

**Proposed Mixed Use Development
5 – 9 Hercules Street, Hamilton**

ENVIRONMENTAL NOISE IMPACT ASSESSMENT

PLANS AND DOCUMENTS
referred to in the ULDA
APPROVAL dated 10 / 5 / 11

Prepared For:

Intercap Pty Ltd

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1. INTRODUCTION

The following report is in response to a request by Intericap Pty Ltd to conduct an environmental noise impact assessment for a proposed mixed use development located at 5 – 9 Hercules Street, Hamilton. A revised assessment was conducted based on the revised plans and is for consideration by ULDA.

In undertaking this assessment, unattended road traffic noise monitoring was conducted, and through modelling, predictions of road traffic noise impacts in the year 2021 were produced. In addition the report addresses both onsite and offsite activity noise. Based upon the predicted noise levels, recommendations regarding acoustic treatments and management controls were specified.

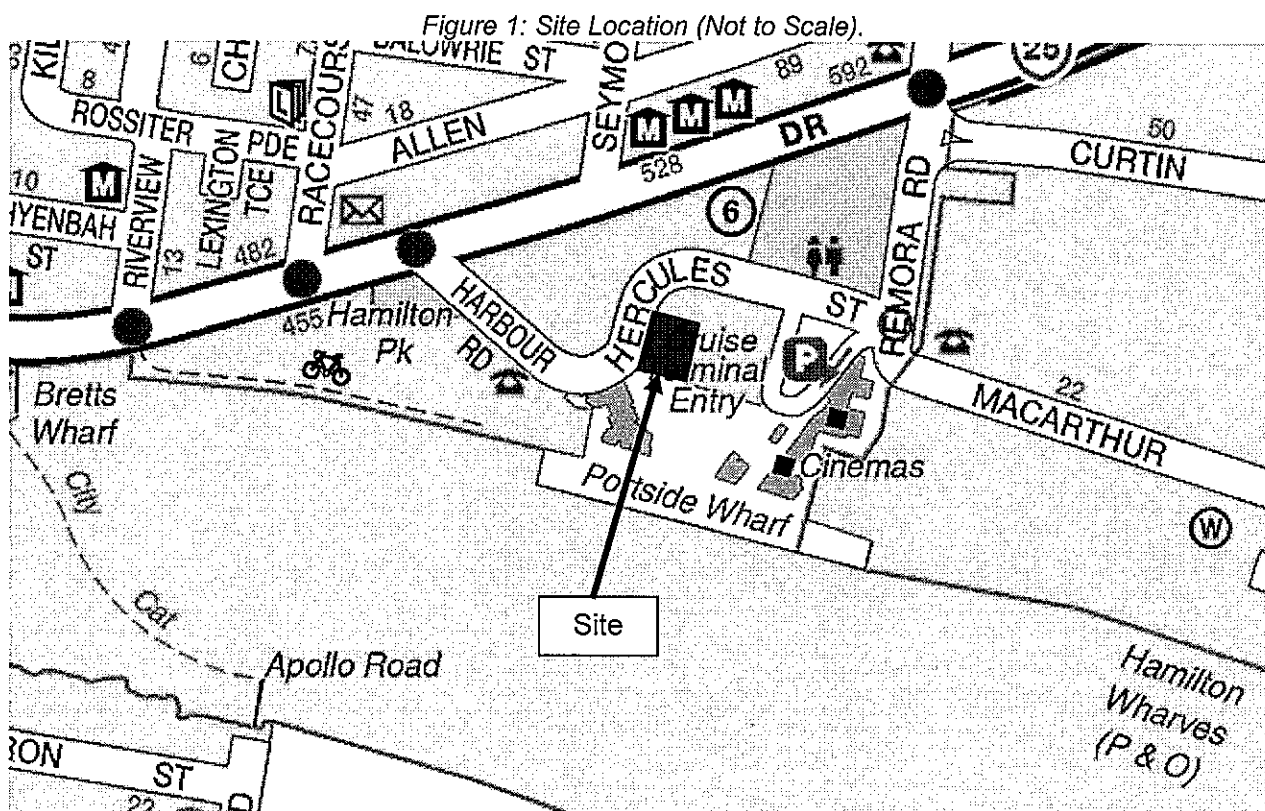
2. SITE DESCRIPTION

2.1. Site Location

The site is described by the following:

*Lot 631 on SL801514 and Lot 645 on SL2184.
5 – 9 Hercules Street, Hamilton.*

Refer to Figure 1 for the site location.



A comprehensive site survey was conducted on the 25th of June, 2009. The survey identified the following:

- Hercules Street is located adjacent the western boundary separating the site from a proposed commercial/residential development.
- "Portside Wharf" is located to the south separating the development from the P & O cruise terminal, the Brisbane River and a mixture of commercial and residential buildings.
- The "Department of Primary Industries" (DPI) is located adjacent the eastern boundary separating the site from "Portside Wharf" shopping centre and some timber storage yards fronting MacArthur Avenue.
- "Samies Girl" fresh seafood market is located adjacent the northern boundary separating the development from Hercules Street, a Caltex service station and Kingsford-Smith Drive.

2.2. Proposal

The proposal is to develop the site over 2 stages incorporating the following:

- Stage 1 includes:
 - Retail shops and residential lift lobbies are located on the ground floor;
 - Levels 1 – 3 contain a total of 31 residential units, a gym and a recreation room;
 - Levels 4 – 10 consist of a total of 77 residential units;
 - The communal recreation area is located on the roof terrace.
- Stage 2 includes:
 - Ground floor contains retail shops, the residential lift lobby, bin storage area and 45 parking spaces;
 - Levels 1 and 2 comprise a total of 12 residential units and 84 parking spaces.
 - The communal recreation area is located on Level 3 and includes 6 residential units;
 - Levels 4 – 18 contain a total of 120 residential units.
- Basement levels:
 - Stage 1 includes 2 basement parking levels with a total of 84 parking spaces;
 - Stage 2 contains 1 basement parking level with a total of 59 parking spaces provided.

Vehicle access to the site is via the future promenade (southern boundary).

Refer to **Appendix A** for the development plans.

2.3. Description of Surrounding Environment

The site is primarily affected by road traffic noise from Kingsford-Smith Drive. Other activities in the area that potentially affect the acoustic amenity include the DPI, *Samies Girl* seafood market, Caltex service station, timber storage yards and the *Portside Wharf* shopping centre.

During the site visit, activities associated with the Portside Wharf shopping centre, P & O cruise terminal and the timber storage yards were inaudible at the site. The Caltex service station, Samies Girl seafood market and DPI were audible at the site. A cursory assessment of the potential impacts from these premises was conducted at the site.

2.4. Affected Receivers

The area surrounding the site consists predominantly of commercial and residential land uses. This assessment will focus on the nearest affected residential receivers as follows:

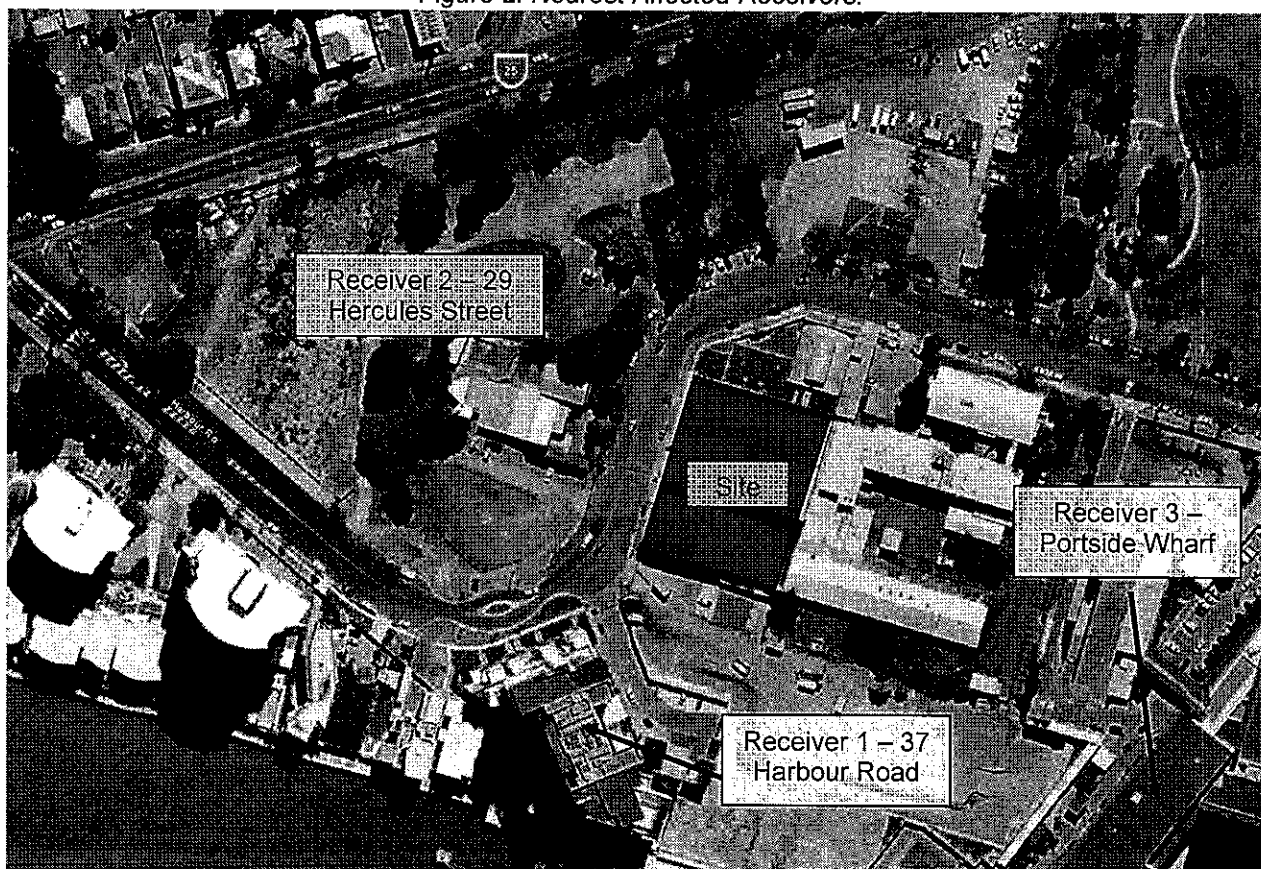
Receiver 1: An 11 storey residential building located at 37 Harbour Road south west of the site. A distance of approximately 40 metres separates the development from the nearest façade of the building.

Receiver 2: A proposed residential apartment building (not constructed) is situated at 29 Hercules Street to the west. Approximately 28 metres separates the site from the nearest boundary.

Receiver 3: A 9 storey residential apartment building located at “Portside Wharf” east of the site. A distance of approximately 140 metres separates the development from the nearest façade.

Refer to Figure 2 for the location of the noise sensitive receivers.

Figure 2: Nearest Affected Receivers.



If compliance can be achieved at residential receivers 1 – 3, compliance will be achieved at all remaining noise sensitive locations.

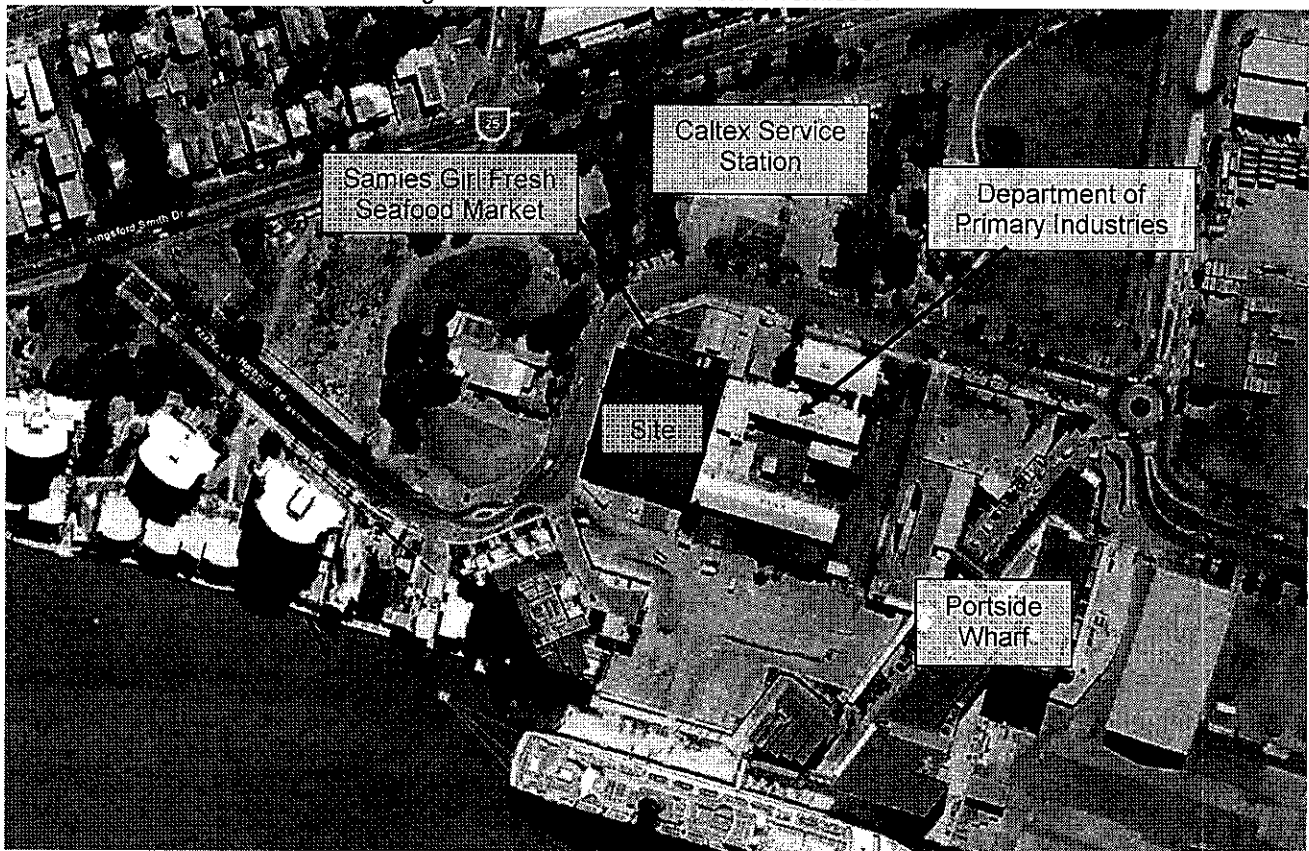
2.5. Offsite Commercial Activities

To adequately assess the site, consideration must be given to the activities associated with commercial premises located in the vicinity of the site. During the site survey, the following offsite premises were identified as having the potential to impact the acoustic amenity of the site:

- “Department of Primary Industries” (operating hours 8am to 6pm Monday to Friday).
- “Samies Girl” fresh seafood market (operating hours 7am to 6pm Monday to Sunday).
- “Caltex Service Station” (operating hours 24hours a day, Monday to Sunday).

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

Figure 3: Nearest Commercial Premises.



A review of the P & O Cruise ship timetable indicates on average 4 ships per month dock at the Hamilton terminal. Noise impacts from the terminal are unlikely to be a cause of annoyance, given that they are generally an infrequent occurrence (i.e. once per week).

A preliminary 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, ambient and offsite activity noise levels in the vicinity of the site:

- Two ARL EL316 Environmental Noise Monitor (SN# 16-004-037 and 16-707-016);
- RION NA-28 Sound Level Meter (SLM) (SN# 01060055), and
- BSWA Technology Co.Ltd Acoustical Calibrator (SN # 44095).

The environmental noise monitors and SLM hold current NATA Laboratory Certification and were field calibrated before and after the monitoring sessions. No significant drift from the reference was signal recorded.

4. METHODOLOGY

4.1. Unattended Road Traffic Noise Measurement Procedure

An ARL EL316 unattended noise monitor was placed at 488 Kingsford-Smith Drive, in a free field position to measure existing road traffic noise levels. The monitor was located approximately 5 metres from the nearest lane and 1.5 metres above road level with an unobstructed line of sight.

A second ARL EL315 unattended noise monitor was placed at 37 Harbour Road in a free field position to measure existing road traffic noise levels. The monitor was located approximately 10 metres from the nearest lane and 1.3 metres above road level with an unobstructed line of sight.

The unattended noise monitors were set to record road traffic noise levels from the 25th to the 30th of June, 2009 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 in general accordance with Australian Standard AS2702:1984 'Acoustics - Methods for the measurement of road traffic noise'.

4.2. Unattended Ambient Noise Measurement Procedure

An ARL EL316 environmental noise monitor was placed in the vicinity of the site to measure existing background noise levels representative of the development. The unattended noise monitor was located 1.3m above ground level, in a free field location.

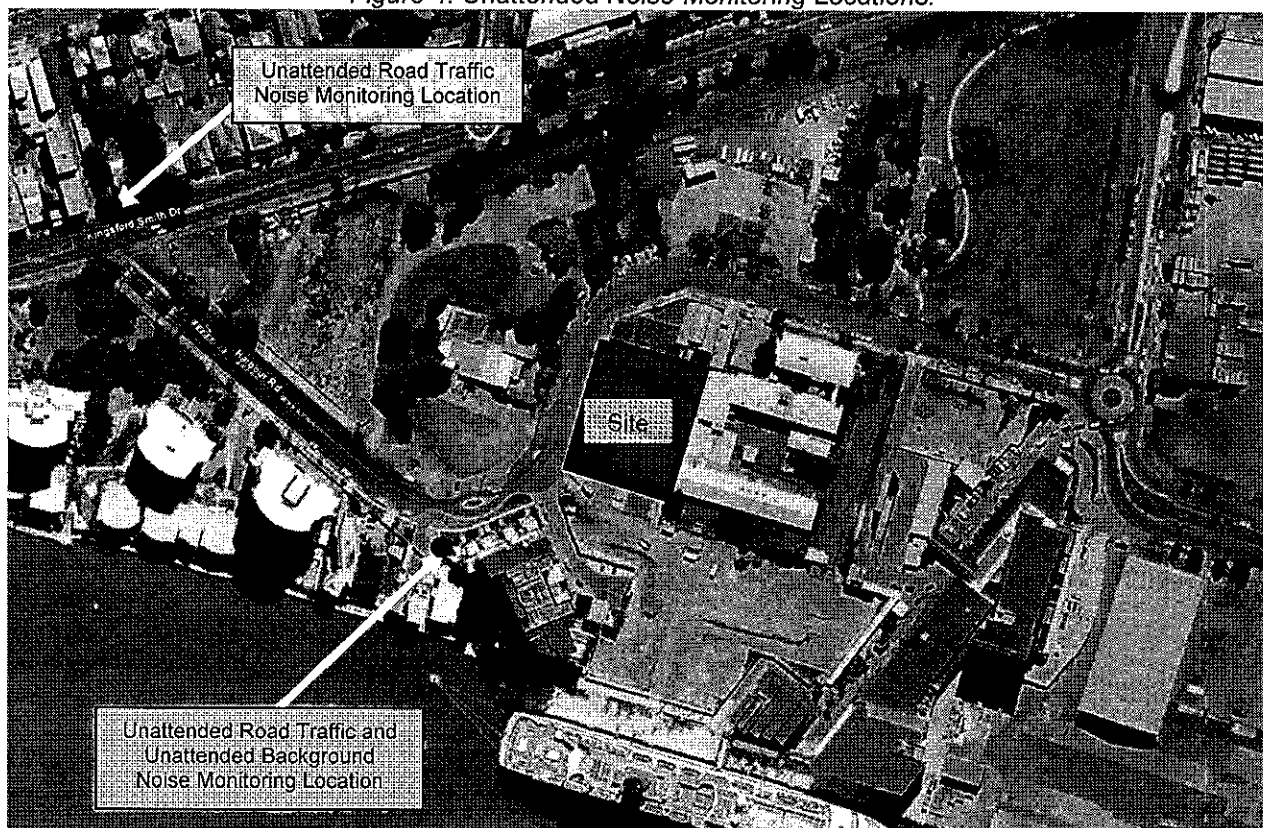
The noise monitor was set to record noise levels between the 25th and 30th of June, 2009 as follows:

- "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'.

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

Figure 4: Unattended Noise Monitoring Locations.



Rainfall was recorded on the 26th and 27th of June, 2009. The data collected on these days were omitted from the analysis. Weather conditions for the remaining days of the monitoring were generally fine with light wind speeds.

4.3. Onsite Activity Noise Measurements

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

4.4. Offsite Activity Noise Measurements

A site survey was conducted to determine the potential for offsite activities to impact the development. Attended noise measurements of plant equipment associated with “Samies Girl” and the “DPI” were conducted on Monday the 29th of June, 2009 between 9:30pm and 10:30pm. Typical noise levels associated with the observed offsite activities were taken from similar investigations by TTM Acoustics. All measurements were conducted generally in accordance with Australian Standard AS1055:1997 *“Acoustics – Description & Measurement of Environmental Noise”*.

5. NOISE CRITERIA

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". The assessment methodology requires that noise from road traffic impacting upon the site in the ten year planning horizon (year 2021) is investigated. Road traffic noise levels are assessed as an outdoor level in recreation areas, and as internal noise levels inside living, work and sleeping areas.

The internal noise limits are the maximum 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	Maximum Recommended Design Sound Level, L_{Aeq} dB(A)
7. RESIDENTIAL BUILDINGS	
Houses and apartments near major roads –	
Living areas	45
Sleeping areas	40
Work areas	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 and offsite activities (i.e. vehicle movements excluding mechanical plant) are assessed and be conducted in accordance with NIAPSP, and detail the location, extent and construction specifications for proposed attenuation measures and include all assumptions and methodologies used.

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

- Assessment of immission¹ and emission².

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 Vs 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)	63 (60+3dB(A))
Evening (6pm – 10pm)	61 (58+3dB(A))
Night time (10pm – 7am)	59 (56+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 L_{10} level is the level exceeded for 10% of the measurement time, and often termed the "average maximum"

Sleep Disturbance Criteria

Criteria for sleep disturbance under the EPP (Noise) is addressed in the User's Guide to the EPP:

'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.

5.3. Mechanical Plant Noise

Application of AS/NZS2107:2000 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 noise area category "areas with dense transportation or with some commerce or industry", the noise design target level defined in AS/NZS2107:2000 for dwellings near major roads is 40 dB(A) $L_{eq} (15 \text{ min})$ in sleeping areas. Further to this, to prevent background creep, the plant must be designed to not exceed the measured background noise levels presented in Table 4.

These various criteria equate to a design target for mechanical plant of the following levels:

Table 4: Criteria for Residential Receivers

Time Period	Criteria L_{90} dB(A)
Daytime	52
Evening	48
Night time	46

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.

6. ANALYSIS AND RESULTS

The results of the assessment are divided into three sections, 6.1 – 6.3. The sections present results of modelling for road traffic, onsite and offsite activity noise assessed at the relevant locations.

6.1. Road Traffic Noise

6.1.1. Measured Levels

Table 5 presents the average measured traffic noise levels recorded at the unattended monitoring locations.

Table 5: Measured Road Traffic Noise Levels.

Location/Date	Road Traffic Noise Descriptor	Time Period	Measured Level dB(A)
Kingsford-Smith Drive Monday 29 th June, 2009	L _{A10,18hr}	6am to midnight	77.4
	Noisiest day-time L _{Aeq,1 hr}		77.0
	Noisiest night-time L _{Aeq,1 hr}		75.1
	L _{Aeq,24 hr}	Midnight to midnight	73.9
Harbour Road, Monday 29 th June, 2009	L _{A10,18hr}	6am to midnight	59.5
	Noisiest day-time L _{Aeq,1 hr}		60.3
	Noisiest night-time L _{Aeq,1 hr}		57.2
	L _{Aeq,24 hr}	Midnight to midnight	57.0

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

6.1.2. Traffic Volumes

The exiting 2008 traffic volumes and percentage heavy vehicles for Kingsford-Smith Drive and Harbour Road were obtained from TTM Consulting. Predicted 2009 volumes are based upon a 1% p.a. growth rate as advised by TTM Consulting. Predicted 2021 traffic volumes are based upon modelling projections by TTM Consulting and are presented in Table 6.

Table 6: Road Traffic Volumes for Surrounding Road Network.

Description (Location):	Traffic Volume (AADT)			Heavy Vehicles % AADT
	2008	2009	2021	
Kingsford-Smith Drive	38,290	38,673	38,685	9.6
Harbour Road	4,625	4,672	5,264	7.7

The 18 hour traffic volumes are taken to be 95% of the Average Annual Daily Traffic volumes.

6.1.3. Road Traffic Noise – 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 $L_{A10,18hr}$ noise levels were calculated and compared to the measured levels as presented in Table 7.

Table 7: Comparison of Measured and Predicted Road Traffic Noise Levels.

Location	Measured $L_{A10,18hr}$	Predicted $L_{A10,18hr}$	Required Correction
Kingsford-Smith Drive	77.4	77.5	0
Harbour Road	59.5	60.8	0

Corrections are applied to the model to ensure that the modelled noise levels equal the measured noise levels (if the model over-predicts, no correction is required, but if the model under-predicts, a correction is required). The CoRTN methodology allows a maximum deviation of 2 dB(A) from measured levels.

As the modelled levels are within the allowable tolerance of 2 dB(A) of the measured levels, no correction is required. It should be noted that CoRTN calculation methodology tends to over-predict.

6.1.4. Predicted Road Traffic Noise Levels – Year 2021

The predicted impacts at each façade of the residential buildings in the planning horizon (presented in Tables 8 and 9) were calculated using SoundPLAN v6.5 and are based on the following assumptions:

- Finished floor levels presented on elevations on plans provided by Noel Robinson Architects were utilised in the modelling (refer to **Appendix A**).
- The speed limits adopted were:
 - Kingsford-Smith Drive – 60km/h; and
 - Harbour Road & Hercules Street – 60km/h.
- Kingsford-Smith Drive was modelled as a 4 lane carriageway (2 lanes each direction).
- Harbour Road and Hercules Street was modelled as a 2 lane road (1 lane each direction).
- Screening from adjacent commercial buildings to the site was considered in the modelling.
- The residential floor heights of the high rise buildings were based on 2.8 metres per floor.
- Building receiver locations were taken at 1 metre in front of the façade.
- SoundPLAN outputs predicted $L_{A10,18hr}$ road traffic noise levels. These levels were converted into $L_{Aeq,1hr}$ levels to compare with the BCC assessment criteria.

Table 8: Predicted Road Traffic Noise Impacts at Stage 1 Residential Building.

Assessment Location:	Façade:	Predicted SPL (dB(A)) in 2021 dB(A)		
		(Façade Corrected)	(Free Field)	
		$L_{A10,18Hour}$	Daytime $L_{Aeq,1hour}$	Night $L_{Aeq,1hour}$
Levels 4 – 8	North	65	63	60
	South	59	57	54
	East	59	57	54
	West	68	66	63

Table 9: Predicted Road Traffic Noise Impacts at Stage 2 Residential Building.

Assessment Location:	Façade:	Predicted SPL (dB(A)) in 2021 dB(A)		
		(Façade Corrected)	(Free Field)	
		L _{A10,18Hour}	Daytime L _{Aeq,1hour}	Night L _{Aeq,1hour}
Levels 1 and 2	North	67	65	62
	South	65	63	60
	West	70	68	65
Levels 3 and 4	North	65	63	60
	South	56	55	51
	East	59	57	54
	West	65	64	61
Levels 5 – 15	North	67	66	63
	South	59	58	54
	East	62	60	57
	West	67	65	62

Based upon the modelled noise levels from the surrounding road network, both residential buildings within stages 1 and 2 are predicted to exceed the BCC criteria and require further acoustic assessment as detailed in Section 7.

Note, if there is a change to the layout (as presented in **Appendix A**) or building pad levels increase by more than 200mm a further acoustic assessment will be required.

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

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

Location:	Predicted SPL (dB(A)) in 2019
	L _{Aeq,24hr} (Free field)
Stage 1 – Rooftop Level	49
Stage 2 – Level 3	54

Based upon the modelled levels, the communal recreation areas are predicted to comply with the criteria due to increased separation distance from the road network.

To assist in the review process detailed SoundPLAN modelling results, including single point calculations and noise contour maps are presented in **Appendix C**.

6.2. Onsite Activity Noise

The noise sources associated with the proposed onsite activities were based on similar investigations. The average maximum levels associated with onsite activities are presented in Table 11 and were selected as they represent the likely activities onsite that have the potential to cause noise annoyance at the nearest noise sensitive places.

Table 11: Average Maximum Noise Levels from Typical Mixed Use 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
Background Music – Indoors	65	N/A	65

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

The nearest noise sensitive properties 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 onto the nearest noise sensitive premises.

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 63dB(A)	Evening 61dB(A)	Sleep 45dB(A)
Car door closure – Ground	48	43	Yes	Yes	Yes
Car starting – Ground	40	35	Yes	Yes	Yes
Car bypass @ 5 km/h – Entrance	43	38	Yes	Yes	Yes
Goods delivery – Loading Bay	27	22	Yes	Yes	Yes
Waste collection – Loading Bay	41	36	Yes	Yes	Yes
Conversation – Southern Facade	47	42	Yes	Yes	Yes
Background Music – Southern Facade	37	32	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)		
	Façade	Internal	Day 63dB(A)	Evening 61dB(A)	Sleep 45dB(A)
Car door closure – Ground	27	22	Yes	Yes	Yes
Car starting – Ground	19	14	Yes	Yes	Yes
Car bypass @ 5 km/h – Entrance	40	35	Yes	Yes	Yes
Goods delivery – Loading Bay	27	22	Yes	Yes	Yes
Waste collection – Loading Bay	39	34	Yes	Yes	Yes
Conversation –	46	41	Yes	Yes	Yes
Background Music – Western Façade	36	31	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 63dB(A)	Evening 61dB(A)	Sleep 45dB(A)
Car door closure – Level 2	39	34	Yes	Yes	Yes
Car starting – Level 2	31	26	Yes	Yes	Yes
Car bypass @ 5 km/h – Entrance	34	29	Yes	Yes	Yes
Goods delivery – Loading Bay	23	18	Yes	Yes	Yes
Waste collection – Loading Bay	35	30	Yes	Yes	Yes
Conversation – Southern Façade	32	27	Yes	Yes	Yes
Background Music – Southern Façade	22	17	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 screening from the proposed development and existing commercial buildings.

It is predicted that all onsite activities will comply with the day, evening and sleep disturbance criteria at receivers 1 – 3 due to significant separation distance and screening from the development.

All onsite activity noise calculations to the nearest sensitive receivers are provided in **Appendix D**.

6.3. Offsite Activity Noise

The noise sources associated with commercial/retail activities were based on similar investigations. The average maximum levels associated with the offsite activities are presented in Table 14 and were selected as they represent the likely activities that have the potential to cause noise annoyance at the development.

Table 15: Average Maximum Noise Levels from Typical Commercial/Retail Activity.

Noise Source	Measured Level SPL @1m dB(A) L_{Amax}	Correction SPL dB(A)*	Corrected Level SPL dB(A) L_{Amax}
Car door closure	78	+ 5 (impulsive)	83
Car starting	75	N/A	75
Car bypass @ 5 km/h	77	N/A	77
Conversation	75	N/A	75
Goods deliveries	85	N/A	85
Truck door closure	80	+ 5 (impulsive)	85
Truck Bypass 5km/h	82	N/A	82

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

Tables 15 – 17 presents predicted noise levels (based on the noise source levels specified in Table 14) from the surrounding commercial/retail activities with the potential to impact the onsite noise sensitive receivers.

Activities associated with Samies Girl, the DPI and the Caltex service station were assessed based upon their current hours of operation (detailed in Section 2.5).

Table 16: Predicted Noise Levels from Samies Girl Fresh Seafood Market.

Noise Source:	Predicted Level L_{Amax} dB(A)		Assessment Criteria Complies (Yes/No)
	Façade	Internal	Day 63dB(A)
Car door closure	52	47	Yes
Car starting	44	39	Yes
Car bypass @ 5 km/h	48	43	Yes
Conversation	49	44	Yes
Goods deliveries	59	54	Yes

Table 17: Predicted Noise Levels from Caltex Service Station.

Noise Source:	Predicted Level L_{Amax} dB(A)		Assessment Criteria Complies (Yes/No)		
	Façade	Internal	Day 63dB(A)	Evening 61dB(A)	Sleep 45dB(A)
Car door closure	47	42	Yes	Yes	Yes
Car starting	39	34	Yes	Yes	Yes
Car bypass @ 5 km/h	43	38	Yes	Yes	Yes
Truck door closure	48	43	Yes	Yes	Yes
Truck Bypass 5km/h	48	43	Yes	Yes	Yes
Conversation	39	34	Yes	Yes	Yes

Table 18: Predicted Noise Levels from the DPI.

Noise Source:	Predicted Level L_{Amax} dB(A)	Assessment Criteria Complies (Yes/No)
	Façade	Day 63dB(A)
Car door closure	55	Yes
Car bypass @ 5 km/hr	47	Yes
Car starting	49	Yes
Conversation	49	Yes

The predicted noise levels in Tables 15 – 17 are based upon the noise source being at the nearest position to the receivers, and assumes direct line of sight to the development.

It is predicted that all offsite activities associated with Samies Girl, the DPI and the Caltex service station will comply with the assessment criteria during the day, evening and night time periods.

All offsite activity noise calculations to the nearest onsite receivers are provided in **Appendix D**.

6.3.1. Mechanical Plant

Attended noise measurements were conducted on the 29th of June, 2009 between the hours of 9:30pm and 10:30pm to measure noise levels from the offsite mechanical plant in the vicinity of the site. Table 19 presents the measured noise levels of plant equipment in the vicinity of the site with the potential to impact the onsite receivers.

Table 19: Average Maximum Noise Levels from Attended Measurements.

Noise Source	Measured Level SPL @1m dB(A) L _{Amax}	Correction SPL dB(A)*	Corrected Level SPL dB(A) L _{Amax}
Samies Girl – Semi-Enclosed Mechanical Plant	78	+5 Tonal	83
DPI – Mechanical Plant Ground Level	82	+5 Tonal	87

Table 20 presents predicted noise levels (based on the noise source levels specified in Table 19) from the offsite plant equipment with the potential to impact the onsite noise sensitive receivers.

Table 20: Predicted Noise Levels from Mechanical Plant.

Noise Source:	Predicted Level L _{Amax} dB(A) Façade	Assessment Criteria Complies (Yes/No)		
		Day 52dB(A)	Evening 48dB(A)	Night 46dB(A)
Samies Girl – Semi-enclosed Mechanical Plant	37	Yes	Yes	Yes
DPI – Mechanical Plant Ground Level	54	No	No	No

The predicted noise levels in Table 20 are based upon the noise source being at the nearest position to the receivers, and assumes direct line of sight to the development.

Based upon the attended noise measurements, the DPI plant equipment located at ground level is predicted to exceed the day (minor 2dB(A)), evening and night time criteria.

The main plant equipment associated with Samies Girl, located on the northern façade is semi-enclosed (opening faces north and is elevated 2metres above ground level). Based upon the design and orientation of the enclosure, it is expected to provide significant screening to the site and is predicted to comply with the criteria.

Base on road traffic noise treatment requirements (detailed in Section 7), noise from activities associated with the offsite mechanical plant are predicted to be inaudible within the apartments provided the windows and doors are closed.

7. RECOMMENDED ACOUSTIC TREATMENTS

The recommended acoustic treatments are presented in four sections, 7.1 – 7.4, detailing the acoustic requirements for road traffic, onsite and offsite activities and mechanical plant noise and are required to ensure compliance with the relevant Brisbane City Council assessment criteria.

7.1. Road Traffic Noise – Brisbane City Council

Compliance is predicted with the BCC assessment criteria on the condition the following treatments are implemented:

- Individual assessment of the following residential units to ensure compliance with the internal noise limits as specified in Table 1:
 - Stage 1 on levels 4 – 8 (units with a northern and western face);
 - Stage 2 Levels 1 – 2;
 - Stage 2 Levels 3 – 4 (units with a northern and western face); and
 - Stage 2 Levels 5 – 15 (units with a northern, eastern and western face)
- If the proposed commercial component requires Green Star compliance, a further detailed assessment is required once detailed floor plans and elevations of the tenancies are available.

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

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 or a change to the assumptions in Section 6.1.4, a further detailed acoustic assessment is required.

Based upon the proposed building floor plans and the predicted road noise impacts, we recommend applying the minimum building shell treatments presented in Sections 7.1.1 – 7.1.4.

7.1.1. Glazing Treatments

All residential windows and sliding doors located within stages 1 and 2 will require a minimum of 6.38mm laminated glazing with acoustic seals and must achieve a minimum R_w of 30.

The installed glass 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.

7.1.2. Wall Treatments

The masonry construction shall achieve the minimum R_w rating requirements.

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 masonry construction shall achieve the minimum R_w rating requirements.

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, doors or windows should be closed. All residential units within stages 1 and 2 will require the provision of alternative ventilation such as mechanical ventilation or air conditioning to ensure compliance with the Brisbane City Council assessment criteria.

7.2. Onsite Activity Noise – Brisbane City Council

This assessment has investigated the 'worst case scenario', by considering potential noise impacts from onsite activities at the nearest location to the sensitive receivers and by applying the criteria described in Section 5.

Based upon the modelled levels, all onsite activities are predicted to comply with the day, evening and sleep disturbance criteria due to significant separation distance and screening from the development.

7.3. Offsite Activity Noise – Brisbane City Council

A preliminary assessment of the offsite commercial activities impacting the onsite receivers was conducted. This assessment has assumed the 'worst case scenario', by considering potential noise impacts from offsite activities at the nearest location to the sensitive receivers (located on the first floor) and by applying the criteria described in Section 5.

Based upon the modelled noise levels, compliance is predicted for all offsite activities associated with Samies Girl, the DPI and the Caltex service station for the day, evening and sleep disturbance criteria.

7.3.1. Mechanical Plant Noise – Brisbane City Council

This assessment has investigated the 'worst case scenario', by considering potential noise impacts from offsite plant equipment at the nearest receivers onsite and by applying the criteria described in Section 5.3.

Based upon the attended noise measurements, the DPI plant equipment located at ground level is predicted to exceed the day (minor 2dB(A)), evening and night time criteria.

The main mechanical plant associated with Samies Girl, located on the northern façade is semi-enclosed with the opening facing north (unit elevated 2metres above ground level). Based upon the design and orientation of the enclosure, it is expected to provide significant screening to the site and is predicted to comply with the criteria.

7.4. Mechanical Plant Noise – Brisbane City Council

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 5 – 9 Hercules Street, Hamilton. On the condition the treatment recommendations and management controls presented in Section 7 are implemented, the development is predicted to comply with the Brisbane City Council 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:

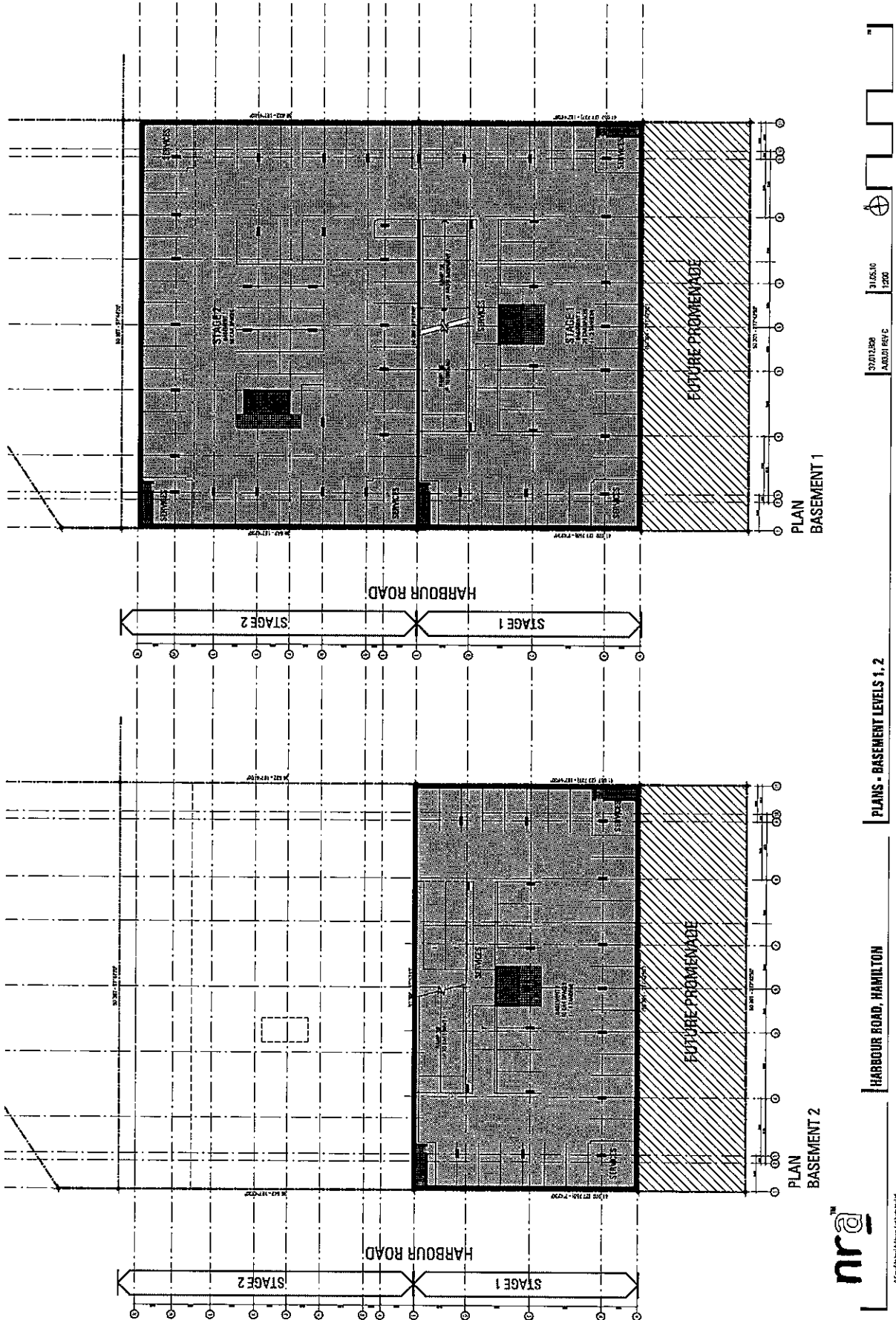


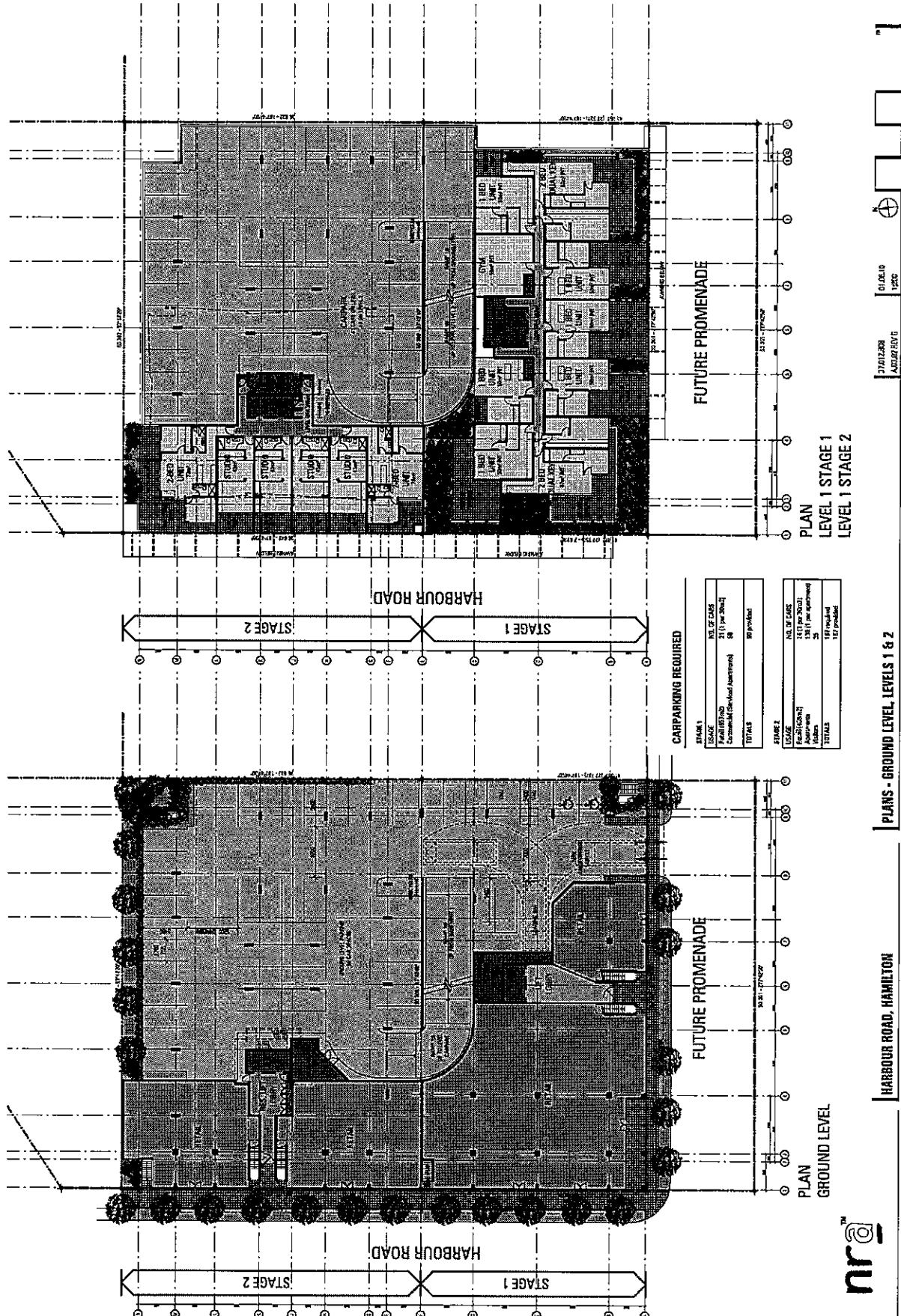
GREG PEARCE B.Eng (Mech)
Associate Director

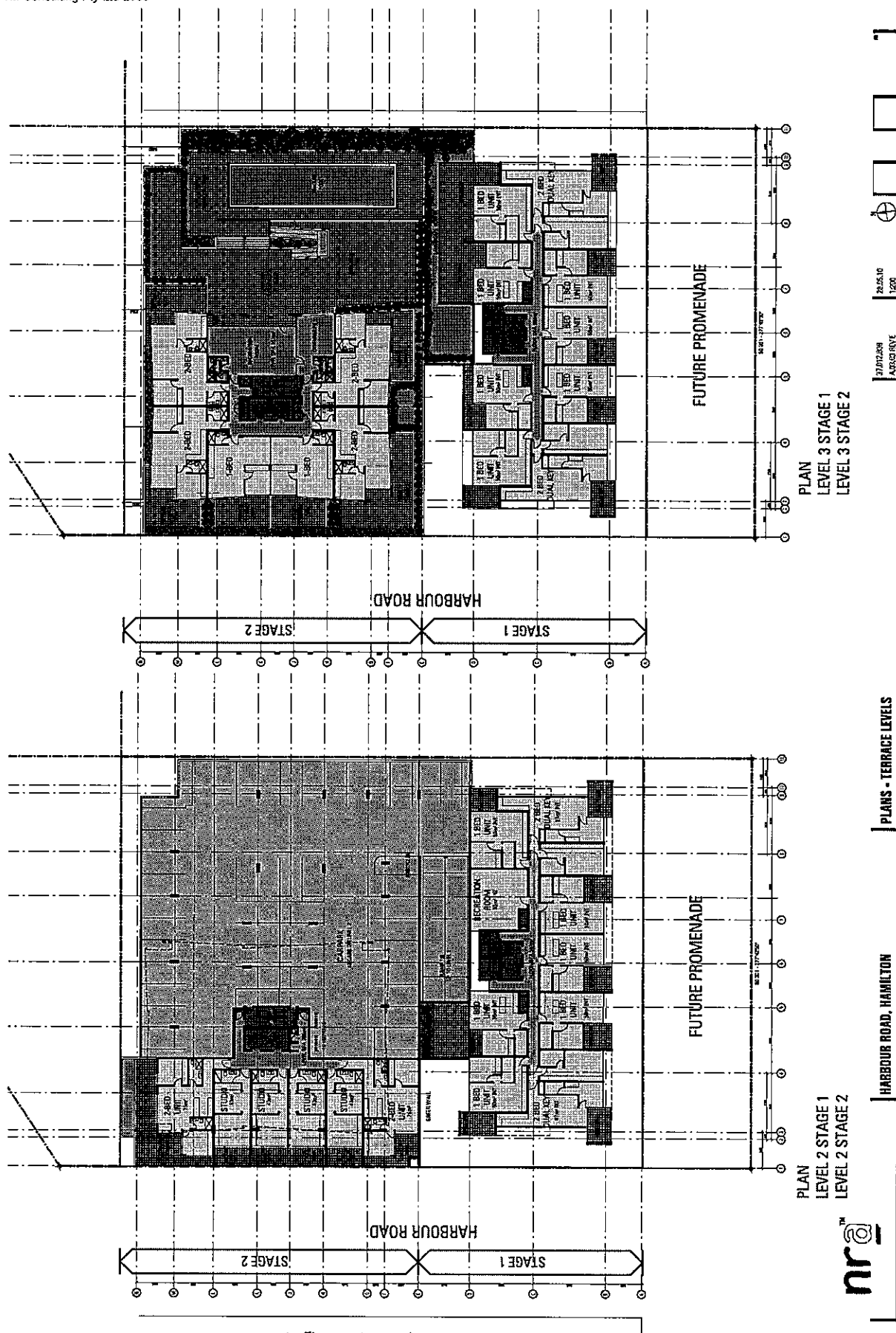
9. APPENDICES

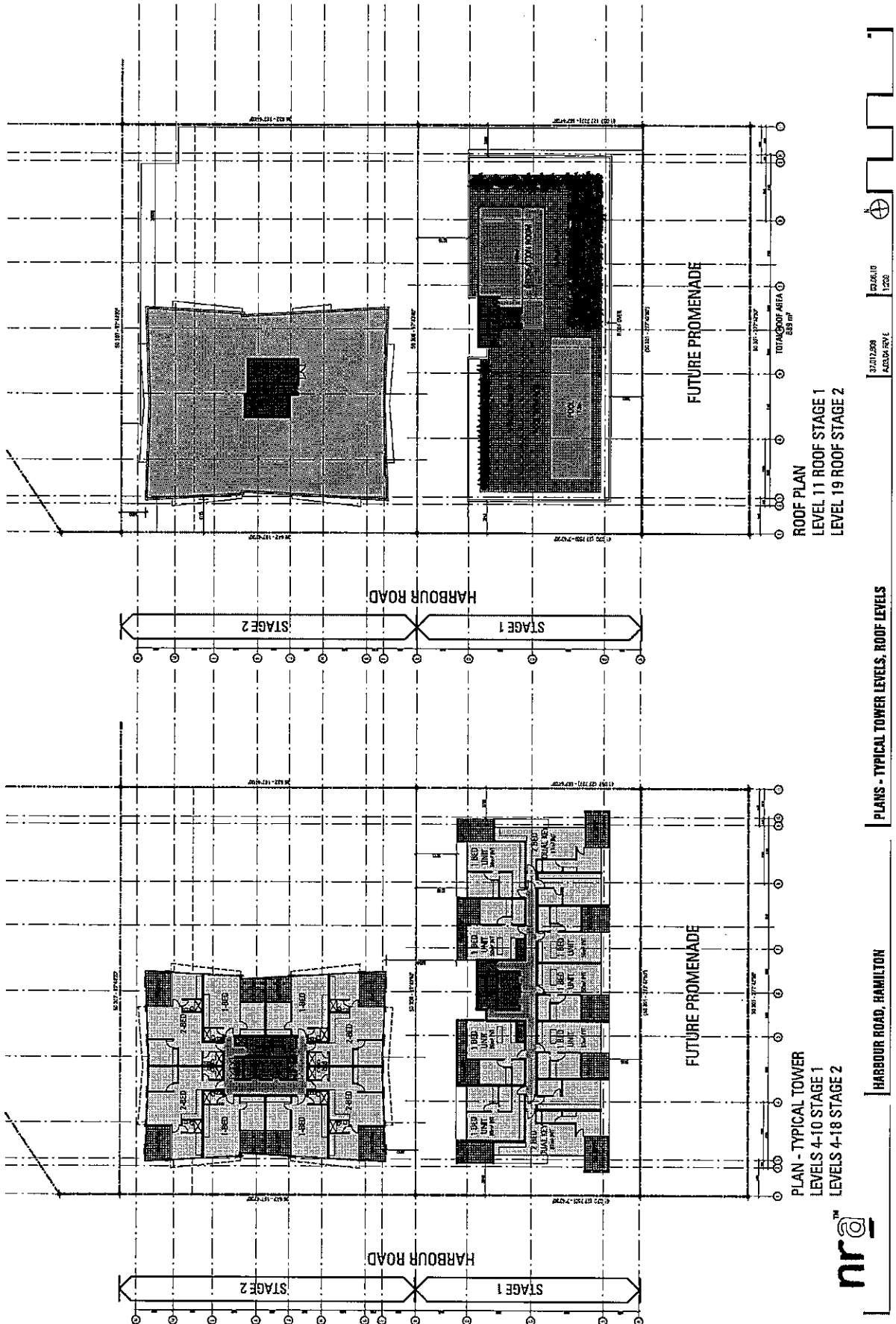
Appendix A

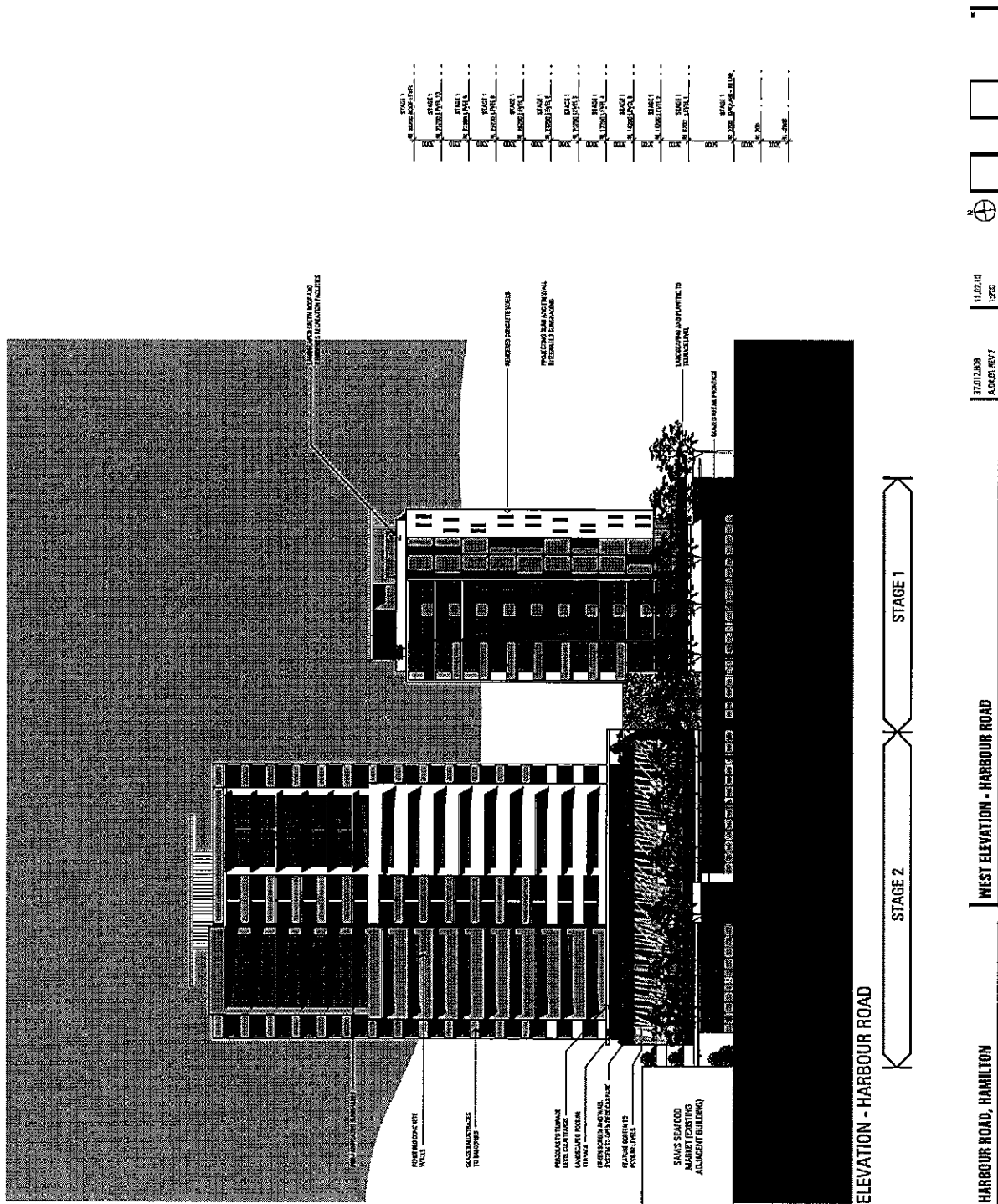
Proposed Development Plans

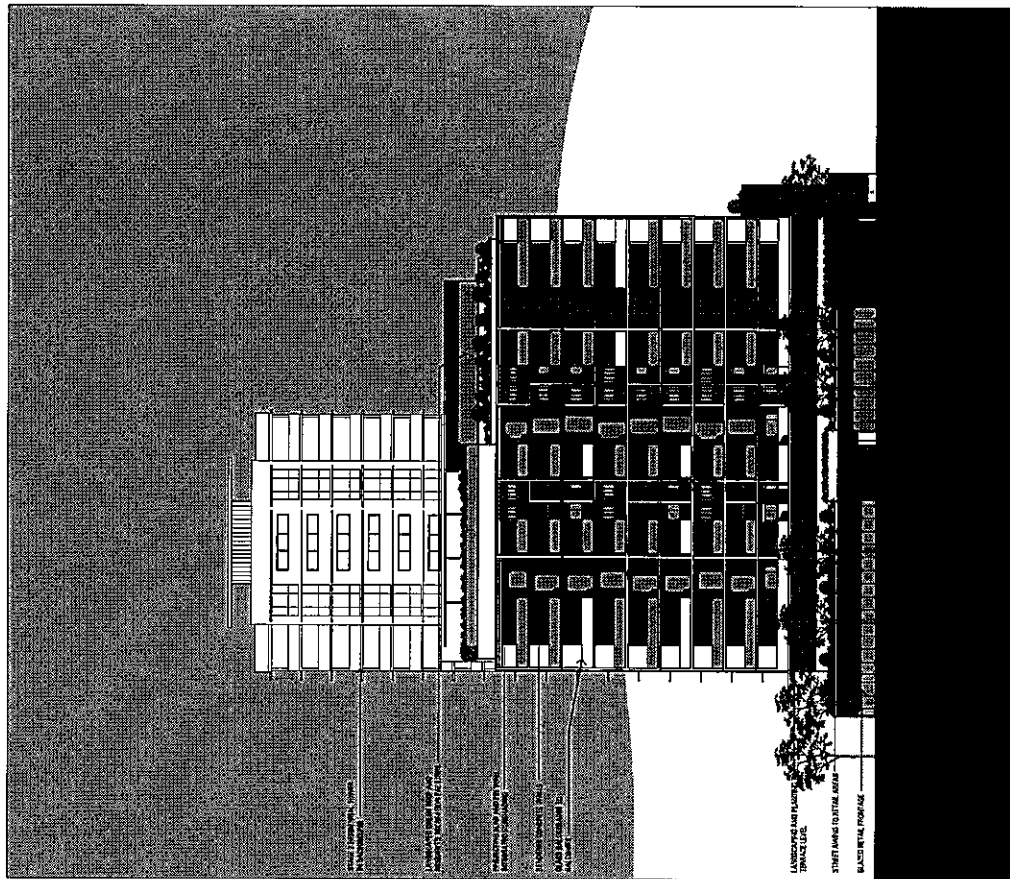










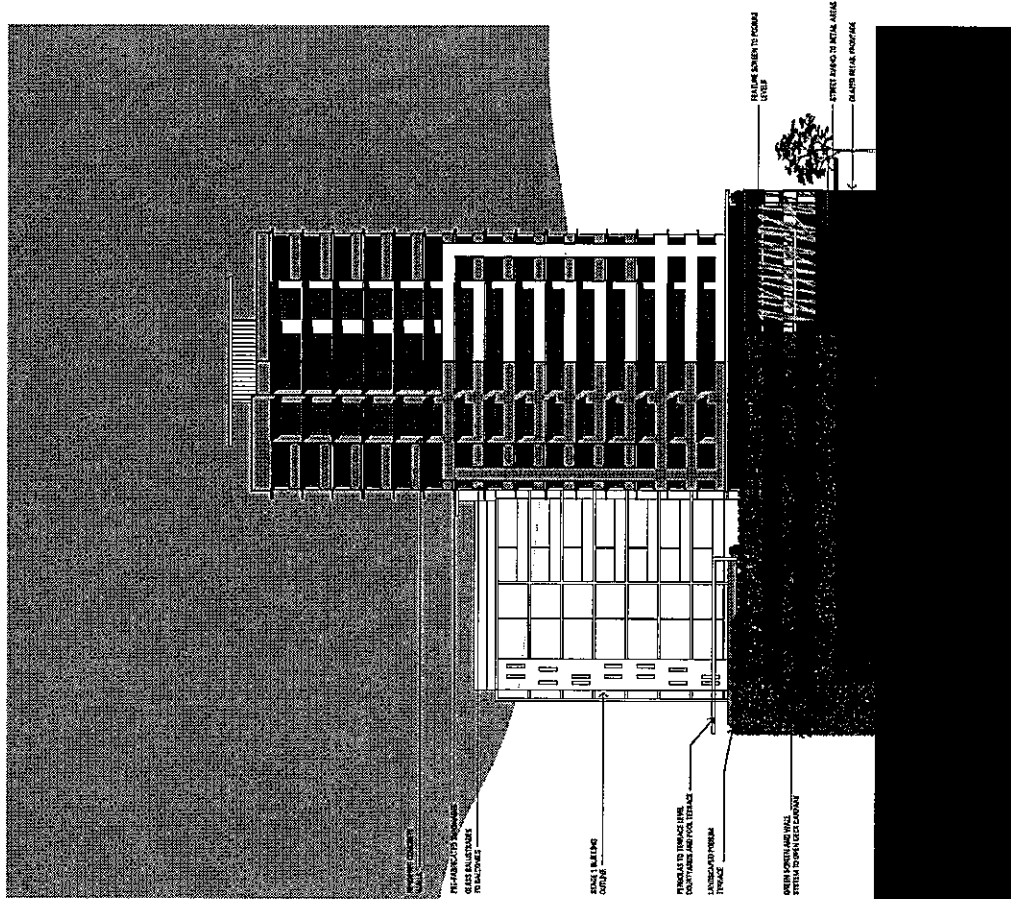


ELEVATION - BOULEVARD

STAGE 1
STAGE 2 IN BACKGROUND

SOUTH ELEVATION - BOULEVARD

HARBOUR ROAD, HAMILTON



NORTH ELEVATION

STAGE 2
 STAGE 1 IN BACKGROUND

HARBOUR ROAD, HAMILTON

NORTH ELEVATION

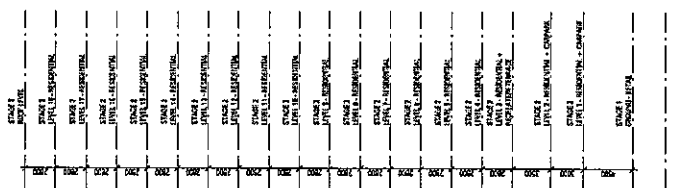
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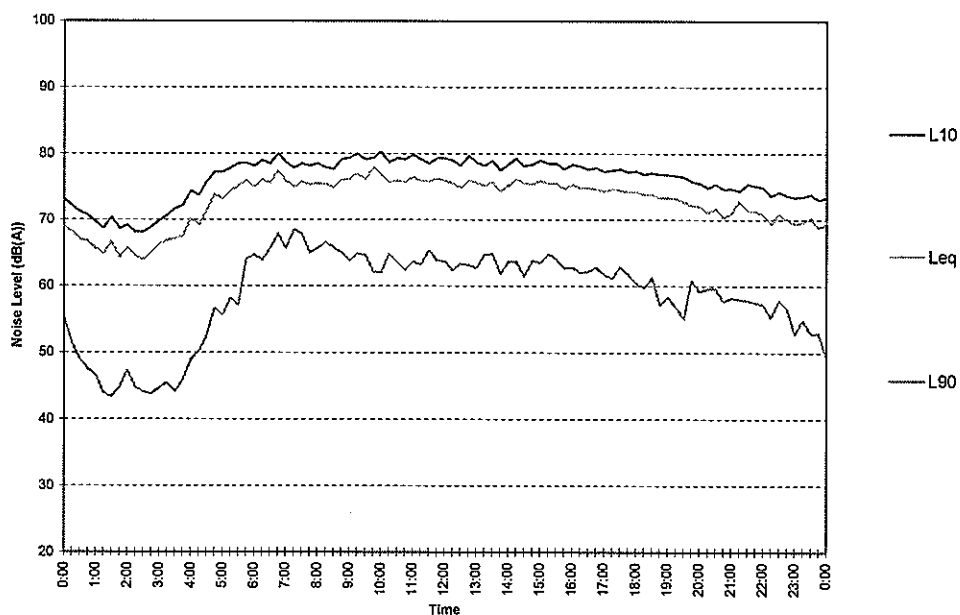


Appendix B

Noise Monitoring Graphs

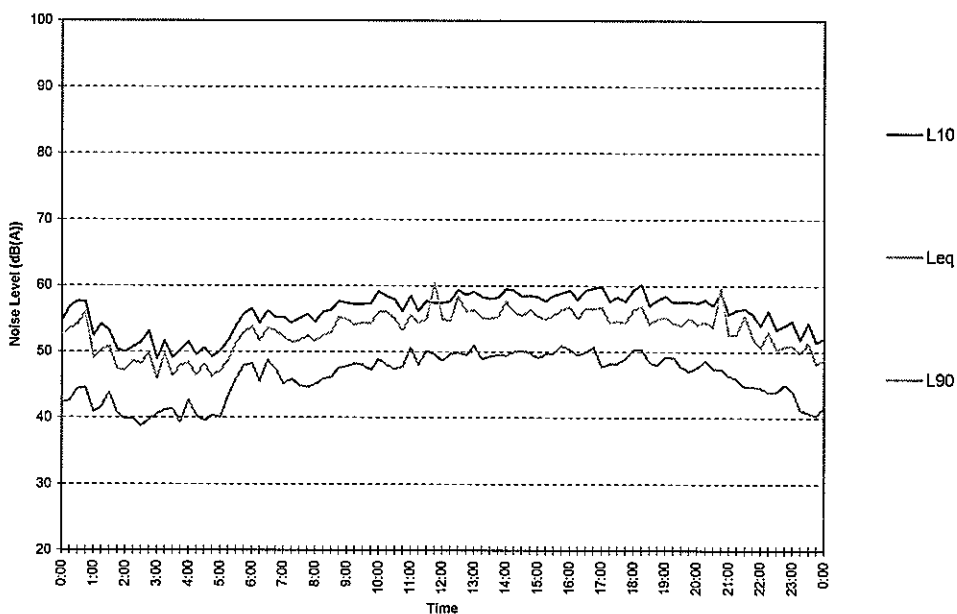
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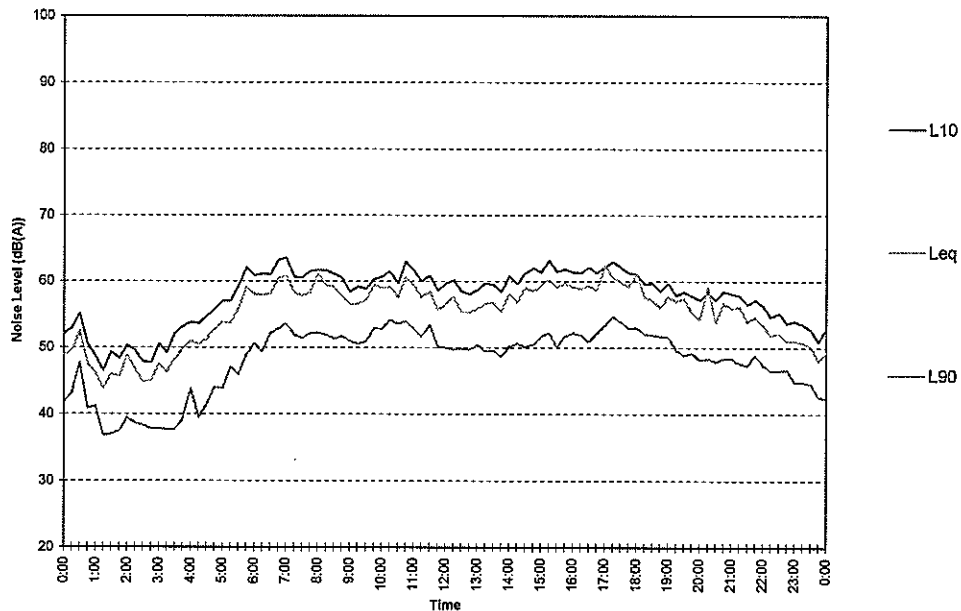
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28/06/2009



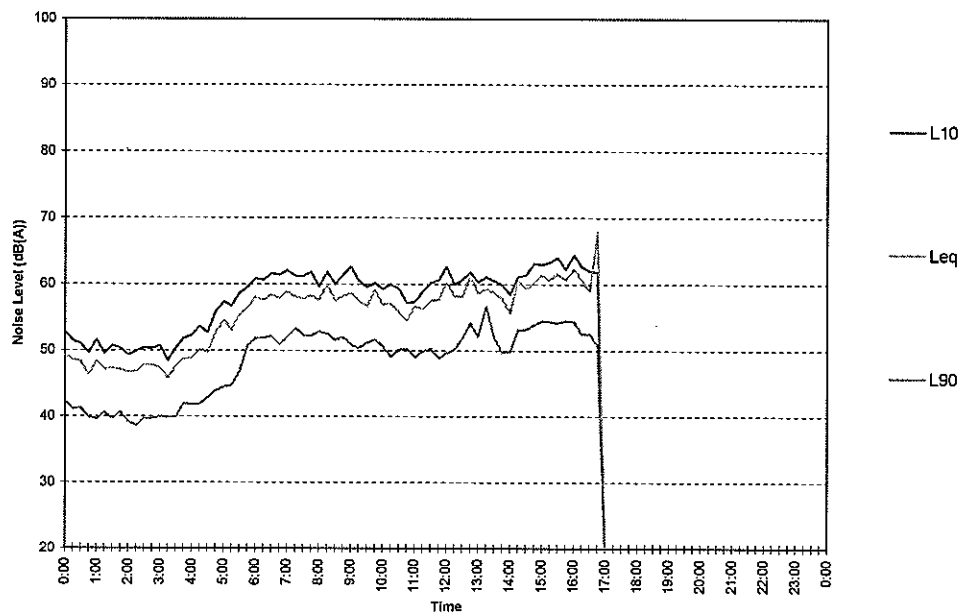
25789_Harbour Road

29/06/2009



25789_Harbour Road

30/06/2009



Appendix C

SoundPLAN Modelling Results

**Proposed Mixed Use Development
 Road Traffic Noise Assessment- Verification 2009**

Name	Level	L10(18h) dB(A)
Harbour Road	1.4m AGL	60.8
Kingsford-Smith Drive	1.4m AGL	77.5

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SoundPLAN 6.5

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

Location	Floor Level	Building Facade	L10(18h) (Facade Corrected) dB(A)
Stage 2 - Levels G - 2	Level 1	N	65.0
Stage 2 - Levels G - 2	Level 2	N	66.4
Stage 2 - Levels G - 2	Level 3	N	66.6
Stage 2 - Levels G - 2	Level 1	W	68.7
Stage 2 - Levels G - 2	Level 2	W	69.5
Stage 2 - Levels G - 2	Level 3	W	69.0
Stage 2 - Levels G - 2	Level 1	S	63.5
Stage 2 - Levels G - 2	Level 2	S	65.1
Stage 2 - Levels G - 2	Level 3	S	64.8
Stage 2 - Levels 3 - 15	Level 1	N	63.8
Stage 2 - Levels 3 - 15	Level 2	N	64.6
Stage 2 - Levels 3 - 15	Level 3	N	65.2
Stage 2 - Levels 3 - 15	Level 4	N	65.6
Stage 2 - Levels 3 - 15	Level 5	N	65.9
Stage 2 - Levels 3 - 15	Level 6	N	66.2
Stage 2 - Levels 3 - 15	Level 7	N	66.5
Stage 2 - Levels 3 - 15	Level 8	N	66.7
Stage 2 - Levels 3 - 15	Level 9	N	66.9
Stage 2 - Levels 3 - 15	Level 10	N	67.0
Stage 2 - Levels 3 - 15	Level 11	N	67.1
Stage 2 - Levels 3 - 15	Level 12	N	67.2
Stage 2 - Levels 3 - 15	Level 13	N	67.3
Stage 2 - Levels 3 - 15	Level 1	W	63.6
Stage 2 - Levels 3 - 15	Level 2	W	65.4
Stage 2 - Levels 3 - 15	Level 3	W	66.8
Stage 2 - Levels 3 - 15	Level 4	W	66.9
Stage 2 - Levels 3 - 15	Level 5	W	66.9
Stage 2 - Levels 3 - 15	Level 6	W	66.9
Stage 2 - Levels 3 - 15	Level 7	W	66.8
Stage 2 - Levels 3 - 15	Level 8	W	66.8
Stage 2 - Levels 3 - 15	Level 9	W	66.8
Stage 2 - Levels 3 - 15	Level 10	W	66.8
Stage 2 - Levels 3 - 15	Level 11	W	66.8
Stage 2 - Levels 3 - 15	Level 12	W	66.7
Stage 2 - Levels 3 - 15	Level 13	W	66.7
Stage 2 - Levels 3 - 15	Level 1	S	55.0
Stage 2 - Levels 3 - 15	Level 2	S	56.2
Stage 2 - Levels 3 - 15	Level 3	S	56.9
Stage 2 - Levels 3 - 15	Level 4	S	57.4
Stage 2 - Levels 3 - 15	Level 5	S	57.6
Stage 2 - Levels 3 - 15	Level 6	S	57.7
Stage 2 - Levels 3 - 15	Level 7	S	57.9
Stage 2 - Levels 3 - 15	Level 8	S	58.1

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SoundPLAN 6.5

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

Location	Floor Level	Building Facade	L10(18h) (Facade Corrected) dB(A)
Stage 2 - Levels 3 - 15	Level 9	S	58.3
Stage 2 - Levels 3 - 15	Level 10	S	58.4
Stage 2 - Levels 3 - 15	Level 11	S	58.7
Stage 2 - Levels 3 - 15	Level 12	S	58.9
Stage 2 - Levels 3 - 15	Level 13	S	59.2
Stage 2 - Levels 3 - 15	Level 1	E	57.9
Stage 2 - Levels 3 - 15	Level 2	E	58.8
Stage 2 - Levels 3 - 15	Level 3	E	59.5
Stage 2 - Levels 3 - 15	Level 4	E	59.9
Stage 2 - Levels 3 - 15	Level 5	E	60.3
Stage 2 - Levels 3 - 15	Level 6	E	60.5
Stage 2 - Levels 3 - 15	Level 7	E	60.7
Stage 2 - Levels 3 - 15	Level 8	E	60.9
Stage 2 - Levels 3 - 15	Level 9	E	61.1
Stage 2 - Levels 3 - 15	Level 10	E	61.2
Stage 2 - Levels 3 - 15	Level 11	E	61.4
Stage 2 - Levels 3 - 15	Level 12	E	61.5
Stage 2 - Levels 3 - 15	Level 13	E	61.7
Stg2 Lvl3 Communal Recreation Area	Level 1		56.8
Stage 1 Levels 4 - 8	Level 1	W	67.8
Stage 1 Levels 4 - 8	Level 2	W	68.8
Stage 1 Levels 4 - 8	Level 3	W	68.5
Stage 1 Levels 4 - 8	Level 4	W	68.1
Stage 1 Levels 4 - 8	Level 5	W	67.8
Stage 1 Levels 4 - 8	Level 6	W	67.5
Stage 1 Levels 4 - 8	Level 7	W	67.2
Stage 1 Levels 4 - 8	Level 8	W	67.0
Stage 1 Levels 4 - 8	Level 9	W	66.9
Stage 1 Levels 4 - 8	Level 1	S	55.5
Stage 1 Levels 4 - 8	Level 2	S	57.4
Stage 1 Levels 4 - 8	Level 3	S	58.2
Stage 1 Levels 4 - 8	Level 4	S	58.4
Stage 1 Levels 4 - 8	Level 5	S	58.5
Stage 1 Levels 4 - 8	Level 6	S	58.5
Stage 1 Levels 4 - 8	Level 7	S	58.5
Stage 1 Levels 4 - 8	Level 8	S	58.4
Stage 1 Levels 4 - 8	Level 9	S	58.5
Stage 1 Levels 4 - 8	Level 1	E	42.6
Stage 1 Levels 4 - 8	Level 2	E	45.0
Stage 1 Levels 4 - 8	Level 3	E	48.5
Stage 1 Levels 4 - 8	Level 4	E	54.1
Stage 1 Levels 4 - 8	Level 5	E	56.9
Stage 1 Levels 4 - 8	Level 6	E	57.5

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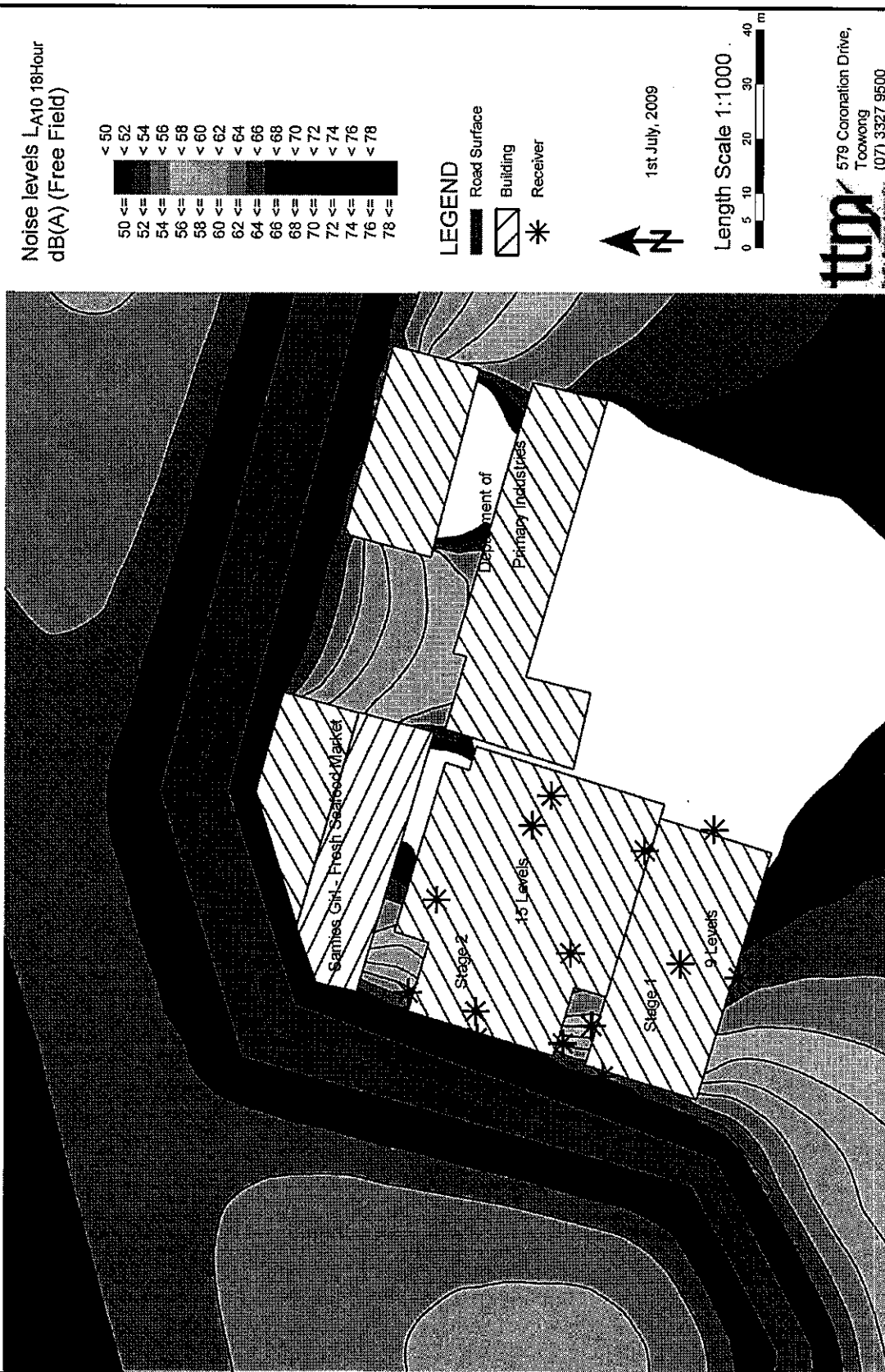
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SoundPLAN 6.5

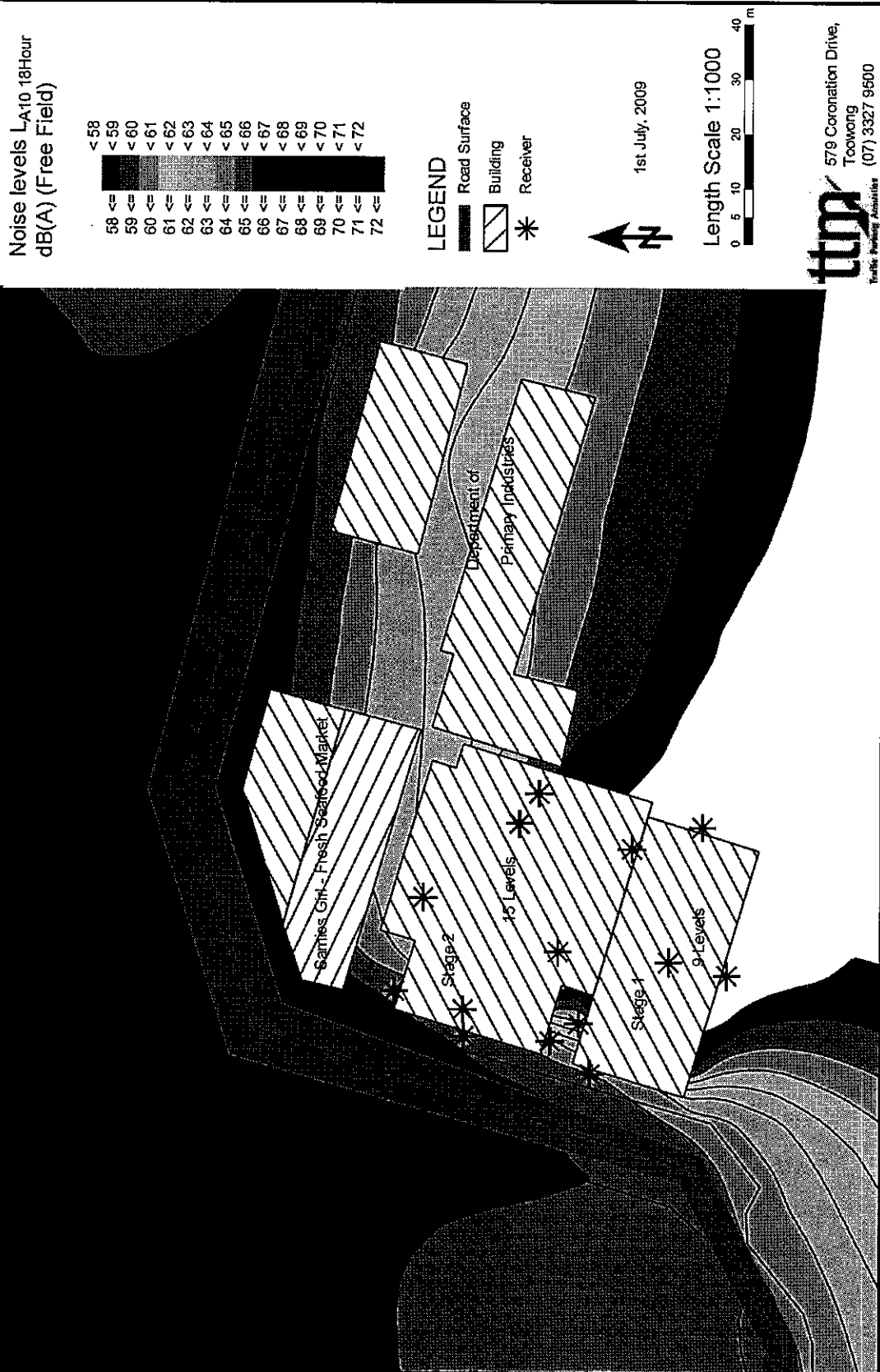
**Proposed Mixed Use Development
 Road Traffic Noise Assessment- Planning Horizon 2021**

Location	Floor Level	Building Facade	L10(18h) (Facade Corrected) dB(A)
Stage 1 Levels 4 - 8	Level 7	E	58.0
Stage 1 Levels 4 - 8	Level 8	E	58.5
Stage 1 Levels 4 - 8	Level 9	E	59.0
Stage 1 Levels 4 - 8	Level 1	N	59.7
Stage 1 Levels 4 - 8	Level 2	N	61.6
Stage 1 Levels 4 - 8	Level 3	N	62.0
Stage 1 Levels 4 - 8	Level 4	N	62.8
Stage 1 Levels 4 - 8	Level 5	N	63.6
Stage 1 Levels 4 - 8	Level 6	N	63.8
Stage 1 Levels 4 - 8	Level 7	N	64.2
Stage 1 Levels 4 - 8	Level 8	N	64.5
Stage 1 Levels 4 - 8	Level 9	N	64.6
Stage 1 Levels 4 - 8	Level 4	N	55.9
Stage 1 Levels 4 - 8	Level 5	N	59.2
Stage 1 Levels 4 - 8	Level 6	N	59.7
Stage 1 Levels 4 - 8	Level 7	N	60.3
Stage 1 Levels 4 - 8	Level 8	N	60.8
Stage 1 Levels 4 - 8	Level 9	N	61.1
Stg1 Rooftop Communal Recreation	Level 1		51.4

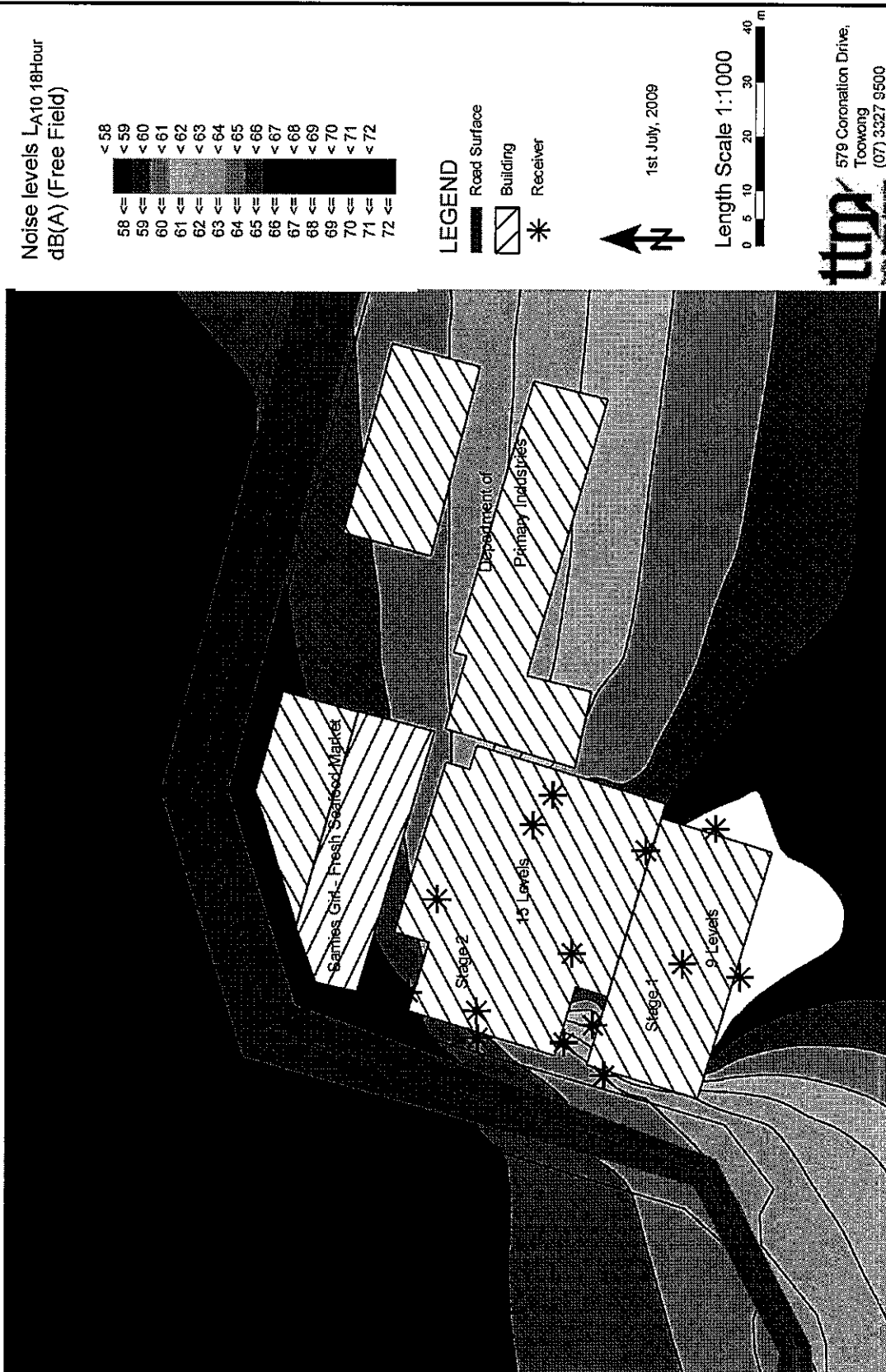
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 Ground Floor Receivers at 1.8m AGL



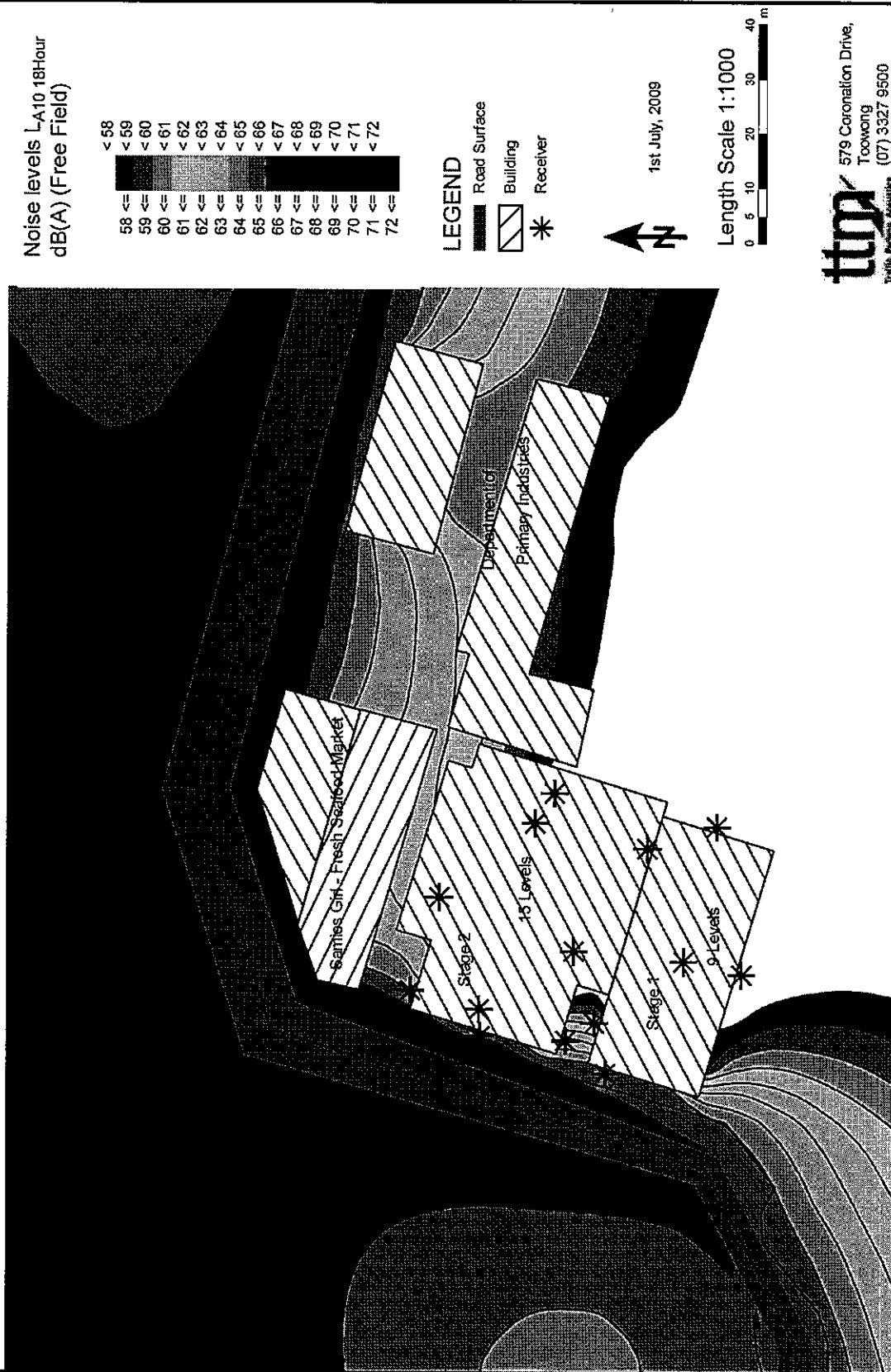
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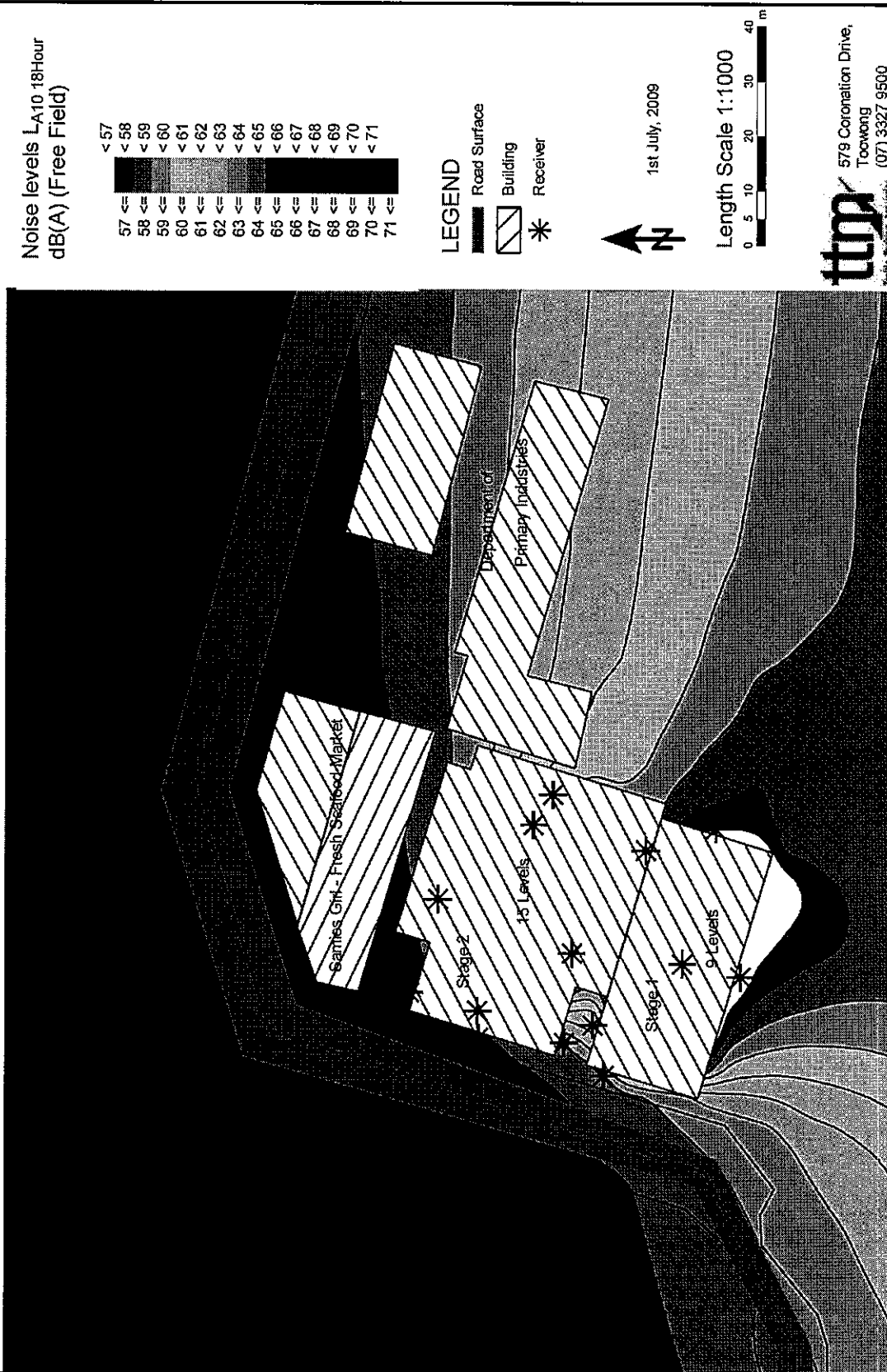
Proposed Mixed Use Development - Road Traffic Noise Assessment
 Stage 1 Rooftop Receivers at 32.5m AGL



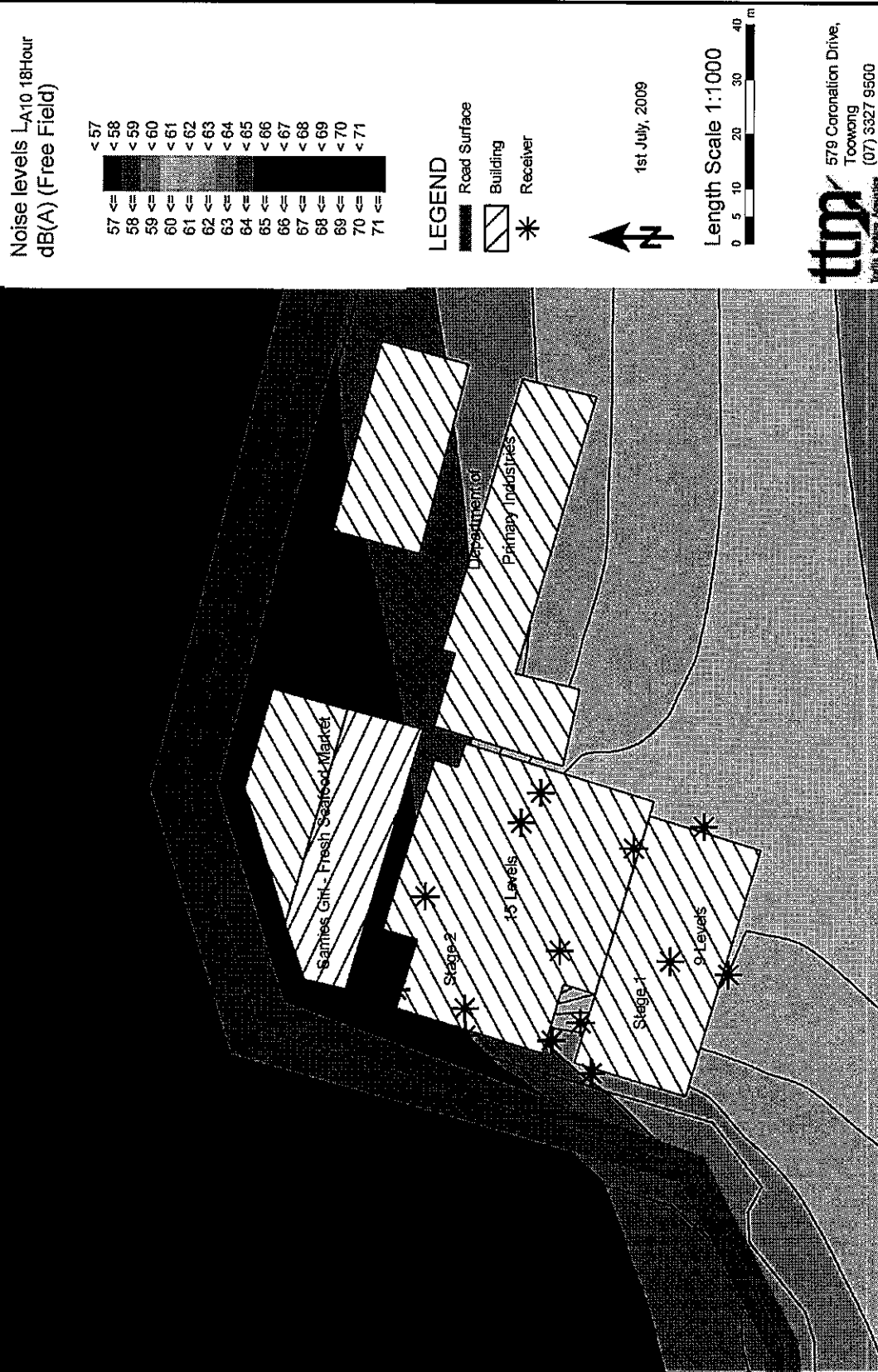
Proposed Mixed Use Development - Road Traffic Noise Assessment
 Stage 2 Level 3 Receivers at 12.5m AGL



Proposed Mixed Use Development - Road Traffic Noise Assessment
 Stage 2 Level 10 Receivers at 32.1m AGL



Proposed Mixed Use Development - Road Traffic Noise Assessment
 Stage 2 Level 15 Receivers at 46.1m AGL



Appendix D

Onsite Activity Noise Calculations

NOISE ASSOCIATED WITH ONSITE ACTIVITIES

Receiver 1 - 37 Harbour Road

Car Door Closure -	
Corrected Source Level @ 1 m	83.0
Distance to Receiver (m)	57.0
Nil	0.0
Distance Attenuation @-6dB/dd	-35.1
Receiver level dB(A)	47.9

Car Starting -Basement	
Corrected Source Level @ 1 m	75.0
Distance to Receiver (m)	57.0
Nil	0.0
Distance Attenuation @-6dB/dd	-35.1
Receiver level dB(A)	39.9

Car Bypass @ 5km/hr - Entrance	
Corrected Source Level @ 1 m	77.0
Distance to Receiver (m)	48.0
Nil	0.0
Distance Attenuation @-6dB/dd	-33.6
Receiver level dB(A)	43.4

Goods Delivery - Loading Dock	
Corrected Source Level @ 1 m	85.0
Distance to Receiver (m)	61.0
Bldg Screening	-22.0
Distance Attenuation @-6dB/dd	-35.7
Receiver level dB(A)	27.3

Waste Collection - Loading Dock	
Corrected Source Level @ 1 m	97.0
Distance to Receiver (m)	61.0
Bldg Screening	-20.0
Distance Attenuation @-6dB/dd	-35.7
Receiver level dB(A)	41.3

Conversation	
Corrected Source Level @ 1 m	75.0
Distance to Receiver (m)	24.0
Nil	0.0
Distance Attenuation @-6dB/dd	-27.6
Receiver level dB(A)	47.4

Background Music	
Corrected Source Level @ 1 m	65.0
Distance to Receiver (m)	24.0
Nil	0.0
Distance Attenuation @-6dB/dd	-27.6
Receiver level dB(A)	37.4

Receiver 2 - 29 Hercules Street - 1st Floor

Car Door Closure -	
Corrected Source Level @ 1 m	83.0
Distance to Receiver (m)	50.0
Bldg Screening	-22.0
Distance Attenuation @-6dB/dd	-34.0
Receiver level dB(A)	27.0

Car Starting -Basement	
Corrected Source Level @ 1 m	75.0
Distance to Receiver (m)	50.0
Bldg Screening	-22.0
Distance Attenuation @-6dB/dd	-34.0
Receiver level dB(A)	19.0

Car Bypass @ 5km/hr - Entrance	
Corrected Source Level @ 1 m	77.0
Distance to Receiver (m)	70.0
Nil	0.0
Distance Attenuation @-6dB/dd	-36.9
Receiver level dB(A)	40.1

Goods Delivery - Loading Dock	
Corrected Source Level @ 1 m	85.0
Distance to Receiver (m)	60.0
Bldg Screening	-22.0
Distance Attenuation @-6dB/dd	-35.6
Receiver level dB(A)	27.4

Waste Collection - Loading Dock	
Corrected Source Level @ 1 m	97.0
Distance to Receiver (m)	60.0
Bldg Screening	-22.0
Distance Attenuation @-6dB/dd	-35.6
Receiver level dB(A)	39.4

Conversation	
Corrected Source Level @ 1 m	75.0
Distance to Receiver (m)	27.0
Com Bldg Screening (Existing)	0.0
Distance Attenuation @-6dB/dd	-28.6
Receiver level dB(A)	46.4

Background Music	
Corrected Source Level @ 1 m	65.0
Distance to Receiver (m)	27.0
Com Bldg Screening (Existing)	0.0
Distance Attenuation @-6dB/dd	-28.6
Receiver level dB(A)	36.4

Receiver 3 - Portside Wharf - 1st Floor

Car Door Closure -	
Corrected Source Level @ 1 m	83.0
Distance to Receiver (m)	165.0
Bldg Screening	0.0
Distance Attenuation @-6dB/dd	-44.3
Receiver level dB(A)	38.7

Car Starting -Basement	
Corrected Source Level @ 1 m	75.0
Distance to Receiver (m)	165.0
Bldg Screening	0.0
Distance Attenuation @-6dB/dd	-44.3
Receiver level dB(A)	30.7

Car Bypass @ 5km/hr - Entrance	
Corrected Source Level @ 1 m	77.0
Distance to Receiver (m)	140.0
Com Bldg Screening (Existing)	0.0
Distance Attenuation @-6dB/dd	-42.9
Receiver level dB(A)	34.1

Goods Delivery - Loading Dock	
Corrected Source Level @ 1 m	85.0
Distance to Receiver (m)	152.0
Bldg Screening (Existing)	-18.0
Distance Attenuation @-6dB/dd	-43.6
Receiver level dB(A)	23.4

Waste Collection - Loading Dock	
Corrected Source Level @ 1 m	97.0
Distance to Receiver (m)	152.0
Bldg Screening (Existing)	-18.0
Distance Attenuation @-6dB/dd	-43.6
Receiver level dB(A)	35.4

Conversation	
Corrected Source Level @ 1 m	75.0
Distance to Receiver (m)	140.0
Com Bldg Screening (Existing)	0.0
Distance Attenuation @-6dB/dd	-42.9
Receiver level dB(A)	32.1

Background Music	
Corrected Source Level @ 1 m	65.0
Distance to Receiver (m)	150.0
Com Bldg Screening (Existing)	0.0
Distance Attenuation @-6dB/dd	-43.5
Receiver level dB(A)	21.5

Offsite Activity Noise Calculations

NOISE ASSOCIATED WITH OFFSITE ACTIVITIES

Samies Girl - Fresh Seafood Market

Car Door Closure -	
Corrected Source Level @ 1 m	83.0
Distance to Receiver (m)	35.0
Nil	0.0
Distance Attenuation @-6dB/dd	-30.9
Receiver level dB(A)	52.1

Car Starting -	
Corrected Source Level @ 1 m	75.0
Distance to Receiver (m)	35.0
Nil	0.0
Distance Attenuation @-6dB/dd	-30.9
Receiver level dB(A)	44.1

Car Bypass @ 5km/hr -	
Corrected Source Level @ 1 m	77.0
Distance to Receiver (m)	28.0
Nil	0.0
Distance Attenuation @-6dB/dd	-28.9
Receiver level dB(A)	48.1

Conversation - Entry	
Corrected Source Level @ 1 m	75.0
Distance to Receiver (m)	20.0
Nil	0.0
Distance Attenuation @-6dB/dd	-26.0
Receiver level dB(A)	49.0

Mechanical Plant - Northern Face - 2m AGL	
Corrected Source Level @ 1 m	71.9
Distance to Receiver (m)	15.0
screening from roof of plant room	-22.0
Distance Attenuation @-6dB/dd	-17.5
Receiver level dB(A)	32.4

Goods Deliveries - front of building	
Corrected Source Level @ 1 m	85.0
Distance to Receiver (m)	20.0
Nil	0.0
Distance Attenuation @-6dB/dd	-26.0
Receiver level dB(A)	59.0

Caltex Service Station

Car Door Closure -	
Corrected Source Level @ 1 m	83.0
Distance to Receiver (m)	61.0
Nil	0.0
Distance Attenuation @-6dB/dd	-35.7
Receiver level dB(A)	47.3

Car Starting -	
Corrected Source Level @ 1 m	75.0
Distance to Receiver (m)	61.0
Nil	0.0
Distance Attenuation @-6dB/dd	-35.7
Receiver level dB(A)	39.3

Car Bypass @ 5km/hr -	
Corrected Source Level @ 1 m	77.0
Distance to Receiver (m)	52.0
Nil	0.0
Distance Attenuation @-6dB/dd	-34.3
Receiver level dB(A)	42.7

Truck Door Closure	
Corrected Source Level @ 1 m	85.0
Distance to Receiver (m)	75.0
Nil	0.0
Distance Attenuation @-6dB/dd	-37.5
Receiver level dB(A)	47.5

Truck Bypass @ 5km/hr	
Corrected Source Level @ 1 m	82.0
Distance to Receiver (m)	52.0
Nil	0.0
Distance Attenuation @-6dB/dd	-34.3
Receiver level dB(A)	47.7

Conversation -	
Corrected Source Level @ 1 m	75.0
Distance to Receiver (m)	71.0
Nil	0.0
Distance Attenuation @-6dB/dd	-37.0
Receiver level dB(A)	38.0

DPI

Car Door Closure -	
Corrected Source Level @ 1 m	83.0
Distance to Receiver (m)	26.0
Nil	0.0
Distance Attenuation @ -6dB/dd	-28.3
Receiver level dB(A)	54.7

Car Starting -	
Corrected Source Level @ 1 m	75.0
Distance to Receiver (m)	26.0
Nil	0.0
Distance Attenuation @ -6dB/dd	-28.3
Receiver level dB(A)	46.7

Car Bypass @ 5km/hr -	
Corrected Source Level @ 1 m	77.0
Distance to Receiver (m)	26.0
Nil	0.0
Distance Attenuation @ -6dB/dd	-28.3
Receiver level dB(A)	48.7

Mechanical Plant - Ground Level	
Corrected Source Level @ 1 m	58.5
Distance to Receiver (m)	43.0
Nil	0.0
Distance Attenuation @ -6dB/dd	-9.1
Receiver level dB(A)	49.4