NOISE AND ODOUR IMPACT ASSESSMENT

PROPOSED MIXED USE DEVELOPMENT

7 REMORA ROAD, HAMILTON

Prepared for:
McDonalds Australia Limited

Prepared by:
MWA Environmental

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1.0 INTRODUCTION

1.1 STUDY BRIEF

MWA Environmental have been engaged by McDonalds Australia Limited to prepare a Noise and Odour Impact Assessment for a proposed mixed use development at 7 Remora Road Hamilton, formally described as Lot 614 on SL4775. The property falls within the Northshore Hamilton Urban Development Area (UDA).

This report has been prepared to assess the potential noise impacts upon future amenity of the development from the surrounding noise sources including:

- Vehicular traffic on surrounding roadways;
- Aircraft take-offs and landings for the Brisbane Airport; and,
- Noise from surrounding land uses including commercial and general industrial uses.

Additionally, the assessment has considered the potential for the proposed development to impact on the amenities of the existing and future surrounding sensitive land uses. In particular, the assessment considered odour emissions from the proposed McDonalds restaurant cooking exhaust vents and noise sources such as, plant and equipment, site traffic, car parking, drive-thru operation, service vehicles and patron noise.

The report has been prepared for submission to *Economic Development Queensland* in accordance with the requirements of applicable Australian Standards, Brisbane City Council (BCC) *Brisbane City Plan 2014, Queensland Development Code, MP4.4*, the *Environmental Protection (Noise) Policy 2008 and* Australian Standard AS 1668 Parts 1 and 2 *The Use of Mechanical Ventilation and Air-conditioning in Buildings*.

1.2 SITE DESCRIPTION

The development site is located at 7 Remora Road, Hamilton, formally described as Lot 614 on SL4775. The location and extent of the subject site, as well as the UDA as a whole is shown on **Figure 1**.

The surrounding land uses are shown on the aerial photograph included as **Figure 2,** which includes the following:

To the North Directly adjoining the site to the north is Curtin Avenue, which provides access to commercial and industrial that are located in Hamilton. In the future Curtin Avenue is proposed to be closed off at Remora Road and turned into a parkland directly north of the site. Beyond Curtin Avenue is a commercial / industrial use area and then Kingsford Smith Drive the major road in the area.

To the East Directly bordering the site to the east are further commercial/ industrial uses.

To the South To the south of the site is a residential apartment development currently under construction and the closest noise sensitive receptor.

To the West The site is bounded to the west by Remora Road, beyond which exists Hamilton Recreational Reserve.

The predominant noise source at the site is traffic noise from the surrounding roadways. The noise from surrounding industrial land uses and aircraft noise is noted to be an intermittent noise source at the site.

1.3 PROPOSED DEVELOPMENT

The development proposal is for an eight (8) storey mixed use construction over the site which consists of a ground level McDonalds Family Restaurant, 2 floors of commercial, with 6 levels of hotel suite accommodation above. The proposed McDonalds restaurant will be located on the ground floor with a drive-thru and loading bay as well as hotel lobby area. The first and second floors will contain commercial uses such as offices and a lounge area. The allocated 6 floors of short term accommodation will sit above.

The indicative design drawings for the development are included as ***Attachment 1***.

2.0 ENVIRONMENTAL ANALYSIS

2.1 EXISTING NOISE ENVIRONMENT

In order to characterise the existing noise environment and determine ambient background noise levels, long term noise measurements were undertaken at the site by MWA Environmental. A noise data logger was positioned at the corner of Remora Road and Curtin Avenue and was programmed to provide a statistical noise level analysis based on 15-minute sampling periods. The logger monitored continually for a period of 8 days between Tuesday 2nd June and Wednesday 10th June 2015 at the location shown on **Figure 3**.

The datalogger used was a Rion Logger, pre-calibrated to 94 dB at 1kHz using a Sound Level Calibrator. At post-calibration, the datalogger exhibited less than ±0.5 dB deviation.

The recorded noise levels are presented as statistical components, which are described as:

L_1: Noise level exceeded for 1 percent of the measurement period, referred to as the adjusted maximum sound pressure level.

L_{10}: Noise level exceeded for 10 percent of the measurement period, referred to as the average maximum sound pressure level.

L_{90}: Noise level exceeded for 90 percent of the measurement period. AS1055.1-1997[1] notes that the L_{90} is described as the background sound pressure level.

L_{eq}: An "average" measurement, and as per AS1055.1-1997 defined as the values of the sound pressure level of a continuous steady sound state, that within a measurement period, has the same mean square sound pressure as a sound under consideration whose level varies with time.

Table 1 below provides the minimum, maximum and average statistical noise levels recorded by the noise data logger. The noise datalogger plots are also included as ***Attachment 2***.

[1] Australian Standard AS 1055.1-1997 Acoustics – Description and measurement of environmental noise, Part 1: General Procedures

Table 1: **Noise Datalogger Recorded Noise Levels - dB(A)**

PARAMETER	PERIOD	RECORDED NOISE LEVELS – dB(A)		
		MINIMUM	MAXIMUM	AVERAGE
L_{max}	Daytime (7am-6pm)	72.1	94.4	82.1
	Evening (6pm-10pm)	70.0	94.1	78.4
	Night-time (10pm-7am)	64.8	92.6	77.1
L_1	Daytime (7am-6pm)	67.7	84.7	74.4
	Evening (6pm-10pm)	66.5	79.2	71.4
	Night-time (10pm-7am)	58.8	78.6	69.6
L_{10}	Daytime (7am-6pm)	60.6	72.5	68.5
	Evening (6pm-10pm)	61.1	70.3	65.4
	Night-time (10pm-7am)	51.2	70.8	61.8
L_{90}	Daytime (7am-6pm)	50.8	64.5	59.1
	Evening (6pm-10pm)	47.9	60.7	54.8
	Night-time (10pm-7am)	37.8	61.6	48.0
L_{eq}	Daytime (7am-6pm)	58.2	71.7	65.8
	Evening (6pm-10pm)	58.0	68.0	62.4
	Night-time (10pm-7am)	48.9	68.1	59.0

Other recorded statistical noise level parameters included:

- Avg. Recorded L10 (18 hour) = 66.9 dB(A)
- Avg. Recorded Leq (24 hour) = 62.5 dB(A)
- Avg. Maximum Leq (1 hour) 7am to 10pm = 66.1 dB(A)
- Avg. Maximum Leq (1 hour) 10pm to 7am = 64.8 dB(A)

It should be noted that during the logging period construction work was taking place to the south of the site, but would not have significantly affected the daytime recorded noise levels presented in **Table 1**.

In addition to the above long-term noise monitoring, manned short-term noise measurements were undertaken at three locations surrounding the site on the 2nd June and again on the 10th June 2015 in order to identify distinct noise emissions from the surrounding land uses. The results of the short-term noise measurements are provided in **Table 2** below, with noise measurement locations shown on **Figure 3**.

Table 2: **Recorded Short-Term Noise Levels – dB(A)**

#	LOCATION	TIME	RECORDED STATISTICAL NOISE LEVEL - dB(A)					COMMENTS
			L_1	L_{10}	L_{max}	L_{90}	L_{eq}	
1	Corner of Remora Road and Curtin Avenue	2 June 1530-1545	79.8	73.0	85.8	61.5	69.8	High traffic flow. Heavy vehicle noise
2	North-eastern Boundary along Curtin Avenue	2 June 1545-1600	75.8	70.3	79.2	55.8	66.0	Larger truck movement and container freighters
3	South-western Boundary along Remora Road	10 June 1315-1330	79.2	69.4	84.8	58.0	67.4	High traffic flow. Heavy vehicle noise

The short-term noise monitoring was undertaken with a Rion NL-21 Precision Sound Level Meter, internally pre-calibrated to 94 dB at 1kHz. There was no deviation from this level at post-calibration.

3.0 NOISE IMPACT ASSESSMENT

3.1 ROAD TRAFFIC NOISE IMPACT ASSESMENT

3.1.1 Road Traffic Noise Criteria

CityPlan 2014 interactive mapping indicates that the subject site is affected by the 'Transport Noise Corridor' overlay. The mapped Queensland Development Code MP4.4 ("**QDC MP4.4**") noise category for the majority of the site is 'Noise Category 1' with a small portion of the site mapped as 'Noise Category 2' (refer **Figure 4**).

As such, the requirements of QDC MP4.4 apply for the design and construction of residential building considering noise emissions from the mapped roadways (Kingsford Smith Drive).

The Performance Requirement and Acceptable Solutions of QDC MP4.4 are as follows:

	PERFORMANCE REQUIREMENTS		ACCEPTABLE SOLUTIONS
	Residential buildings		
P1	*Habitable rooms* in *residential buildings* located in a *transport noise corridor* are adequately protected from *transport noise* to safeguard occupants' health and amenity.	A1	The *external envelope* of *habitable rooms* in a *residential building* located in a *transport noise corridor* complies with the minimum R_w for each building component specified in Schedule 1 to achieve a minimum *transport noise reduction* level for the relevant *noise category* by: (a) using materials specified in Schedule 2; OR (b) using materials with *manufacturer's specifications* that, in combination, achieve the minimum R_w value for the relevant building component and applicable *noise category*.

As such, the Performance Requirement of QDC MP4.4 may be achieved by:

A. Applying the Acceptable Solutions specified in A1 by adopting the default CityPlan 2014 mapping Transport Noise Category for all building facades;
B. Applying the Acceptable Solutions specified in A1 based upon a site-specific assessment of the appropriate Noise Category for each building façade i.e. based upon detailed noise modelling; or
C. Undertaking detailed assessment using AS3671 to specify acoustic ratings for individual building elements to achieve the design indoor noise levels of AS2107:2000.

It is considered that EDQ approval conditions are likely to include an advice note that QDC MP4.4 is applicable to the development, EDQ does not regulate the QDC requirements and the ultimate means of achieving the QDC MP4.4 Performance Requirement is a matter to be resolved to the satisfaction of the building certifier.

The applicant may commission an appropriately qualified acoustic consultant to the detailed design stage of the project to provide specifications for the most commercially appropriate methods to achieve the Performance Requirement of QDC MP4.4.

The overall acoustic treatment requirements for the building considering the Transport Noise Corridor Overlay Code requirements and other Code requirements are summarised in **Section 4**.

3.1.2 Traffic Volume Data

In order to determine the relevant QDC MP4.4 noise categories for each proposed accommodation façade, ultimate design horizon traffic noise predictions have been made across the site. The future traffic noise modelling (10-year design horizon till Year 2026) was developed considering the proposed building location and finished floor levels as per the architectural drawings included in **Attachment 1.** The modelling considered receivers at finished floor level plus 1.5 metres.

The SoundPLAN 7.3 model was setup to predict the external $L_{10\ (18\ hour)}$ traffic noise levels under ultimate traffic flow conditions for the Year 2026. Existing and ultimate traffic data for Kingsford Smith Drive past the subject site was previously supplied by Brisbane City Council Transport Planning as 50,000 vehicles per day (vpd) and 64,000 vpd, respectively. The commercial vehicle content was provided as 12%. A traffic volume growth rate of 3.5% per annum is considered applicable to calculate the current and ultimate traffic volume.

It is noted that direct access to Curtin Avenue, north of the site from Remora Road will be closed and redirected as part of the future development plan. The entrance to Curtin Avenue directly north of the site will be turned into a parkland area for community use, thus Curtin Avenue is not considered in this assessment as part of the ultimate planning horizon.

The 18 hour (6am to Midnight) traffic volume is generally approximated as 94% of the daily volume. The existing (Year 2015) and ultimate (Year 2026) traffic volumes for Kingsford Smith Drive past the site, as determined from the data provided, are listed in **Table 3** below.

Table 3: Existing and Ultimate Traffic Volumes

Roadway	VPD		VP 18hr		%CV
	2015 Existing	2026 Ultimate	2015 Existing	2026 Ultimate	
Kingsford Smith Drive	50,000	64,000	47,000	60,160	12.0

3.1.3 Traffic Noise Model Validation

The first step in the predictive traffic noise process is to validate the model to the recorded noise levels, i.e. the aim being to predict within ±2dB of the recorded level, with selected parameters used in the future traffic (ten year horizon) noise modelling scenarios.

The model used in the traffic noise modelling process was SoundPLAN 7.3. This model uses the CoRTN methodology for traffic noise prediction, a method accepted by regulatory bodies in Queensland.

The level of traffic noise exposure recorded at the noise datalogger located on the north western part of the site (corner of Remora Road and Curtin Avenue) was recorded to be 66.9 dB(A) as the average L_{10} (18 hour). The model prediction for this datalogger location was an L_{10} (18 hour) of 68.5 dB(A).

The validation model predicted high noise level then measured onsite, thus, the model is considered to be conservative and suitable for future traffic noise predictions.

3.1.4 Predicted Future Traffic Noise Levels

The SoundPLAN 7.3 model was setup to predict the external L_{10} (18 hour) traffic noise levels under ultimate traffic flow conditions. The model layout and predicted results for the ultimate planning horizon including the noise contour maps are presented in **Attachment 3**. A summary of the predicted ultimate L_{10} (18 hour) noise levels external to the representative short term accommodation floor levels of the proposed development building and the corresponding QDC MP4.4 Noise Category required is provided in **Table 4** below.

The overall acoustic treatment requirements for the development considering the Transport Noise Corridor Overlay Code and other code requirements are summarised in **Section 4**.

Table 4: **Ultimate Traffic Noise Level Predictions Including Façade Reflection**

PREDICTED TRAFFIC NOISE LEVEL - dB(A)			
Façade	**Floor Level**	**$L_{10(18h)}$**	**QDC MP4.4 Noise Category**
North	2	69	Category 3
	3	70	Category 3
	4	70	Category 3
	5	71	Category 3
	6	71	Category 3
	7	71	Category 3
East	2	60	Category 1
	3	61	Category 1
	4	61	Category 1
	5	61	Category 1
	6	62	Category 1
	7	62	Category 1
South	2	58	Category 1
	3	58	Category 1
	4	59	Category 1
	5	59	Category 1
	6	59	Category 1
	7	60	Category 1
West	2	69	Category 3
	3	70	Category 3
	4	70	Category 3
	5	70	Category 3
	6	71	Category 3
	7	71	Category 3

3.1.5 Outdoor Traffic Noise Requirements

The Transport Noise Corridor Overlay Code also includes the acceptable construction of outdoor recreation space.

Currently no detailed design of the proposed accommodation units and balcony layout is available. The unit balconies on building facades to the north have line-of-sight to Kingsford Smith Drive and therefore should incorporate solid balustrades to balconies. Solid balustrades may be constructed of appropriate materials to achieve a minimum surface density of 10 kg/m^2 and be gap-free (minimum leakage of 1% total balustrade area) using materials such as glass and/or masonry.

3.2 AIRCRAFT NOISE IMPACT ASSESSMENT

3.2.1 Aircraft Noise Criteria

The site is located adjacent but outside the ANEF 20-25 sub category of Brisbane CityPlan *Airport environs overlay* map. This notwithstanding, it is considered that an aircraft noise impact assessment is warranted. It is noted that the Brisbane CityPlan *Airport environs overlay* code contains acceptable solutions regarding designated Rw ratings for building components for developments located within the ANEF 20-25 sub category, however given that the site is located outside this zone the following assessment has been conducted to determine suitable Rw ratings for the proposed short term accommodation.

The applicable standard with respect to development suitability within aircraft noise affected areas is *AS 2021-2000 Acoustics - Aircraft noise intrusion - Building siting and construction.* The effect of an ANEF on land use planning may be summarised in the **Table 5**, (Table 2.1 from AS2021-2000):

Table 5: Building Site Acceptability Based on ANEF Zones (to be used in conjunction with Table 3.3 from AS2021-2000)

Building Type	ANEF zone of site		
	Acceptable	Conditional	Unacceptable
House, home unit, flat, caravan park	Less than 20 ANEF (Note 1)	20 to 25 ANEF (Note 2)	Greater than 25 ANEF
Hotel, motel, hostel	Less than 25 ANEF	25 to 30 ANEF	Greater than 30 ANEF
School, university	Less than 20 ANEF (Note 1)	20 to 25 ANEF (Note 2)	Greater than 25 ANEF
Hospital, nursing home	Less than 20 ANEF (Note 1)	20 to 25 ANEF	Greater than 25 ANEF
Public building	Less than 20 ANEF (Note 1)	20 to 30 ANEF	Greater than 30 ANEF
Commercial building	Less than 25 ANEF	25 to 35 ANEF	Greater than 35 ANEF
Light industrial	Less than 30 ANEF	30 to 40 ANEF	Greater than 40 ANEF
Other industrial	Acceptable in all ANEF zones		

NOTES:(from *AS2021-2000*)

1. The actual location of the 20 ANEF contour is difficult to define accurately, mainly because of variation in aircraft flight paths. Because of this, the procedure of Clause 2.3.2 may be followed for building sites outside but near to the 20 ANEF contour.

2. Within 20 ANEF to 25 ANEF, some people may find that the land is not compatible with residential or educational uses. Land use authorities may consider that the incorporation of noise control features in the construction of residences or schools is appropriate (see also Figure A1 of Appendix A).

3. There will be cases where a building of a particular type will contain spaces used for activities which would generally be found in a different type of building (e.g. an office in an industrial building). In these cases Table 2.1 should be used to determine site acceptability, but internal design noise levels within the specific spaces should be determined by Table 3.3.

The Standard then requires the following actions:

1 **Acceptable**

If from Table 2.1, the building site is classified as "acceptable", there is usually no need for the building construction to provide protection specifically against aircraft noise.

2 ***Conditional***

If from Table 2.1, the building site is classified as "conditional", the maximum aircraft noise levels for the relevant aircraft and the required noise reduction should be determined from the procedure of Clauses 3.1 and 3.2, and the aircraft noise attenuation to be expected from the proposed construction should be determined in accordance with Clause 3.3.

3 **Unacceptable**

If, from Table 2.1, the building site is classified as "unacceptable", construction of the proposed building should not normally be considered.

NOTE: In certain circumstances it may be proposed to construct or upgrade buildings on sites that could be classified as unacceptable, e.g. a hotel in the immediate vicinity of an aerodrome. In these cases, refer to Note 2 of Clause 1.1. This does not apply to sites to be used for residential purposes.

For the assessment of internal aircraft noise levels within the proposed short term accommodation, Table 3.3 of AS2021-2000 provides design indoor sound levels for aircraft noise reduction assessment. Note that these are the same internal noise criteria as per the Brisbane CityPlan *Airport environs overlay code* and provides for:

Houses, home units, flats, caravan parks

Sleeping areas	*50 dB(A) indoor design sound level*
Other habitable rooms	*55 dB(A) indoor design sound level*

3.2.1 Existing Aircraft Noise Levels

Previous detailed aircraft noise levels have been recorded by MWA Environmental at adjacent developments to the subject site. The recorded aircraft noise levels varied significantly dependent upon the aircraft flight path. The loudest peak aircraft noise levels were associated with planes approaching from the west and banking above the site before aligning with

the runway for landing. Recorded peak aircraft noise levels ranged 55 to 72 dB(A) at adjacent development sites and are considered similar to those that would be experienced at the site. From site inspections at the subject site, aircraft noise levels at the site were typically below the ambient traffic noise levels.

The issue of future aircraft noise at the site relates to air traffic using a future proposed parallel runway at the Brisbane Airport for which the site is adjacent but outside the ANEF 20-25 contour. As such, future aircraft noise levels for assessment purposes will be determined by calculation, not by measurement.

3.2.2 Predicted Future Aircraft Noise Levels at Development

The site is located adjacent but outside the ANEF 20-25 sub category of Brisbane CityPlan *Airport environs overlay map* as presented in **Figure 5**. Thus, it is considered that the site is potentially affected by aircraft noise and should incorporate appropriate noise control measures (i.e. building construction) to provide suitable internal acoustic amenity as per Table 3.3 of *AS 2021-2000*. These standards requires that internal aircraft noise levels, calculated as per AS 2021-2000.

The site location with respect to the Brisbane Airport runway flight path was defined in terms of DS, DL and DT as per *Clause 3.4* of *AS 2021-2000* as follows:

Table 6: Site Locational Data (as per AS 2021-2000)

SITE LOCATIONAL DATA (Clause 3.4 of AS2021-2000)		
DS	**DL**	**DT**
230	7300	10400

AS 2021-2000 considers noise levels generated by numerous types of aircraft that are active in Australia. The noise level at the subject site of aircraft that use the Brisbane Airport was calculated as per *Tables 3.4* to *3.13* and *3.17* to *3.18* of *AS 2021-2000* using the locational data detailed in **Table 6** above. The predicted noise levels are outlined in **Table 7** below:

Table 7: Predicted Aircraft Noise Levels (as per AS 2021-2000)

Aircraft Type	Predicted Future Aircraft Noise Level - dB(A)	
	Take-off	Landing
Boeing 727 (Hush Kitted)	83	73
Boeing 747-200B	88 (long range)	80
	80 (short range)	
Boeing 747-400	84 (long range)	78
	77 (short range)	
Boeing 737-300, -400, and Airbus A320	71	71
Boeing 767	79 (long range)	74
	72 (short range)	
BAe146	69	68

Many of the noisier aircraft considered in *AS 2021-2000* use the Brisbane Airport relatively infrequently and thus have a much lesser potential to result in a loss of acoustic amenity. It is thus considered that as a realistic approach to providing for a reasonable level of internal noise amenity that the more prevalent Boeing 747-400, Boeing 737-300, -400, Airbus A320 and Bae146 should be used as a planning tool for acoustic ratings on the building components for the proposed development.

As such, the design external aircraft noise level at the site as per **Table 7** is taken as 88 dB(A) for assessment purposes.

Building componentry calculations are required to be performed in accordance with *Appendix F* of *AS 2021-2000* to determine the minimum Weighted Sound Reduction Index (R_w) of building components of the proposed short term accommodation apartments in order to achieve the appropriate internal noise levels.

It is recommended that at the Building Approval stage when more detailed construction drawings are available that detailed Rw calculations for all accommodation building components be conducted to ensure appropriate acoustic elements are incorporated in the final design.

3.3 INDUSTRIAL NOISE IMPACT ASSESSMENT

3.3.1 Industrial Noise Criteria

CityPlan 2014 interactive mapping indicates that the subject site is affected by the 'Industrial Amenity Investigation Area' overlay.

The Industrial Amenity Overlay Code includes the following PO2 related to noise amenity:

Performance outcomes	Acceptable outcomes
Section A—If in the Industrial amenity investigation area sub-category	
PO2 Development is located, designed and constructed to achieve the noise (planning) criteria in Table 8.2.13.3.E to protect the development from adverse noise impacts. Note—A noise impact assessment report prepared in accordance with the Noise impact assessment planning scheme policy can assist in demonstrating achievement of this performance outcome.	**AO2** Development for a sensitive use is located no closer than: (a) 150m to a medium impact industry A; (b) 250m to a medium impact industry B; (c) 500m to a high impact industry; (d) 1500m to a special industry.

The subject site is located generally close to small workshops, storage and warehousing type industries.

The relevant Noise (planning) criteria are specified in the following Table 8.2.13.3.E:

Table 8.2.13.3.E—Noise (planning) criteria

Location where the criteria applies inside a sensitive use	Adjusted equivalent continuous sound pressure level ($L_{Aeq,adj,T}$) to be achieved during day, evening and night-time periods			Adjusted maximum sound pressure level ($L_{Amax,adj}$) to be achieved during the night-time period
	Day 7am–6pm $L_{Aeq,adj,11hr}$	Evening 6pm–10pm $L_{Aeq,adj,4hr}$	Night 10pm–7am $L_{Aeq,adj,9hr}$	Night 10pm–7am
Sleeping areas	35dB(A)	35dB(A)	30dB(A)	45dB(A)
Other habitable rooms	35dB(A)	35dB(A)	35dB(A)	-

3.3.2 Predicted Commercial & General Industry Noise Impact

Surrounding land uses include commercial uses to the east and general industry to the north across Curtin Avenue.

From site inspections, the surrounding industrial/commercial uses are considered to be low noise impact and do not have any potential to adversely impact upon short term accommodation amenity at the proposed development.

Noise impacts from the car parking at surrounding land uses were noted to be insignificant noise level compared to the more frequent traffic noise peaks. It is also noted that car parking activities typically take place during the daytime and evening periods only where peak traffic occurs. Hence it is considered that surrounding car parking activities do not have significant potential to adversely impact upon short term accommodation amenity at the proposed development.

From site inspections conducted, the noise of surrounding plant, equipment and machinery were generally inaudible at the subject site over the prevailing traffic noise. There was no noted air-conditioning plant and equipment surrounding the site, associated with the commercial and warehousing uses.

As such, considering the existing low noise impact uses surrounding the site and the design of the development to ameliorate traffic and aircraft noise impacts, the noise of surrounding commercial and general industry uses will not adversely impact short term accommodation amenity at the proposed development.

4.0 OVERALL BUILDING COMPONENTRY RECOMMENDATIONS

As the site is affected by aircraft and road traffic noise, overall building componentry requirements must consider the maximum R_w and transport noise reduction required for the attenuation of either aircraft noise or road traffic noise.

Due to the preliminary nature of the proposed mixed use development layouts, detailed acoustic design on the individual short term accommodation units cannot be carried out. It will be necessary to provide detailed acceptable construction outcome at the detailed design phase of the development to ensure appropriate acoustic amenity is achieved for all accommodation areas.

Based upon the detailed assessment presented in **Section 3**, overall acoustic specifications for the development must take account of the minimum required noise reduction considering road traffic noise and aircraft noise requirements.

The following summarises the relevant noise reduction requirements for the development:

- Road traffic noise as per **Table 4,** the deemed QDC MP4.4 Noise Category as follows
    - **QDC MP4.4 Noise Category 3 construction standard – Northern building facades**
    - **QDC MP4.4 Noise Category 3 construction standard – Western building facades**
    - **QDC MP4.4 Noise Category 1 construction standard – Eastern building facades**
    - **QDC MP4.4 Noise Category 1 construction standard – Southern building facades**

- Aircraft noise – up to 38 dB(A) sound transmission loss by façades to short term accommodation sleeping areas. To be assessed at the detailed design phase of the project using the methodology of AS2021 "Acoustics – Aircraft Noise – building siting and construction".

5.0 NOISE IMPACT FROM PROPOSED DEVELOPMENT

The proposed development has the potential to cause noise impact from the following sources:

- Plant and equipment noise, e.g. air-conditioning, refrigeration, exhaust fans;
- Service noise, e.g. goods delivery vehicles, loading / unloading impact noise; and,
- Site traffic, patron noise, drive thru traffic and car parking noise, e.g. slow-speed traffic, car starts and door slams.

The *Environmental Protection (Noise) Policy 2008* provides 'Acoustic Quality Objectives' which, in urban areas, may be currently exceeded due to existing noise sources and 'Controlling background creep' criteria for the management of noise from the above activities.

5.1 MECHANICAL PLANT AND SERVICE VEHICLE NOISE CRITERIA

5.1.1 Acoustic Quality Objective

The *Environmental Protection (Noise) Policy 2008* **("the Policy")** specifies Acoustic Quality Objectives for sensitive receptors to enhance or protect acoustic amenity.

The applicable Acoustic Quality Objectives from Schedule 1 of the policy are presented in **Table 8.**

Table 8: Acoustic Quality Objectives

Sensitive Receptor	Period	Acoustic Quality Objectives (measured at the receptor) dB(A)			Environmental Value
		($L_{Aeq,adj,1\text{-}hour}$)	($L_{A10,adj,1\text{-}hour}$)	($L_{A1,adj,1\text{-}hour}$)	
Dwelling (for outdoors)	Daytime and evening	50	55	65	Health and wellbeing
Dwelling (for indoors)	Daytime and evening	35	40	45	Health and wellbeing
	Night-time	30	35	40	Health and wellbeing, in relation to the ability to sleep

A t 7 dBA reduction by the building envelope with windows open, was considered to derive the representative external noise criteria from the

respective indoors noise limits[2]. Albeit it is recognised from experience with surrounding residential developments that external façade elements are generally required to be closed to achieve compliance with road and aircraft noise is this locality.

Comparison of the Acoustic Quality Objectives and the measured existing noise levels at the subject site, as presented in **Table 1,** demonstrates that the Acoustic Quality Objectives are currently exceeded in this urban locality due to road traffic noise and therefore are not considered the appropriate basis for determination of project noise criteria to protect the environmental values of the nearby sensitive receptors. Therefore the 'controlling background creep' criteria specified in the Policy are applied for this assessment.

5.1.2 Controlling Background Creep

Part 4, Section 10 of the *Environmental Protection (Noise) Policy (2008)* provides 'controlling background creep' noise criteria for the assessment of amenity impacts for an activity involving noise from the development (such as vehicle movements on internal roadways, car park, waste collection and mechanical plant and equipment).

Considering the nature of noise emissions from a service station, the relevant 'controlling background creep' criteria are those specified for both 'continuous noise and noise that varies over time', as follows:

10 Controlling Background Creep

(1) This section states the management intent for an activity involving noise.

Note—

See section 51 of the *Environmental Protection Regulation 2008.*

(2) To the extent that it is reasonable to do so, noise from an activity must not be—

(a) for noise that is continuous noise measured by $L_{A90,T}$ – more than nil dB(A) greater than the existing acoustic environment measured by $L_{A90,T}$: or

(b) for noise that varies over time measured by $L_{Aeq,adj,T}$ - more than 5 dB(A) greater than the existing acoustic environment measured by $L_{A90,T}$.

[2] AS3671 states approximate 10 dB(A) noise reduction through a façade with 10% open area. Thus approximately 7 dB(A) noise reduction through a façade with 20% open area. A large 1200x1800 sliding window relates to approximately 10% open area. A large 2100x2300 sliding glass door represents approximately 20% open area. Thus, 7dB(A) noise reduction is conservatively adopted based upon a large sliding glass door in the affected façade. Openings larger than 20% open area are unlikely to be necessary for ventilation during the night period.

As such, the adopted noise criteria for this assessment of noise impacts from the proposed development are that:

- the noise from the **mechanical plant** (continuous noise) measured as the $L_{A90,adj,T}$ does not exceed the otherwise prevailing $L_{A90,T}$; and
- the **overall noise** from the site measured as the $L_{Aeq,adj,T}$ including vehicle and servicing activities (noise varies over time) does not exceed the otherwise prevailing $L_{A90,T}$ by more than 5 dB(A).

The applicable criteria are presented in **Table 9**.

Table 9: Background Creep Criteria

Period	Background Noise Level (L_{A90}) – dB(A)	Mechanical Plant Noise Criteria (L_{A90}) – dB(A)	Overall Noise Criteria (L_{Aeq}) – dB(A)
Daytime (7:00am to 6:00pm)	59	**59**	**64**
Evening (6:00pm to 10:00pm)	55	**55**	**60**
Night-time (10:00pm to 7:00am)	48	**48**	**53**

5.1.3 Sleep Disturbance

As the site will operate during the night period (10pm to 7am) it is appropriate to consider the potential for sleep disturbance at nearby sensitive receptors. Queensland *Ecoaccess Guideline: Noise - Planning for Noise Control* (2004) indicates that unreasonable sleep disturbance impacts due to impulsive noise sources such as car starts and door slams can occur at levels of 45 to 50 dB(A) within a bedroom depending upon the number of noise events per night. Consideration of potential sleep disturbance noise criteria should also give consideration to the existing noise environment i.e. whether existing noise from vehicles on public roads results in noise levels above the default planning criteria.

Given the significant existing transportation noise at the locality, the appropriate sleep disturbance noise criterion of 50 dB(A) L_{max} noise level within a bedroom due to noise from vehicle movements and car starts / door slams during the night period. Adopting a typical 7 dB(A) noise reduction through an open window relates to a sleep disturbance criterion of **L_{max} 57 dB(A) external** to a bedroom window.

5.2 PLANT AND EQUIPMENT NOISE IMPACT ASSESSMENT

To enable an assessment of noise from the proposed development including the McDonald's Restaurant, a computer noise model has been established using the SoundPLAN 7.3 software. This model is an accepted regulatory model that allows input of terrain specific data and source noise data as sound power level spectra.

External plant and equipment associated with the proposed development is likely to include air-conditioning units, ventilation fans, refrigeration units and possible car park exhaust. Plant and equipment will be associated with the proposed McDonalds restaurant with the commercial and accommodation levels requiring air conditioning and ventilation system.

No detailed specification for external mechanical plant associated with the development is available at this stage but experience with other McDonalds and commercial development provides a basis for assessment of the likely equipment that may be used.

The required plant and equipment is likely to be located in an allocated plant room. If this is so, the proposed plant rooms should be suitably designed (i.e. constructed with masonry walls / roofs) to ensure that noise from the required plant and equipment does not impact upon on-site or surrounding residential amenity.

Where any external plant and equipment are located on roof top, they shall be mounted on external roof deck area and acoustically screened with appropriate vertical acoustic screens around the perimeter of the plant area.

Ventilation of the exhaust from the McDonalds kitchen is proposed to be done via the roof and it is recommended that any externally located ventilation fans located at the roof top deck are acoustically screened.

A conservative noise propagation modelling exercise was carried out in the likelihood of the proposed plant and equipment to be located externally on the roof top. Recent experience with other McDonald's Restaurant developments provides information on possible plant and equipment noise levels as listed in **Table 10** below:

Table 10: Plant and Equipment Noise Data – Roof

Noise Source	Maximum Operating Sound Pressure Level dB(A) At 3 m
2 x A/C Units	60 each
Refrigeration	65
9 x Bathroom exhaust fan	52
Fryer exhaust fan	65
Fillet exhaust fan	60
Clam/Deli exhaust fan	60

The acoustic selection of future plant, the roof mounted location and use of acoustic control measures will be undertaken at the detailed design phase to achieve the desired noise criteria levels.

A conservative SoundPLAN noise propagation modelling methodology was adopted and assessed against "background creep" criteria for continuous noise sources to meet the more stringent night-time background criterion of **48 dB(A)**.

The results of the continuous sources noise modelling are presented in **Table 11** for the nearest existing/proposed residence to the south of the development site as illustrated in **Figure 7.**

A full set of the predicted results for the plant and equipment noise including the noise contour maps are presented in **Attachment 4.**

Table 11: Predicted Plant and Equipment Noise Levels – dB(A) Nearest Existing Residence to South

Building	Floor	Facade	L_{A90} dB(A)	Criterion dB(A)
Building 5B	2	North	43	48
	3		45	
	4		45	
	5		46	
	6		46	
	7		47	
	8		47	
Building 5B	2	East	47	
	3		41	
	4		42	
	5		43	
	6		44	
	7		44	
	8		45	

The above predictions demonstrate that compliance with the 48 dB(A) night-time criterion can be achieved at the nearest surrounding residences to the south without any specific acoustic control measures.

Any lift motors should be selected and acoustically enclosed if required in order to achieve the 48 dB(A) limit external to on-site and surrounding residential facades. This design standard will ensure that the noise of the lift motors does not adversely impact on amenity at surrounding and on-site residential premises.

5.3 VEHICLE AND PATRON NOISE IMPACT ASSESSMENT

5.3.1 Predicted Service Vehicle Noise Impact

This section addresses potential noise amenity impacts from the intermittent short duration noise sources associated with the proposed development. The noise source are likely to include:

- slow-speed vehicle movements;
- carparking noise; and
- servicing (e.g. loading bay) activities.
- patron noise

The SoundPLAN 7.3 model has been setup to represent peak noise emissions for various on-site activities (e.g. site traffic manoeuvring, car starts / door slams, service vehicle activities, drive-thru ordering point and collection and patron noise) and assessed against the noise criteria as outlined above in **Section 5.1.2.**

Appropriate noise source locations were determined from the proposed development plan. The model was established over an area including the subject site and the nearest surrounding residential dwellings. The SoundPLAN noise model layout is included as **Attachment 5**.

Source noise data for this assessment were derived from measurements undertaken by MWA Environmental and others for similar developments and existing McDonald's Restaurants.

The proposed development provides servicing arrangements with a loading bay area on ground level in the carparking area. Noise from car parking area relates to the ground level parking areas including some areas beneath of overhead building proposed. The drive-thru is also located on the ground floor in the carparking area.

The proposed McDonald's restaurant includes a covered Terrace area and a covered Playland area on the northern portion of the building.

The McDonalds also includes remote order point on the entry to the drive-thru lane. Current equipment adopted by McDonald's is supplied by 3M and provides a volume adjustable speaker at the order points. The speakers are located within enclosed upstands and short-throw speakers are used to provide speech intelligibility at an adjacent car but to limit broadcast of sound far beyond this point. Each unit has volume adjustment within the restaurant drive-thru booth such that operators can adjust the volume depending upon the external ambient noise conditions, i.e. during the day period the maximum setting might be used, however during the evening and night-time periods, the settings allow significant reduction in volume when ambient noise levels are lower.

The sources represented in the SoundPLAN 7.3 modelling are outlined in the following **Table 12**.

Table 12: Noise Sources Considered in SoundPLAN 7.3 Modelling

MODELLED NOISE SOURCE	MODELLED SOURCE TYPE	SOUND POWER LEVEL – dB(A)	
		L_{max}	L_{eq}
Idling truck at loading area	Point Source	93.0	76
Slow moving truck accessing loading area	Line Source	93.0	62/m[3]
Reversing beeper on truck at loading area	Point Source	98.0	85
Site traffic on site driveways and drive-thru	Line Source	88.0	68.9 - 74.4/m[4]
Vehicle starts / door slams at car parking locations / 38 parking bays	Area & Line Source	88.0	70.8/m[5]
Amplified voice at Drive-thru ordering points (x2)	Point Sources	83.1	81.6
Voices at pay / collection booths (x2)	Point Sources	82.9	77.9
Patrons talking loudly at external terrace area (x2)	Point Source	87.5	76
Children playing at Playland area	Point Source	87.0	73

Other noise generating activities may occur at the site at times but are not considered to be typically above the noise level of the major sources which have been identified above.

Proposed Acoustic Controls:

In order to satisfy the relevant noise criteria at the nearest surrounding residences which will be approximately 4 metres from the southern boundary, the modelling included the following noise control measures which will be necessary for the development:

- Solid **2.4 metre high acoustic barrier on the southern boundary** of the proposed development to contain noise levels to accepted limit for noise emissions form the carparking and drive-thru areas.

[3] Based on 4 truck movement per hour
[4] Based on 100 car movement per hour
[5] Based on 2 car bay movements per hour

- Service vehicle activities and refuse collection associated with the development site are limited to occur between the daytime and evening periods only (i.e. no servicing or refuse collection is to occur during the night period (10pm to 7am)).

The extent of the recommended acoustic treatments is provided on **Figure 6**.

The results of the intermittent sources noise modelling, considering the recommended acoustic controls for the site as above and representing the site noise sources as per **Table 12**, are presented in the following **Tables 13** for the nearest existing or proposed surrounding residence to the south of the site.

Table 13: Predicted Noise Levels at Adjacent development to South

Receptor	Floor	Facade	Predicted Noise Level L_{Aeq} dB(A) Night-time
Building 5B	2	North	52
	3		53
	4		53
	5		52
	6		51
	7		51
	8		50
Building 6B	2	North	47
	3		53
	4		53
	5		53
	6		52
	7		52
	8		51
Criterion			***53***

The predicted L_{Amax} noise levels for assessment of potential "sleep disturbance" from service vehicles, car accelerations, car starts and door slams (vehicle noise) and patron noise during the night-time period (10pm to 7am) at the nearest representative residence (refer **Figure 6**) are summarised in **Table 14** below.

Table 14: Predicted L_{Amax} External Noise Levels for Sleep Disturbance During Night-time

Receptor	Floor	Predicted Noise Level – L_{Amax} dB(A)
Building 5B	2	55
	3	56
	4	55
	5	54
	6	53
	7	52
	8	51
Building 6B	2	50
	3	54
	4	55
	5	54
	6	53
	7	52
	8	50
Criterion		***57***

The results of the noise modelling indicate that, with the implementation of the recommended acoustic control measures for the development, the relevant noise criteria can be satisfied at the nearest surrounding residences.

As such, noise impacts from intermittent noise activities are adequately separated and / or shielded by the recommended acoustic control measures such that the relevant noise criteria are satisfied for all assessed noise events at the nearest surrounding residential land uses to the south.

The L_{Amax} night-time (10pm to 7am) criterion for sleep disturbance, for vehicle movement, patron noise, car start and door slam noise peaks satisfy the relevant external sleep disturbance noise criteria of 57 dB(A) at all surrounding residences. This notwithstanding, given the proposed on-site accommodation uses proposed and the adjoining existing and proposed residential development it is a recommendation of this report that service vehicle activities and refuse collection associated with the development site be limited to the time period 7am to 10pm only.

6.0 ODOUR IMPACT ASSESSMENT

6.1 COOKING ODOURS

The air quality issues associated with the operation phase of a McDonald's Restaurant includes odour emissions from cooking exhaust vents. The McDonald's level of air quality control is maintained to a high standard by the use of separate exhaust ventilation fans for various internal kitchen areas, use of appropriately sized range hoods fitted with appropriate filters and regular maintenance of this system.

Kitchen exhaust fans for this development will be mounted on the roof level above the accommodation levels and are selected as high duty fans, with adequate vertical discharge velocities to promote odour dispersion.

Experience demonstrates that cooking odours are controlled by using appropriate exhaust ventilation systems, which include filtration and appropriate exhaust heights and discharge velocities in accordance with AS1668.2 - *The use of ventilation and air-conditioning in buildings - Part 2: Ventilation design for indoor air contaminant control.*

Cooking odours are collected by range hoods which remove grease and other contaminants before discharge through the roof top exhaust fans. The design height of fan discharge is such that odours are adequately dispersed. The design of mechanical exhaust ventilation systems must comply with Australian Standard AS 1668 Parts 1 and 2 *The Use of Mechanical Ventilation and Air-conditioning in Buildings.*

Section *5.10 Air Discharges* of AS 1668.2-1991 includes:

> *5.10.1 General*
>
> *All exhaust air shall be discharged to atmosphere in such a manner as not to cause danger or nuisance to occupants in the building, occupants of neighbouring buildings or members of the public.*

McDonald's exhaust ventilation design provides for the location of exhaust fan outlets, their height and discharge rates are such that the requirements of AS1668.2 are complied with, taking account of surrounding land uses, including in this instance, existing residential land uses.

Specific detail with respect to possible exhaust hoods and cooking exhaust ventilation has been provided by McDonald's Australia Ltd.

The standard specification for installations at all McDonald's Restaurants requires that as a minimum the entire exhaust extraction systems comply with AS1668 Parts 1 & 2.

The following provides a description of the cooking exhaust collection and extraction systems typical to a McDonald's Restaurant as is proposed at the development site at Hamilton.

1. Cooking fumes are generated from two areas within the restaurant, viz:
    a. Grill – electric grill with specific design canopy exhaust hood with inline filters mounted above the grill. The detail of a typical canopy is provided in ***Attachment 4***.
    b. Fryer – deep fryer, for fries etc., has a separate specific design canopy exhaust hood with inline filters mounted above the fryer. The detail of a typical canopy is provided in ***Attachment 5***.

2. Extraction of fumes from both the grill and fryer is achieved by each having a specific exhaust canopy fitted with a roof mounted centrifugal fan with vertical discharge.

3. Minimisation of emitted odour is achieved by the following:
    a. No char grilling, only electric grills are used.
    b. Fryer oils are regularly replaced which prevents generation of odours as fresh oils are regularly used.
    c. Canopy exhaust hoods above both the grill and fryer units are fitted with removable inline filter panels to specific McDonald's Design provided by H&K Australia.
    d. The canopy exhaust filters are cleaned on a daily basis as part of daily housekeeping procedures. This regularity of cleaning is exemplary in our professional opinion, with many other kitchen establishments cleaning filters on a monthly basis or longer in our experience.
    e. The filters used are composite panels of varying grades and thickness. A detail drawing of the filter panels is included as ***Attachment 6***.
    f. Roof exhaust fans are fitted with specific grease arrestors and catch systems which separate grease from any rainwater and collect the grease for disposal.
    g. Programmed maintenance of fans, canopies and exhaust ducting are as follows (extract from McDonald's Programmed Maintenance Manual for their restaurants):

Exhaust Fans	Weekly	empty grease catch pans
	Weekly	clean fan and check condition of subbase gasket.
	Monthly	maintenance – clean, check operation – by technician.
	Quarterly	maintenance – overhaul by service technician.
Exhaust Ducting	6 monthly	check and clean.

Canopy filters	Daily	remove, wash and clean then reinstall.

Kitchen exhaust fans provide for a minimum vertical discharge velocity of approximately 7m/s minimum.

For the proposed McDonald's Restaurant at Hamilton, the following site specific items are noteworthy.

1. The closest residential area to the site is a proposed new development directly to the south, across a new proposed road **(see Figure 6).** The proposed development will be separated from the McDonalds Restaurant roof level exhaust fans by approximately 30 metres.

2. The design of the exhaust ventilation system and the daily cleaning of exhaust filters is a McDonald's standard policy to minimise odours and present their sites and operations as neighbour friendly.

The following paragraphs provide the performance standard requirements. It should be noted, however, that McDonald's standard systems are considered to be of a higher standard than that deemed satisfactory under the Building Code of Australia.

- The regulatory code with respect to cooking exhaust hoods as enforced by the **Building Code of Australia** is **AS1668.2**.

- The aim of the kitchen exhaust system is to capture the cooking odours, greases and particulates at the cooking location with a canopy over the cooking surface. The filter in the canopy trapping the majority of emissions.

- The design of the canopy can either be a "deemed to satisfy" solution in accordance with **AS1668.2** or it may be performance engineered and warranted to operate in a satisfactory manner by the proprietary canopy hood manufacturer.

  Performance engineered solutions can be employed where the use is unable to comply with required **AS1668.2** discharge location i.e. inadequate separation distance between discharge point and adjacent sensitive land use. This typically relates to an installation where the discharge point is within 6 metres of a neighbouring building – this is not the case with the proposed development at Hamilton where further setback distance is available.

- The required **AS1668.2** discharge location is important to ensure that odours are discharged sufficiently far enough away to not cause health or nuisance complaints from people within the development and adjacent neighbours.

- The required **AS1668.2** discharge separations from outside air intakes,

neighbour boundaries and natural ventilation openings in buildings can be reduced via performance engineered solutions if the kitchen exhaust discharge is treated to remove odours and particulates using specific in-line treatment measures.

There are design alternatives to the standard deemed to satisfy AS1668.2 exhaust ventilation systems which can be implemented either from day one or as a retrofit installation where high levels of odour control are required. In the case of the proposed McDonald's Restaurant development at Hamilton, the available separation distances between cooking source emission points and the surrounding residential dwellings are significantly greater than required by the Australian Standard deemed to satisfy provisions i.e. AS1668.2 would require a less significant setback (i.e. minimum 6 metres) as compared to in excess of 30 metres actually available from the nearest potential cooking source to the nearest existing residences.

On the basis of the above, it is considered that the available engineered solutions to contain and prevent odour emissions from cooking range hoods will be implemented as part of detailed design such that the amenity of neighbouring residents with respect to cooking odours will not be adversely affected.

6.2 REFUSE STORAGE

The proposed development includes a solid walled garbage storage facility to the eastern side of the site, located a minimum 35 metres from the nearest surrounding residences.

The garbage storage areas are proposed to be roofed, which will minimise the exposure of putrescible wastes to sunlight and heat which can accelerate the decomposition of organic material and thus increase odour generation.

Regular removal of any putrescible wastes held in bins with lids is typically undertaken by external licensed waste collectors on a regular basis to minimise odour. Refuse with odour generating potential shall not be left for extended periods such as over the weekend. Bins shall be regularly cleaned and disinfected as per standard Council requirements. The use of management measures to regularly empty and maintain refuse bins in addition to the proposed roofed corral storage bin area will ensure that adverse odours are contained. These are common management measures for service stations and McDonald's Restaurants.

In summary, provision of roofed storage areas, use of bulk refuse bins fitted with lids, regular collection of refuse and cleaning of putrescibles bins will ensure that adverse odour does not result at residential areas.

7.0 CONCLUSIONS

MWA Environmental have been engaged by McDonalds Australia Limited to conduct a Noise and Odour Impact Assessment for a proposed residential development at 7 Remora Road in Hamilton, more properly described as Lot 614 on SL4775. The site is part of the larger Northshore Hamilton Urban Development Area (UDA).

The report has been prepared for submission to *Economic Development Queensland* and has been prepared in accordance with the requirements of applicable Australian Standards, with the requirements of the Brisbane City Council (BCC) *Brisbane City Plan 2014*, *Queensland Development Code, MP4.4*, with the requirements of the *Environmental Protection (Noise) Policy 2008 and* Australian Standard AS 1668 Parts 1 and 2 *The Use of Mechanical Ventilation and Air-conditioning in Buildings*.

Detailed noise monitoring has been undertaken to characterise the existing level of noise amenity at the site and the current impact of the surrounding noise sources.

Detailed traffic noise modelling has been conducted to predict 10 year design horizon traffic noise levels at the proposed development. The development can be constructed to achieve acceptable levels of amenity for future occupants. The traffic noise assessment and façade acoustic design will be undertaken prior to building approval to provide façade systems to achieve the outcomes of the QDC MP 4.4 acoustic requirements.

An aircraft noise assessment has been conducted to calculate R_w ratings that will be required of the building components to achieve the design internal aircraft noise level criteria.

It is recommended to provide detailed R_w ratings calculations at the detailed design phase of the development to ensure appropriate acoustic amenity is achieved to prevent aircraft noise intrusion for all residential areas.

An industrial noise assessment has also been conducted to consider the noise impact of surrounding commercial and general industry land uses upon the proposed development. From site inspection and measurement measures conducted on site, it is consider that the surrounding commercial and industry are largely inaudible and have low noise impact compared with the high traffic noise on site.

It is considered that the design requirements for road traffic and aircraft noise attenuation will ensure that the proposed short term accommodation unit will also achieve a suitable level of internal industrial noise amenity.

Additionally the assessment has considered the potential noise amenity impacts of the development upon nearby sensitive receptors, mainly the future residential building to the south of the subject site. In particular, noise

impact from the proposed McDonalds restaurant and its associated noise source such as, plant and equipment, site traffic, car parking, drive-thru operation, service vehicles and patron noise.

The assessment is based noise measurements previously conducted on typical sources associated with the proposed use and detailed computer noise modelling.

The assessment conducted has demonstrated the following:

1. For any external plant and equipment located on the roof top, it shall be mounted on external roof deck area and acoustically screened with appropriate vertical acoustic screens around the perimeter of the plant area to comply with the relevant noise criteria.
2. Ventilation of the exhaust from the kitchen, toilet and carparking via the roof top should ensure that the external ventilation fans are acoustical screened.
3. The acoustic selection of future plant, the roof mount location and use of acoustic control measures will be undertaken at the detailed design phase to achieve the desired noise criteria levels.
4. Noise from traffic through the site, car parking, drive-thru activities, patron noise and servicing activities will comply with the relevant noise criteria at existing and proposed surrounding residences to the south with the following noise control measures:
    - A **2.4 metre acoustic barrier** to be constructed on the southern boundary of the proposed development to contain noise emissions from the carparking and drive-thru areas.
    - Service vehicle activities and refuse collection associated with the development site are limited to occur between the daytime and evening periods only (i.e. from 7am to 10pm).

The extent of the recommended acoustic treatments is provided on **Figure 7**.

The air quality issues associated with the operation phase of a McDonald's Restaurant includes odour emissions from cooking exhaust vents. The McDonald's level of air quality control is maintained to a high standard by the use of separate exhaust ventilation fans for various internal kitchen areas, use of appropriately sized range hoods fitted with appropriate filters and regular maintenance of this system.

Kitchen exhaust fans for this development will likely be mounted on the roof level above the accommodation levels and are selected as high duty fans, with adequate vertical discharge velocities to promote odour dispersion.

The available separation distances between cooking source emission points and the surrounding residential dwellings are significantly greater than required by the Australian Standard deemed to satisfy provisions i.e. AS1668.2 would

require a less significant setback (i.e. minimum 6 metres) as compared to in excess of 30 metres actually available from the nearest potential cooking source to the nearest existing or proposed off-site residence.

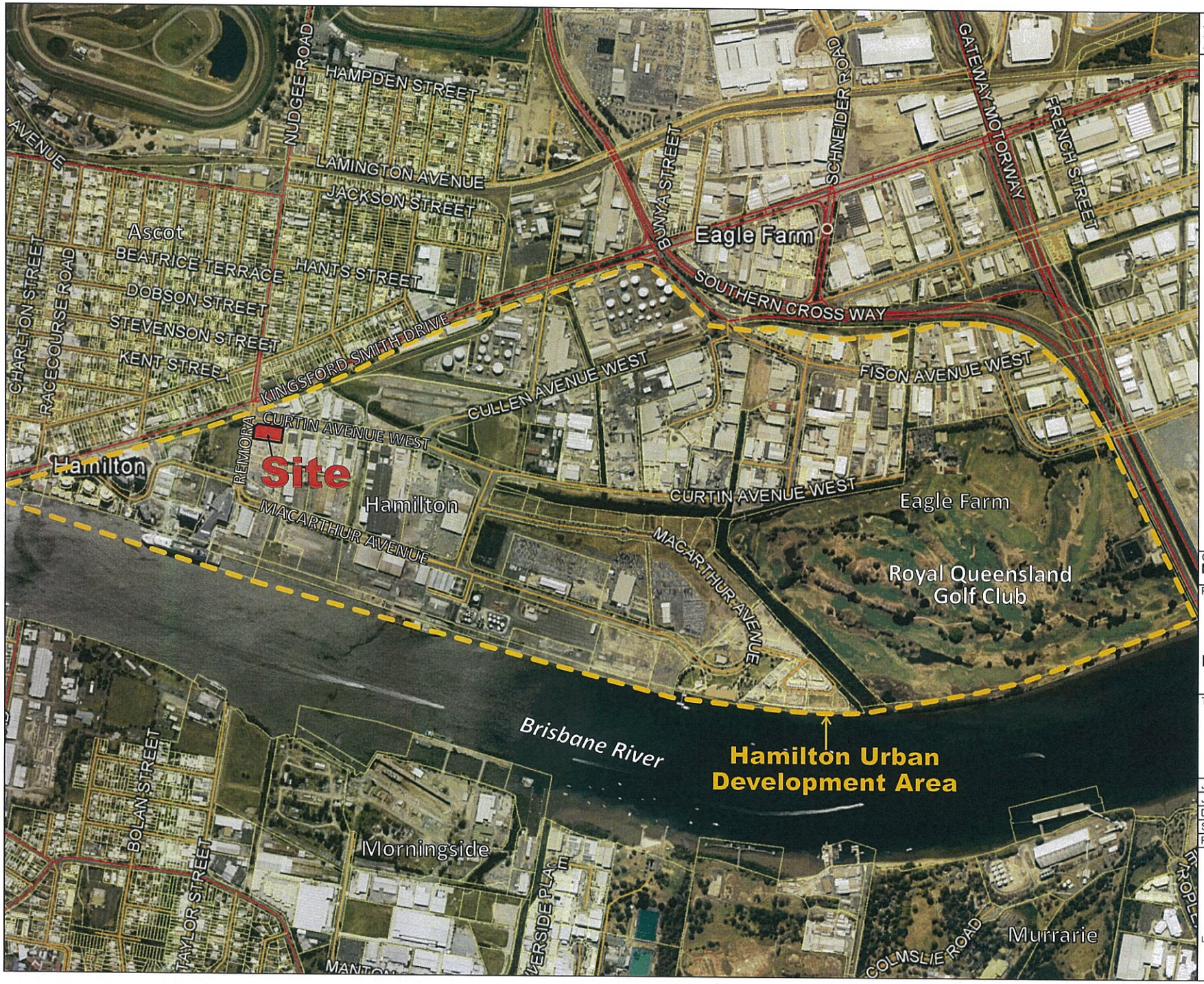
The provision of roofed storage areas, use of bulk refuse bins fitted with lids, regular collection of refuse and cleaning of putrescibles bins will ensure that adverse odour does not result at residential areas.

It is considered that the available engineered solutions to contain and prevent odour emissions will be implemented as part of detailed design such that the amenity of neighbouring residents with respect to cooking odours will not be adversely affected.

In summary, the assessment has determined that with appropriate odour and noise control measures, the proposed mixed use development will provide a suitable level of amenity for future residents and not impact on the surrounding amenity.

MWA Environmental
21 July 2015

FIGURES



DRAWING REFERENCES

- © THE STATE OF QUEENSLAND 2015 QLDGLOBE
- GOOGLE EARTH PRO, 18/09/13.

CLIENT
McDonalds Australia Limited

PROJECT
HAMILTON NOISE IMPACT ASSESSMENT
Proposed Mixed Use Development
7 Remora Road Hamilton Qld

TITLE
SITE LOCATION

JOB	HAMILTON	**FIGURE 1**
JOB NO.	15-051	
DATE	21/07/15	DRAWING NUMBER
SCALE	1:15,000 (A4)	**15-051-1**
REV.		

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LEGEND

SITE BOUNDARY

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CLIENT
McDonalds Australia Limited

PROJECT
HAMILTON NOISE IMPACT ASSESSMENT
Proposed Mixed Use Development
7 Remora Road Hamilton Qld

TITLE
SURROUNDING LAND USE

JOB	HAMILTON	**FIGURE 2**
JOB NO.	15-051	
DATE	21/07/15	DRAWING NUMBER
SCALE	1:4,000 (A4)	**15-051-2**
REV.		

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LEGEND

- SITE BOUNDARY
- D — NOISE DATALOGGER LOCATION (UNATTENDED)
- 3 — SHORT TERM NOISE MONITORING LOCATIONS 1-3 (ATTENDED)

DRAWING REFERENCES

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N

0 20 40 60m

CLIENT
McDonalds Australia Limited

PROJECT
HAMILTON NOISE IMPACT ASSESSMENT
Proposed Mixed Use Development
7 Remora Road Hamilton Qld

TITLE
NOISE MONITORING LOCATIONS

JOB	HAMILTON	FIGURE 3
JOB NO.	15-051	
DATE	21/07/15	DRAWING NUMBER
SCALE	1:2,000 (A4)	15-051-3
REV.		

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PROJECT **HAMILTON NOISE IMPACT ASSESSMENT**
Proposed Mixed Use Development
7 Remora Road Hamilton Qld

CLIENT	MCDONALDS AUSTRALIA LIMITED
JOB	HAMILTON
JOB NO.	15-051
DATE	21/07/15
SCALE	1:2500 (A4)

FIGURE 4
DRAWING NUMBER **15-051-4**

TITLE **BCC CITY PLAN TRANSPORT NOISE OVERLAY**

Brisbane City Plan 2014

BRISBANE CITY Planning Scheme

NOTES

This map is notional only and should not be used for interpreting City Plan provisions relating to specific sites. To properly interpret the maps, the planning scheme must be referred to. The Digital Cadastre Database (supplied by State of Queensland - Department of Natural Resources and Mines) will be updated from time to time.

Mapping adopted by Council, effective 12 September 2014.

Projection: Map Grid of Australia, Zone 56
Horizontal Datum: Geocentric Datum of Australia 1994

Approximate Scale @ A4 1:2,500

0 90
Metres

Date: 15/06/2015

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PROJECT **HAMILTON NOISE IMPACT ASSESSMENT**
Proposed Mixed Use Development
7 Remora Road Hamilton Qld

CLIENT	MCDONALDS AUSTRALIA LIMITED
JOB	HAMILTON
JOB NO.	15-051
DATE	21/07/15
SCALE	1:2500 (A4)

FIGURE 5

DRAWING NUMBER **15-051-5**

TITLE **BCC CITY PLAN TRANSPORT NOISE OVERLAY & ANEF**

Brisbane City Plan 2014

BRISBANE CITY Planning Scheme

NOTES

This map is notional only and should not be used for interpreting City Plan provisions relating to specific sites. To properly interpret the maps, the planning scheme must be referred to. The Digital Cadastre Database (supplied by State of Queensland - Department of Natural Resources and Mines) will be updated from time to time.

Mapping adopted by Council, effective 12 September 2014.

Projection: Map Grid of Australia, Zone 56
Horizontal Datum: Geocentric Datum of Australia 1994

Approximate Scale @ A4 1:2,500

0 90

Metres

Date: 15/06/2015

LEGEND

SITE BOUNDARY

DRAWING REFERENCES

- © THE STATE OF QUEENSLAND 2015 QLDGLOBE
- GOOGLE EARTH PRO, 18/09/13.
- AECOM AUSTRALIA PTY LTD PROJECT 60334598, GROUND PLAN DWG DA02 E.
- WOODS BAGOT PROJECT 150001, SITE PLAN DWG SK 1100 C, 22/03/12.

0 10 20 30 40 50m

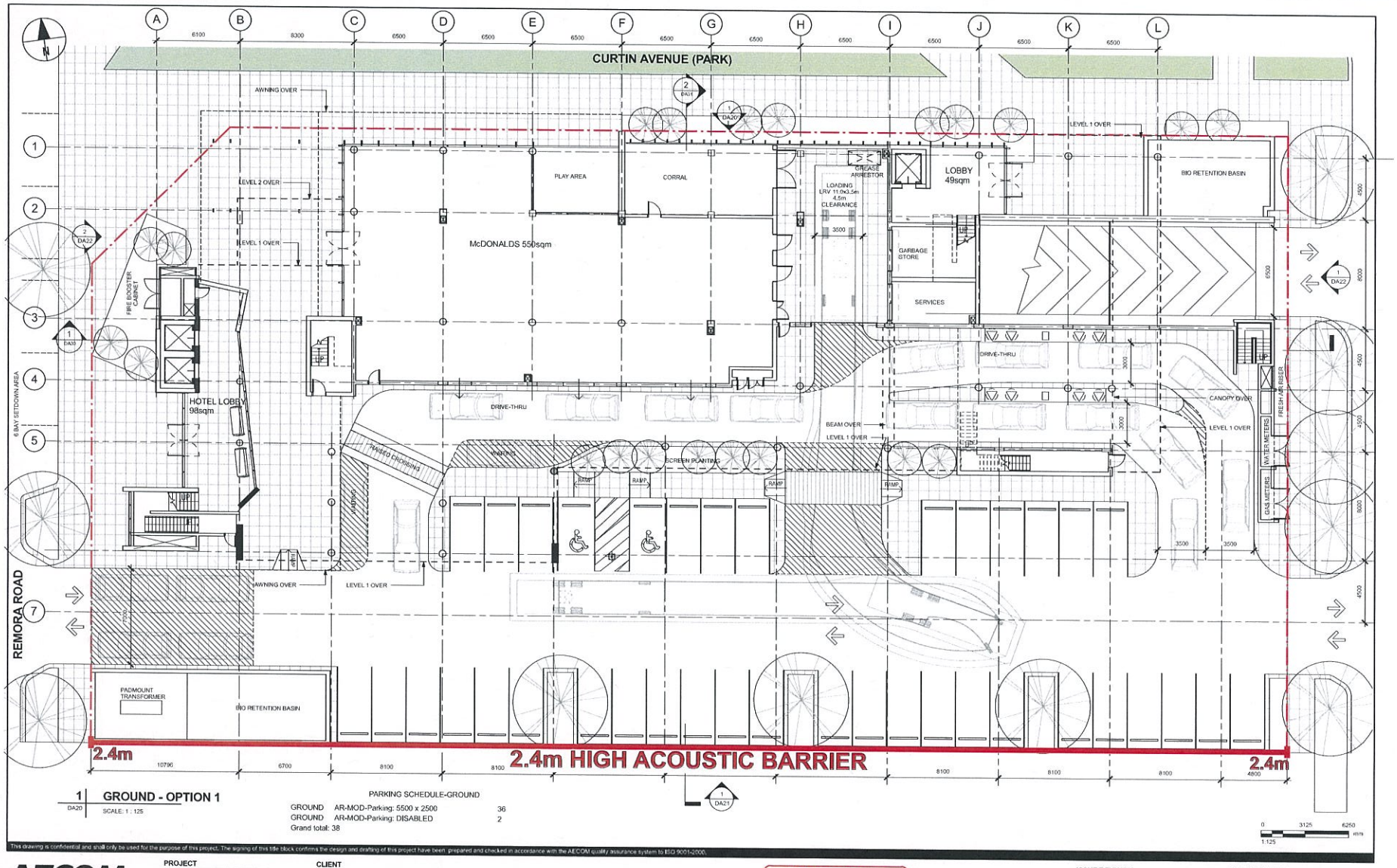
CLIENT
McDonalds Australia Limited

PROJECT
HAMILTON NOISE IMPACT ASSESSMENT
Proposed Mixed Use Development
7 Remora Road Hamilton Qld

TITLE
NEAREST RECEPTORS

JOB	HAMILTON	**FIGURE 6**
JOB NO.	15-051	
DATE	21/07/15	DRAWING NUMBER
SCALE	1:1,500 (A4)	**15-051-6**
REV.		

mwa ENVIRONMENTAL
Max Winders & Associates Pty Ltd tas MWA Environmental
Level 15, 241 Adelaide St, Brisbane. GPO BOX 3137, Brisbane Qld 4001
P 07 3002 5500 F 07 3002 5588 E mail@mwaenviro.com.au
W www.mwaenviro.com.au
ABN 94 010 833 084



1 DA20 **GROUND - OPTION 1**

SCALE: 1 : 125

PARKING SCHEDULE-GROUND

GROUND	AR-MOD-Parking: 5500 x 2500	36
GROUND	AR-MOD-Parking: DISABLED	2
Grand total: 38		

1:125

AECOM

CONSULTANT
AECOM Australia Pty. Ltd.
A.B.N. 20 093 846 925
www.aecom.com

PROJECT
MIXED USE DEVELOPMENT HAMILTON
BRISBANE

CLIENT
RESOURCE CONNECT

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P 07 3002 5500 F 07 3002 5588 E mail@mwaenviro.com.au
W www.mwaenviro.com.au
ABN 94 010 833 084

CLIENT	McDonalds Australia Limited
JOB	HAMILTON
JOB NO.	15-051
DATE	21/07/15
SCALE	NOT TO SCALE

FIGURE 7

DRAWING NUMBER
15-051-7

PROJECT **HAMILTON NOISE IMPACT ASSESSMENT**
Proposed Mixed Use Development 7 Remora Road Hamilton Qld

TITLE
ACOUSTIC BARRIER LOCATION

ISSUE/REVISION		
IR	DATE	DESCRIPTION

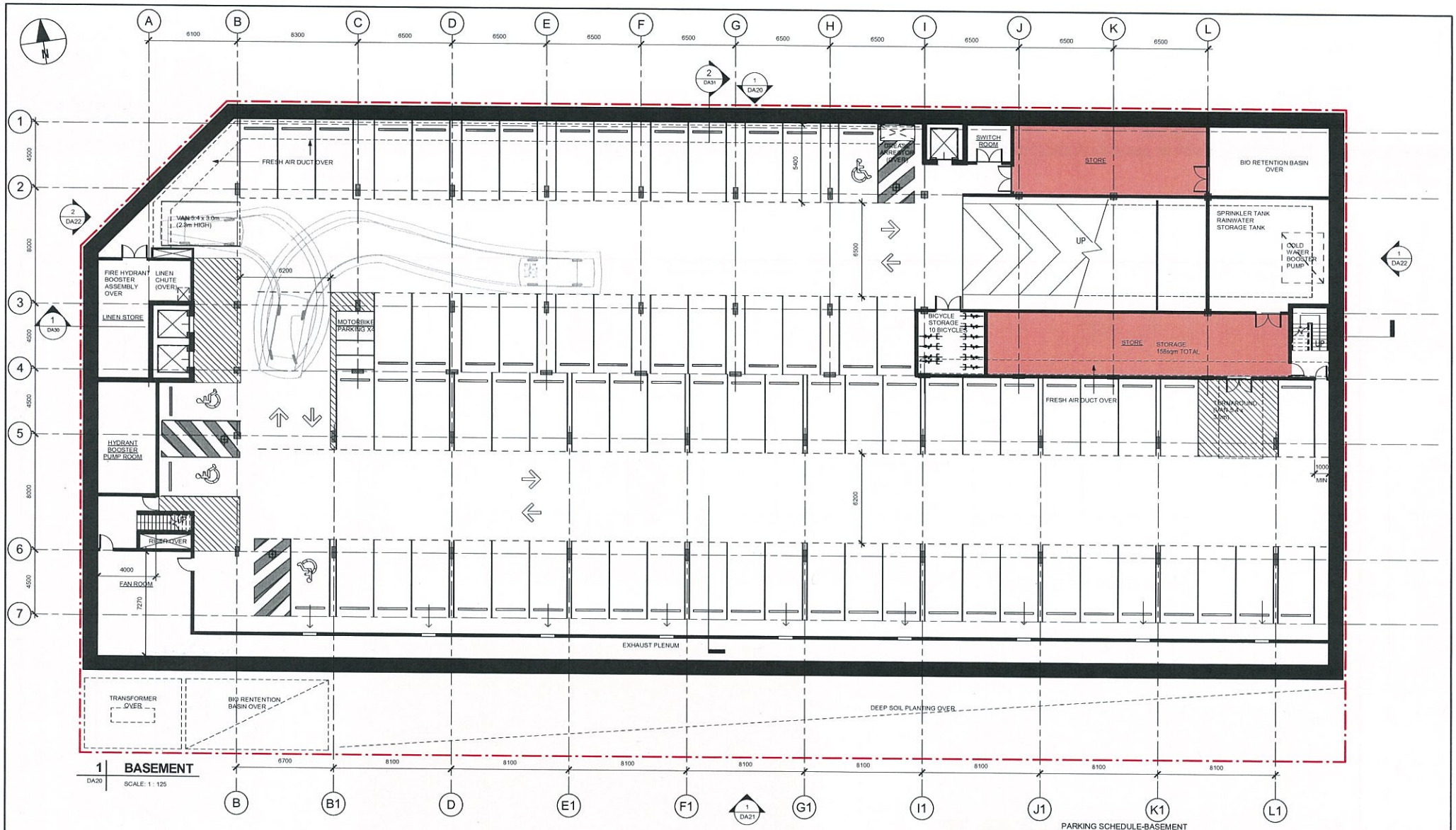
PROJECT NUMBER
60334598

SHEET TITLE
GROUND PLAN

SHEET NUMBER
DA02 E

ATTACHMENT 1

Indicative Design Drawings



1 DA20 **BASEMENT**
SCALE: 1 : 125

PARKING SCHEDULE-BASEMENT

BASEMENT	AR-MOD-Parking MOTORBIKE: 2600 x 1000 MOTORBIKE PARKING	4
BASEMENT	AR-MOD-Parking: 5400 x 2500	2
BASEMENT	AR-MOD-Parking: 5400 x 2600	71
BASEMENT	AR-MOD-Parking: 5400 x 2600 DISABLED SHARED	1
BASEMENT	AR-MOD-Parking: DISABLED	3

Grand total: 81

0 3125 6250 mm
1:125

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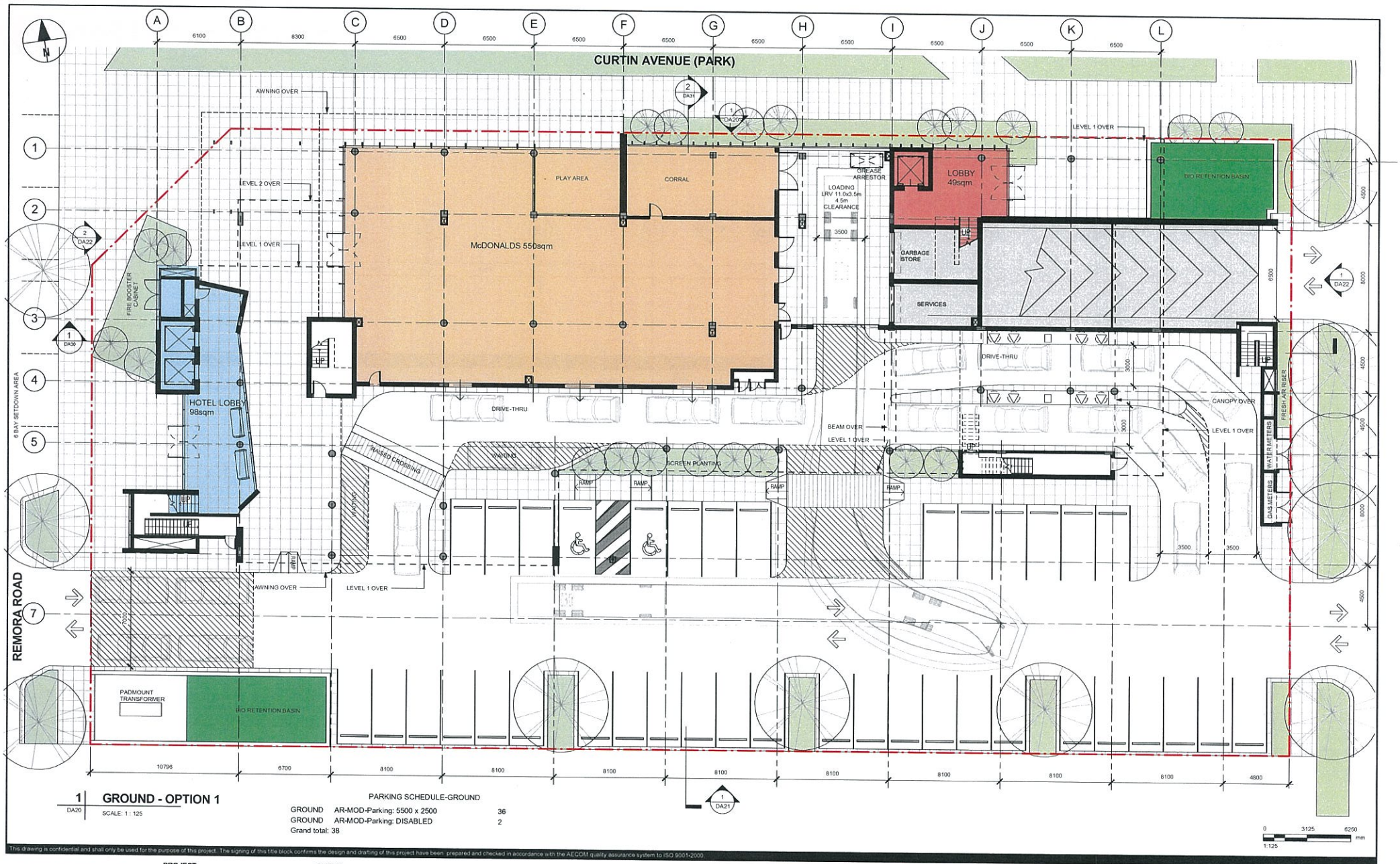
ISSUE/REVISION

I/R	DATE	DESCRIPTION

PROJECT NUMBER
60334598

SHEET TITLE
BASEMENT PLAN

SHEET NUMBER
DA01 E



1 GROUND - OPTION 1
DA20 SCALE: 1 : 125

PARKING SCHEDULE-GROUND

GROUND	AR-MOD-Parking: 5500 x 2500	36
GROUND	AR-MOD-Parking: DISABLED	2
Grand total: 38		

0 3125 6250 mm
1:125

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ISSUE/REVISION

I/R	DATE	DESCRIPTION

PROJECT NUMBER
60334598

SHEET TITLE
GROUND PLAN

SHEET NUMBER
DA02 E

1 | DA20 **LEVEL 1**

SCALE: 1 : 125

0 3125 6250 mm

1:125

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HAMILTON
BRISBANE

CLIENT

RESOURCE CONNECT

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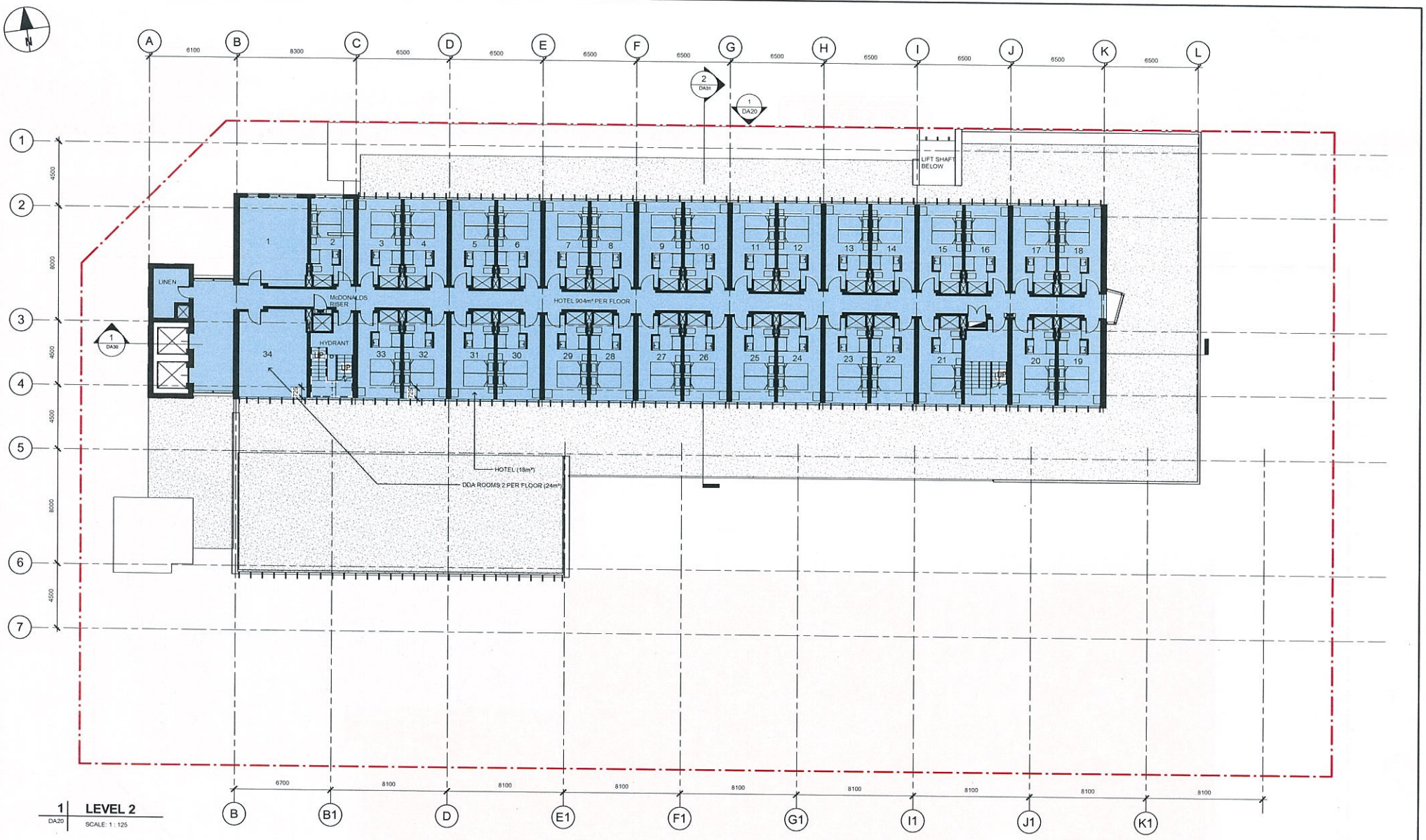
ISSUE/REVISION

I/R	DATE	DESCRIPTION

PROJECT NUMBER
60334598

SHEET TITLE
LEVEL 1 PLAN

SHEET NUMBER
DA03 E



1 | DA20 **LEVEL 2**

SCALE: 1 : 125

0 2500 5000 mm

1:100

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BRISBANE

CLIENT

RESOURCE CONNECT

NOT TO BE ISSUED
DRAWING CURRENTLY IN PROGRESS

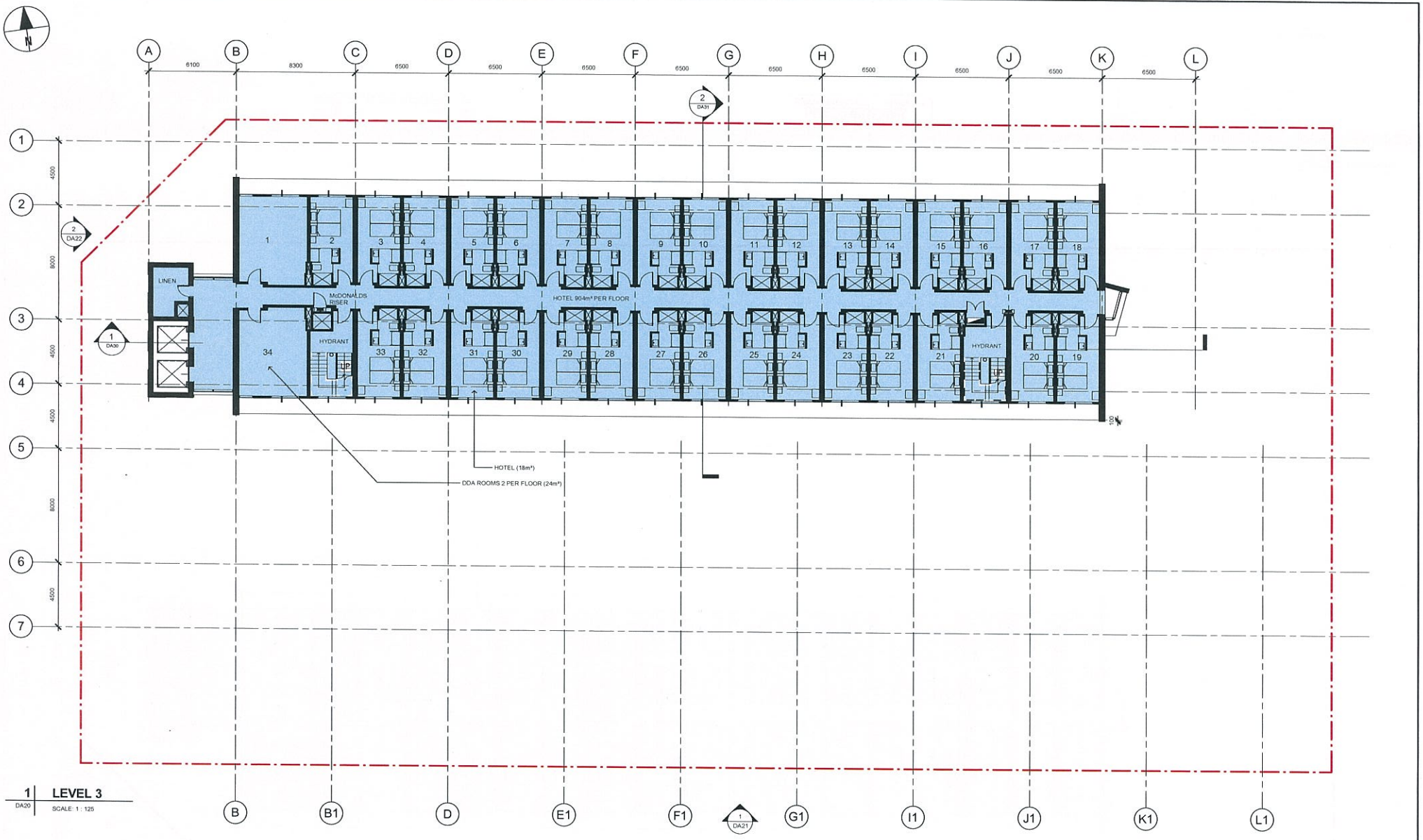
ISSUE/REVISION

I/R	DATE	DESCRIPTION

PROJECT NUMBER
60334598

SHEET TITLE
LEVEL 2 PLAN

SHEET NUMBER
DA04 C



1 DA20 **LEVEL 3**

SCALE: 1 : 125

0 3125 6250 mm

1:125

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CLIENT

RESOURCE CONNECT

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DRAWING CURRENTLY IN PROGRESS

ISSUE/REVISION

I/R	DATE	DESCRIPTION

PROJECT NUMBER

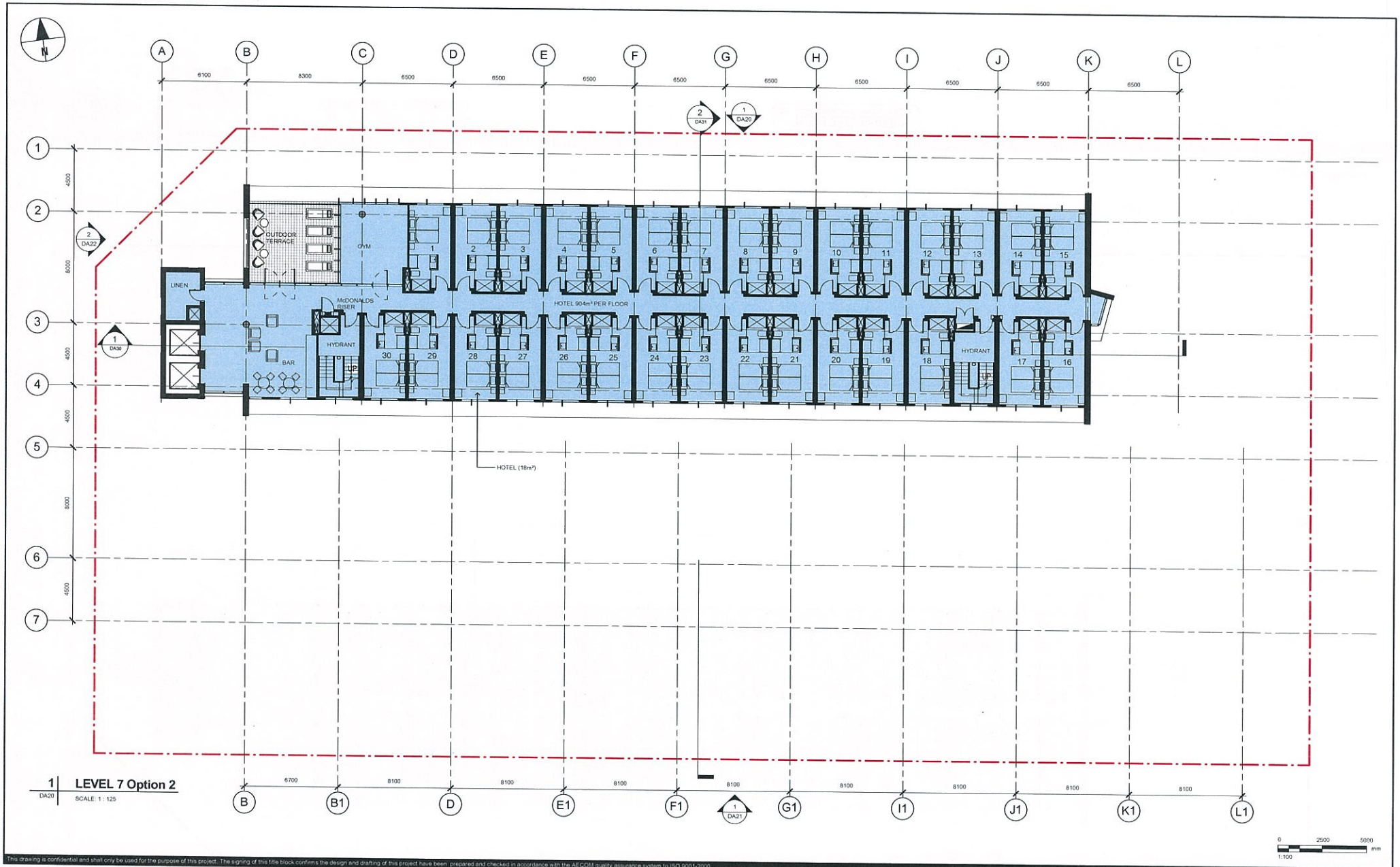
60334598

SHEET TITLE

LEVEL 3 PLAN

SHEET NUMBER

DA05 B



1 DA20 **LEVEL 7 Option 2**

SCALE: 1 : 125

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RESOURCE CONNECT

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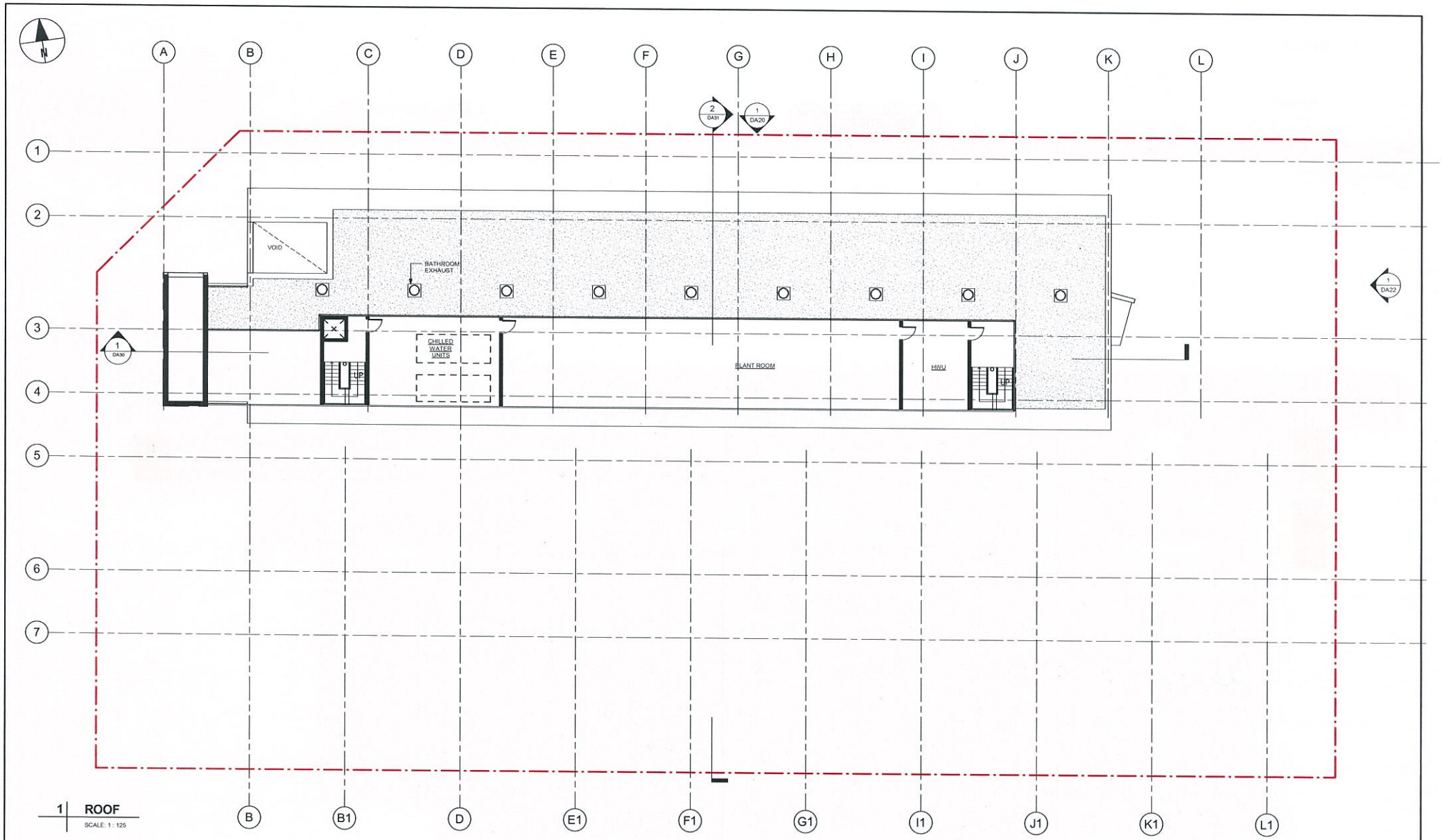
ISSUE/REVISION

I/R	DATE	DESCRIPTION

PROJECT NUMBER
60334598

SHEET TITLE
LEVEL 7 PLAN - OPTION 2

SHEET NUMBER
DA09-OP2 B



1 ROOF
SCALE: 1 : 125

0 3125 6250 mm
1:125

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ISSUE/REVISION

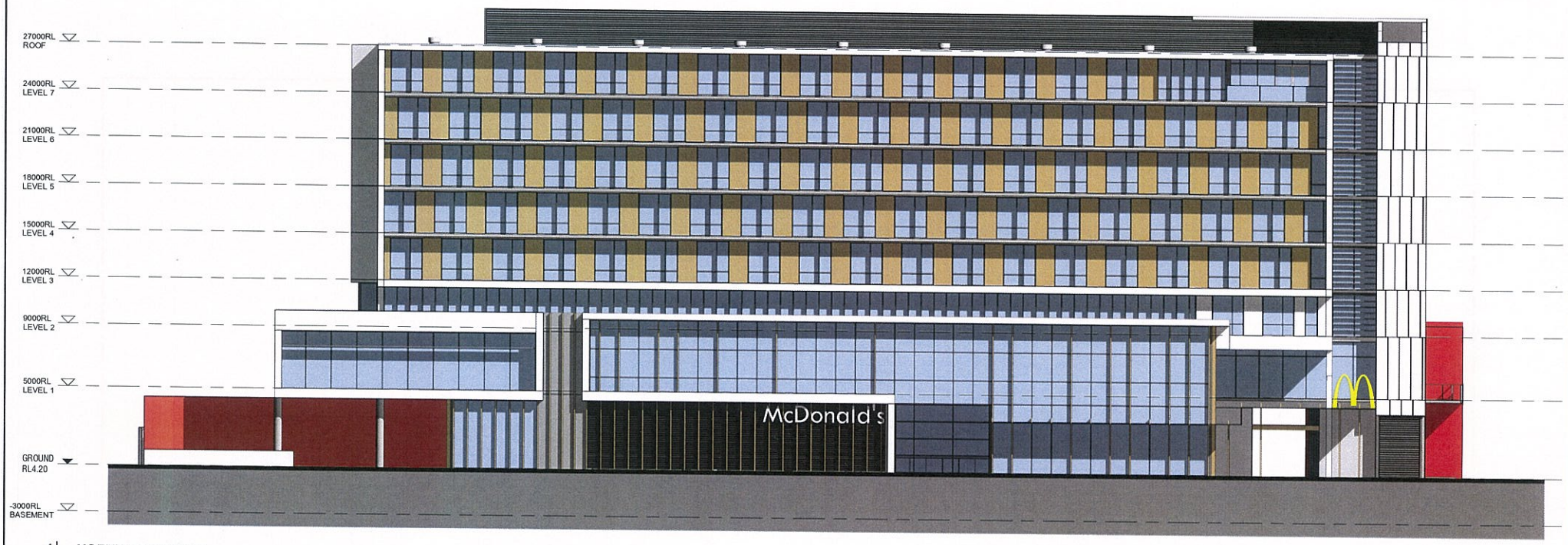
I/R	DATE	DESCRIPTION

PROJECT NUMBER
60334598

SHEET TITLE
ROOF PLAN

SHEET NUMBER
DA10 B

ISO A1 594mm x 841mm



1 | DA01 **NORTH ELEVATION**
SCALE: 1 : 125

0 3125 6250 mm
1:125

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PROJECT
MIXED USE DEVELOPMENT
HAMILTON
BRISBANE

CLIENT
RESOURCE CONNECT

NOT TO BE ISSUED
DRAWING CURRENTLY IN PROGRESS

ISSUE/REVISION

I/R	DATE	DESCRIPTION

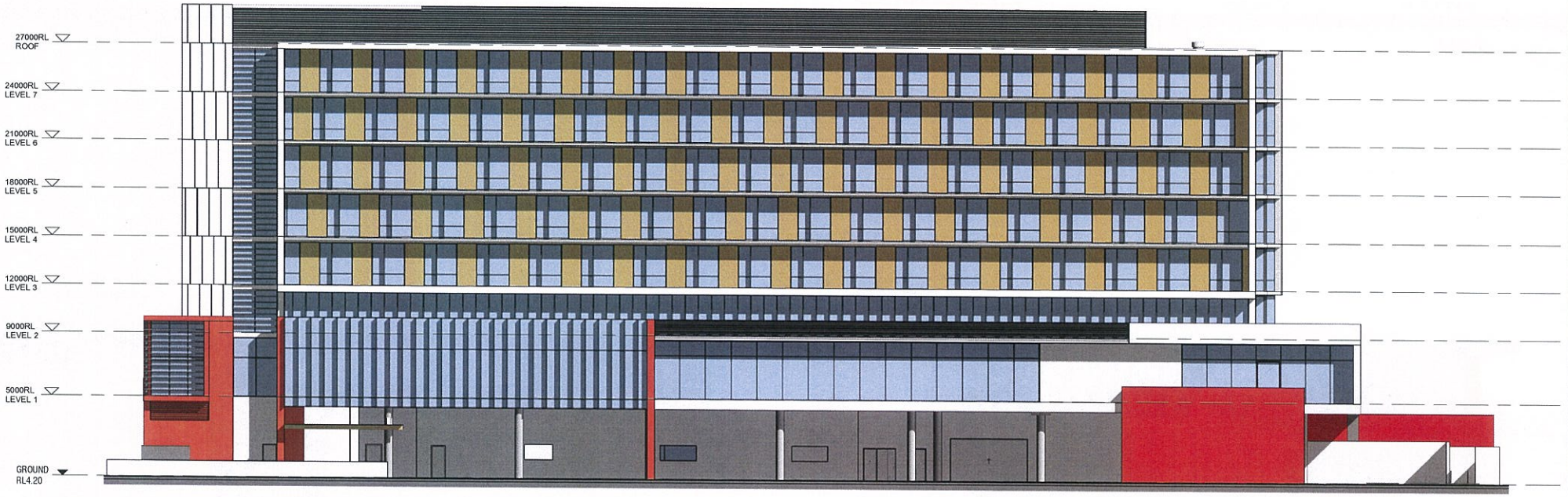
PROJECT NUMBER
60334598

SHEET TITLE
ELEVATIONS

SHEET NUMBER
DA20 B

Last Saved: 6/07/2015 4:47:55 PM
Filename: C:\Users\howardb1\Documents\AR-Hamilton-Central_howardb1.rvt

ISO A1 594mm x 841mm



1 DA01 **SOUTH ELEVATION**

SCALE: 1 : 125

Last Saved: 6/07/2016 4:48:11 PM
Filename: C:\Users\howardb\Documents\AR-Hamilton-Central_howardb1.rvt

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PROJECT
MIXED USE DEVELOPMENT
HAMILTON
BRISBANE

CLIENT
RESOURCE CONNECT

NOT TO BE ISSUED
DRAWING CURRENTLY IN PROGRESS

ISSUE/REVISION

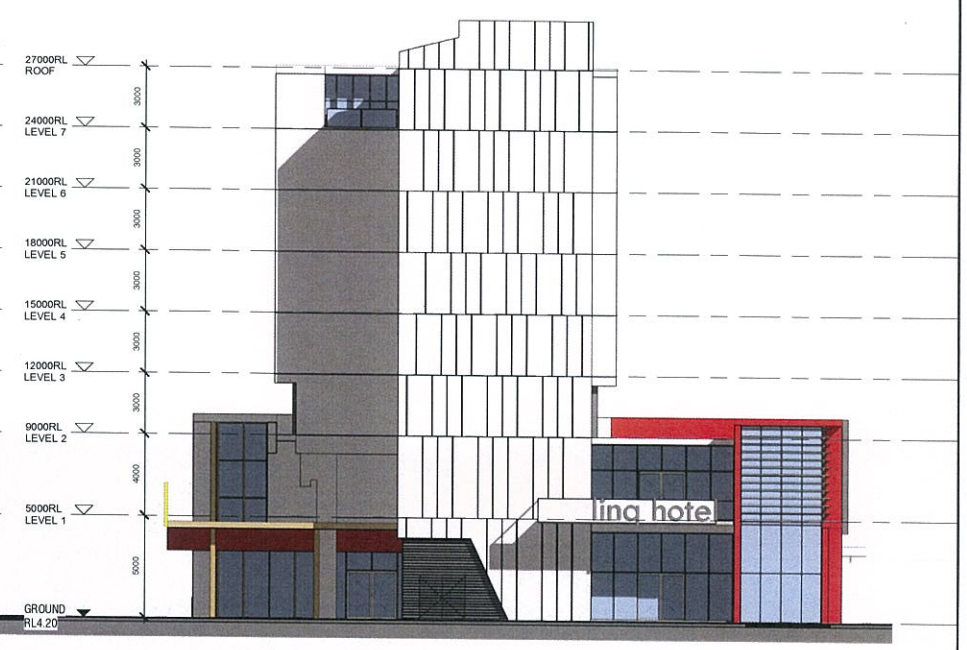
I/R	DATE	DESCRIPTION

PROJECT NUMBER
60334598

SHEET TITLE
ELEVATIONS

SHEET NUMBER
DA21 B

1 | DA01 **EAST ELEVATION**
SCALE: 1 : 125



2 | DA01 **WEST ELEVATION**
SCALE: 1 : 125

0 2500 5000 mm
1:100

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MIXED USE DEVELOPMENT
HAMILTON
BRISBANE

CLIENT
RESOURCE CONNECT

NOT TO BE ISSUED
DRAWING CURRENTLY IN PROGRESS

ISSUE/REVISION

I/R	DATE	DESCRIPTION

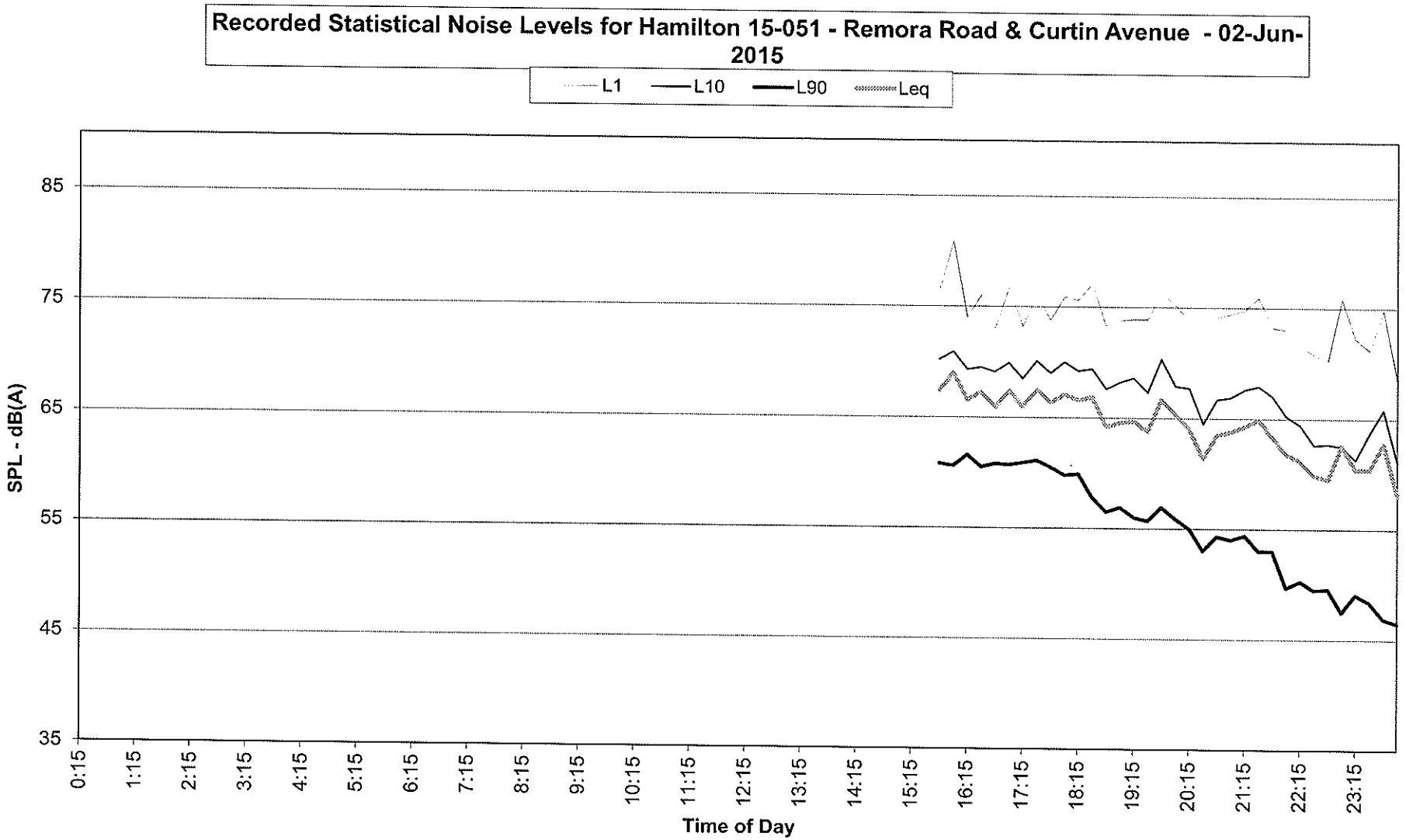
PROJECT NUMBER
60334598

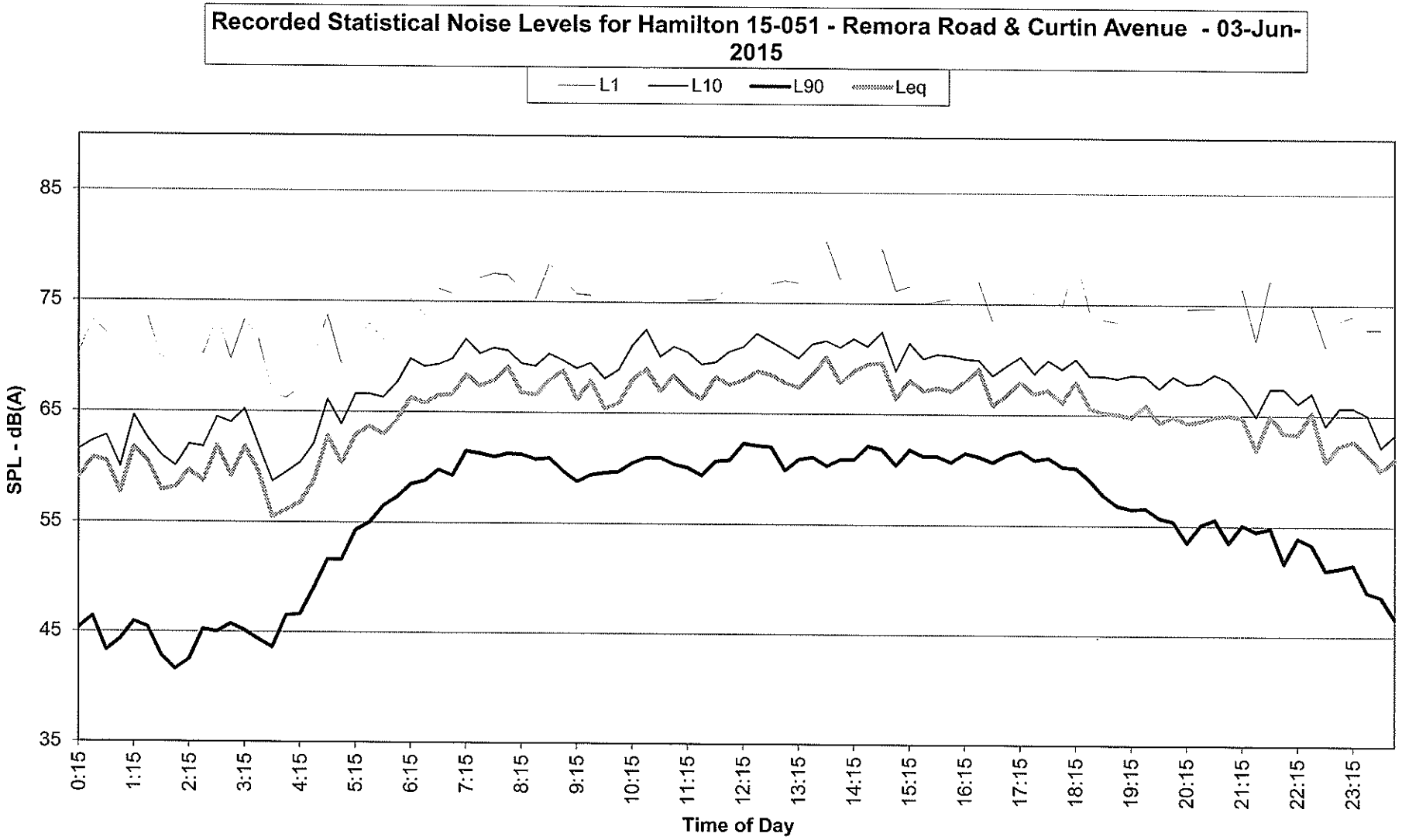
SHEET TITLE
ELEVATIONS

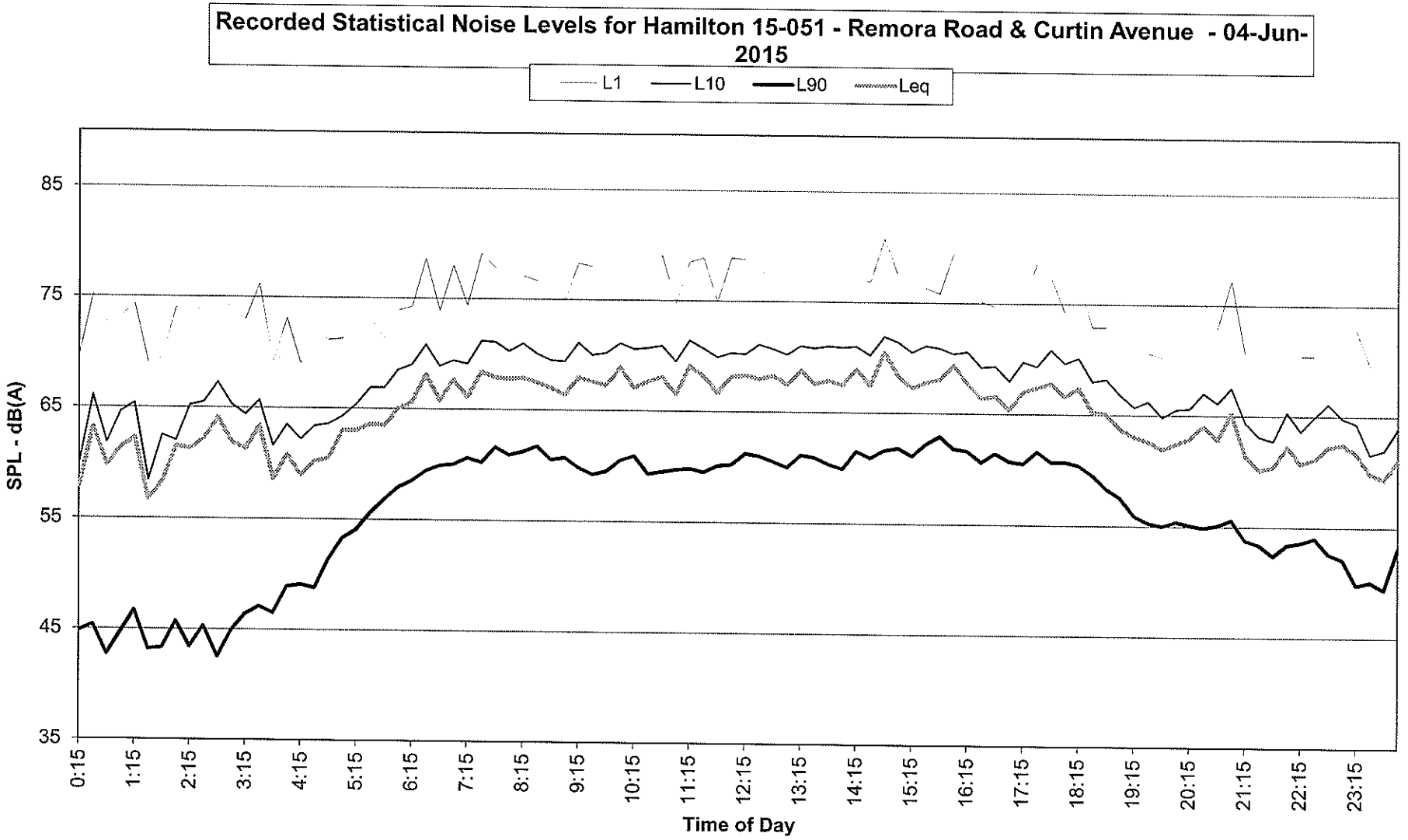
SHEET NUMBER
DA22 B

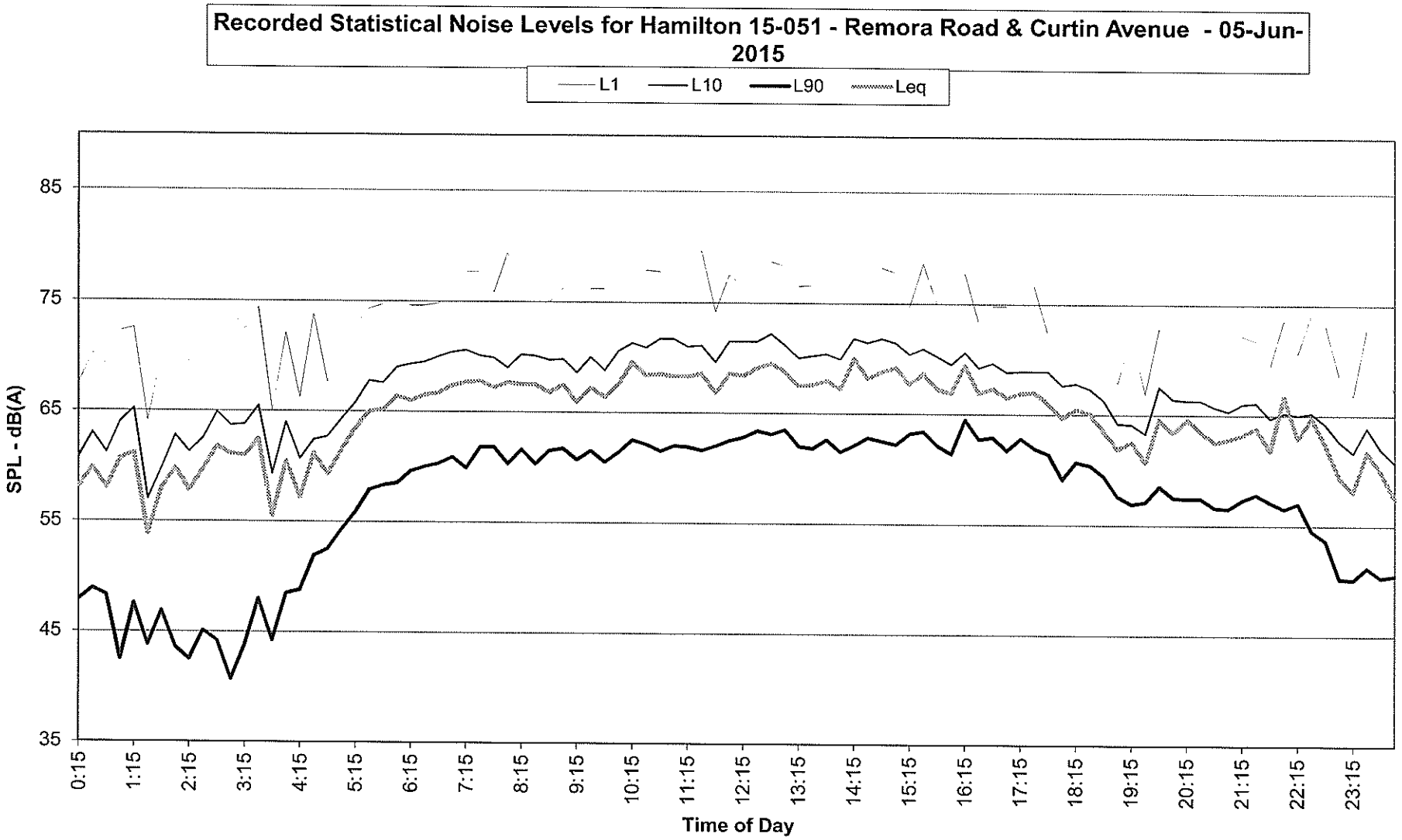
ATTACHMENT 2

Noise Datalogger Results

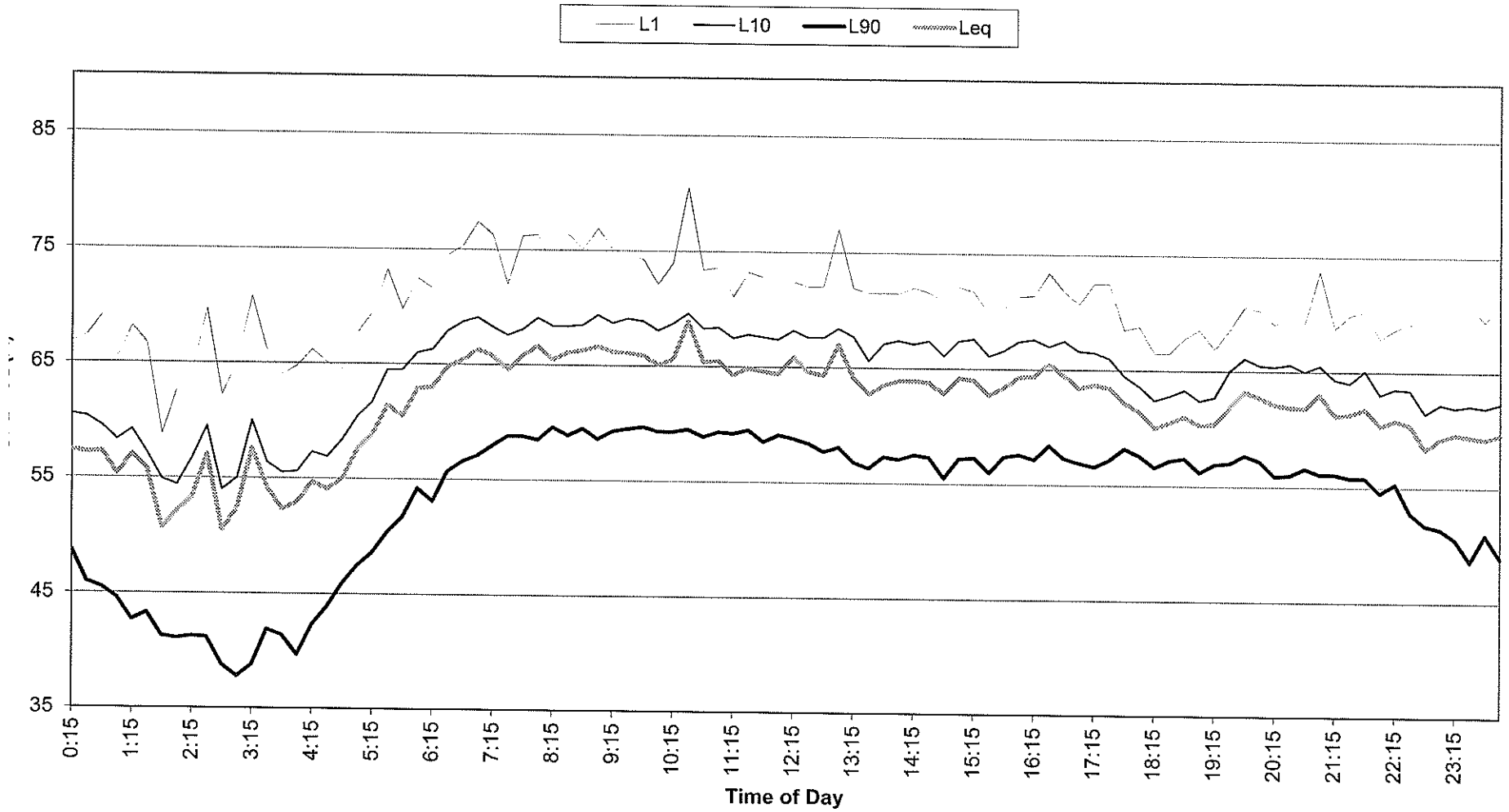

Recorded Statistical Noise Levels for Hamilton 15-051 - Remora Road & Curtin Avenue - 02-Jun-2015
L1
L10
L90
Leq
SPL - dB(A)
85
75
65
55
45
35
0:15
1:15
2:15
3:15
4:15
5:15
6:15
7:15
8:15
9:15
10:15
11:15
12:15
13:15
14:15
15:15
16:15
17:15
18:15
19:15
20:15
21:15
22:15
23:15
Time of Day


Recorded Statistical Noise Levels for Hamilton 15-051 - Remora Road & Curtin Avenue - 03-Jun-2015
L1
L10
L90
Leq
SPL - dB(A)
85
75
65
55
45
35
0:15
1:15
2:15
3:15
4:15
5:15
6:15
7:15
8:15
9:15
10:15
11:15
12:15
13:15
14:15
15:15
16:15
17:15
18:15
19:15
20:15
21:15
22:15
23:15
Time of Day

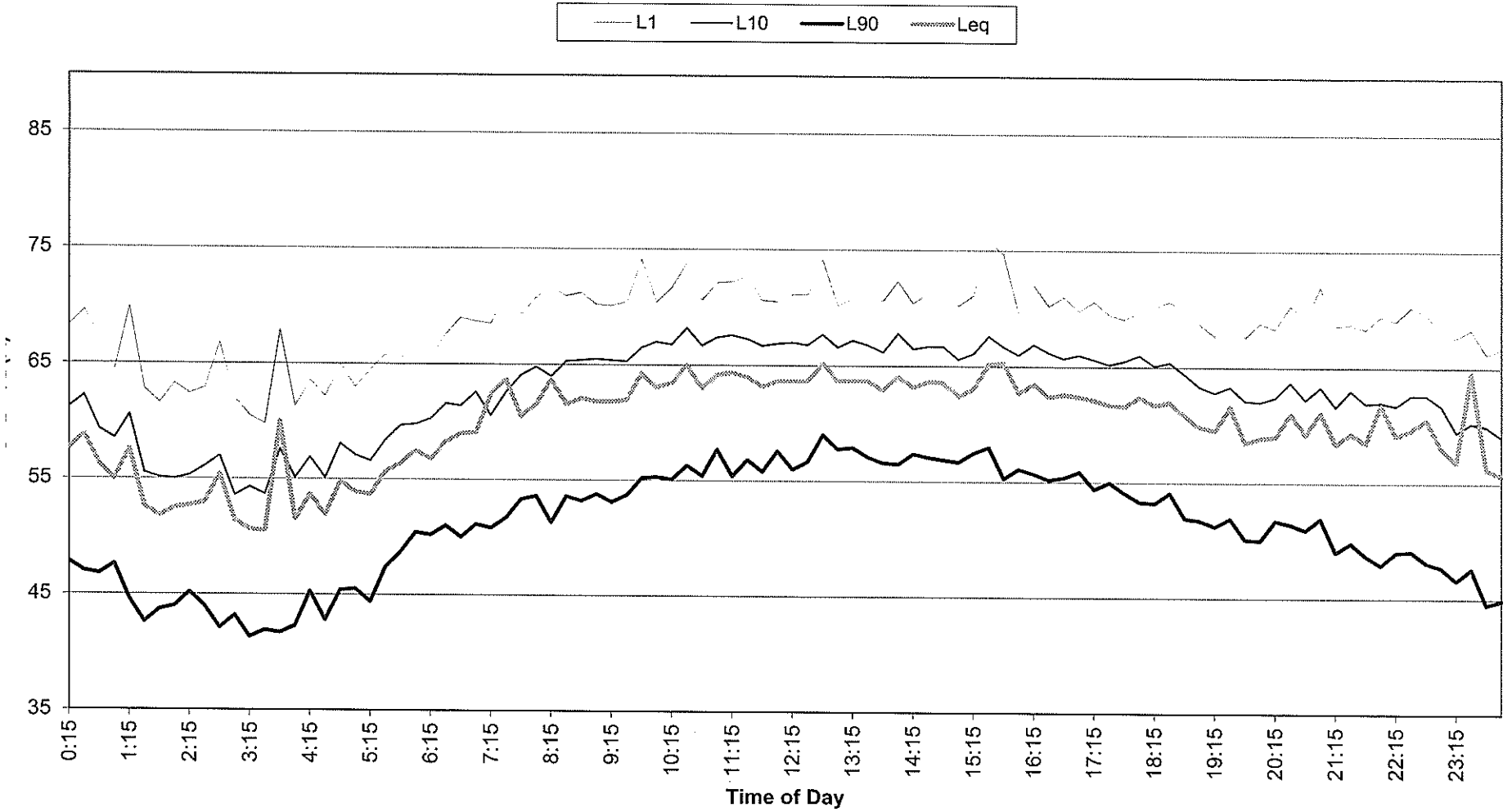

Recorded Statistical Noise Levels for Hamilton 15-051 - Remora Road & Curtin Avenue - 04-Jun-2015
L1
L10
L90
Leq
SPL - dB(A)
85
75
65
55
45
35
0:15
1:15
2:15
3:15
4:15
5:15
6:15
7:15
8:15
9:15
10:15
11:15
12:15
13:15
14:15
15:15
16:15
17:15
18:15
19:15
20:15
21:15
22:15
23:15
Time of Day

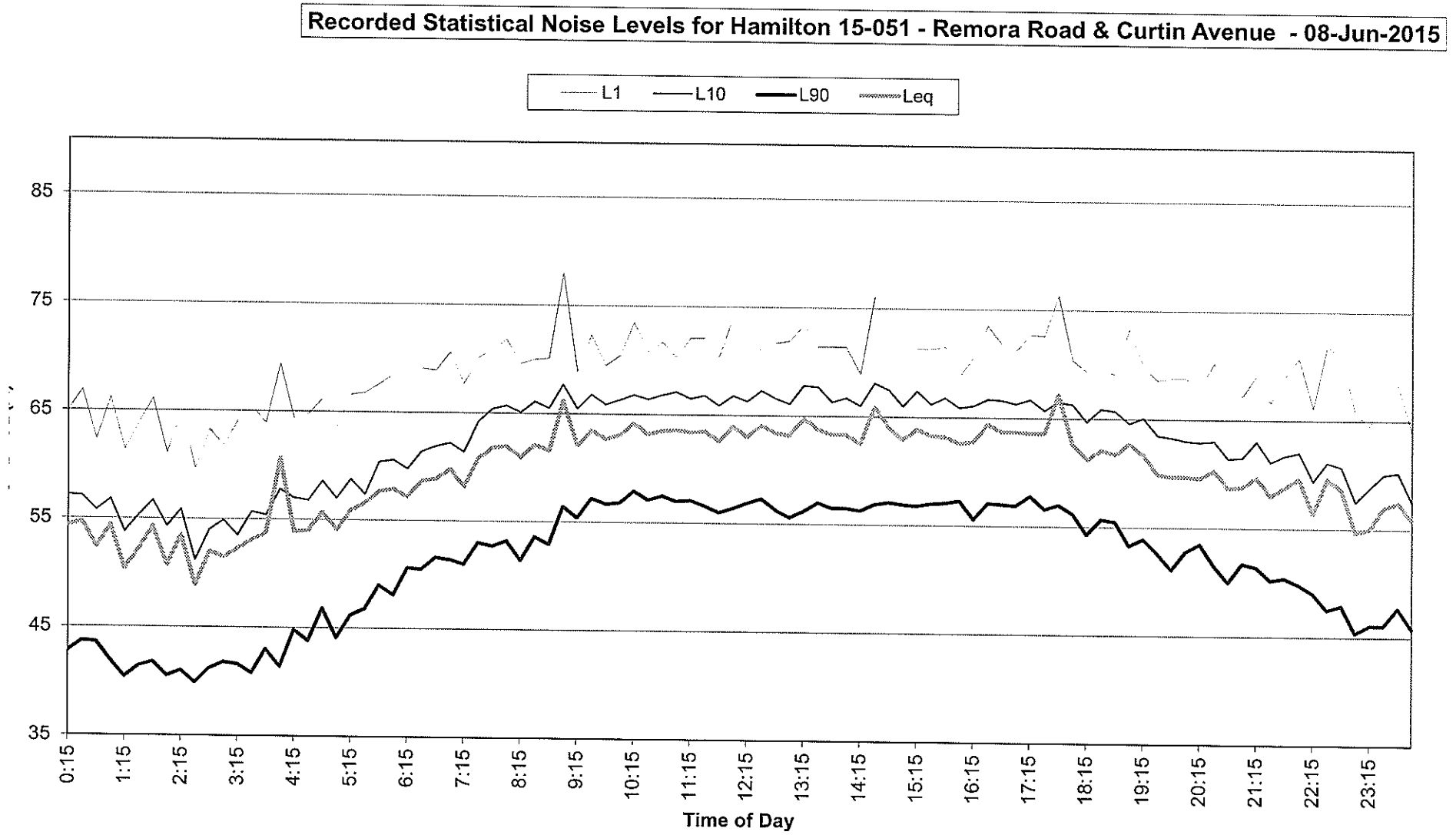

Recorded Statistical Noise Levels for Hamilton 15-051 - Remora Road & Curtin Avenue - 05-Jun-2015
L1
L10
L90
Leq
SPL - dB(A)
85
75
65
55
45
35
0:15
1:15
2:15
3:15
4:15
5:15
6:15
7:15
8:15
9:15
10:15
11:15
12:15
13:15
14:15
15:15
16:15
17:15
18:15
19:15
20:15
21:15
22:15
23:15
Time of Day

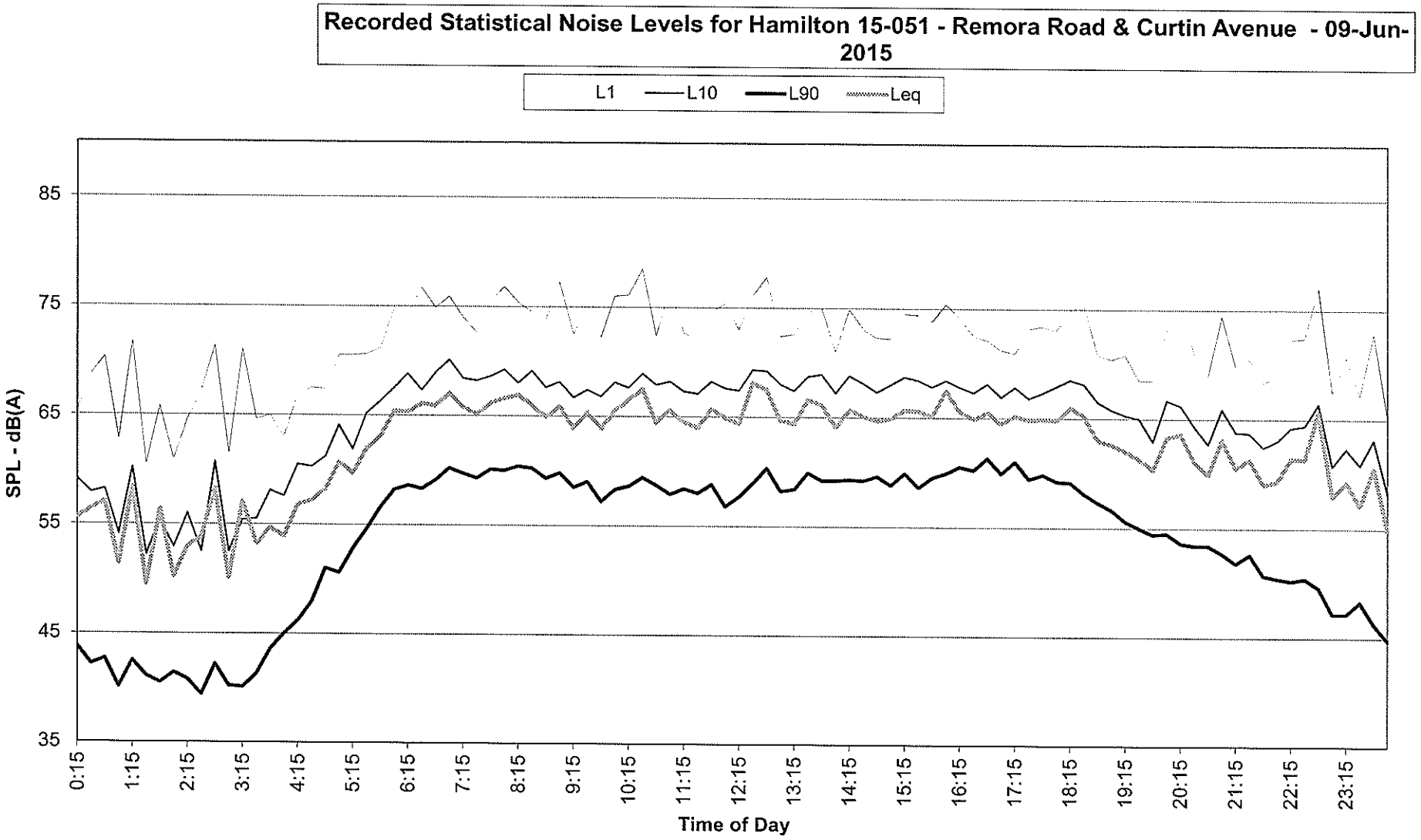
Recorded Statistical Noise Levels for Hamilton 15-051 - Remora Road & Curtin Avenue - 06-Jun-2015

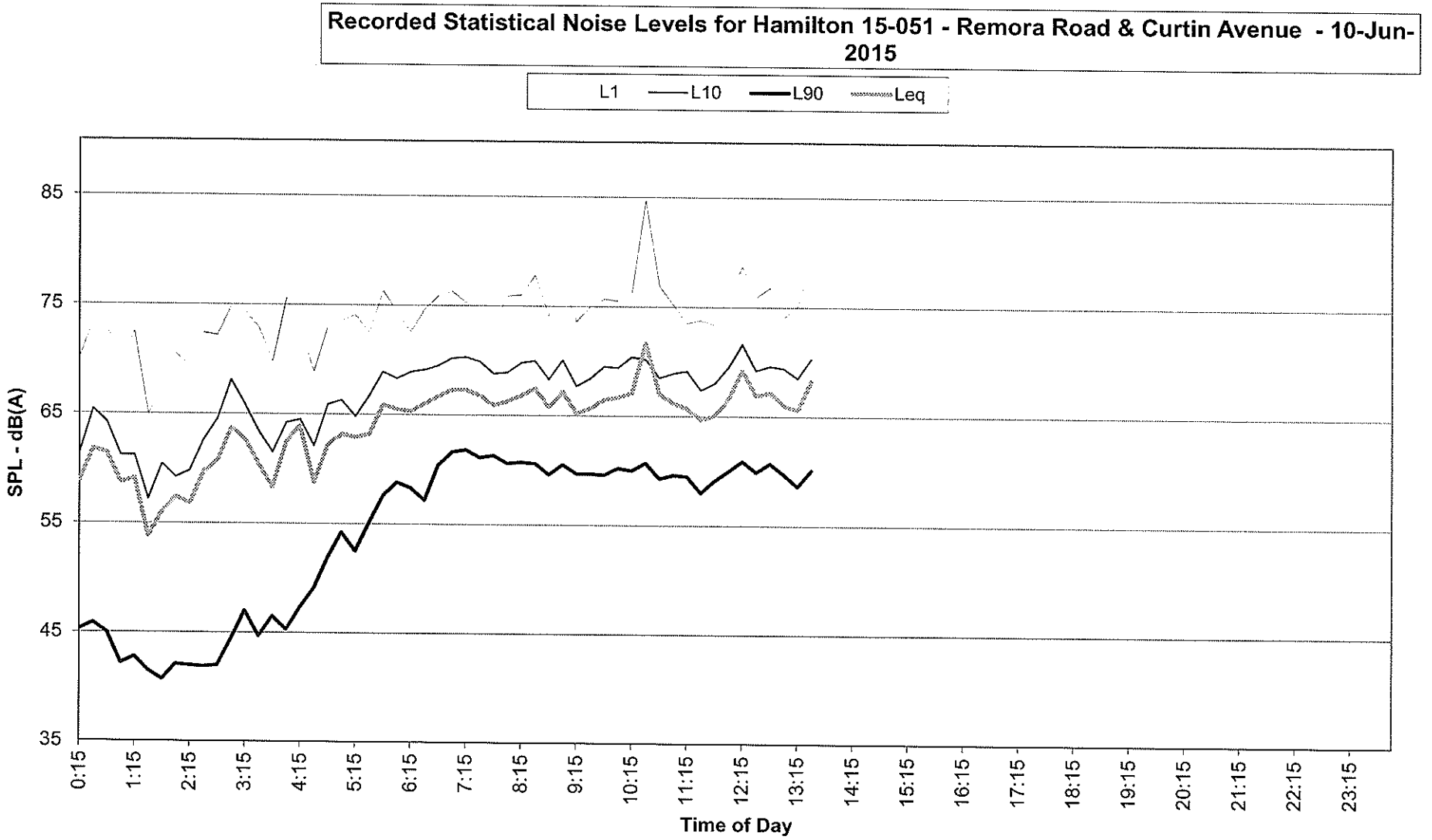


Recorded Statistical Noise Levels for Hamilton 15-051 - Remora Road & Curtin Avenue - 07-Jun-2015




Recorded Statistical Noise Levels for Hamilton 15-051 - Remora Road & Curtin Avenue - 08-Jun-2015
L1
L10
L90
Leq
85
75
65
55
45
35
0:15
1:15
2:15
3:15
4:15
5:15
6:15
7:15
8:15
9:15
10:15
11:15
12:15
13:15
14:15
15:15
16:15
17:15
18:15
19:15
20:15
21:15
22:15
23:15
Time of Day

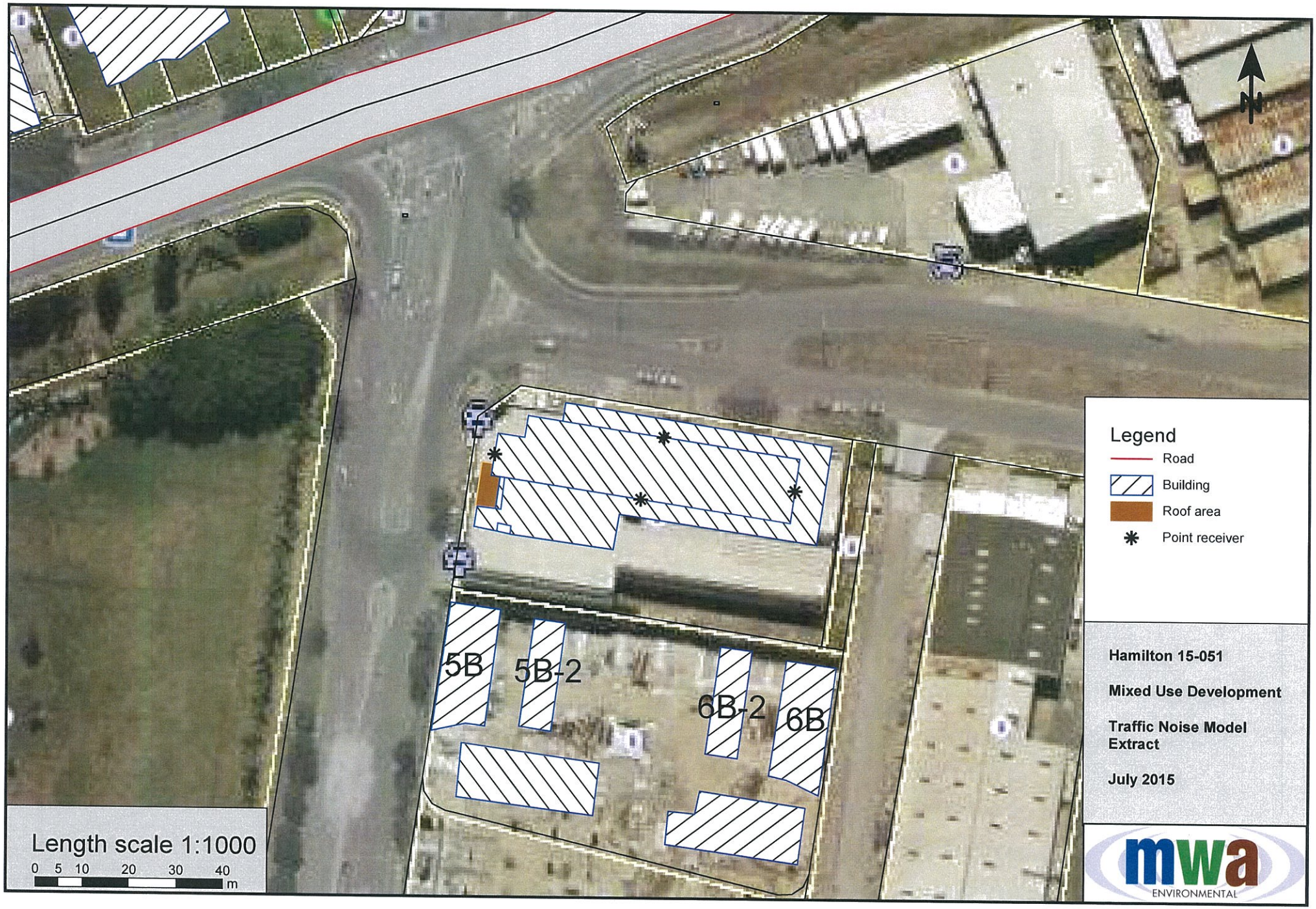

Recorded Statistical Noise Levels for Hamilton 15-051 - Remora Road & Curtin Avenue - 09-Jun-2015
L1
L10
L90
Leq
SPL - dB(A)
85
75
65
55
45
35
0:15
1:15
2:15
3:15
4:15
5:15
6:15
7:15
8:15
9:15
10:15
11:15
12:15
13:15
14:15
15:15
16:15
17:15
18:15
19:15
20:15
21:15
22:15
23:15
Time of Day


Recorded Statistical Noise Levels for Hamilton 15-051 - Remora Road & Curtin Avenue - 10-Jun-2015
L1
L10
L90
Leq
SPL - dB(A)
85
75
65
55
45
35
0:15
1:15
2:15
3:15
4:15
5:15
6:15
7:15
8:15
9:15
10:15
11:15
12:15
13:15
14:15
15:15
16:15
17:15
18:15
19:15
20:15
21:15
22:15
23:15
Time of Day

ATTACHMENT 3

SoundPLAN 7.3 Modelling

Year 2026 Traffic Noise Model Results


N
Legend
Road
Building
Roof area
Point receiver
5B
5B-2
6B-2
6B
Length scale 1:1000
0 5 10 20 30 40
m
Hamilton 15-051
Mixed Use Development
Traffic Noise Model Extract
July 2015
mwa
ENVIRONMENTAL

Hamilton
Assessed receiver levels
Validation

2

Receiver	L10(18h) dB(A)
Validation	68.5

Hamilton
Assessed receiver levels
Traffic Noise - 2026

Receiver	Fl	Dir	L10(18h) dB(A)
Level 2-7	GF	E	60.0
	F 1		60.5
	F 2		61.0
	F 3		61.3
	F 4		61.6
	F 5		62.2
Level 2-7	GF	S	57.2
	F 1		58.3
	F 2		58.7
	F 3		59.0
	F 4		59.4
	F 5		60.2
Level 2-7	GF	W	69.3
	F 1		69.8
	F 2		70.2
	F 3		70.4
	F 4		70.6
	F 5		70.6
Level 2-7	GF	N	69.2
	F 1		69.8
	F 2		70.2
	F 3		70.5
	F 4		70.7
	F 5		70.9


Noise level
L10(18hr)
incl. facade reflection
in dB(A)
Noise Category 0
<= 58.0
Noise Category 1
58.0< <= 63.0
Noise Category 2
63.0< <= 68.0
Noise Category 3
68.0< <= 73.0
Noise Category 4
73.0<
Legend
Road Centreline
Cadastral
Main building
Roof area
Point receiver
5B
5B-2
6B-2
6B
Length scale 1:1000
0 5 10 20 30 40 m
N
Hamilton 15-051
Mixed Use Development
Year 2026 Traffic Noise
MP4.4 Noise Categories
Level 2 Facades
July 2015
mwa
ENVIRONMENTAL

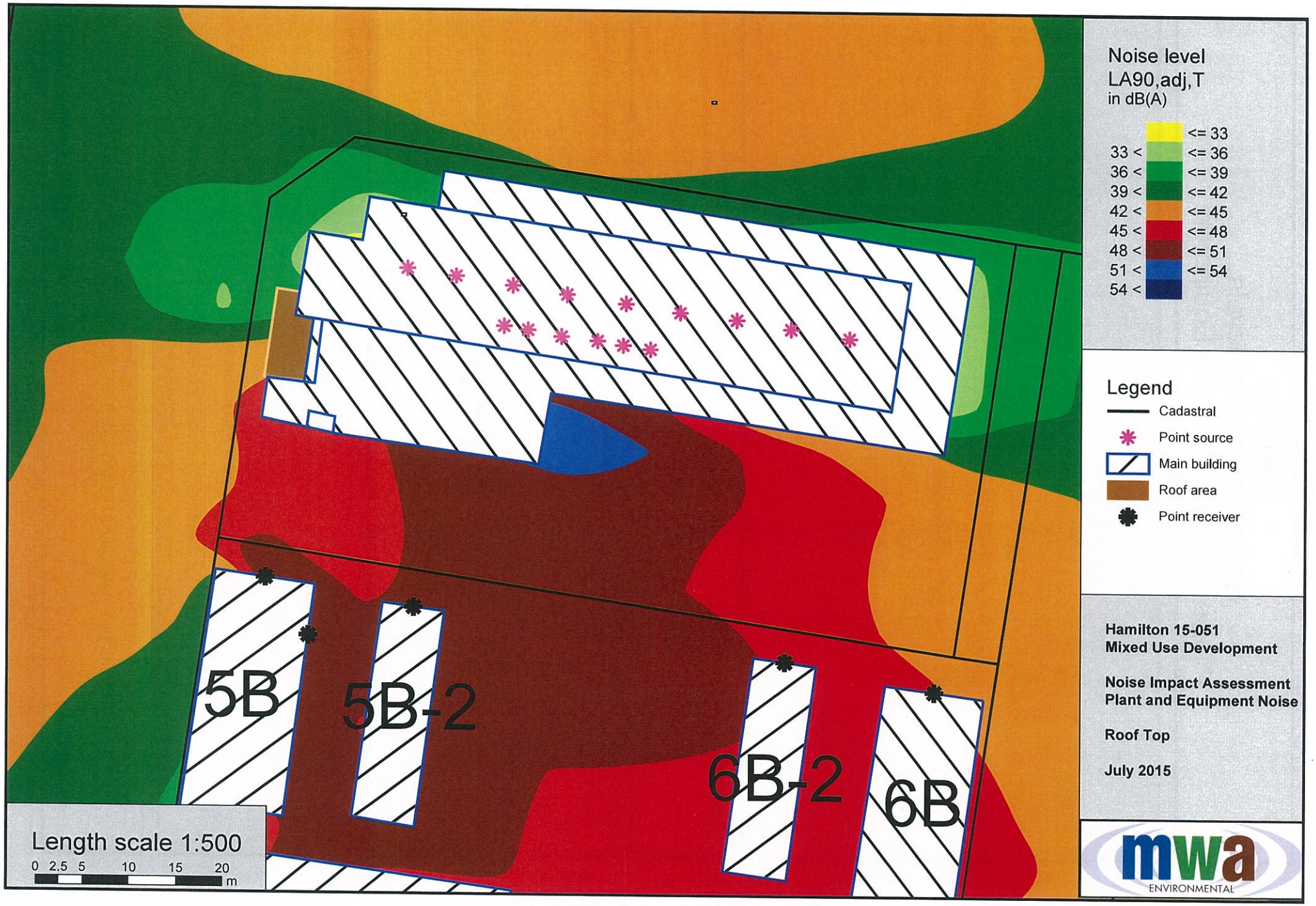
ATTACHMENT 4

SoundPLAN 7.3 Modelling

Plant and Equipment Noise Model Results

Hamilton
Assessed receiver levels
Noise Impact - Plant and Equipment

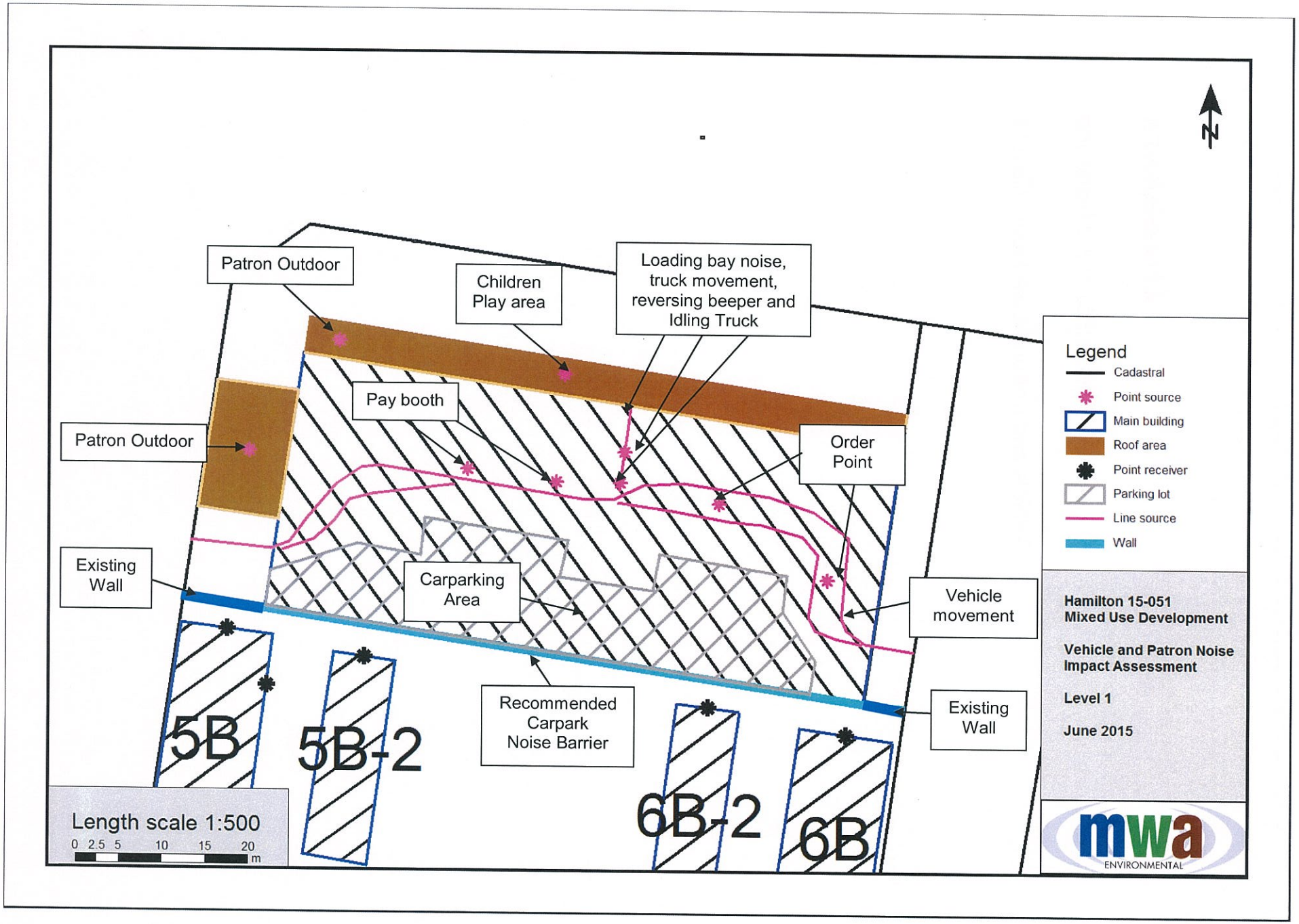
Receiver	Fl	Dir	L90 dB(A)
Building 5B	GF	E	43.3
	F 1		44.5
	F 2		45.2
	F 3		46.1
	F 4		46.3
	F 5		46.7
	F 6		46.8
	F 7		47.4
Building 5B	GF	N	40.6
	F 1		41.7
	F 2		42.5
	F 3		43.8
	F 4		44.4
	F 5		44.5
	F 6		44.4
	F 7		46.0
Building 5B -2	GF	N	42.8
	F 1		43.8
	F 2		43.9
	F 3		45.2
	F 4		45.8
Building 6B	GF	N	40.6
	F 1		41.5
	F 2		41.8
	F 3		42.4
	F 4		42.5
	F 5		42.6
	F 6		43.4
Building 6B -2	GF	N	41.3
	F 1		42.4
	F 2		43.2
	F 3		43.9
	F 4		44.4

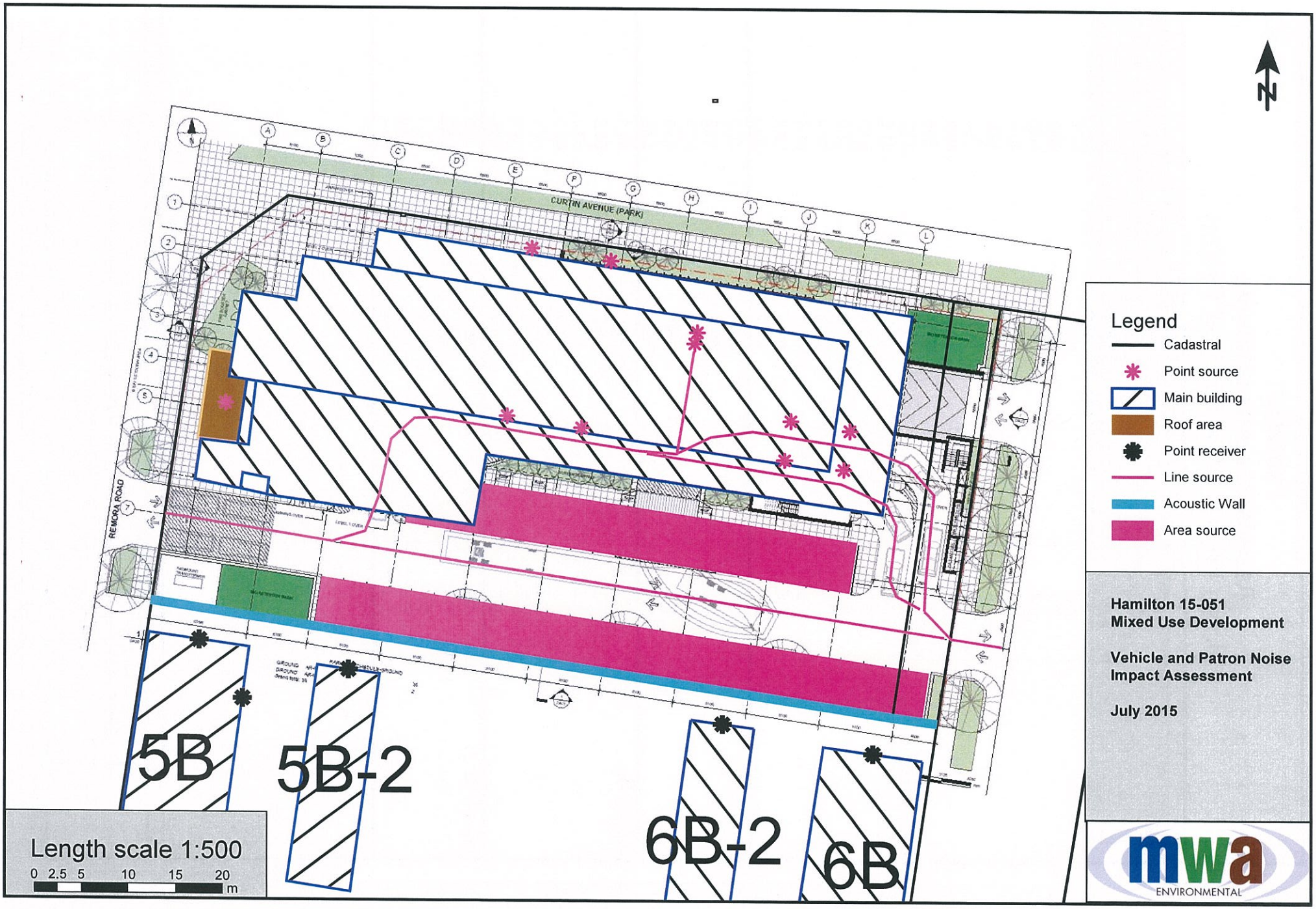

Noise level
LA90,adj,T
in dB(A)
<= 33
33 < <= 36
36 < <= 39
39 < <= 42
42 < <= 45
45 < <= 48
48 < <= 51
51 < <= 54
54 <
Legend
Cadastral
Point source
Main building
Roof area
Point receiver
5B
5B-2
6B-2
6B
Length scale 1:500
0 2.5 5 10 15 20
m
Hamilton 15-051
Mixed Use Development
Noise Impact Assessment
Plant and Equipment Noise
Roof Top
July 2015
mwa
ENVIRONMENTAL

ATTACHMENT 5

SoundPLAN 7.3 Modelling

Vehicle and Patron Noise Model Results

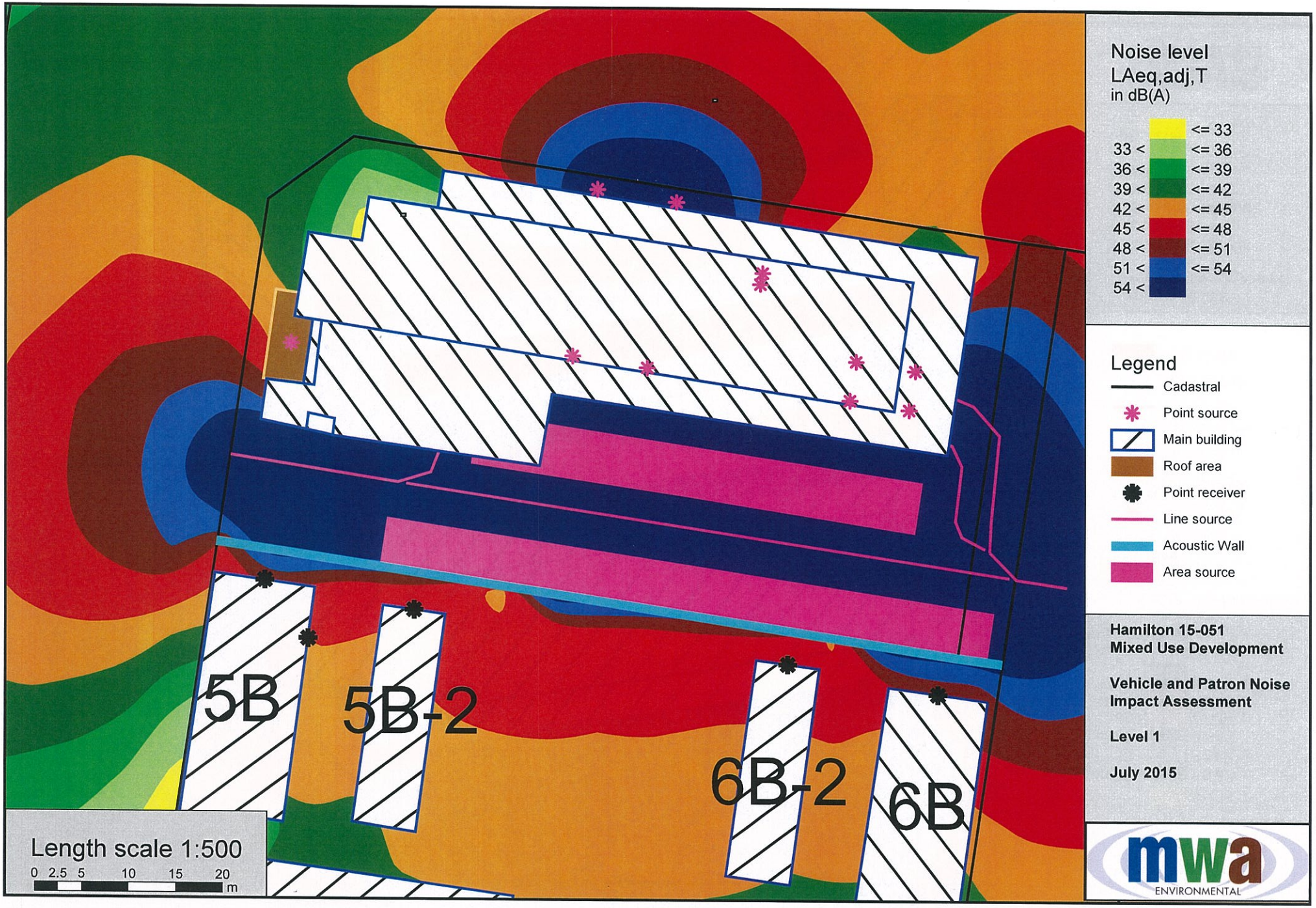

N
Patron Outdoor
Children Play area
Loading bay noise, truck movement, reversing beeper and Idling Truck
Pay booth
Patron Outdoor
Order Point
Existing Wall
Carparking Area
Vehicle movement
Recommended Carpark Noise Barrier
Existing Wall
5B
5B-2
6B-2
6B
Length scale 1:500
0 2.5 5 10 15 20 m
Legend
Cadastral
Point source
Main building
Roof area
Point receiver
Parking lot
Line source
Wall
Hamilton 15-051
Mixed Use Development
Vehicle and Patron Noise Impact Assessment
Level 1
June 2015
mwa
ENVIRONMENTAL

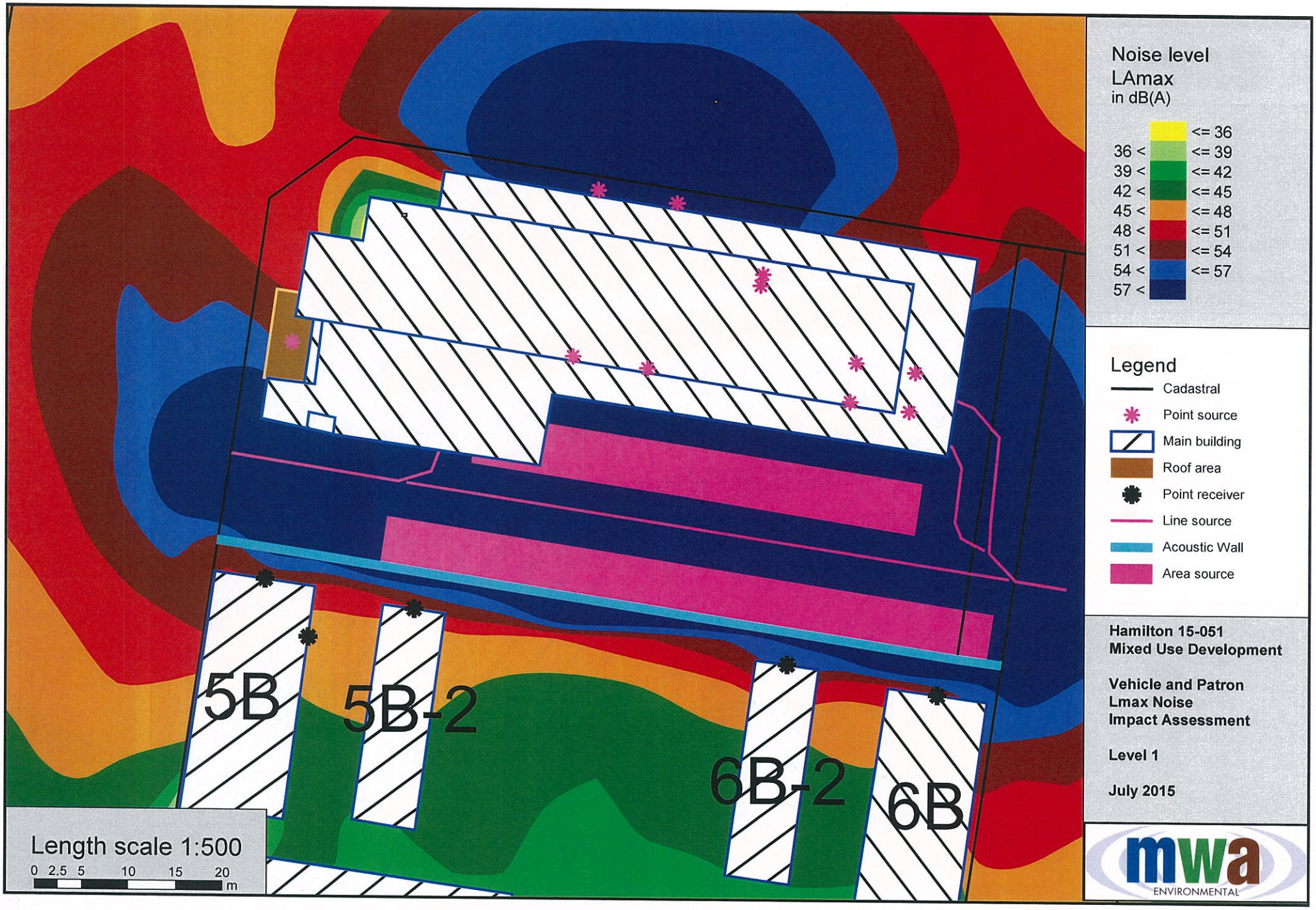

CURTIN AVENUE (PARK)
REMORA ROAD
5B
5B-2
6B-2
6B
Length scale 1:500
0 2.5 5 10 15 20 m
Legend
Cadastral
Point source
Main building
Roof area
Point receiver
Line source
Acoustic Wall
Area source
Hamilton 15-051
Mixed Use Development
Vehicle and Patron Noise
Impact Assessment
July 2015
mwa
ENVIRONMENTAL

Hamilton
Assessed receiver levels
Noise Impact - Vehicle and Patron

2

Receiver	Fl	Dir	Lmax dB(A)	Leq dB(A)
Building 5B	GF	E	43.8	42.2
	F 1		48.7	46.4
	F 2		51.9	49.5
	F 3		52.0	49.8
	F 4		51.8	49.6
	F 5		51.1	49.4
	F 6		50.6	49.2
	F 7		50.0	49.5
Building 5B	GF	N	50.3	47.2
	F 1		54.7	51.8
	F 2		55.5	53.0
	F 3		54.8	52.6
	F 4		54.0	52.0
	F 5		53.0	51.4
	F 6		52.2	50.8
	F 7		51.4	50.3
Building 5B -2	GF	N	49.6	45.9
	F 1		53.9	53.2
	F 2		55.8	53.4
	F 3		55.4	53.3
	F 4		54.1	52.8
Building 6B	GF	N	49.5	46.8
	F 1		53.8	52.8
	F 2		55.0	53.1
	F 3		54.2	52.7
	F 4		52.8	52.1
	F 5		51.7	51.5
	F 6		50.4	50.9
Building 6B -2	GF	N	50.4	46.2
	F 1		53.6	52.9
	F 2		56.2	53.3
	F 3		55.0	53.0
	F 4		53.6	52.5


Noise level
LAeq,adj,T
in dB(A)
<= 33
33 < <= 36
36 < <= 39
39 < <= 42
42 < <= 45
45 < <= 48
48 < <= 51
51 < <= 54
54 <
Legend
Cadastral
Point source
Main building
Roof area
Point receiver
Line source
Acoustic Wall
Area source
5B
5B-2
6B-2
6B
Length scale 1:500
0 2.5 5 10 15 20
m
Hamilton 15-051
Mixed Use Development
Vehicle and Patron Noise
Impact Assessment
Level 1
July 2015
mwa
ENVIRONMENTAL


Noise level
LAmax
in dB(A)
<= 36
36 < <= 39
39 < <= 42
42 < <= 45
45 < <= 48
48 < <= 51
51 < <= 54
54 < <= 57
57 <
Legend
Cadastral
Point source
Main building
Roof area
Point receiver
Line source
Acoustic Wall
Area source
5B
5B-2
6B-2
6B
Length scale 1:500
0 2.5 5 10 15 20
m
Hamilton 15-051
Mixed Use Development
Vehicle and Patron
Lmax Noise
Impact Assessment
Level 1
July 2015
mwa
ENVIRONMENTAL