Noise Assessment

Proposed Service Station Redevelopment

4 Dunheved Road, Werrington, NSW.

Prepared for : KDC Pty Ltd

March 2017

MAC
Muller Acoustic Consulting

Document Information

Noise Assessment

Proposed Service Station Redevelopment

4 Dunheved Road, Werrington, NSW.

Prepared for: KDC Pty Ltd

PO Box 70

The Junction NSW 2291

Prepared by: Muller Acoustic Consulting Pty Ltd
PO Box 262, Newcastle NSW 2300
ABN: 36 602 225 132
P: +61 2 4920 1833
www.mulleracoustic.com

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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 a proposed service station redevelopment which incorporates a take away food and drink premises (the 'project') at an existing service station site, 4 Dunheved Road, Werrington, NSW 2747.

The development includes demolition of existing commercial building, car wash and mechanical workshop and the establishment of a service station kiosk and take away food and drink premises. The redevelopment does not include changes to the existing canopy. The NA has quantified potential operational, sleep disturbance and construction (and 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) 2000, NSW Industrial Noise Policy (INP);
- Department of Environment and Climate Change (DECC) 2009, Interim Construction Noise Guideline (ICNG);
- Australian Standard AS 2436-2010 (R2016) Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites; and
- Standards Australia AS 1055.1:1997 - Acoustics - Description and measurement of environmental noise - General Procedures.

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 4 Dunheved Rd, Werrington, NSW. This locality comprises a mix of commercial and residential land uses. The nearest residential receivers to the project are situated to the east of the project site in Lockyer Avenue and to the west in Poets Glen. The site directly to the north of the project is currently undeveloped, however is proposed for future redevelopment. Therefore, a hypothetical receiver has been included in this assessment to quantify project emissions to the north of the project.

The project proposes the construction of a new service station building and take away food and drink tenancy with a drive-thru facility on an existing commercial site. The project will retain the existing ten petrol bowsers and 12 light vehicle car parks with 10 additional car park spaces to be constructed as part of the redevelopment. 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 in close proximity to the project has been completed and are summarised in Table 1. Figure 1 provides a locality plan identifying the position of these receivers in relation to the project.

Table 1 Receiver Locations

Receivers	Receiver Name or Address	Coordinates		Receiver Category
R1	43 Lockyer Avenue	290874	6263704	Residential
R2	45 Lockyer Avenue	290858	6263708	Residential
R3	46 Lockyer Avenue	290839	6263713	Residential
R4	47 Lockyer Avenue	290818	6263714	Residential
R5	48 Lockyer Avenue	290798	6263734	Residential
R6	125 Henry Lawson Avenue	290804	6263755	Residential
R7	123 Henry Lawson Avenue	290806	6263776	Residential
R8	121 Henry Lawson Avenue	290809	6263791	Residential
R9	119 Henry Lawson Avenue	290812	6263810	Residential
R10	36 Grazier Crescent	290680	6263849	Residential
R11	38 Grazier Crescent	290672	6263833	Residential
R12	1 Poets Glen	290663	6263814	Residential
R13	2 Poets Glen	290671	6263798	Residential
R14	3 Poets Glen	290668	6263777	Residential
R15	4 Poets Glen	290668	6263757	Residential
R16	5 Poets Glen	290652	6263741	Residential
FD1	Future Development 1	290741	6263836	Residential
C1	Shopping Centre	290709	6263788	Commercial
C2	Restaurant (Red Rooster)	290732	6263679	Commercial
C3	Werrington Sports Club	290629	6263684	Commercial

FIGURE 1

LOCALITY PLAN

REF: MAC160361

0 50m

KEY	
R1	RECEIVER
	PROJECT SITE
L1	LOGGER LOCATION

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*Imagery Source : nearmap

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	Operational
Customer light vehicles (service station 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)	x
Waste Collection	Day (7am to 6pm)	✓
	Evening (6pm to 10pm)	✓
	Night (10pm to 7am)	x
Fuel Deliveries	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)	✓

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

3 Noise Policy and Guidelines

3.1 Operational Noise

The EPA released the NSW INP in January 2000. The INP provides a process for establishing noise criteria for consents and licences enabling the EPA to regulate noise emissions from scheduled premises under the Protection of the Environment Operations Act 1997.

The specific policy objectives of the INP are:

- to establish noise criteria that would protect the community from excessive intrusive noise and preserve amenity for specific land uses;
- to use the criteria as the basis for deriving project specific noise levels;
- to promote uniform methods to predict, quantify and assess noise impacts, including a procedure for evaluating meteorological effects;
- to outline a range of mitigation measures that could be used to minimise noise impacts;
- to provide a formal process to guide the determination of feasible and reasonable noise limits for consents or licences that reconcile noise impacts with the economic, social and environmental considerations of developments; and
- to carry out functions relating to the prevention, minimisation and control of noise from premises scheduled under the Act.

3.1.1 Assessing Intrusiveness

The intrusiveness criterion essentially means that the equivalent continuous noise level (LA_{eq}) from the project should not be more than 5dB above the existing rating background level (RBL) in any assessment period. Therefore, when assessing intrusiveness, the background noise needs to be measured.

3.1.2 Assessing Amenity

The amenity assessment is based on noise criteria relevant to a specific land use or locality. The criteria relate only to limiting cumulative or combined levels of industrial noise in a locality. Where existing industrial noise approaches the criterion value, then noise levels from proposed industries need meet the amenity criteria so that cumulative noise or 'industrial-creep' is minimised. The amenity assessment

methodology takes into consideration areas of high traffic noise when assessing ambient industrial noise.

Private residences and other sensitive receivers potentially affected by the project are safeguarded by the EPA's suburban amenity category as per Table 2.1 of the INP. Table 2.1 of the INP for receivers is reproduced in Table 3.

Table 3 Amenity Criteria

Type	Period	Recommended LAeq Noise Level dBA		Amenity Criteria, LAeq(period)
		Acceptable	Recommended Maximum	
Residential	Day	55	60	55
	Evening	45	50	45
	Night	40	45	40
Commercial	When in use	65	70	65

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

3.2 Sleep Disturbance

The most important impact of intermittent noise would be to potentially disturb the sleep of nearby residents. The EPA provides guidance on assessing sleep disturbance for industrial and commercial sites. The EPA nominates that a screening criterion of background noise level (L_{A90}) plus 15dB shall apply to maximum noise level events from the site which are to be calculated at one metre from the bedroom facade at the nearest residential properties. Where noise levels have been calculated above the screening criterion, additional analysis should be undertaken, referencing guidance on maximum noise levels and sleep disturbance listed in the Road Noise Policy (RNP) (Department of Environment, Climate Change and Water, DECCW, 2011). This guidance states:

- maximum internal noise levels below 50 to 55dB are unlikely to wake sleeping occupants; and
- one or two noise events per night, with maximum internal noise levels of 65 to 70dBA, are not likely to affect the health and wellbeing of occupant's significantly.

It is commonly accepted by acoustic practitioners and regulatory bodies that a partially open window will reduce external noise levels by 10dBA. Therefore, external noise levels in the order of 60 to 65dBA calculated at the facade of a residence are unlikely to cause sleep disturbance affects at worst case (ie with windows open). Similarly, the World Health Organisation (WHO, 1999) suggests that levels below 45dBA inside homes are unlikely to wake sleeping occupants. The descriptors LAmax and LA1 are considered interchangeable by the EPA. If noise levels over the screening criterion were identified, then additional analysis would consider factors such as:

- how often the events would occur;
- the time the events would occur (between 10pm and 7am); and
- whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods).

The project proposes to operate between 10pm and 7am, therefore, sleep disturbance has been considered in this assessment.

3.3 Interim Construction Noise Guideline

The assessment and management of noise from construction works (and demolition) is completed using the ICNG. The ICNG is specifically aimed at managing noise from construction works and is used to assist in setting statutory conditions in licences or other regulatory instruments.

The ICNG sets out procedures to identify and address the impacts of construction noise on residences and other sensitive land uses.

3.3.1 Standard Hours for Construction

Table 4 summarises the ICNG recommended standard hours for construction activities where the noise from construction is audible at residential premises.

Table 4 Recommended Standard Hours for Construction

Day	Preferred Construction Hours
Monday to Friday	7am to 6pm
Saturdays	8am to 1pm
Sundays or Public Holidays	No construction

These 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.

3.3.2 Construction Noise Management Levels

Table 5 reproduces the ICNG management levels for residential receivers. The construction noise management levels are the sum of the management level and relevant rating background level (RBL) for each specific assessment period.

Table 5 ICNG Residential Management Levels

Time of day	Management level LAeq (15-minute)	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 + 10dB.[1]	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured LAeq(15 min) 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 works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75dBA.	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 works near schools), or mid-morning or mid-afternoon for works near residences. -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 + 5dB.	A strong justification would typically be required for works 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.

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 logging was conducted adjacent to the nearest residential receivers situated in Dunheved Road, Werrington, NSW. The selected monitoring location is shown in **Figure 1.**

The unattended noise survey was 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 a Svantek Type 1, 977 noise analyser from Wednesday 23 November 2016 to Friday 2 December 2016. Observations on-site identified the surrounding locality was typical of a suburban environment, with wind, birds and noise from Dunheved Road traffic. 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 Chapter 3 of the INP. Residential receivers for this project have been classified under the EPA's suburban amenity category. This criterion is used in conjunction with the intrusiveness criteria to determine the limiting criteria. The results of long-term unattended noise monitoring are provided in **Table 6**. The noise monitoring charts for the background logging assessment are provided in **Appendix C**.

Table 6 Background Noise Monitoring Summary

Monitoring Location	Period[1]	Measured Background Noise Level (LA90), RBL, dBA	Measured LAeq, dBA
L1	Day	53	68
	Evening	49	67
	Night	39	63

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: Excludes periods of wind or rain affected data. Meteorological data obtained from the Bureau of Meteorology Bankstown Airport (33.9181°S 150.9864°E 7m AMSL).

4.2 Project Specific Noise Levels

The operational noise emission criteria for the project have been set in accordance with Section 3.0 of the INP. The intrusiveness and amenity design criteria have been set, based on unattended logging measurements. The Project Specific Noise Levels (PSNLs) (project criteria) are the lower of the intrusive or amenity criteria. However, in accordance with the INPs application notes, where the amenity criterion is marginally lower than the intrusive criteria, both may be applied. This is due to the amenity being assessed over several hours while the intrusive is assessed over a fifteen-minute period.

R1 to R5 and R16 are closest to Dunheved Road and have adopted a criteria representative of the logging location (L1). R6 to R15 and FD1 have a greater offset from Dunheved Road, therefore, as a conservative measure R6 to R15 and FD1 have been assigned a lower criteria that is consistent with the suburban amenity levels as per the INP. The PSNLs for the proposal are presented in **Table 7.**

Table 7 Project Specific Noise Levels

Receiver Location	Period	RBL	Intrusiveness Criteria LAeq(15minute), dBA	Amenity Criterion LAeq(period), dBA	PSNL, dBA
R1 to R5 and R16	Day	53	58	57[1]	57[1]
	Evening	49	54	57[1]	54
	Night	39	44	53[1]	44
R6 to R15 and FD1	Day	53	58	55	55
	Evening	49	54	45	45
	Night	39	44	40	40
Commercial	When in use	N/A	N/A	65	65

Note 1: ANL is the LAeq(period) traffic, as per the INP.

4.3 Sleep Disturbance Criterion

Table 8 provides the sleep disturbance criterion for the nearest residential receivers. The sleep disturbance criterion has been derived based on the night RBL.

Table 8 Sleep Disturbance Noise Criterion

Location	Rating Background Level (RBL), LA90 dBA	Sleep Disturbance Noise Criterion LAmax, dBA
All receivers	39	54

4.3.1 Construction Noise Criteria

The construction noise management levels (criteria), established in accordance with the ICNG for the project are presented in **Table 9**.

Table 9 Construction Noise Management Levels

Location	Period	Rating Background Level (RBL), LA90 dBA	Noise Management Level LAeq(15min)
Residential receivers	Day	53	63
Commercial Receivers	Day	N/A[1]	70

Note 1: Not applicable when establishing construction criteria for this type of receiver.

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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 10 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 service station project sites. The sound power levels have been adjusted to account for duration over a fifteen-minute period.

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

Item and number modelled per 15 minutes	Sound Power Level, $LA_{eq(15min)}$ dBA	Source Height
Operational Noise Sources		
Cooling plant (x2)	75	1m
A/C plant (x2)	70	1m
Fuel tanker/deliveries (gravity fed) (x1)	82	0.3m[2]
COD (assumes x 30 customers per 15min)	77	1m
Truck deliveries (x1)	92	1.5m
Car idle and start up, drive off and tyre inflation point1 (x19)[1]	73	0.5m
Sleep Disturbance Noise Sources (LA_{max}), Night time periods (10pm to 7am)		
Fuel delivery impact noise or truck reverse alarm[3]	102	1.5m
Construction/Demolition $LA_{eq(15min)}$ dBA		
Road Trucks	103	1.5m
Excavator/Backhoe	106	1.5m
Hand tools	97	1.5m
Combined fleet construction/demolition noise level	108	1.5m

Note 1: This assumes tyre inflation system does not have an audible alarm.

Note 2: Fill points are situated at ground level or at a height just above ground level.

Note 3: Based on SAE type C reverse alarm and includes a 5dB adjustment for tonality. Assumed to be from any truck on site (eg waste collection, deliveries or customers).

It is noted that there are potentially multiple and varied plant items which may be used in the construction phase of this project. Notwithstanding, the adopted fleet sound power level is considered representative of construction activities for this type of project.

5.2 Noise Attenuation Assumptions

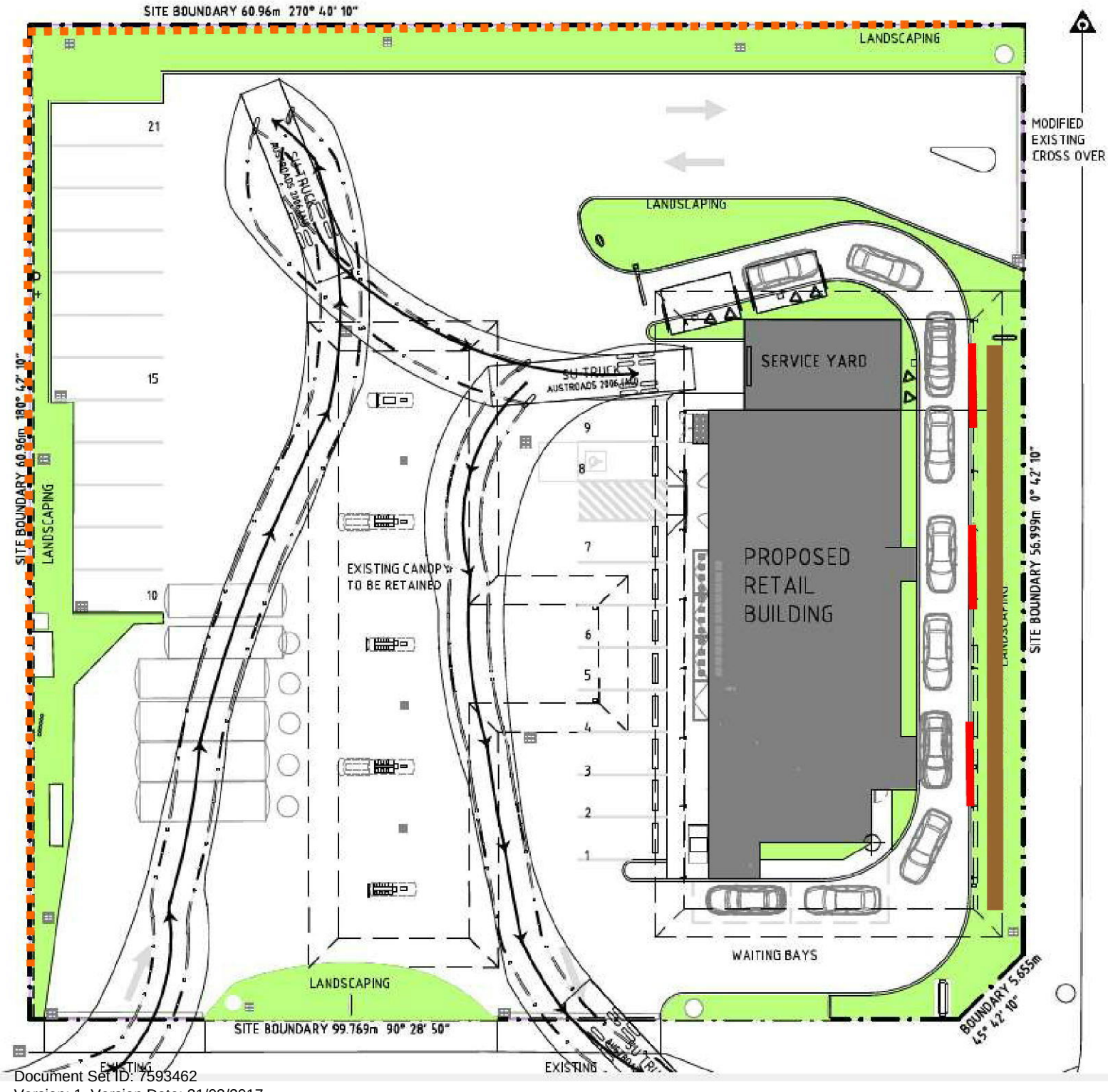
The noise model adopted the following noise controls:

- construction of an impervious barrier along the western and northern boundaries. The barriers should be constructed to an RL of 1.8m above the carpark level and consist of materials that have a surface density of at least 10kg/m^2, and not contain any gaps (ie colourbond or equivalent);
- Construction of an earthen mound running along the eastern boundary of the drive thru lane. The mound should be constructed to an RL of 0.9m above the drive thru level and not contain any gaps. (see **Figure 2** for indicative mound layout);
- construction of acoustic screens adjacent to the drive-thru order and pickup points. The screens are to be 4.0m in width and to an RL of 3.0m above ground level of the drive-thru lanes and consist of materials with a surface density of at least 10kg/m^2 (such as lapped and capped timber or equivalent) and not contain any gaps (see **Figure 2** for indicative acoustic screen layout); and
- the mechanical plant deck will be located within the service area and will be screened by an impervious barrier extending at least 500mm above the top of the condenser units.

FIGURE 2

INDICATIVE ACOUSTIC BARRIER/SCREEN POSITIONS

REF: MAC160361



PROPERTY DE
LOT NUMBER :
DEPOSITED PLAN N

N

KEY

- 1.8m BOUNDARY FENCE
- 0.9m DRIVE-THRU EARTHEN MOUND
- 3m DRIVE-THRU ACOUSTIC SCREENS

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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 the following sources:

- Customer car noise (driving around site, drive-thru or petrol bowsers) and tyre inflation;
- Truck idle/drive off, customers, 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 and are presented in Table 11. 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 service station sources or activities. Noise levels from combined activities are predicted to satisfy the relevant INP noise criteria at all nearest receivers.

Table 11 Combined Noise Predictions – All Receivers

Residential Receivers

Receiver	Predicted Noise Level, $LA_{eq(15min)}$ dBA			PSNL $LA_{eq(15min)}$ dBA			Compliant
	Day	Evening	Night	Day	Evening	Night	
R1	27	27	24	57	54	44	✓
R2	30	30	25	57	54	44	✓
R3	30	30	26	57	54	44	✓
R4	34	34	30	57	54	44	✓
R5	40	40	36	57	54	44	✓
R6	42	42	41	55	45	40	✓
R7	44	44	41	55	45	40	✓
R8	45	45	39	55	45	40	✓
R9	39	39	35	55	45	40	✓
R10	35	35	29	55	45	40	✓
R11	35	35	30	55	45	40	✓
R12	37	37	31	55	45	40	✓
R13	39	39	32	55	45	40	✓
R14	39	39	33	55	45	40	✓
R15	40	40	34	55	45	40	✓
R16	39	39	34	57	54	44	✓
FD1	45	45	39	55	45	40	✓

Other Receivers

Receiver	Period	Predicted Noise Level, $LA_{eq(15min)}$ dBA	PSNL $LA_{eq(15min)}$ dBA	Compliant
C1	When in Use	46	65	✓
C2	When in Use	36	65	✓
C3	When in Use	38	65	✓

6.2 Sleep Disturbance Noise 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 delivery or truck reverse alarm noise impacts are adopted for this assessment.

Predicted noise levels from L_{Amax} events for assessed receivers are presented in **Table 12**. Results identify that the sleep disturbance screening criterion will be satisfied for all assessed receivers.

Table 12 Sleep Disturbance Noise Levels

Location	Period	Predicted Noise Level, L_{Amax}, dBA	Screening Criterion, L_{Amax} dBA	Compliant
R1	Night	37	54	✓
R2	Night	37	54	✓
R3	Night	38	54	✓
R4	Night	40	54	✓
R5	Night	44	54	✓
R6	Night	44	54	✓
R7	Night	52	54	✓
R8	Night	48	54	✓
R9	Night	44	54	✓
R10	Night	44	54	✓
R11	Night	45	54	✓
R12	Night	45	54	✓
R13	Night	47	54	✓
R14	Night	49	54	✓
R15	Night	50	54	✓
R16	Night	51	54	✓
FD1	Night	51	54	✓

6.3 Construction Noise Results

Predictions identify that levels from construction/demolition have the potential to be above the adopted noise management levels for all assessed receivers. Therefore, recommendations to mitigate these exceedances 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 13** presents the results of modelled construction (and demolition) noise emissions with and without the noise walls in place.

Table 13 Construction/Demolition Noise Levels – All Receivers

Receiver	Period	Predicted Noise Level, $L_{Aeq(15min)}$ dBA (no noise control)	Predicted Noise Level, $L_{Aeq(15min)}$ dBA (with noise control)	Management Level $L_{Aeq(15min)}$ dBA
Residential Receiver				
R1	Day	49	49	63
R2	Day	50	50	63
R3	Day	52	52	63
R4	Day	62	62	63
R5	Day	66	66	63
R6	Day	64	64	63
R7	Day	58	58	63
R8	Day	54	53	63
R9	Day	52	50	63
R10	Day	54	47	63
R11	Day	55	49	63
R12	Day	56	48	63
R13	Day	58	50	63
R14	Day	58	51	63
R15	Day	59	52	63
R16	Day	60	53	63
FD1	Day	62	52	63
Other Receivers				
C1	When in use	63	63	70
C2	When in use	50	50	70
C3	When in use	57	51	70

7 Construction Recommendations

The results of the noise assessment demonstrate that levels during standard construction hours may impact the nearest receivers to the project during construction/demolition activities, with exceedances above the noise management level. 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 shutdown 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

MAC has completed a Noise Assessment to quantify potential noise impacts from the proposed service station redevelopment and establishment of take away food and drink premises to be established at 4 Dunheved Road, Werrington, NSW.

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

The results of the Noise Assessment demonstrate that emissions from the project would satisfy the relevant PSNL at all assessed receivers for all assessment periods following implementation of noise controls recommended in this report.

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

Modelled noise emissions from project construction and demolition activities identify that relevant noise management levels may be exceeded. Hence, noise management measures are provided in 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 current project design and 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.

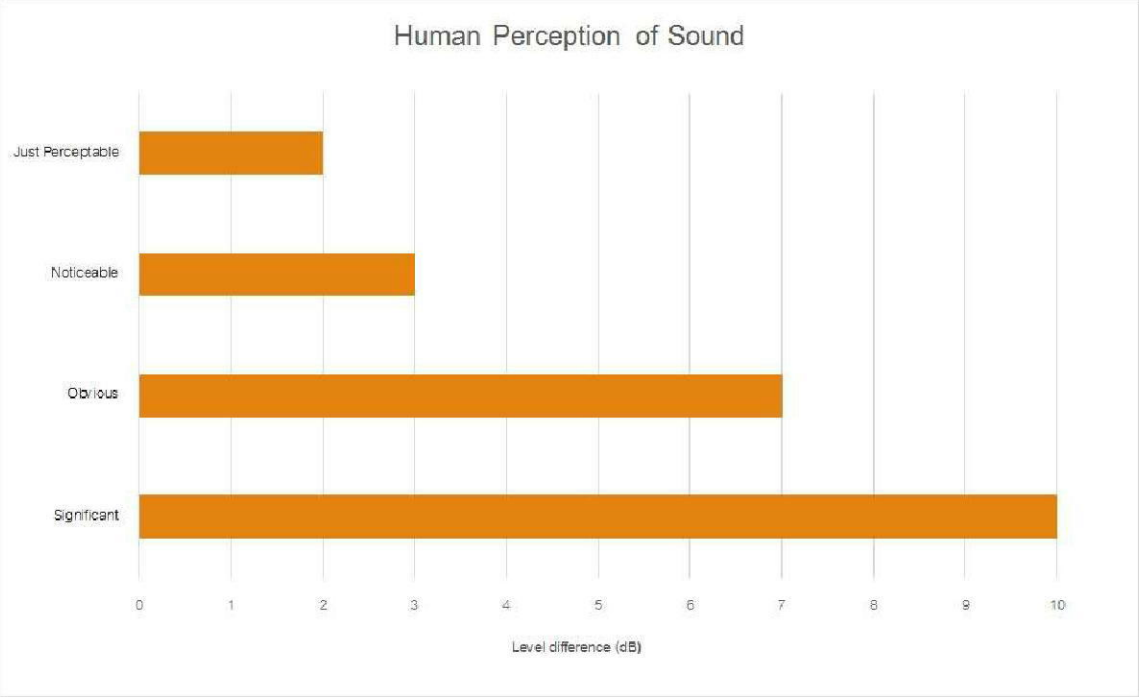
Table A1 Glossary of Terms	
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the INP as a single 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.
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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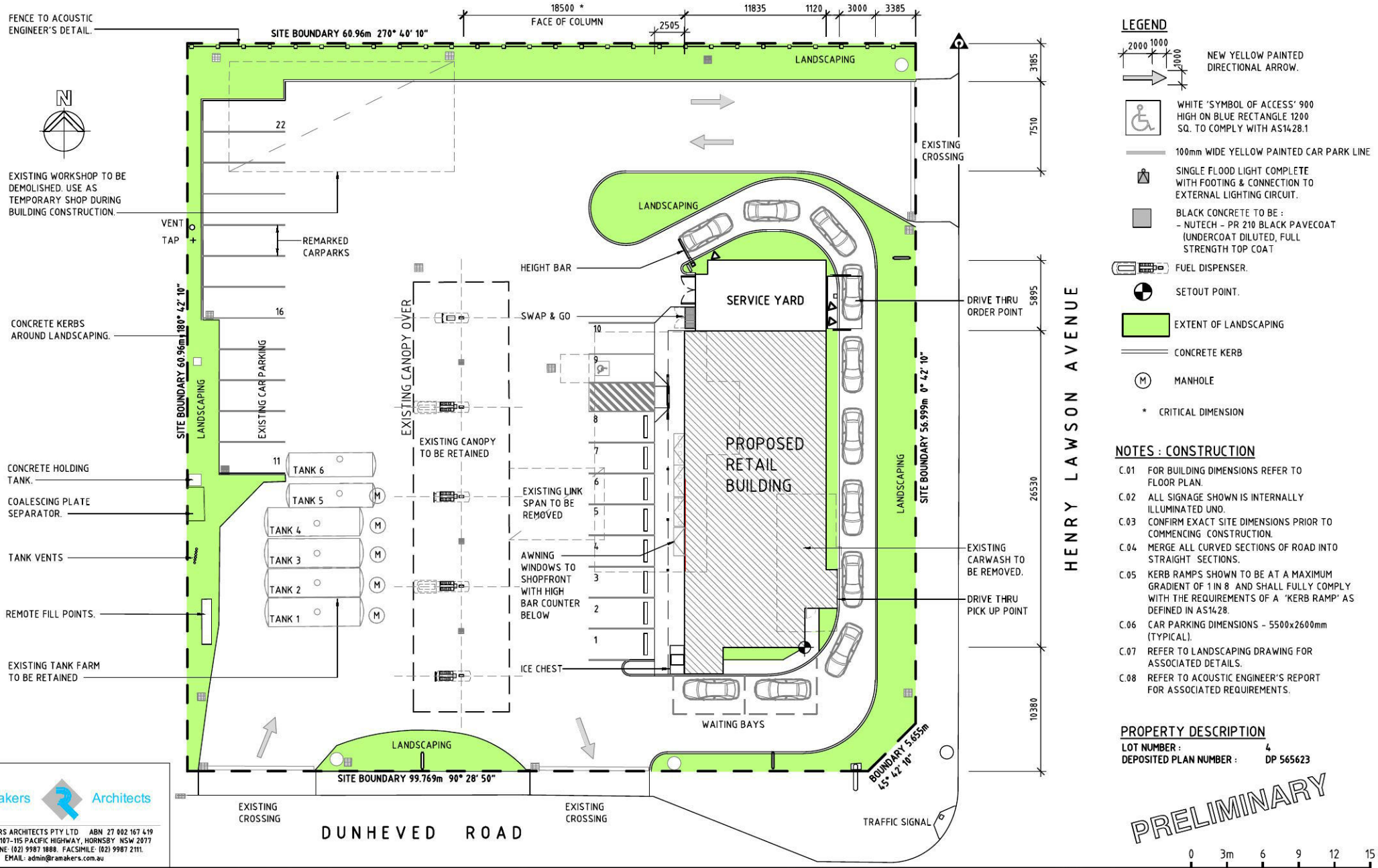
Appendix B - Site Plans



LEGEND

- NEW YELLOW PAINTED DIRECTIONAL ARROW.
- WHITE 'SYMBOL OF ACCESS' 900 HIGH ON BLUE RECTANGLE 1200 SQ. TO COMPLY WITH AS1428.1
- 100mm WIDE YELLOW PAINTED CAR PARK LINE
- SINGLE FLOOD LIGHT COMPLETE WITH FOOTING & CONNECTION TO EXTERNAL LIGHTING CIRCUIT.
- BLACK CONCRETE TO BE :
  - NUTECH - PR 210 BLACK PAVECOAT (UNDERCOAT DILUTED, FULL STRENGTH TOP COAT
- FUEL DISPENSER.
- SETOUT POINT.
- EXTENT OF LANDSCAPING
- CONCRETE KERB
- MANHOLE
- * CRITICAL DIMENSION

NOTES : CONSTRUCTION

C.01 FOR BUILDING DIMENSIONS REFER TO FLOOR PLAN.
C.02 ALL SIGNAGE SHOWN IS INTERNALLY ILLUMINATED UNO.
C.03 CONFIRM EXACT SITE DIMENSIONS PRIOR TO COMMENCING CONSTRUCTION.
C.04 MERGE ALL CURVED SECTIONS OF ROAD INTO STRAIGHT SECTIONS.
C.05 KERB RAMPS SHOWN TO BE AT A MAXIMUM GRADIENT OF 1 IN 8 AND SHALL FULLY COMPLY WITH THE REQUIREMENTS OF A 'KERB RAMP' AS DEFINED IN AS1428.
C.06 CAR PARKING DIMENSIONS - 5500x2600mm (TYPICAL).
C.07 REFER TO LANDSCAPING DRAWING FOR ASSOCIATED DETAILS.
C.08 REFER TO ACOUSTIC ENGINEER'S REPORT FOR ASSOCIATED REQUIREMENTS.

PROPERTY DESCRIPTION

LOT NUMBER : 4
DEPOSITED PLAN NUMBER : DP 565623

PRELIMINARY

0 3m 6 9 12 15

Ramakers Architects
RAMAKERS ARCHITECTS PTY LTD ABN 27 002 167 419
SUITE 3, 107-115 PACIFIC HIGHWAY, HORNSBY NSW 2077
TELEPHONE: (02) 9987 1888. FACSIMILE: (02) 9987 2111.
EMAIL: admin@ramakers.com.au

CONSULTANT REF. - 2873

A.01

CALTEX
Caltex Australia Petroleum Pty Ltd

REV.	BY	DATE	DESCRIPTION OF CHANGE
A	GM	--.--.--	DA ISSUE

REVISION

PROJECT
WERRINGTON NSW
CNR DUNHEVED RD &
HENRY LAWSON AVE

TITLE
PROJECT OYSTER
SITE PLAN - PROPOSED

SCALE 1:300

DEVELOPMENT APPLICATION

APPROVED | DATE

SIZE A3

DRAWING No. 28569-DA04

REV. -

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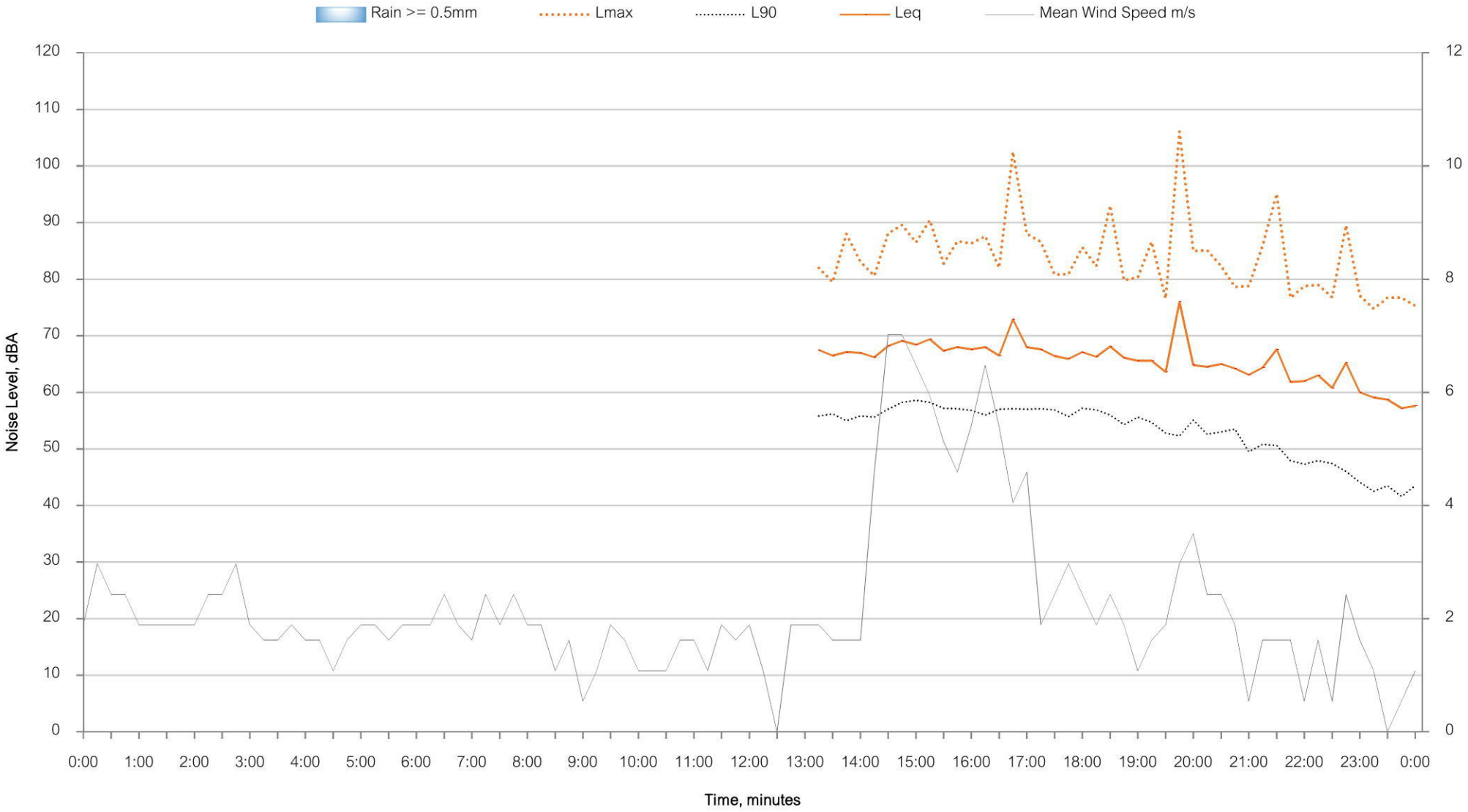
Appendix C - Noise Logging Charts

Background Noise Levels

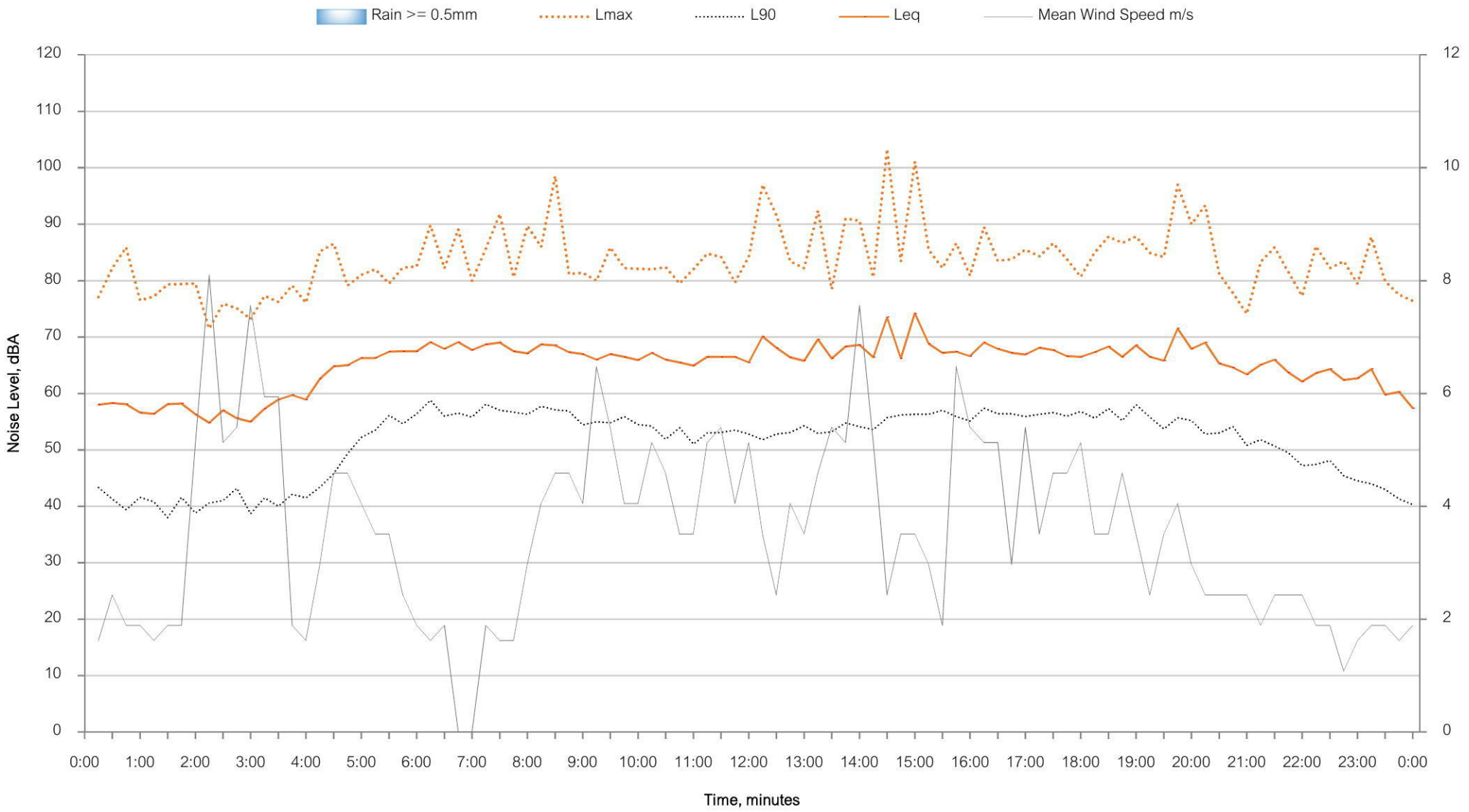
Caltex Werrington - Wednesday 23 November 2016



Document Set ID: 7593462
Version: 1, Version Date: 31/03/2017

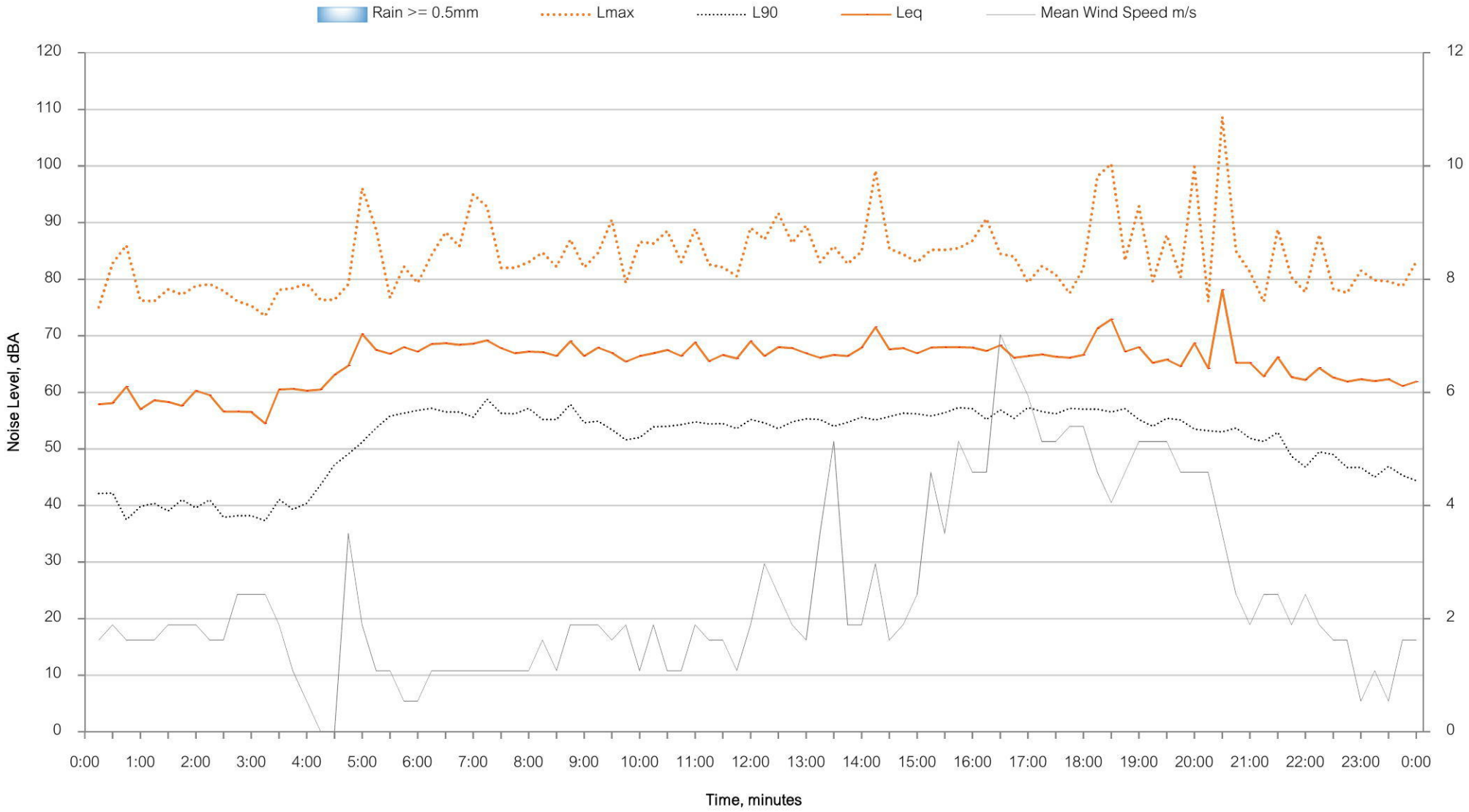
Background Noise Levels

Caltex Werrington - Thursday 24 November 2016



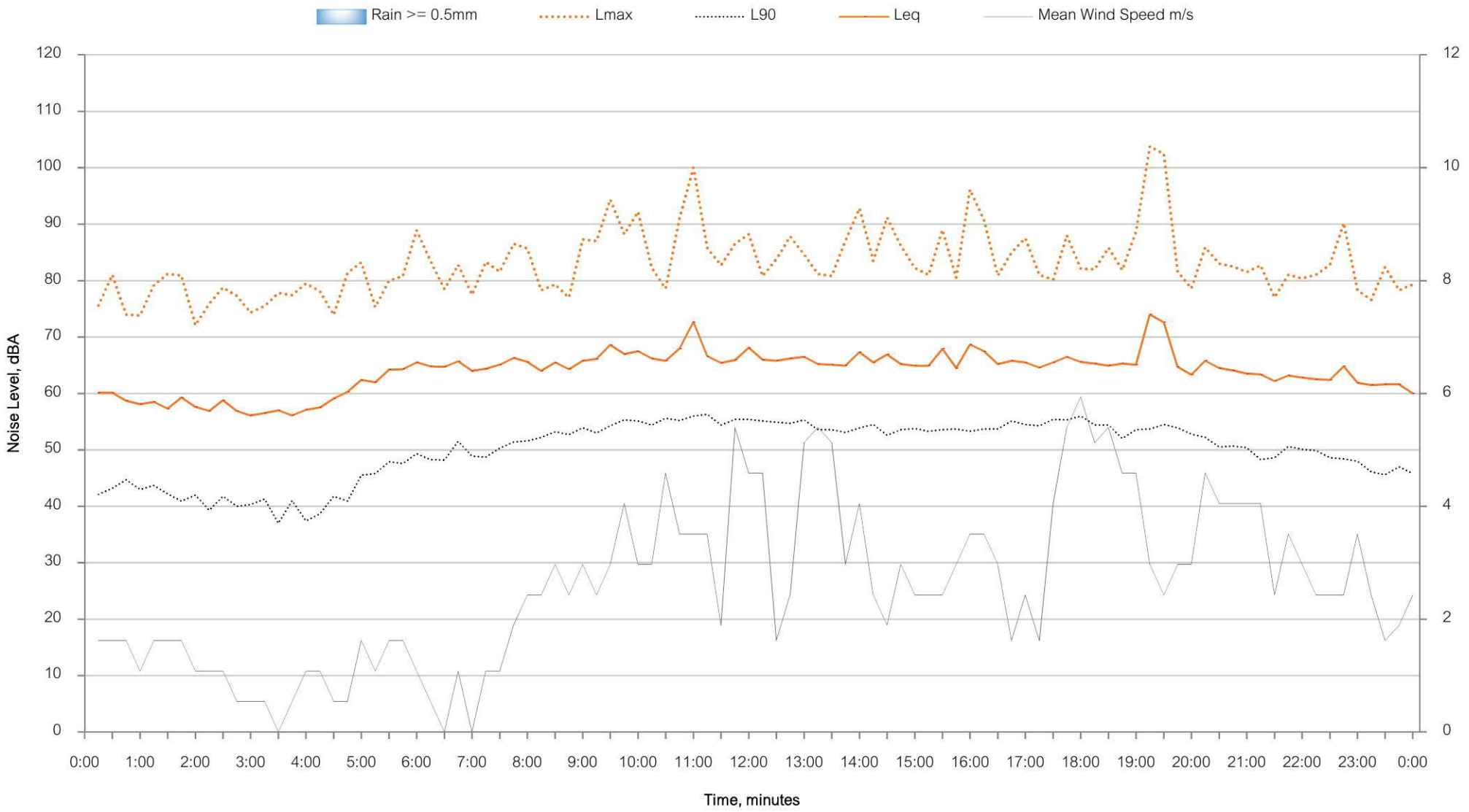
Background Noise Levels

Caltex Werrington - Friday 25 November 2016



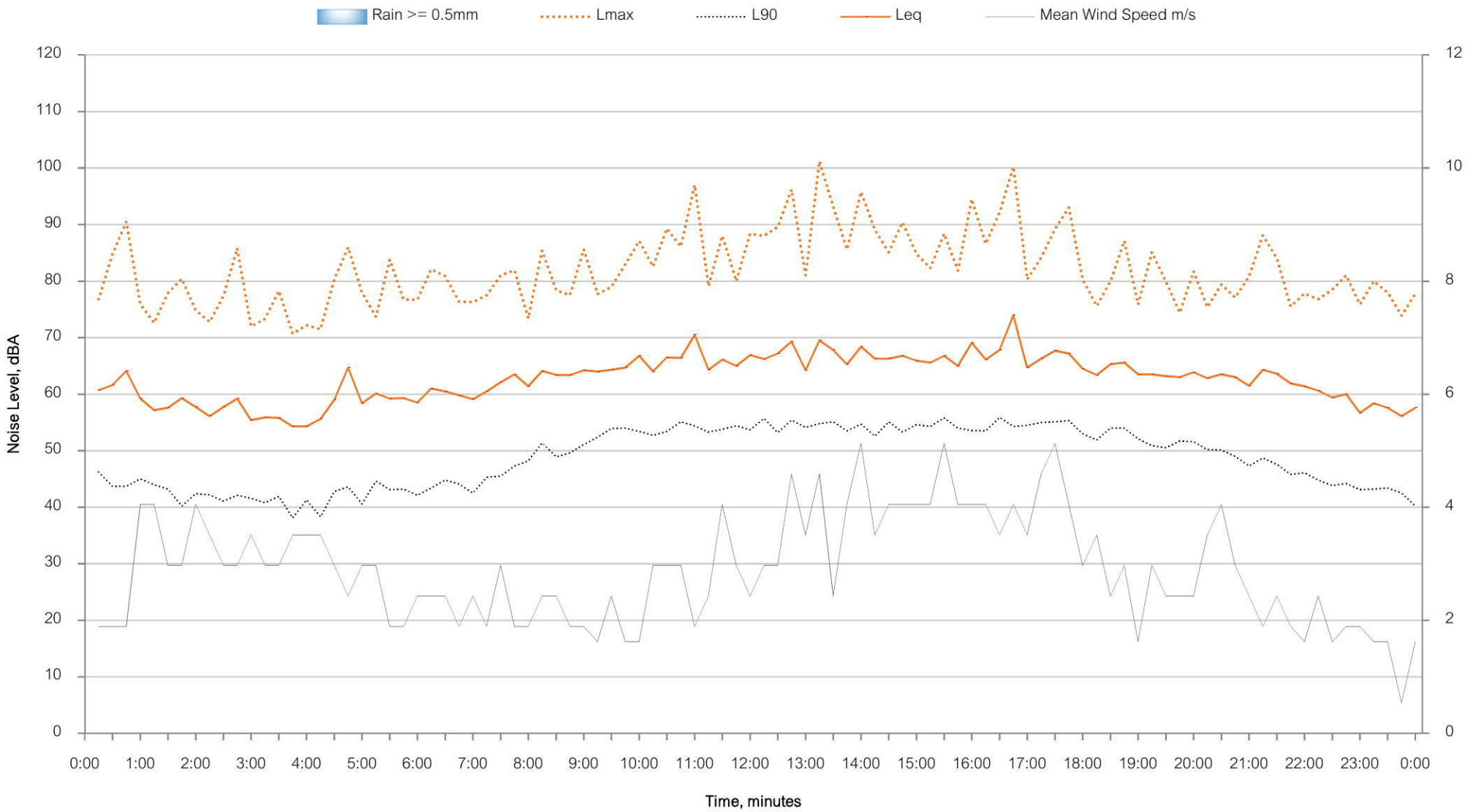
Background Noise Levels

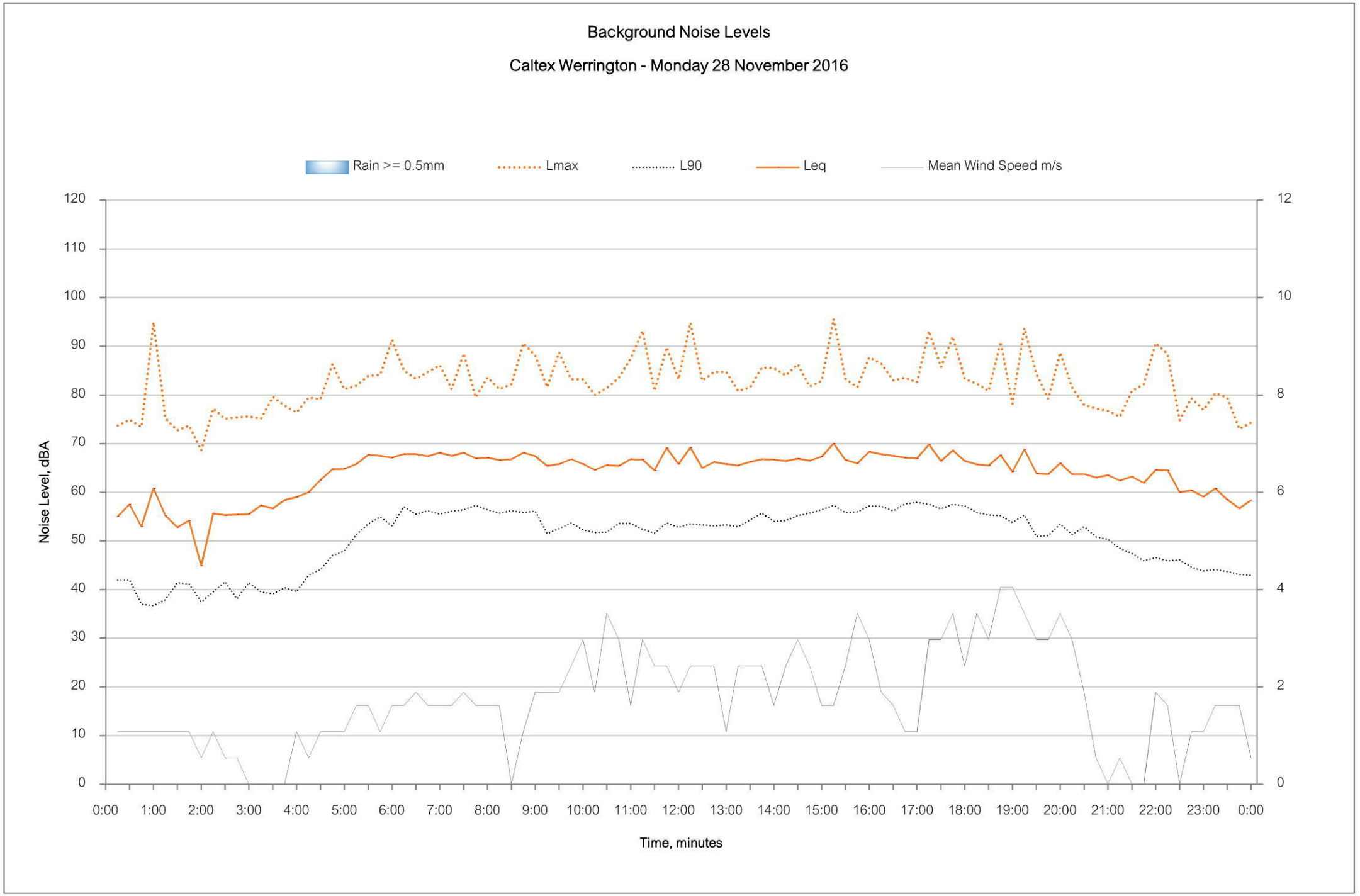
Caltex Werrington - Saturday 26 November 2016



Background Noise Levels

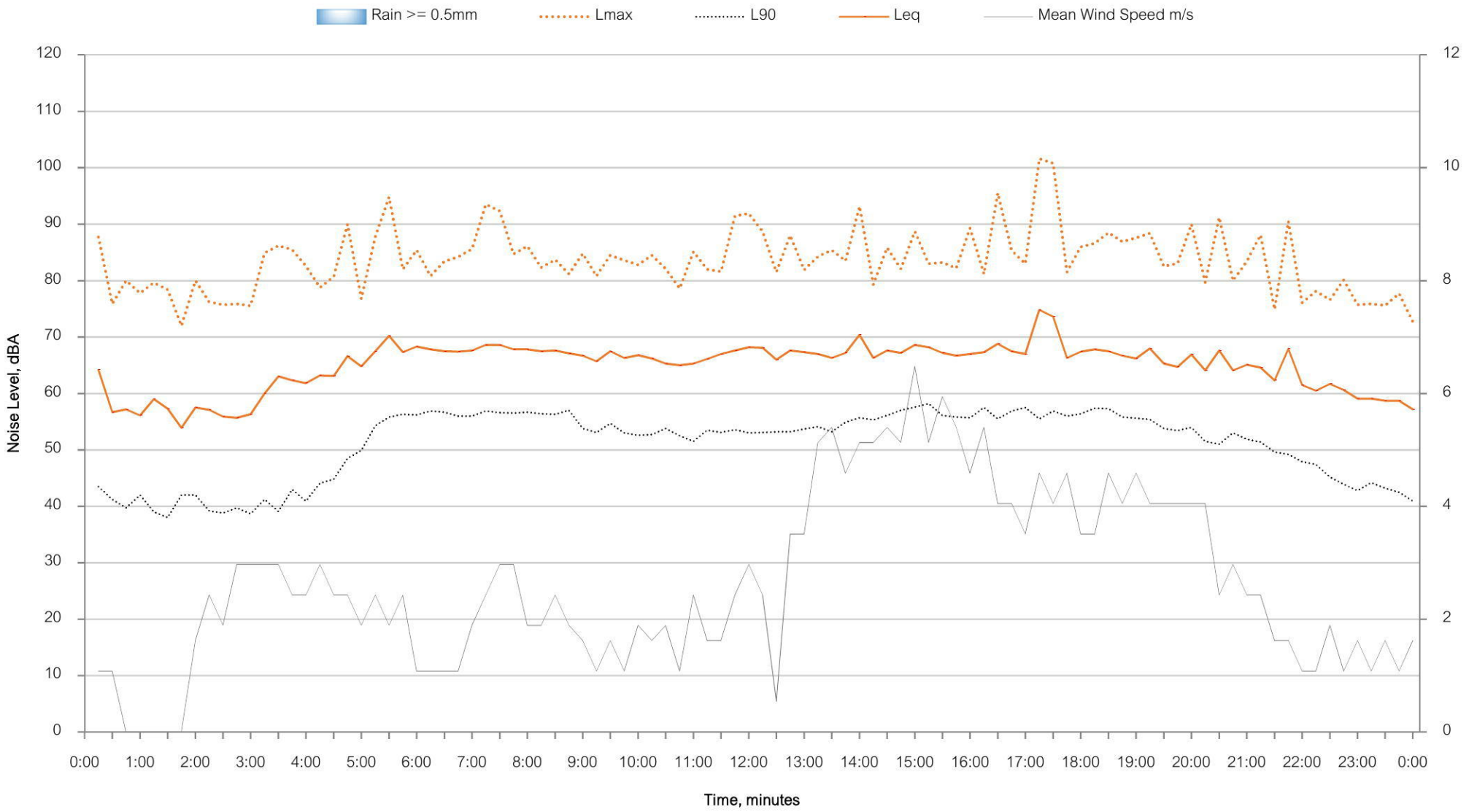
Caltex Werrington - Sunday 27 November 2016





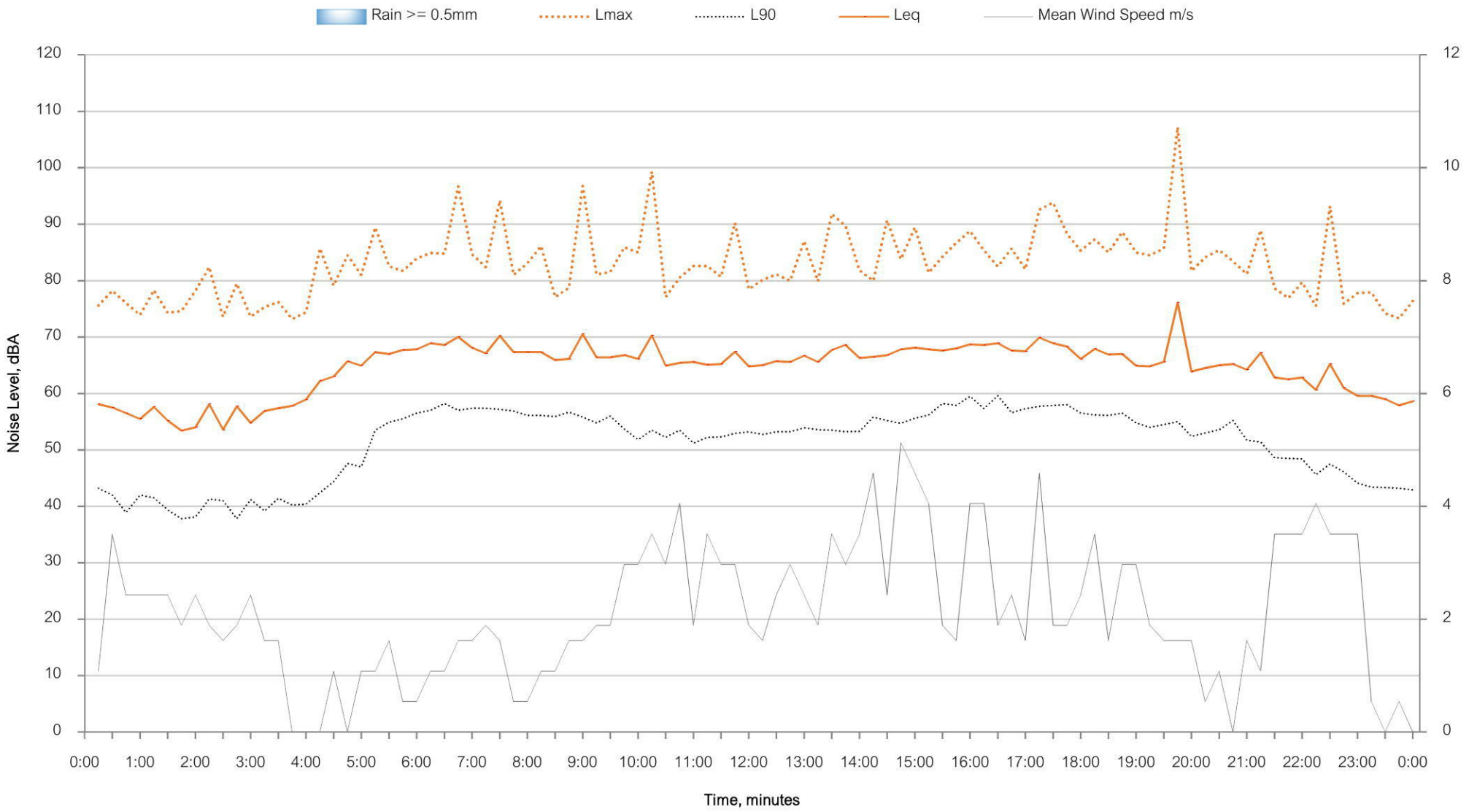
Background Noise Levels

Caltex Werrington - Tuesday 29 November 2016



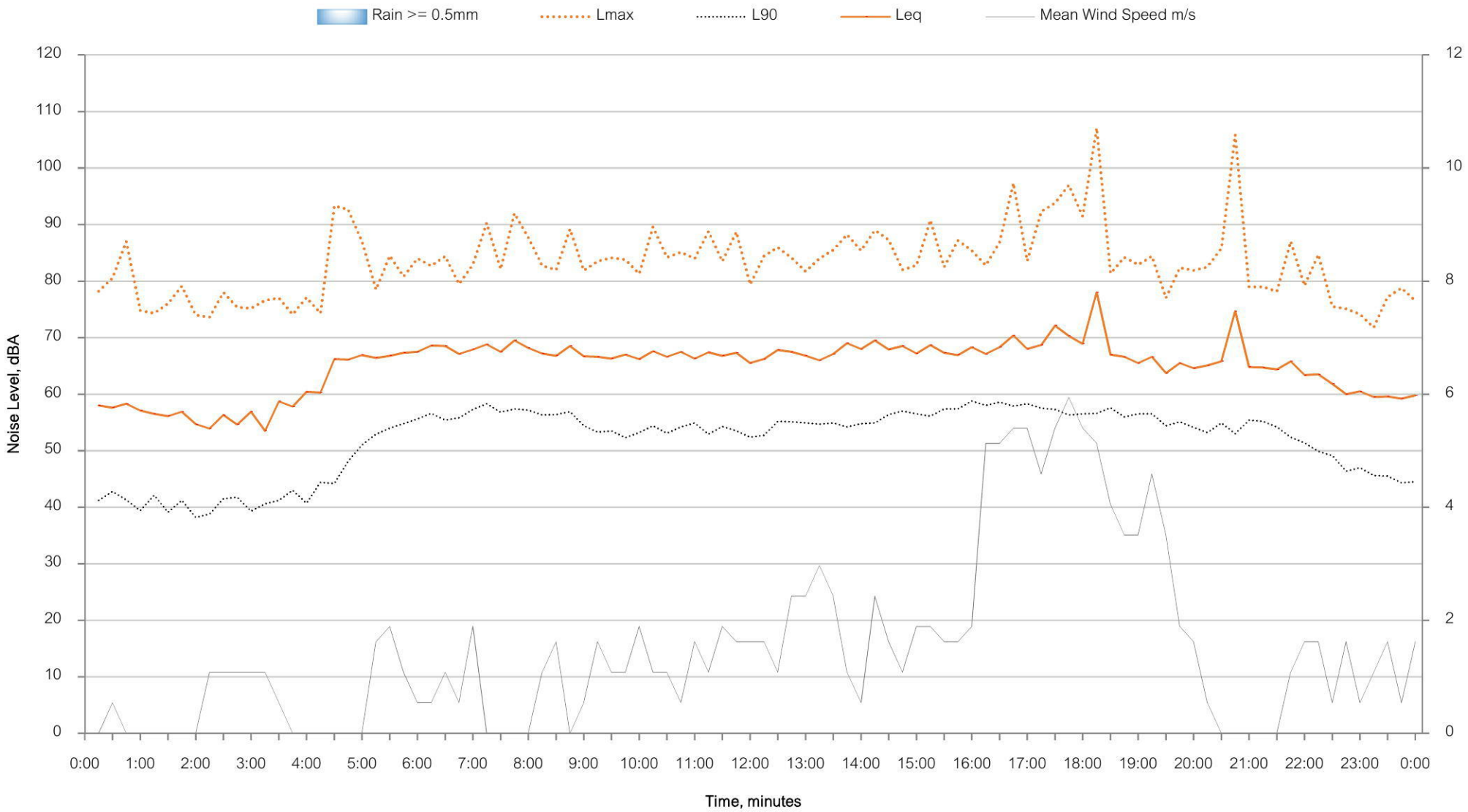
Background Noise Levels

Caltex Werrington - Wednesday 30 November 2016



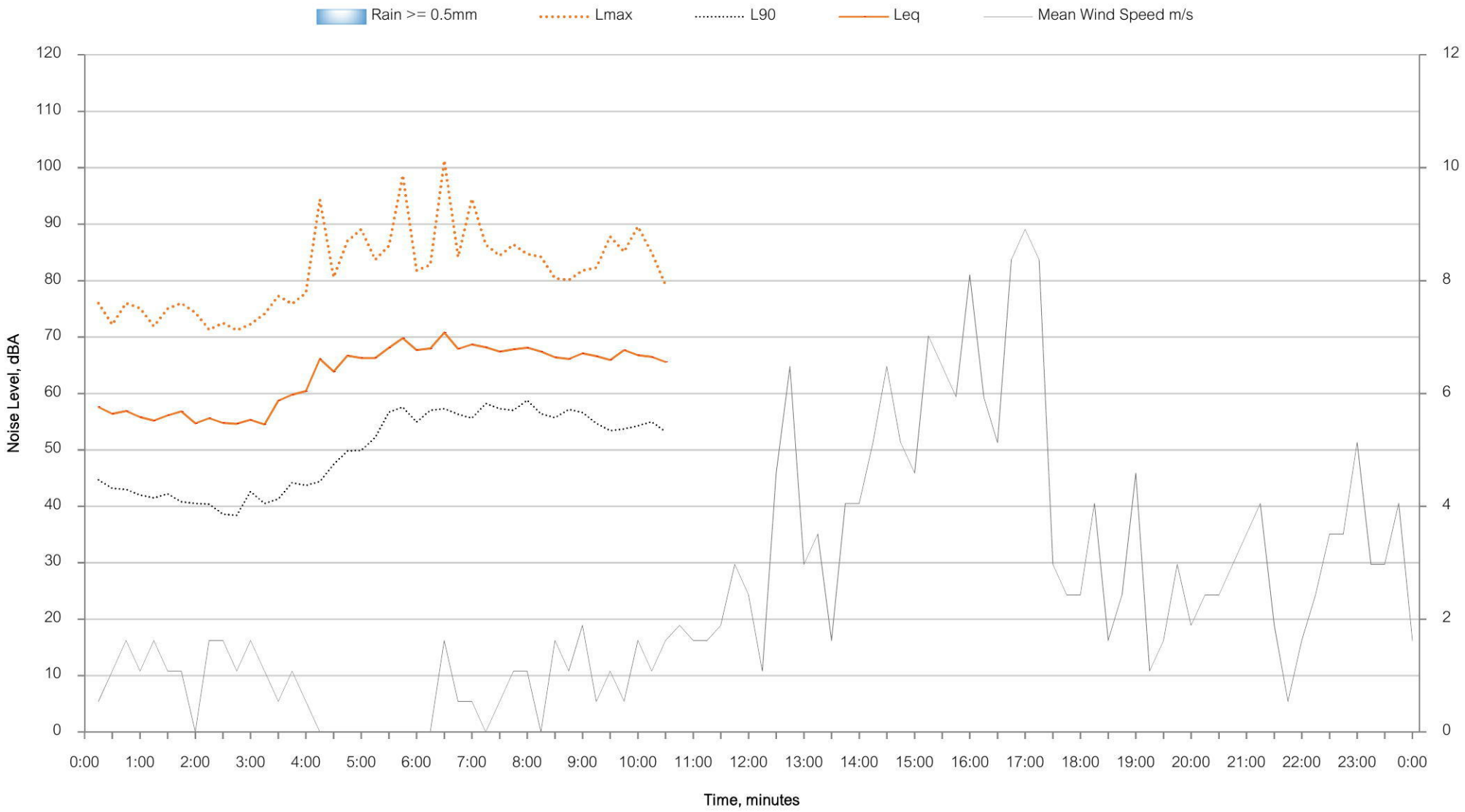
Background Noise Levels

Caltex Werrington - Thursday 1 December 2016



Background Noise Levels

Caltex Werrington - Friday 2 December 2016



Muller Acoustic Consulting Pty Ltd
PO Box 262, Newcastle NSW 2300
ABN: 36 602 225 132
P: +61 2 4920 1833
www.mulleracoustic.com

MAC
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