Noise Assessment

Proposed Service Station, Kiosk and Food and Drinks Premises
601-605 Great Western Highway, Greystanes, NSW.

Prepared for: KDC Pty Ltd
December 2017

MAC
Muller Acoustic Consulting

Document Information

Noise Assessment

Proposed Service Station, Kiosk and Food and Drinks Premises,

601-605 Great Western Highway, Greystanes, NSW.

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by KDC Pty Ltd (KDC) to prepare a Noise Assessment (NA) to quantify emissions from the proposed Service Station, Kiosk and Food and Drinks Premises (the 'project') to be established at the 601-605 Great Western Highway, Greystanes, NSW.

The NA has quantified potential operational, maximum noise level and construction/demolition noise emissions from the project and recommends reasonable and feasible noise controls where required.

The assessment has been undertaken in accordance with the following documents:

- Environment Protection Authority (EPA), NSW Noise Policy for Industry (NPI) (2017);
- Standards Australia AS 1055.1:1997 - Acoustics - Description and measurement of environmental noise - General Procedures; and
- International Standard ISO 9613:1993 - Acoustics - Attenuation of sound during propagation outdoors.

A glossary of terms, definitions and abbreviations used in this report is provided in **Appendix A**.

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2 Project Description

2.1 General

The project is to be established at the 601-605 Great Western Highway, Greystanes, NSW. This locality comprises a mix of residential, commercial and industrial land uses. The project site is bounded to the north by the Great Western Highway and to the south by the Western Motorway. The nearest proposed residential receivers to the project consist of a residential development, situated 30 metres to the east of the project site with additional residential receivers further to the north, west and south west.

The project proposes the demolition of an existing heavy vehicle dealership and construction of a new Service Station, Kiosk and Food and Drinks Premises. The project will consist of several buildings, drive-thru lanes and vehicle car parks. The proposed operating hours of the project is 24 hours, seven days. **Appendix B** provides the site layout plans of the project.

2.2 Receiver Review

A review of receivers surrounding the project has been completed and are summarised in **Table 1.** **Figure 1** provides a locality plan showing the position of these receivers in relation to the project. Residential receiver heights were set to 1.5m above relative ground level for single storey dwelling and 4.0m for two storey dwellings.

Table 1 Receiver Locations

Receiver	Coordinates		Receiver Height	Receiver Type
R1	308817	6257217	1.5m	Residential
R2	308845	6257208	1.5m	Residential
R3	308990	6257225	1.5m	Residential
R4	308995	6257156	1.5 / 4.0m	Residential
R5	308989	6257140	1.5 / 4.0m	Residential
R6	308986	6257127	1.5 / 4.0m	Residential
R7	308983	6257118	1.5 / 4.0m	Residential
R8	309007	6257116	1.5 / 4.0m	Residential
R9	309028	6257116	1.5 / 4.0m	Residential
R10	309030	6257131	1.5 / 4.0m	Residential
R11	309026	6257140	1.5m	Residential
R12	309009	6257144	1.5m	Residential
R13	309075	6257106	1.5 / 4.0m	Residential
R14	309071	6257059	1.5m	Residential
R15	309025	6257075	1.5m	Residential

Table 1 Receiver Locations				
Receiver	Coordinates		Receiver Height	Receiver Type
R16	309022	6256955	1.5m	Residential
R17	309004	6256963	1.5m	Residential
R18	308985	6256969	1.5 / 4.0m	Residential
R19	308970	6256972	1.5m	Residential
R20	308951	6256976	1.5m	Residential
R21	308938	6256982	1.5m	Residential
R22	308923	6256990	1.5 / 4.0m	Residential
R23	308907	6256994	1.5m	Residential
R24	308897	6257002	1.5m	Residential
R25	308881	6257007	1.5m	Residential
R26	308872	6257021	1.5m	Residential
R27	308856	6257030	1.5 / 4.0m	Residential
R28	308852	6257059	1.5 / 4.0m	Residential
R29	308839	6257069	1.5 / 4.0m	Residential
R30	308823	6257077	1.5 / 4.0m	Residential
R31	308813	6257085	1.5 / 4.0m	Residential
R32	308798	6257093	1.5 / 4.0m	Residential
R33	308787	6257101	1.5 / 4.0m	Residential
R34	308774	6257109	1.5 / 4.0m	Residential
R35	308763	6257116	1.5 / 4.0m	Residential
R36	308752	6257125	1.5 / 4.0m	Residential
R37	308737	6257131	1.5 / 4.0m	Residential
R38	308724	6257133	1.5 / 4.0m	Residential
R39	308713	6257138	1.5 / 4.0m	Residential
R40	308698	6257140	1.5m	Residential
C1	308896	6257175	1.5m	Commercial
C2	309014	6257226	1.5m	Commercial
I1	308862	6257325	1.5m	Industrial
I2	308934	6257252	1.5m	Industrial

FIGURE 1

LOCALITY PLAN

REF: MAC170556

0 50m

KEY	
R1	RECEIVER LOCATION
L1	LOGGER LOCATION
	SITE LOCATION

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*Imagery Source : nearmaps

2.3 Proposed Activities

There are several key activities associated with the project that have the potential to generate acoustic impacts on nearby receivers.

Table 2 provides a summary of project noise sources and the assessment period in which they propose to occur.

Table 2 Noise Generating Activities

Activity/Source	Period[1]	Operational
Customer light vehicles (customers)	Day (7am to 6pm)	✓
	Evening (6pm to 10pm)	✓
	Night (10pm to 7am)	✓
Truck Consumable Deliveries	Day (7am to 6pm)	✓
	Evening (6pm to 10pm)	✓
	Night (10pm to 7am)	✓
Waste Collection	Day (7am to 6pm)	✓
	Evening (6pm to 10pm)	✓
	Night (10pm to 7am)	✓
Mechanical Plant	Day (7am to 6pm)	✓
	Evening (6pm to 10pm)	✓
	Night (10pm to 7am)	✓
Customer Ordering Displays	Day (7am to 6pm)	✓
	Evening (6pm to 10pm)	✓
	Night (10pm to 7am)	✓

Note 1: Day is 7am to 6pm, Evening is 6pm to 10pm, Night is from 10pm to 7am.

3 Noise Policy and Guidelines

The methodology and assumptions utilised in the NA are outlined below.

3.1 Guidelines and Standards

This NA has been conducted with due regard to and in accordance with the following key policy and guidelines:

- Environment Protection Authority's (EPA's), Noise Policy for Industry (NPI), 2017;
- NSW Department of Environment and Climate Change – NSW Interim Construction Noise Guideline (ICNG), July 2009; and
- NSW Department of Environment, Climate Change and Water – NSW Road Noise Policy (RNP), March 2011.

The NA has also considered and applied the following additional policy, guidelines and standards where relevant:

- Standards Australia AS 2436–2010™ (AS2436) – Guide to Noise and Vibration Control on Construction, Demolition and Maintenance sites;
- Standards Australia AS1055–1997™ (AS1055) – Description and Measurement of Environmental Noise;
- Standards Australia AS IEC 61672.1–2004™ (AS61672) – Electro Acoustics - Sound Level Meters Specifications Monitoring or Standards Australia AS1259.2-1990™ (AS1259) – Acoustics – Sound Level Meters – Integrating/Averaging as appropriate to the device; and
- Standards Australia AS/IEC 60942:2004/IEC 60942:2003 (IEC60942) – Australian Standard™ – Electroacoustics – Sound Calibrators.

3.2 Noise Policy for Industry

The EPA released the Noise Policy for Industry (NPI) in October 2017 which provides a process for establishing noise criteria for consents and licenses enabling the EPA to regulate noise emissions from scheduled premises under the Protection of the Environment Operations Act 1997.

The objectives of the NPI are to:

- provide the noise levels that are used to assess both change in noise level and long-term noise levels;
- provide a clear and consistent framework for assessing environmental noise impacts from industrial premises and industrial development proposals;
- promote the use of best-practice noise mitigation measures that are feasible and reasonable where potential impacts have been identified; and
- support a process to guide the determination of achievable noise limits for planning approvals and/or licences, taking into account the matters that must be considered under the relevant legislation (such as the economic and social benefits and impacts of industrial development).

The policy sets out a process for industrial noise management involving the following key steps:

1. Determine the project noise trigger levels for a development. These are the levels (criteria), above which noise management measures are required to be considered. They are derived by considering two factors: shorter-term intrusiveness due to changes in the noise environment and require the measurement of existing background levels; and maintaining the noise amenity of an area.
2. Predict or measure the noise levels produced by the development with regard to the presence of annoying noise characteristics and meteorological effects such as temperature inversions and wind.
3. Compare the predicted or measured noise level with the project noise trigger level, and assessing impacts and the need for noise mitigation and management measures.
4. Consider residual noise impacts - that is, where noise levels exceed the Project Noise Trigger Levels (PNTL) after the application of feasible and reasonable noise mitigation measures. This may involve balancing economic, social and environmental costs and benefits from the proposed development against the noise impacts, including consultation with the affected community where impacts are expected to be significant.
5. Set statutory compliance levels that reflect the best achievable and agreed noise limits for the development.
6. Monitor and report environmental noise levels from the development.

3.2.1 Industrial Noise Trigger Levels

The policy sets out the procedure to determine the PNTL (i.e. criteria) relevant to a particular industrial development. The PNTL applies to existing noise-sensitive receivers, however, it may also be used in strategic planning processes for proposed land uses.

The PNTL is the lower (that is, the more stringent) value of the **project intrusiveness noise level** and **project amenity noise level** determined in accordance with Sections 2.3 and 2.4 of the NPI. The project intrusiveness noise level aims to protect against significant changes in noise levels, whilst the project amenity noise level seeks to protect against cumulative noise impacts from industry and maintain amenity for particular land uses.

3.2.2 Intrusiveness Noise Level

The project intrusiveness noise level ($L_{Aeq,15min}$) is the RBL + 5dB and seeks to limit the degree of change a new noise source introduces to an existing environment. Hence, when assessing intrusiveness, background noise levels needs to be measured.

3.2.3 Assessing Amenity

Amenity noise levels are relevant to a specific land use or locality. To limit continuing increases in intrusiveness levels, the ambient noise level within an area from all combined industrial sources should remain below the recommended amenity noise levels specified in Table 2.2 (of the NPI). The NPI defines two categories of amenity noise levels:

- **Amenity Noise Levels** – are determined considering all current and future industrial noise within a receiver area.
- **Project Amenity Noise Levels** – is the recommended levels for a receiver area, specifically focusing the project under investigation.

As per Section 2.4 of the NPI, amenity noise levels and project amenity noise levels consider:

- areas with high traffic noise levels;
- proposed developments in major industrial clusters;
- existing industrial noise; and
- greenfield sites.

The recommended amenity noise levels as per Table 2.2 of the NPI reproduced in **Table 3**.

Table 3 Amenity Criteria

Receiver Type	Noise Amenity Area	Time of day	Recommended amenity noise level L_{Aeq} dBA
Residential	Rural	Day	50
		Evening	45
		Night	40
	Suburban	Day	55
		Evening	45
		Night	40
	Urban	Day	60
		Evening	50
		Night	45
Hotels, motels, caretakers' quarters, holiday accommodation, permanent resident caravan parks	See column 4	See column 4	5dBA above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day
School classroom – internal	All	Noisiest 1 hour period when in use	35
Hospital ward	All		
- internal		Noisiest 1 hour	35
- external		Noisiest 1 hour	50
Place of worship – internal	All	When in use	40
Area specifically reserved for passive recreation (e.g. national park)	All	When in use	50
Active recreation area (e.g. school playground, golf course)	All	When in use	55
Commercial premises	All	When in use	65
Industrial premises	All	When in use	70
Industrial interface (applicable only to residential noise amenity areas)	All	All	Add 5dBA to recommended noise amenity area

Notes: The recommended amenity noise levels refer only to noise from industrial noise sources. However, they refer to noise from all such sources at the receiver location, and not only noise due to a specific project under consideration. The levels represent outdoor levels except where otherwise stated.

Types of receivers are defined as rural residential; suburban residential; urban residential; industrial interface; commercial; industrial – see Table 2.3 and Section 2.7.

Time of day is defined as follows: (These periods may be varied where appropriate, for example, see A3 in Fact Sheet A.)

- day – the period from 7 am to 6 pm Monday to Saturday or 8 am to 6 pm on Sundays and public holidays
- evening – the period from 6 pm to 10 pm
- night – the remaining periods.

In the case where existing schools are affected by noise from existing industrial noise sources, the acceptable LAeq noise level may be increased to 40 dB LAeq(1hr).

3.2.4 Maximum Noise Level Assessment

The potential for sleep disturbance from maximum noise level events from premises during the night-time period needs to be considered. The NPI considers sleep disturbance to be both awakenings and disturbance to sleep stages.

Where night-time noise levels from a development/premises at a residential location exceed:

- $L_{Aeq,15min}$ 40dBA or the prevailing RBL plus 5dB, whichever is the greater, and/or
- L_{AFmax} 52dBA or the prevailing RBL plus 15dB, whichever is the greater,

a detailed maximum noise level event assessment should be undertaken.

A detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period.

Other factors that may be important in assessing the impacts on sleep disturbance include:

- how often the events would occur;
- the distribution of likely events across the night-time period and the existing ambient maximum events in the absence of the development;
- whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods); and
- current understanding of effects of maximum noise level events at night.

3.3 Interim Construction Noise Guideline

The assessment and management of noise from construction work is completed with reference to the Interim Construction Noise Guideline (ICNG). The ICNG is specifically aimed at managing noise from construction work regulated by the EPA, and is used to assist in setting statutory conditions in licences or other regulatory instruments. The types of construction regulated by the EPA under the POEO Act (1997), include construction, maintenance and renewal activities carried out by a public authority, such as road upgrades as described in Schedule 1 of the POEO Act.

The ICNG sets out procedures to identify and address the impact of construction noise on residences and other sensitive land uses. This section provides a summary of noise objectives that are applicable to the assessment.

The ICNG provides two methodologies for the assessment of construction noise emissions:

- Quantitative, which is suited to major construction projects with typical durations of more than three weeks;
- Qualitative, which is suited to short term infrastructure maintenance (for projects with a typical duration of less than three weeks).

The methodology for a quantitative assessment requires a more complex approach, involving noise emission predictions from construction activities to the nearest relevant receptors. The qualitative assessment methodology is a more simplified approach that relies more on noise management strategies. This study has adopted a quantitative assessment approach.

The quantitative approach includes identification of potentially affected receptors, description of activities involved in the project, derivation of the construction noise management levels, quantification of potential noise impact at receptors and, provides management and mitigation recommendations. **Table 4** summarises the ICNG recommended standard hours for construction.

Table 4 Recommended Standard Hours for Construction

Period	Preferred Construction Hours
Day (Standard construction hours)	Monday to Friday - 7am to 6pm Saturdays - 8am to 1pm Sundays or Public Holidays - No construction

The recommended hours do not apply in the event of direction from police, or other relevant authorities, for safety reasons or where required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm. Work conducted outside of standard hours are considered out of hours work (OOH). OOH periods are divided into two categories representing evening and night periods and cover the hours listed below:

Period 1 (evening/low risk period): Monday to Friday – 6pm to 10pm, Saturdays – 1pm to 6pm, Sundays 8am to 6pm.

Period 2 (night/medium to high risk period): Monday to Friday – 10pm to 7am, Saturdays/Sundays – 6pm to 7am (8am on Sunday mornings).

3.3.1 Construction Noise Management Levels

Section 4 of the ICNG details the quantitative assessment method involving predicting noise levels and comparing them with the Noise Management Level (NML), and are important indicators of the potential level of construction noise impact. **Table 5** provides the ICNG recommended $LA_{eq(15min)}$ NMLs and how they are to be applied.

Table 5 Noise Management Levels

Time of Day	Management Level $LA_{eq(15min)}$[1]	How to Apply
Recommended standard hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays.	Noise affected RBL + 10 dB.	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $LA_{eq(15min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of work to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dBA.	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account times identified by the community when they are less sensitive to noise (such as before and after school for work near schools, or mid-morning or mid-afternoon for work near residences; and if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours.	Noise affected RBL + 5 dB.	A strong justification would typically be required for work outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2.

Note 1: The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the construction noise management levels for noise assessment purposes and is the median of the ABL's.

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4 Noise Criteria

4.1 Background Noise Environment

4.1.1 Unattended Noise Monitoring

To quantify the existing background noise environment of the area, unattended noise measurements were conducted at the south-eastern corner of the project site, adjacent to the nearest residential receivers. The selected monitoring locations are shown in **Figure 1.**

The unattended noise measurements were conducted in general accordance with the procedures described in Australian Standard AS 1055-1997, "Acoustics - Description and Measurement of Environmental Noise". The measurements were carried out using one Svantek 958 noise analyser from Thursday 23 November 2017 to Thursday 30 November 2017. Observations on-site identified the surrounding locality was typical of an urban area with noise from traffic on the Great Western Highway and Western Motorway, the Steggles poultry factory and urban hum audible. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ±0.5dBA. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates.

Data affected by adverse meteorological conditions have been excluded from the results in accordance with methodologies provided in Fact Sheet A4 of the NPI. Residential receptors situated in surrounding area have been classified under the EPA's urban amenity category. This criterion is used in conjunction with the intrusiveness criteria to determine the limiting criteria. A summary of measured background noise levels and derived intrusive criteria are summarised in **Table 6** and plotted in graph format in **Appendix C.**

Table 6 Background Noise Monitoring Summary

Location	Measured background noise level, RBL, dBA			Measured LA_{eq}, dBA		
	Day 7am to 6pm	Evening 6pm to 10pm	Night 10pm to 7am	Day 7am to 6pm	Evening 6pm to 10pm	Night 10pm to 7am
L1	56	54	47	61	58	57

4.2 Operational Noise Criteria

4.2.1 Intrusiveness Noise Levels

The intrusiveness criteria for the project are presented in **Table 7** and have been determined based on the RBL +5dBA.

Table 7 Intrusiveness Noise Levels, dBA $L_{Aeq(15min)}$

Receiver	Period[1]	Measured RBL dB L_{A90}	Intrusiveness Noise Level, dB $L_{Aeq,15min}$
All Residential Receivers	Day	56	61
	Evening	54	59
	Night	47	52

Note 1: Monday to Saturday: Day 7am to 6pm; Evening 6pm to 10pm; Night 10pm to 7am. On Sundays and Public Holidays: Day 8am to 6pm; Evening 6pm to 10pm; Night 10pm to 8am.

4.2.2 Amenity Nosie Levels and Project Amenity Noise Levels

The amenity noise levels for residential receivers and other sensitive receivers potentially affected by the project are presented in **Table 8.**

Table 8 Amenity Noise Levels and Project Amenity Levels

Receiver Type	Noise Amenity Area	Period[1]	Recommended Amenity Noise Level $L_{Aeq,period}$	Project Amenity Noise Level, $L_{Aeq,period}$[2]	Project Amenity Noise Level, $L_{Aeq,15min}$[2]
Residential	Urban	Day	60	55	58
		Evening	50	45	48
		Night	45	40	45[3]
Commercial		When in use	65	65	65
Industrial		When in use	70	70	70

Note 1: Monday to Saturday: Day 7am to 6pm; Evening 6pm to 10pm; Night 10pm to 7am. On Sundays and Public Holidays: Day 8am to 6pm; Evening 6pm to 10pm; Night 10pm to 8am.

Note 2: Includes a +3dB adjustment to the amenity period level to convert to a fifteen-minute assessment period as per Section 2.2 of the NPI.

Note 3: LAeq(traffic) converted to LAeq(15min).

4.2.3 Project Noise Trigger Levels

The Project Noise Trigger Levels (PNTLs) is the lower of either the intrusiveness noise level and the Project Amenity Noise Level. **Table 9** presents the derivation of the PNTL's in accordance with the methodologies outlined in the NPI.

Table 9 Project Noise Trigger Levels

Receiver	Period[1]	Intrusiveness Noise Level, dB $L_{Aeq,15min}$	Project Amenity Noise Level, dB $L_{Aeq,15min}$	PNTL, dB $L_{Aeq,15min}$
Residential	Day	61	58	**58**
	Evening	59	48	**48**
	Night	52	45	**45**
Commercial	When in use	N/A	65	**65**
Industrial	When in use	N/A	70	**70**

Note 1: Monday to Saturday: Day 7am to 6pm; Evening 6pm to 10pm; Night 10pm to 7am. On Sundays and Public Holidays: Day 8am to 6pm; Evening 6pm to 10pm; Night 10pm to 8am.

4.3 Maximum Noise Level Assessment Criterion

Table 10 provides the sleep disturbance criterion for the nearest residential receivers. The sleep disturbance criterion has been derived based on the night RBL.

Table 10 Maximum Noise Level Assessment Screening Criterion

Operational		
$L_{Aeq\ 15min}$	RBL +5	Maximum Noise Screening Criteria
40	(47+5) = 52	52
Transient Events		
L_{AFmax}	RBL +15	Maximum Noise Screening Criteria
52	(47 + 15) = 62	**62**[1]

Note: Monday to Saturday; Night 10pm to 7am. On Sundays and Public Holidays Night 10pm to 8am.

Note 1: NPI identifies that maximum of the two values is to be adopted.

4.4 Construction Noise Management Levels

The construction noise management levels, established in accordance with the ICNG for the project are presented in **Table 11**.

Table 11 Construction Noise Management Levels

Location	Period[1]	Rating Background Level (RBL), LA_{90} dBA	Noise Management Level $LA_{eq(15min)}$ (RBL+10dB)
Residential receivers	Day	56	66
Commercial	Day	N/A	70
Industrial	Day	N/A	75

Note 1: See Table 4 of this report for Recommended Standard Hours for Construction

5 Noise Assessment Methodology

Brüel and Kjær Predictor Type 7810 (Version 11.10) noise modelling software was used to assess potential noise impacts from the project. The model incorporated three-dimensional ground contours and buildings within the project site and the surrounding locality. Plant and equipment were modelled at various locations and heights, representative of realistic operating conditions for assessed scenarios. The model calculation method used to predict noise levels was in accordance with ISO 9613-1 'Acoustics - Attenuation of sound during propagation outdoors. Part 1: Calculation of the absorption of sound by the atmosphere' and ISO 9613-2 'Acoustics - Attenuation of sound during propagation outdoors. Part 2: General method of calculation'.

5.1 Sound Power Levels

Table 12 presents the sound power level for each noise source modelled in this assessment. It is noted that sound power levels were sourced from manufacturer's specifications or from in-field measurements at similar project sites. The sound power levels have been adjusted to account for duration over a fifteen-minute period.

Table 12 Acoustically Significant Sources - Sound Power Levels *(re 10-12 Watts)*

Item and number modelled per 15 minutes	Individual Sound Power Level, $LA_{eq(15min)}$ dBA	Total Source Sound Power Level, $LA_{eq(15min)}$ dBA	Source Height[1]
Operation and Drive-Thru			
AC Plant (x2)	71	74	1m
Refrigeration Plant (x2)	75	78	1m
Fuel Delivery	82	82	1.5m
Truck deliveries (x1)	92	92	1.5m
Car idle and start up and drive off (x40)	73	89	0.5m
Customer Ordering Displays (x2)	75	78	1.2m
Maximum Noise Assessment (LAmax), Night time periods (10pm to 7am)			
Fuel Nozzle/Hose Impact	102		0.3m
Construction Fleet			
Combined Construction Fleet	108		1.5m

Noe 1: Height above the relative ground or building below source.

5.2 Noise Attenuation Assumptions

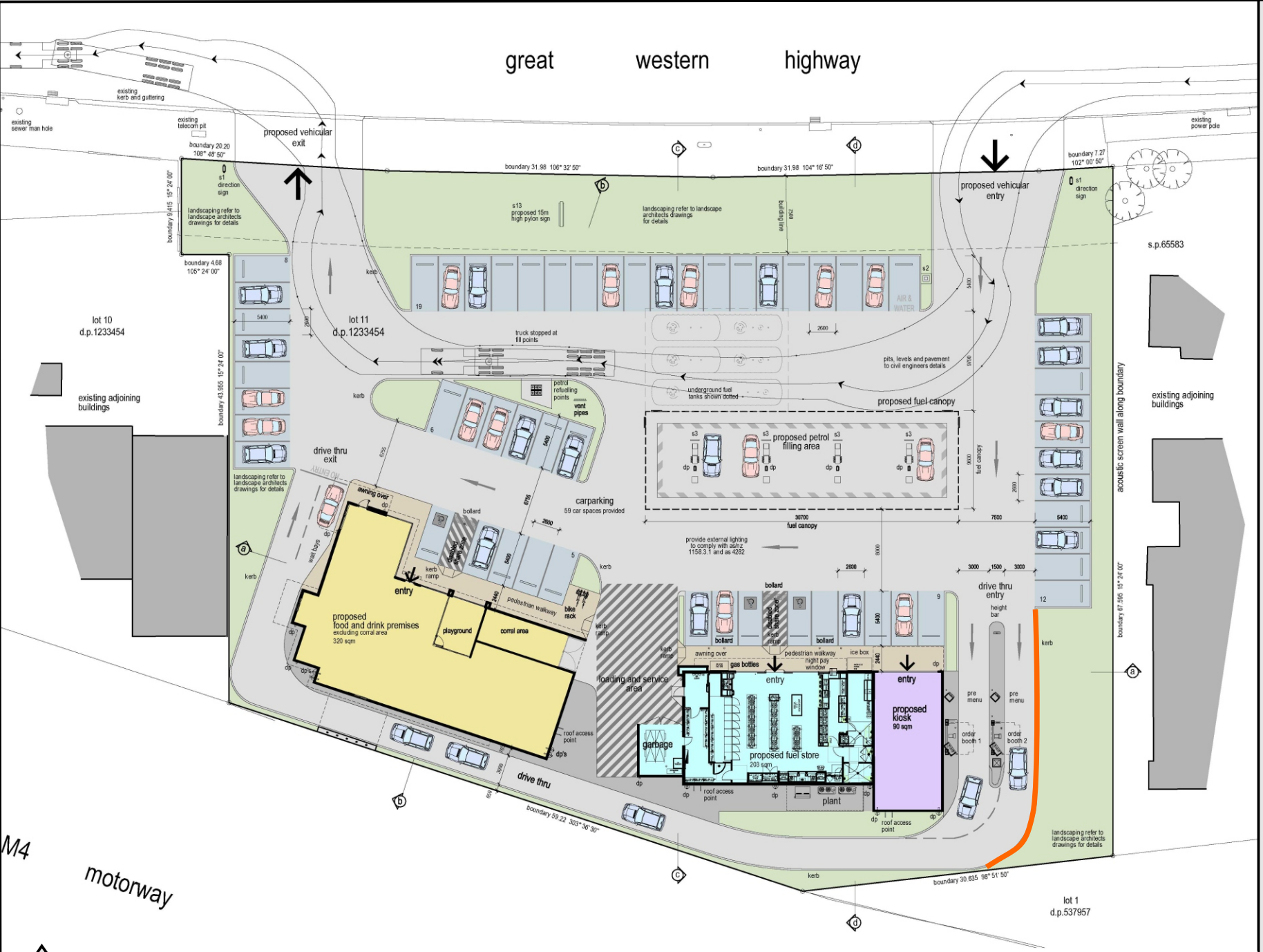
The noise model adopted the following noise controls:

- construction of a 30m impervious barrier along the eastern boundary adjacent to the drive-thru (see **Figure 2**). The barrier should be constructed to an RL of 4.7m above the drive-thru ground level and consist of materials with a surface density of at least 10kg/m^2, and not contain any gaps (i.e. lapped and capped timber or equivalent); and
- the mechanical plant is to be located in a compound on the southern side of the kiosk building and will be shielded to receivers by the acoustic enclosure that extends 600mm above the top of the mechanical plant. The enclosure should have the same composition as the noise barrier described above.

FIGURE 2

BARRIER LOCATION

REF: MAC170556



KEY

Barrier

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6 Noise Assessment Results

This assessment has quantified operational noise levels at the nearest residential and commercial receivers combining simultaneous occurrence of all the following sources:

- customer car noise (driving around site or parking);
- truck idle/drive off, customers, drive-thru, passbys and deliveries/collections; and
- mechanical plant.

It is noted that the potential for maximum noise level events to occur simultaneously is unlikely for this project as the majority of vehicles in any fifteen-minute period would be parked and not operational.

6.1 Operational Noise Results

Noise predictions from all sources have been quantified at surrounding residential receivers to the project site and are presented in **Table 13**. The coincidence of all plant occurring onsite simultaneously for an entire fifteen-minute period is unlikely.

However, it is probable that several plant may operate simultaneously on occasion for a limited duration. To account for this, modelling has adopted the $LA_{eq(15min)}$ contribution of sources which were derived from in-field measurements of operation sources or activities. Noise levels from combined activities are predicted to satisfy the relevant NPI noise criteria at all nearest receivers.

Table 13 Combined Noise Predictions – All Receivers

Residential Receivers							
Receiver	Predicted Noise Level, $LA_{eq(15min)}$ dBA[2]			PNTL $LA_{eq(15min)}$ dBA			Compliant
	Day[1]	Evening[1]	Night[1]	Day[1]	Evening[1]	Night[1]	
R1	31	31	31	58	48	45	✓
R2	36	36	35	58	48	45	✓
R3	42	42	41	58	48	45	✓
R4	45	45	44	58	48	45	✓
R5	45	45	44	58	48	45	✓
R6	45	45	43	58	48	45	✓
R7	45	45	44	58	48	45	✓
R8	<30	<30	<30	58	48	45	✓
R9	30	30	<30	58	48	45	✓
R10	31	31	31	58	48	45	✓
R11	31	31	31	58	48	45	✓
R12	33	33	32	58	48	45	✓
R13	<30	<30	<30	58	48	45	✓

Table 13 Combined Noise Predictions – All Receivers

Residential Receivers

Receiver	Predicted Noise Level, $LA_{eq(15min)}$ dBA[2]			PNTL $LA_{eq(15min)}$ dBA			Compliant
	Day[1]	Evening[1]	Night[1]	Day[1]	Evening[1]	Night[1]	
R14	<30	<30	<30	58	48	45	✓
R15	<30	<30	<30	58	48	45	✓
R16	<30	<30	<30	58	48	45	✓
R17	<30	<30	<30	58	48	45	✓
R18	32	32	32	58	48	45	✓
R19	<30	<30	<30	58	48	45	✓
R20	<30	<30	<30	58	48	45	✓
R21	<30	<30	<30	58	48	45	✓
R22	<30	<30	<30	58	48	45	✓
R23	<30	<30	<30	58	48	45	✓
R24	<30	<30	<30	58	48	45	✓
R25	<30	<30	<30	58	48	45	✓
R26	30	30	<30	58	48	45	✓
R27	30	30	<30	58	48	45	✓
R28	33	33	31	58	48	45	✓
R29	31	31	30	58	48	45	✓
R30	37	37	37	58	48	45	✓
R31	37	37	37	58	48	45	✓
R3	36	36	36	58	48	45	✓
R33	35	35	35	58	48	45	✓
R34	32	32	31	58	48	45	✓
R35	30	30	<30	58	48	45	✓
R36	<30	<30	<30	58	48	45	✓
R37	<30	<30	<30	58	48	45	✓
R38	<30	<30	<30	58	48	45	✓
R39	<30	<30	<30	58	48	45	✓
R40	<30	<30	<30	58	48	45	✓

Other Receivers

Receiver	Period	Predicted Noise Level, $LA_{eq(15min)}$ dBA	PNTL $LA_{eq(15min)}$ dBA	Compliant
C1	When in use	48	65	✓
C2	When in use	40	65	✓
I1	When in use	31	70	✓
I2	When in use	41	70	✓

Note 1: Monday to Saturday; Day 7am to 6pm; Evening 6pm to 10pm; Night 10pm to 7am. On Sundays and Public Holidays, Day 8am to 6pm; Evening 6pm to 10pm; Night 10pm to 8am.

Note: 2: Prediction to worst case floor of receiver. (ie ground or first floor).

6.2 Maximum Noise Levels Assessment Results

In assessing sleep disturbance, typical L_{Amax} noise levels from transient events were assessed to the nearest residential receivers. The use of the L_{Amax} noise level provides a worst-case prediction since the $L_{A1(1minute)}$ noise level of a noise event is likely to be less than the L_{Amax}. For the sleep disturbance assessment, a sound power level of 102dBA for fuel truck delivery noise impacts are adopted for this assessment with the night-time operational scenario adopted for the awakenings assessment.

Predicted noise levels from $L_{Aeq(15min)}$ and L_{Amax} events for assessed receivers are presented in **Table 14.** Results identify that the sleep disturbance screening criterion will be satisfied for all assessed receivers.

Table 14 Maximum Noise Levels Assessment (Night)[1]

Receiver	Predicted Noise Level,		Screening Criterion		Compliant
	$L_{Aeq(15min)}$ dBA	L_{Amax} dBA	$L_{Aeq(15min)}$ dBA	L_{Amax} dBA	
R1	31	42	52	62	✓
R2	35	47	52	62	✓
R3	41	52	52	62	✓
R4	44	55	52	62	✓
R5	44	54	52	62	✓
R6	43	53	52	62	✓
R7	44	53	52	62	✓
R8	<30	32	52	62	✓
R9	<30	33	52	62	✓
R10	31	39	52	62	✓
R11	31	39	52	62	✓
R12	32	39	52	62	✓
R13	<30	30	52	62	✓
R14	<30	33	52	62	✓
R15	<30	37	52	62	✓
R16	<30	39	52	62	✓
R17	<30	37	52	62	✓
R18	32	34	52	62	✓
R19	<30	34	52	62	✓
R20	<30	39	52	62	✓
R21	<30	40	52	62	✓
R22	<30	35	52	62	✓
R23	<30	33	52	62	✓
R24	<30	33	52	62	✓

Table 14 Maximum Noise Levels Assessment (Night)[1]					
Receiver	Predicted Noise Level,		Screening Criterion		Compliant
	$L_{Aeq(15min)}$ dBA	L_{Amax} dBA	$L_{Aeq(15min)}$ dBA	L_{Amax} dBA	
R25	<30	36	52	62	✓
R26	<30	34	52	62	✓
R27	<30	34	52	62	✓
R28	31	39	52	62	✓
R29	30	41	52	62	✓
R30	37	39	52	62	✓
R31	37	40	52	62	✓
R3	36	41	52	62	✓
R33	35	41	52	62	✓
R34	31	39	52	62	✓
R35	<30	38	52	62	✓
R36	<30	38	52	62	✓
R37	<30	36	52	62	✓
R38	<30	35	52	62	✓
R39	<30	34	52	62	✓
R40	<30	34	52	62	✓

Note 1: Monday to Saturday; Night 10pm to 7am. On Sundays and Public Holidays Night 10pm to 8am.

Note:2: Prediction to worst case floor of receiver. (ie ground or first floor).

6.3 Construction Noise Results

Predictions identify that levels from construction/demolition satisfy the adopted noise management levels for all assessed receivers. Notwithstanding, recommendations to reduce the impact of construction noise emissions on surrounding receivers, are provided in **Section 7**. Furthermore, significant noise reductions would be achieved if construction of the noise walls discussed in **Section 5.2** is completed prior to major construction works commencing.

Therefore, where feasible, it is recommended that the noise walls be completed prior to the commencement of construction activities. **Table 15** presents the results of modelled construction (and demolition) noise emissions.

Table 15 Construction/Demolition Noise Levels – All Receivers

Receiver[1]	Period	Predicted Noise Level, $L_{Aeq(15min)}$ dBA	Management Level $L_{Aeq(15min)}$ dBA	Compliant
Residential Receiver				
R1	Day	47	66	✓
R2	Day	49	66	✓
R3	Day	57	66	✓
R4	Day	62	66	✓
R5	Day	63	66	✓
R6	Day	64	66	✓
R7	Day	64	66	✓
R8	Day	64	66	✓
R9	Day	40	66	✓
R10	Day	41	66	✓
R11	Day	56	66	✓
R12	Day	52	66	✓
R13	Day	54	66	✓
R14	Day	36	66	✓
R15	Day	42	66	✓
R16	Day	56	66	✓
R17	Day	48	66	✓
R18	Day	43	66	✓
R19	Day	49	66	✓
R20	Day	44	66	✓
R21	Day	51	66	✓
R22	Day	51	66	✓

Table 15 Construction/Demolition Noise Levels – All Receivers				
Receiver[1]	Period	Predicted Noise Level, $L_{Aeq(15min)}$ dBA	Management Level $L_{Aeq(15min)}$ dBA	Compliant
R23	Day	52	66	✓
R24	Day	52	66	✓
R25	Day	53	66	✓
R26	Day	53	66	✓
R27	Day	53	66	✓
R28	Day	53	66	✓
R29	Day	55	66	✓
R30	Day	54	66	✓
R31	Day	53	66	✓
R3	Day	53	66	✓
R33	Day	52	66	✓
R34	Day	51	66	✓
R35	Day	51	66	✓
R36	Day	50	66	✓
R37	Day	49	66	✓
R38	Day	48	66	✓
R39	Day	48	66	✓
R40	Day	47	66	✓
Other Receivers				
C1	When in use	62	70	✓
C2	When in use	55	70	✓
I1	When in use	43	75	✓
I2	When in use	55	75	✓

Note: 1: Prediction to worst case floor of receiver. (ie ground or first floor).

7 Construction Recommendations

The results of the noise assessment demonstrate that levels during standard construction hours satisfy the noise management levels at the nearest receivers to the project during construction/demolition activities. Notwithstanding, it is recommended that noise management and mitigation measures be adopted during noise intensive construction/demolition activities.

Recommendations for consideration during construction/demolition activities for this project may include:

- implement boundary fences/retaining walls as early as possible to maximise their attenuation benefits to surrounding receivers;
- toolbox and induction of personnel prior to shift to discuss noise control measures that may be implemented to reduce noise emissions to the community;
- where possible use mobile screens or construction hording to act as barriers between construction works and receivers;
- all plant should be shut down when not in use. Plant to be parked/started at farthest point from relevant assessment locations;
- operating plant in a conservative manner (no over-revving);
- selection of the quietest suitable machinery available for each activity;
- avoidance of noisy plant/machinery working simultaneously where practicable;
- minimisation of metallic impact noise;
- all plant are to utilise a broadband reverse alarm in lieu of the traditional hi frequency type reverse alarm; and
- undertake letter box drops to notify receivers of potential works.

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8 Discussion and Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Assessment to quantify potential impacts from the proposed food and drink, kiosk and service station premises to be established at 601-605 Great Western Highway, Greystanes, NSW.

The assessment has quantified potential operational emissions pertaining to customer generated noise, including light vehicles, truck deliveries and mechanical plant.

The results of the NA demonstrate that emissions from the project would satisfy the relevant PNTL at all assessed receivers for all assessment periods.

Furthermore, sleep disturbance is not anticipated, as emissions from operational and impact noise are predicted to remain below the EPA screening criterion for sleep disturbance and awakenings.

Modelled noise emissions from project construction and demolition activities identify that relevant noise management levels will be satisfied. Notwithstanding, noise management measures are provided in Section 7 of this report to reduce potential impacts on surrounding receivers.

Based on the findings of the Noise Assessment, it is recommended Council approve the project taking into consideration the noise control and management strategies provided in this report.

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Appendix A - Glossary of Terms

A number of technical terms have been used in this report and are explained in **Table A1**.

Table A1 Glossary of Terms

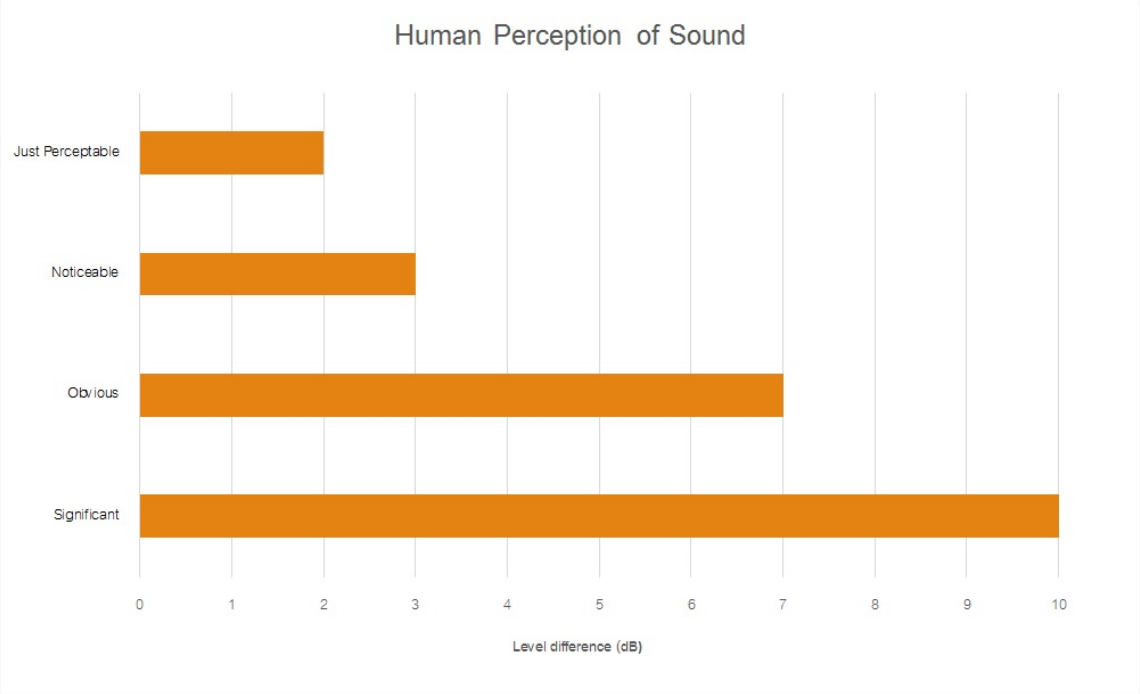
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured LA90 statistical noise levels.
Ambient Noise	The noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sound is dominant.
Extraneous Noise	Noise resulting from activities that are not typical of the area. Atypical activities include sources such as construction and holiday period traffic.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(Z), dB(L)	Decibels Linear or decibels Z-weighted.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels.
LA90	Commonly referred to as the background noise, this is the level exceeded 90 % of the time.
LAeq	The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period.
LAmax	The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval.
RBL	The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's.
Sound power level (LW)	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment. Or a measure of the energy emitted from a source as sound and is given by : = 10.log10 (W/Wo) Where: W is the sound power in watts and Wo is the sound reference power at 10-12 watts.

Table A2 provides a list of common noise sources and their typical sound level.

Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA

Source	Typical Sound Level
Threshold of pain	140
Jet engine	130
Hydraulic hammer	120
Chainsaw	110
Industrial workshop	100
Lawn-mower (operator position)	90
Heavy traffic (footpath)	80
Elevated speech	70
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

Figure A1 – Human Perception of Sound



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Appendix B - Site Plans

verify all dimensions on site prior to commencement of work
figured dimensions to be taken in preference to scaling

amendments

issue	details	by	date
A	issue for pre DA	GLA	07/11/2017
B	issue for information	GLA	10/11/2017
C	7-11 fuel store and kiosk location revised	GLA	14/11/2017
D	issue for information	GLA	28/11/2017
E	entry and exit driveways adjusted	GLA	04/12/2017
F	for information	MCJ	14/12/2017

SITE + FLOOR PLAN
PROPOSED FUEL STORE & FAST FOOD PREMISES
601-605 GREAT WESTERN HIGHWAY
GREYSTANES NSW
FOR GREYSTANES SERVICE CENTRE PTY LTD
17010 DA 1.04 F

copyright of this design remains the property of d + r architects october 2017

scale 1:200 @ A1

0 1 2 4 8 16m

IsaacProperty

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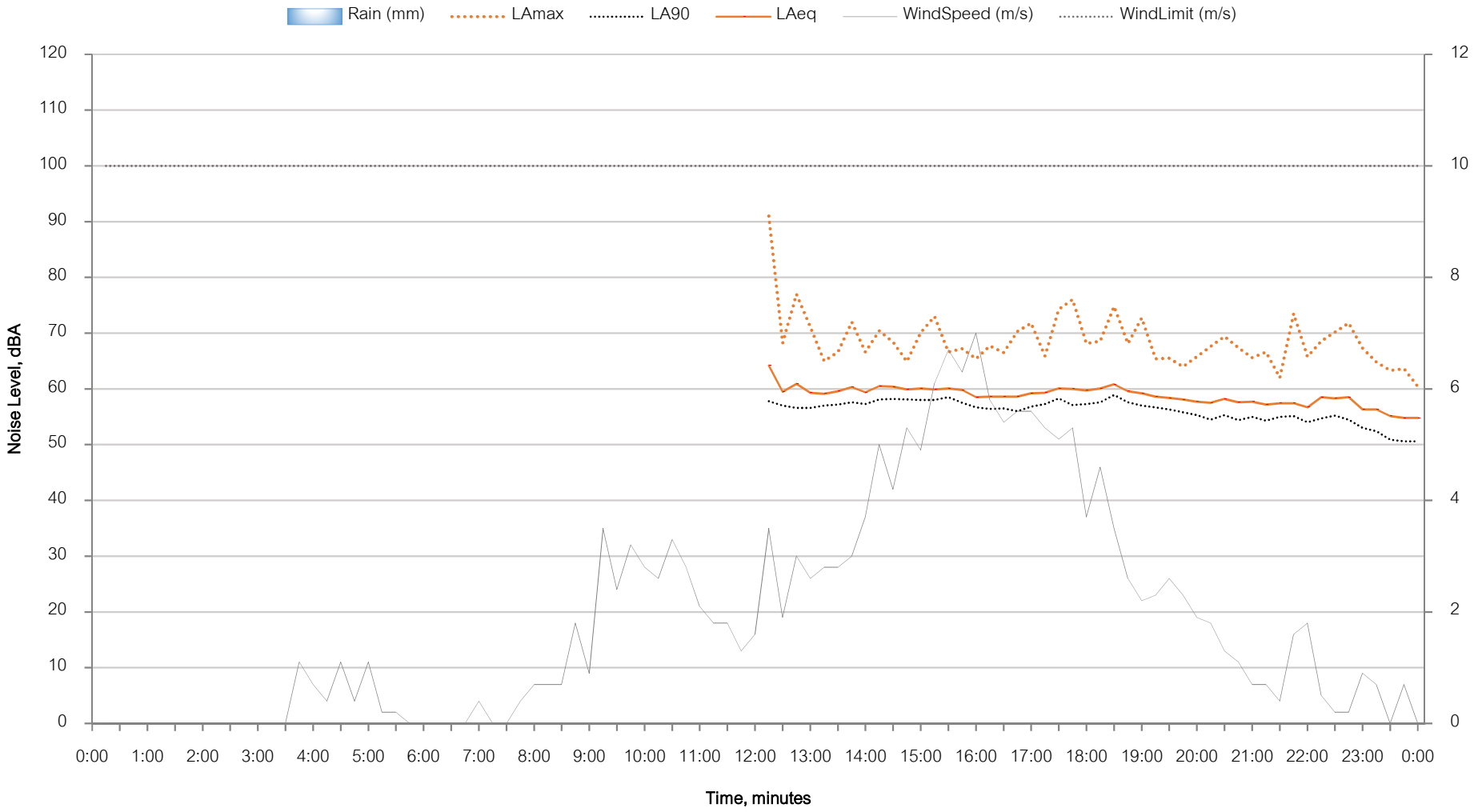
TEL: (02) 9569 8711
FAX: (02) 9569 8799
E Mail:architects@drarchitecture.com.au

Appendix C - Noise Logging Charts

Measured Ambient Noise Levels

Location 1 - 601-605 Great Western Highway Greystanes

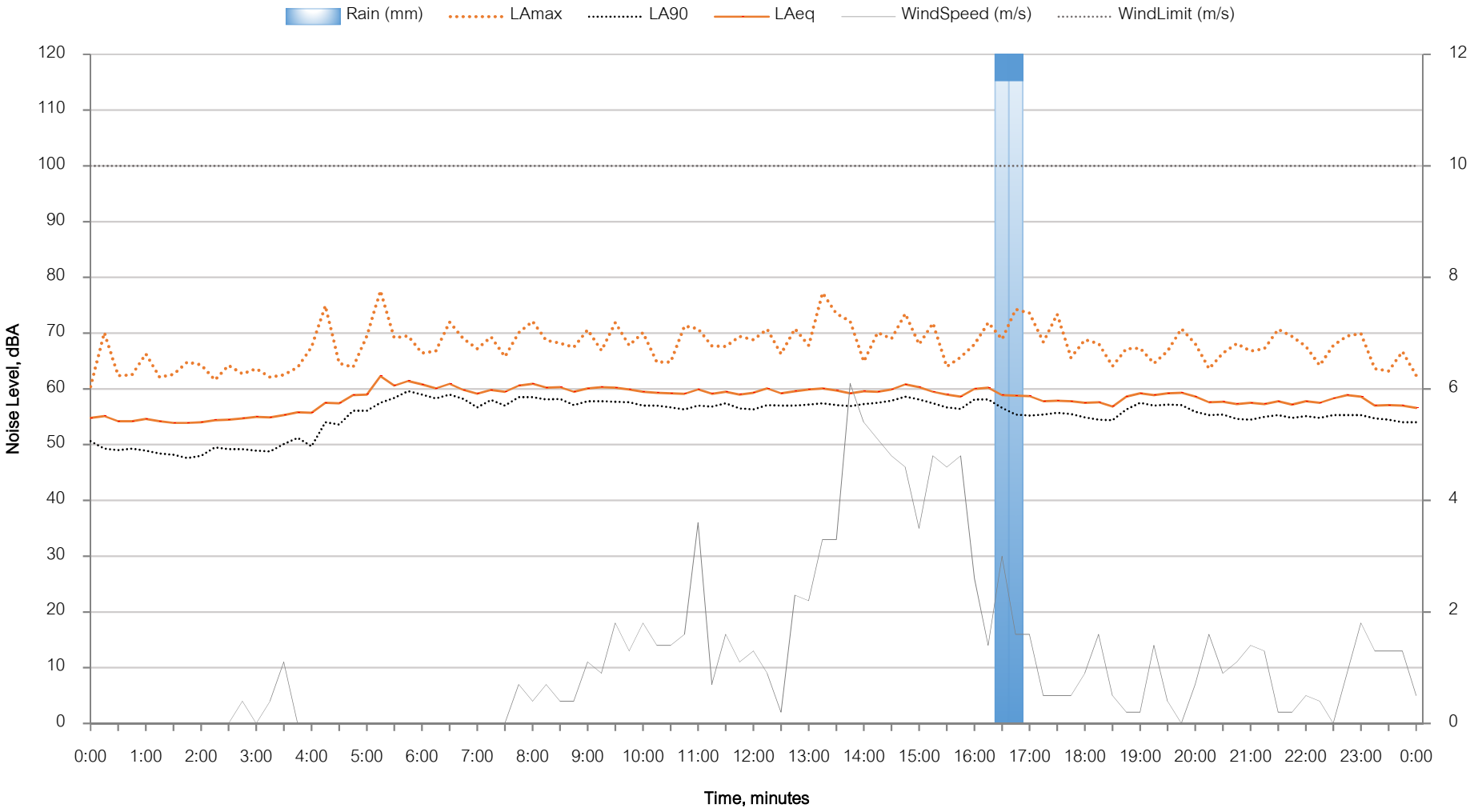
Thursday, 23-11-17



Measured Ambient Noise Levels

Location 1 - 601-605 Great Western Highway Greystanes

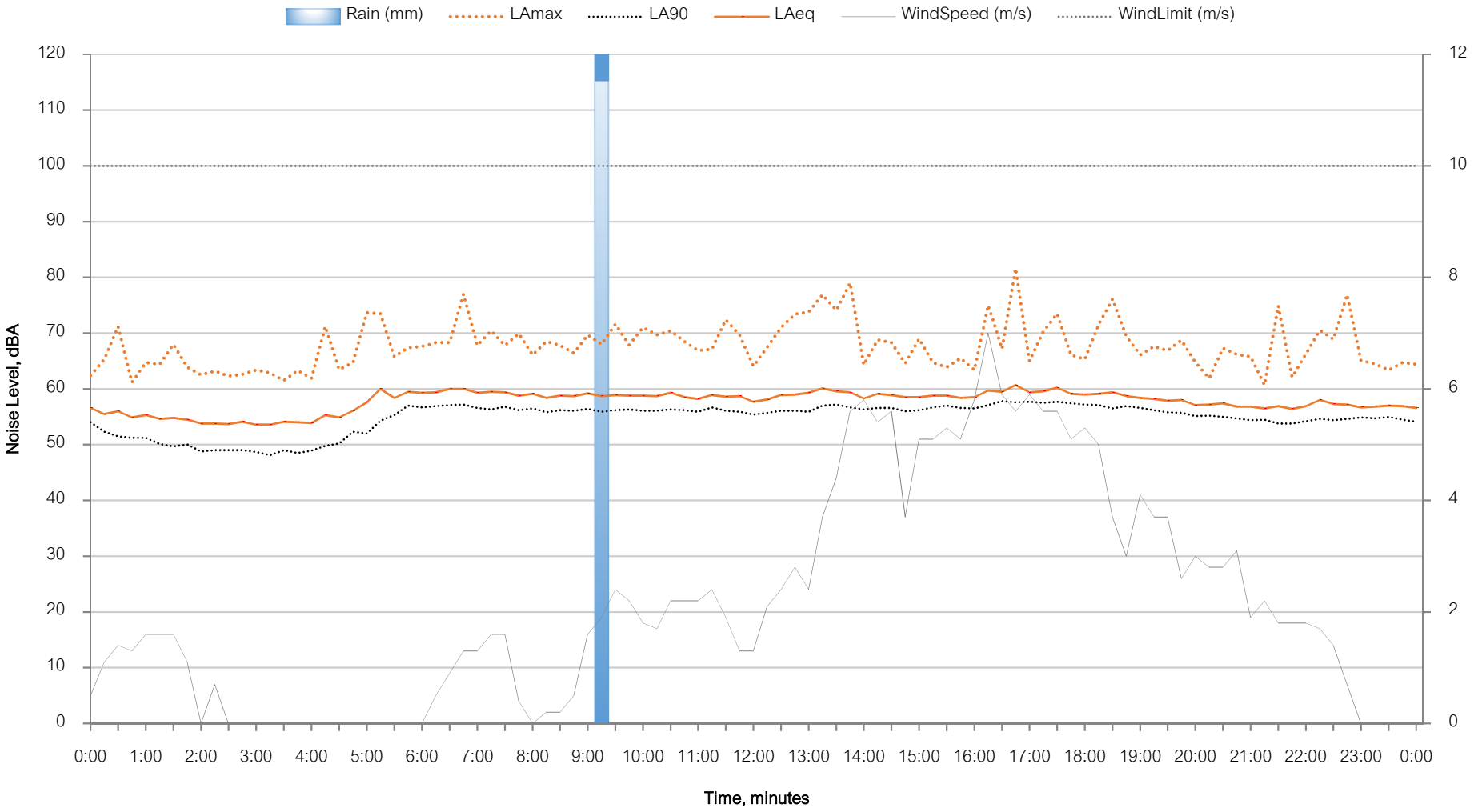
Friday, 24-11-17



Measured Ambient Noise Levels

Location 1 - 601-605 Great Western Highway Greystanes

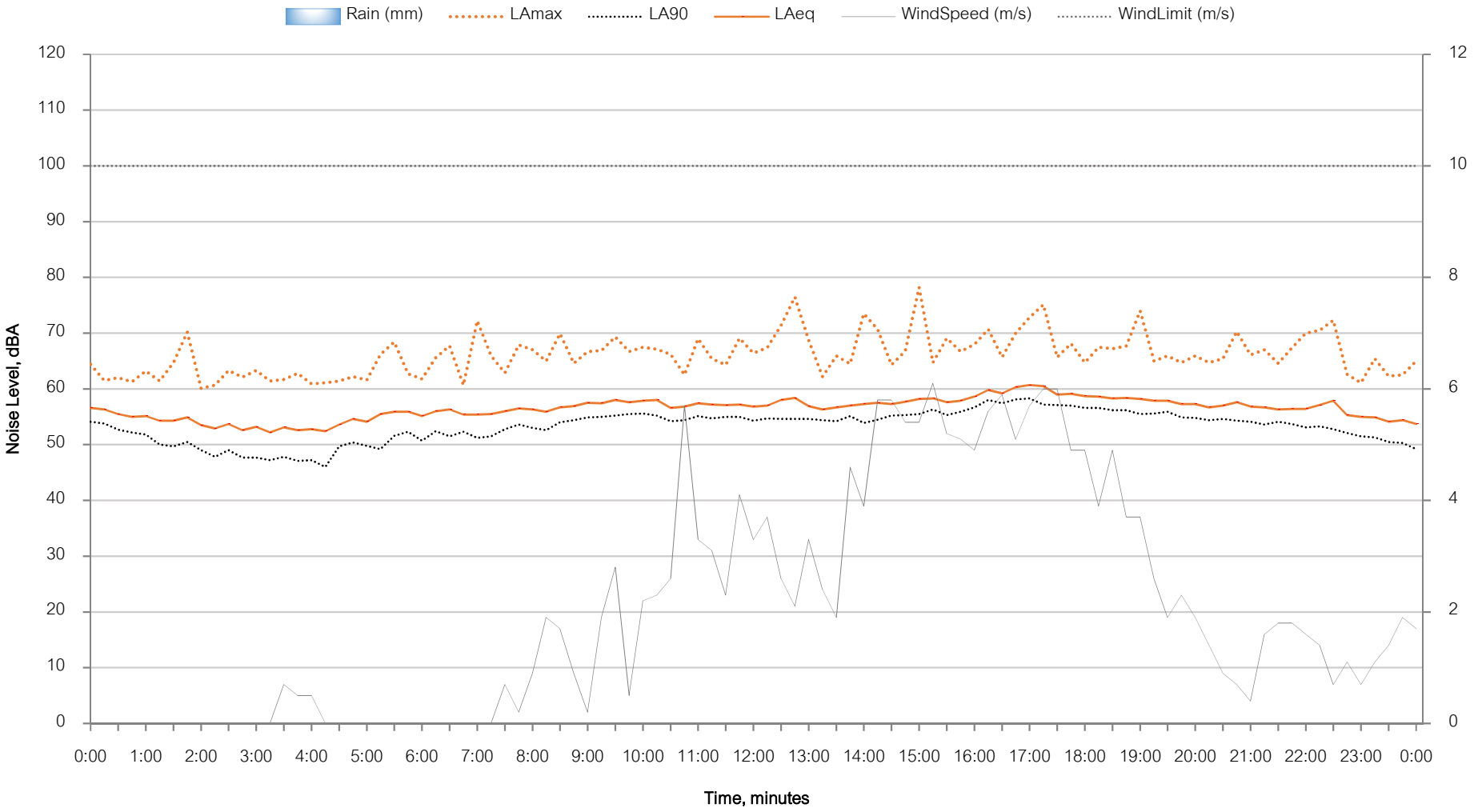
Saturday, 25-11-17



Measured Ambient Noise Levels

Location 1 - 601-605 Great Western Highway Greystanes

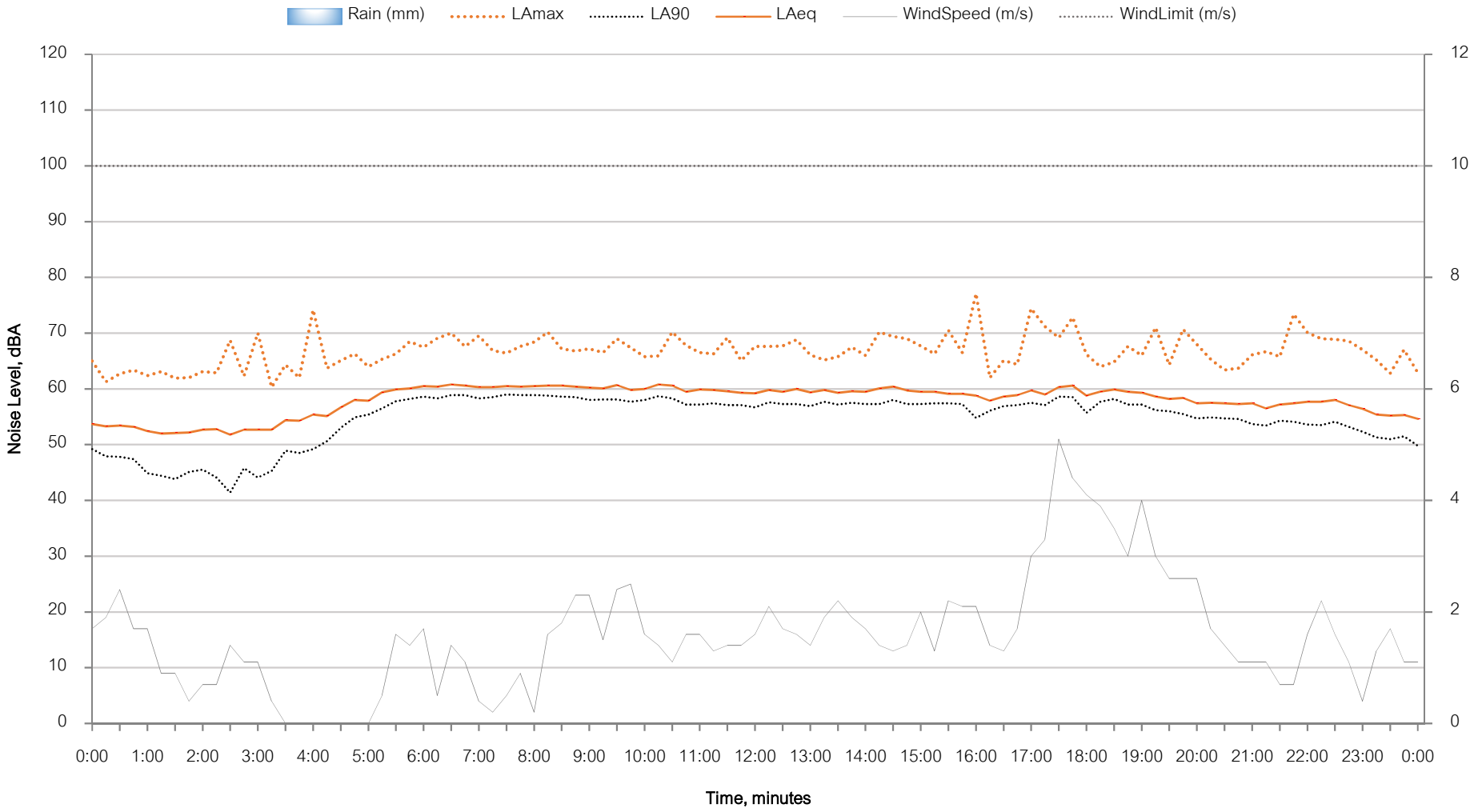
Sunday, 26-11-17



Measured Ambient Noise Levels

Location 1 - 601-605 Great Western Highway Greystanes

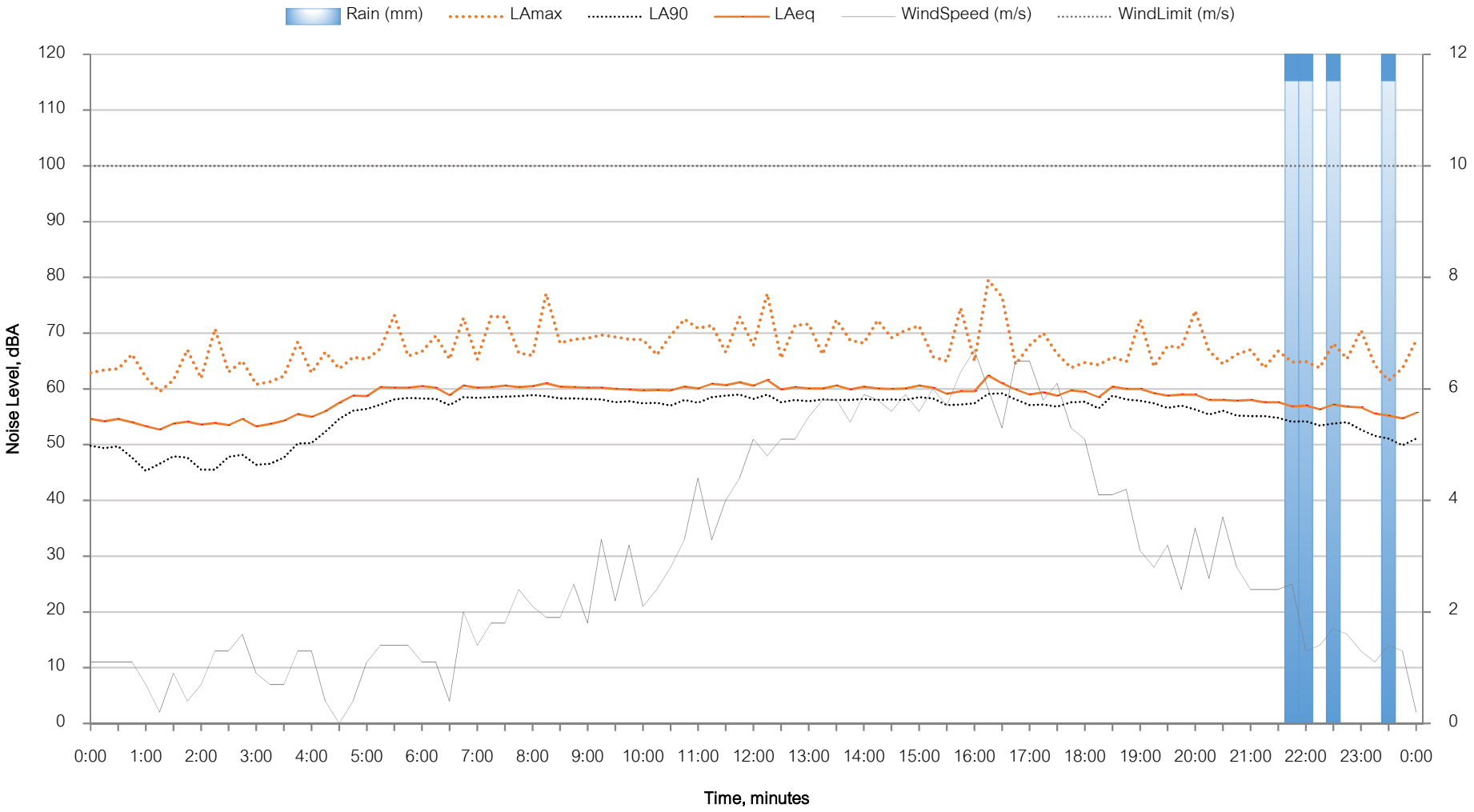
Monday, 27-11-17



Measured Ambient Noise Levels

Location 1 - 601-605 Great Western Highway Greystanes

Tuesday, 28-11-17



Measured Ambient Noise Levels

Location 1 - 601-605 Great Western Highway Greystanes

Wednesday, 29-11-17

Measured Ambient Noise Levels

Location 1 - 601-605 Great Western Highway Greystanes

Thursday, 30-11-17

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MAC
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