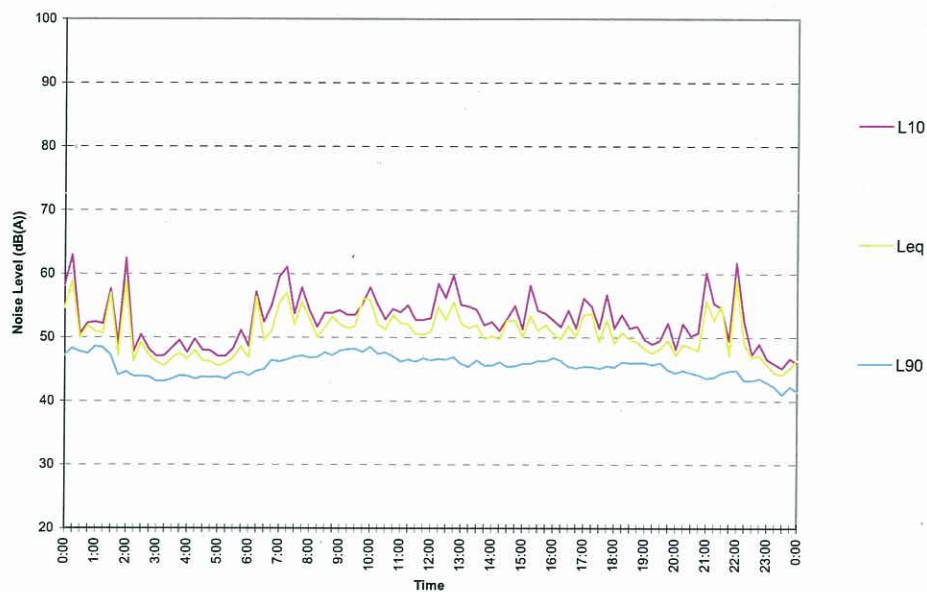
9 Tufton St, Bowen Hills - ENV

Saturday May 22, 2010



9 Tufton St, Bowen Hills - ENV

Sunday May 23, 2010



9 Tufton St, Bowen Hills - ENV

Monday May 24, 2010



Appendix B

SoundPLAN Calculations

**Proposed Residential Development
 Road Traffic Noise Assessment- RTN 2021**

Location	Building Facade	Natural Surface Level RL (m)	Floor Level	L10(18h) (Facade Corrected) dB(A)
East Tower	N	20.50	Level 1	60.5
East Tower	N	20.50	Level 2	61.9
East Tower	N	20.50	Level 3	62.8
East Tower	N	20.50	Level 4	63.5
East Tower	N	20.50	Level 5	64.0
East Tower	N	20.50	Level 6	64.7
East Tower	N	20.50	Level 7	65.2
East Tower	N	20.50	Level 8	65.4
East Tower	N	20.50	Level 9	65.6
East Tower	N	20.50	Level 10	65.7
East Tower	N	20.50	Level 11	65.7
East Tower	W	20.50	Level 1	40.4
East Tower	W	20.50	Level 2	40.6
East Tower	W	20.50	Level 3	40.8
East Tower	W	20.50	Level 4	41.1
East Tower	W	20.50	Level 5	41.4
East Tower	W	20.50	Level 6	41.6
East Tower	W	20.50	Level 7	41.9
East Tower	W	20.50	Level 8	42.2
East Tower	W	20.50	Level 9	42.6
East Tower	W	20.50	Level 10	43.4
East Tower	W	20.50	Level 11	44.7
East Tower	S	20.50	Level 1	65.2
East Tower	S	20.50	Level 2	67.4
East Tower	S	20.50	Level 3	68.4
East Tower	S	20.50	Level 4	68.6
East Tower	S	20.50	Level 5	68.6
East Tower	S	20.50	Level 6	68.7
East Tower	S	20.50	Level 7	68.6
East Tower	S	20.50	Level 8	68.7
East Tower	S	20.50	Level 9	68.9
East Tower	S	20.50	Level 10	69.1
East Tower	S	20.50	Level 11	69.1
East Tower	E	20.50	Level 1	72.8
East Tower	E	20.50	Level 2	74.7
East Tower	E	20.50	Level 3	74.7
East Tower	E	20.50	Level 4	74.3
East Tower	E	20.50	Level 5	73.9
East Tower	E	20.50	Level 6	73.5
East Tower	E	20.50	Level 7	73.1
East Tower	E	20.50	Level 8	72.6
East Tower	E	20.50	Level 9	72.2
East Tower	E	20.50	Level 10	71.7

Location	Building Facade	Natural Surface Level RL (m)	Floor Level	L10(18h) (Facade Corrected) dB(A)
East Tower	E	20.50	Level 11	71.3
West Tower	N	20.50	Level 1	44.1
West Tower	N	20.50	Level 2	44.9
West Tower	N	20.50	Level 3	46.4
West Tower	N	20.50	Level 4	47.5
West Tower	N	20.50	Level 5	48.7
West Tower	N	20.50	Level 6	50.1
West Tower	N	20.50	Level 7	51.9
West Tower	N	20.50	Level 8	53.7
West Tower	N	20.50	Level 9	55.2
West Tower	N	20.50	Level 10	56.6
West Tower	N	20.50	Level 11	57.5
West Tower	N	20.50	Level 12	58.2
West Tower	N	20.50	Level 13	58.7
West Tower	N	20.50	Level 14	59.1
West Tower	N	20.50	Level 15	59.4
West Tower	W	20.50	Level 1	56.6
West Tower	W	20.50	Level 2	58.1
West Tower	W	20.50	Level 3	59.1
West Tower	W	20.50	Level 4	59.6
West Tower	W	20.50	Level 5	60.1
West Tower	W	20.50	Level 6	60.4
West Tower	W	20.50	Level 7	60.7
West Tower	W	20.50	Level 8	60.9
West Tower	W	20.50	Level 9	60.9
West Tower	W	20.50	Level 10	60.8
West Tower	W	20.50	Level 11	60.8
West Tower	W	20.50	Level 12	60.7
West Tower	W	20.50	Level 13	60.6
West Tower	W	20.50	Level 14	60.5
West Tower	W	20.50	Level 15	60.5
West Tower	S	20.50	Level 1	58.0
West Tower	S	20.50	Level 2	60.2
West Tower	S	20.50	Level 3	61.3
West Tower	S	20.50	Level 4	62.1
West Tower	S	20.50	Level 5	62.7
West Tower	S	20.50	Level 6	63.4
West Tower	S	20.50	Level 7	64.1
West Tower	S	20.50	Level 8	64.5
West Tower	S	20.50	Level 9	64.8
West Tower	S	20.50	Level 10	65.0
West Tower	S	20.50	Level 11	65.2
West Tower	S	20.50	Level 12	65.4

**Proposed Residential Development
 Rail Verification**

Name	Natural Surface Level (AHD m)	Building Facade	Floor Level	L _{max} dB(A)
East Tower	20.50	N	Level 1	63.6
East Tower	20.50	N	Level 2	66.6
East Tower	20.50	N	Level 3	70.3
East Tower	20.50	N	Level 4	71.6
East Tower	20.50	N	Level 5	72.7
East Tower	20.50	N	Level 6	72.7
East Tower	20.50	N	Level 7	72.8
East Tower	20.50	N	Level 8	72.5
East Tower	20.50	N	Level 9	72.6
East Tower	20.50	N	Level 10	72.7
East Tower	20.50	N	Level 11	72.8
East Tower	20.50	W	Level 1	68.1
East Tower	20.50	W	Level 2	70.9
East Tower	20.50	W	Level 3	73.0
East Tower	20.50	W	Level 4	73.5
East Tower	20.50	W	Level 5	74.1
East Tower	20.50	W	Level 6	74.0
East Tower	20.50	W	Level 7	73.8
East Tower	20.50	W	Level 8	73.7
East Tower	20.50	W	Level 9	73.7
East Tower	20.50	W	Level 10	73.8
East Tower	20.50	W	Level 11	74.0
East Tower	20.50	S	Level 1	61.1
East Tower	20.50	S	Level 2	63.3
East Tower	20.50	S	Level 3	64.7
East Tower	20.50	S	Level 4	65.6
East Tower	20.50	S	Level 5	66.6
East Tower	20.50	S	Level 6	65.9
East Tower	20.50	S	Level 7	66.1
East Tower	20.50	S	Level 8	66.9
East Tower	20.50	S	Level 9	67.5
East Tower	20.50	S	Level 10	68.2
East Tower	20.50	S	Level 11	68.7
East Tower	20.50	E	Level 1	51.3
East Tower	20.50	E	Level 2	51.3
East Tower	20.50	E	Level 3	51.3
East Tower	20.50	E	Level 4	51.4
East Tower	20.50	E	Level 5	51.4
East Tower	20.50	E	Level 6	51.5
East Tower	20.50	E	Level 7	51.5
East Tower	20.50	E	Level 8	51.6
East Tower	20.50	E	Level 9	51.7
East Tower	20.50	E	Level 10	51.9
East Tower	20.50	E	Level 11	52.2
SLM	8.77		Level 1	88.7
West Tower	20.50	W	Level 1	70.6
West Tower	20.50	W	Level 2	73.3
West Tower	20.50	W	Level 3	75.1

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**Proposed Residential Development
 Rail Verification**

Name	Natural Surface Level (AHD m)	Building Facade	Floor Level	L _{Amax} dB(A)
West Tower	20.50	W	Level 4	75.6
West Tower	20.50	W	Level 5	76.3
West Tower	20.50	W	Level 6	76.6
West Tower	20.50	W	Level 7	76.9
West Tower	20.50	W	Level 8	77.3
West Tower	20.50	W	Level 9	77.7
West Tower	20.50	W	Level 10	78.1
West Tower	20.50	W	Level 11	78.5
West Tower	20.50	W	Level 12	78.8
West Tower	20.50	W	Level 13	78.9
West Tower	20.50	W	Level 14	78.9
West Tower	20.50	W	Level 15	78.9
West Tower	20.50	N	Level 1	69.9
West Tower	20.50	N	Level 2	73.1
West Tower	20.50	N	Level 3	73.9
West Tower	20.50	N	Level 4	74.3
West Tower	20.50	N	Level 5	74.7
West Tower	20.50	N	Level 6	74.7
West Tower	20.50	N	Level 7	74.7
West Tower	20.50	N	Level 8	74.7
West Tower	20.50	N	Level 9	75.0
West Tower	20.50	N	Level 10	75.2
West Tower	20.50	N	Level 11	75.6
West Tower	20.50	N	Level 12	76.0
West Tower	20.50	N	Level 13	76.4
West Tower	20.50	N	Level 14	76.6
West Tower	20.50	N	Level 15	76.6
West Tower	20.50	S	Level 1	65.0
West Tower	20.50	S	Level 2	66.2
West Tower	20.50	S	Level 3	67.7
West Tower	20.50	S	Level 4	69.2
West Tower	20.50	S	Level 5	68.3
West Tower	20.50	S	Level 6	69.6
West Tower	20.50	S	Level 7	70.3
West Tower	20.50	S	Level 8	71.0
West Tower	20.50	S	Level 9	71.7
West Tower	20.50	S	Level 10	72.3
West Tower	20.50	S	Level 11	72.8
West Tower	20.50	S	Level 12	73.2
West Tower	20.50	S	Level 13	73.5
West Tower	20.50	S	Level 14	73.7
West Tower	20.50	S	Level 15	73.7
West Tower	20.50	E	Level 1	55.5
West Tower	20.50	E	Level 2	55.6
West Tower	20.50	E	Level 3	55.7
West Tower	20.50	E	Level 4	55.8
West Tower	20.50	E	Level 5	56.0
West Tower	20.50	E	Level 6	56.2

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**Proposed Residential Development
 Rail Verification**

Name	Natural Surface Level (AHD m)	Building Facade	Floor Level	L _{Amax} dB(A)
West Tower	20.50	E	Level 7	56.5
West Tower	20.50	E	Level 8	56.9
West Tower	20.50	E	Level 9	57.1
West Tower	20.50	E	Level 10	57.8
West Tower	20.50	E	Level 11	58.4
West Tower	20.50	E	Level 12	59.3
West Tower	20.50	E	Level 13	60.1
West Tower	20.50	E	Level 14	53.0
West Tower	20.50	E	Level 15	53.3