MANAGING DIRECTORS
MATTHEW PALAVIDIS
VICTOR FATTORETTO

DIRECTORS
MATTHEW SHIELDS
BEN WHITE

Brookvale Community Health Centre

Noise and Vibration Impact Assessment

SYDNEY
A: 9 Sarah St Mascot NSW 2020
T: (02) 8339 8000
F: (02) 8338 8399

SYDNEY MELBOURNE BRISBANE CANBERRA
LONDON DUBAI SINGAPORE GREECE

www.acousticlogic.com.au
ABN: 11 068 954 343

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1 INTRODUCTION

This report presents our assessment of the potential noise impacts associated with the demolition, construction, and operational noise generated by the proposed Brookvale Community Health Centre development located at 612-624 Pittwater Road, Brookvale.

Specifically, a preliminary assessment of noise emissions from the operation of the community health centre will be conducted, along with an assessment of construction noise and vibration emissions during the demolition/construction phase of the development.

This assessment has been compiled to address requirement 10 of the Secretary's Environmental Assessment Requirements (SEAR's) for the project dated 16th April 2015 (Application Number: SSD 6980).

The assessment has been based on the drawings provided by McConnel Smith & Johnson Architects dated 2nd April 2015.

2 SITE DESCRIPTION

The Brookvale Community Health Centre development contains a five level community health facility building with a seven level above ground carpark located at 612-624 Pittwater Road, Brookvale at the intersection of William Street and Pittwater Road.

The proposed multi-level carpark is to be located at the north-eastern corner of the development, with access to the carpark available via an entry off Pittwater Road along the northern boundary of the site. A proposed pedestrian bridge linking the health centre to the western side of Pittwater Road will be constructed along the western boundary of the site.

The most significant noise source in the vicinity of the site is caused by road traffic along Pittwater Road lining the western boundary of the site. Road traffic along Pittwater Road generally dictates the background noise levels in the area surrounding the development.

The nearest potentially affected noise receivers in the vicinity of the site are outlined below (refer to figure 2.1 for site plan):

- **Receiver Location 1:** Commercial tenancy located at 628 Pittwater Road located along the northern boundary of the site
- **Receiver Location 2:** Commercial tenancy located at 626 Pittwater Road located behind the development at the northeast corner of the development.
- **Receiver Location 3:** Several commercial tenancies located at 2-10 William Street at the south-eastern corner of the development.
- **Receiver Location 4:** Several residential dwellings located across William Street to the south at 1-7 William Street and at 610 Pittwater Road located on the corner of William Street and Pittwater Road.

Long term noise monitoring has been conducted at the site at the location indicated in figure 2.1 to determine the ambient noise levels effective at the site. The noise levels measured at the locations indicated below will be used to determine the noise goals for the development. In addition to the long term monitoring data, ALC has conducted extensive short term attended measurements to determine the spectral characteristics of the ambient noise levels effective at the development.

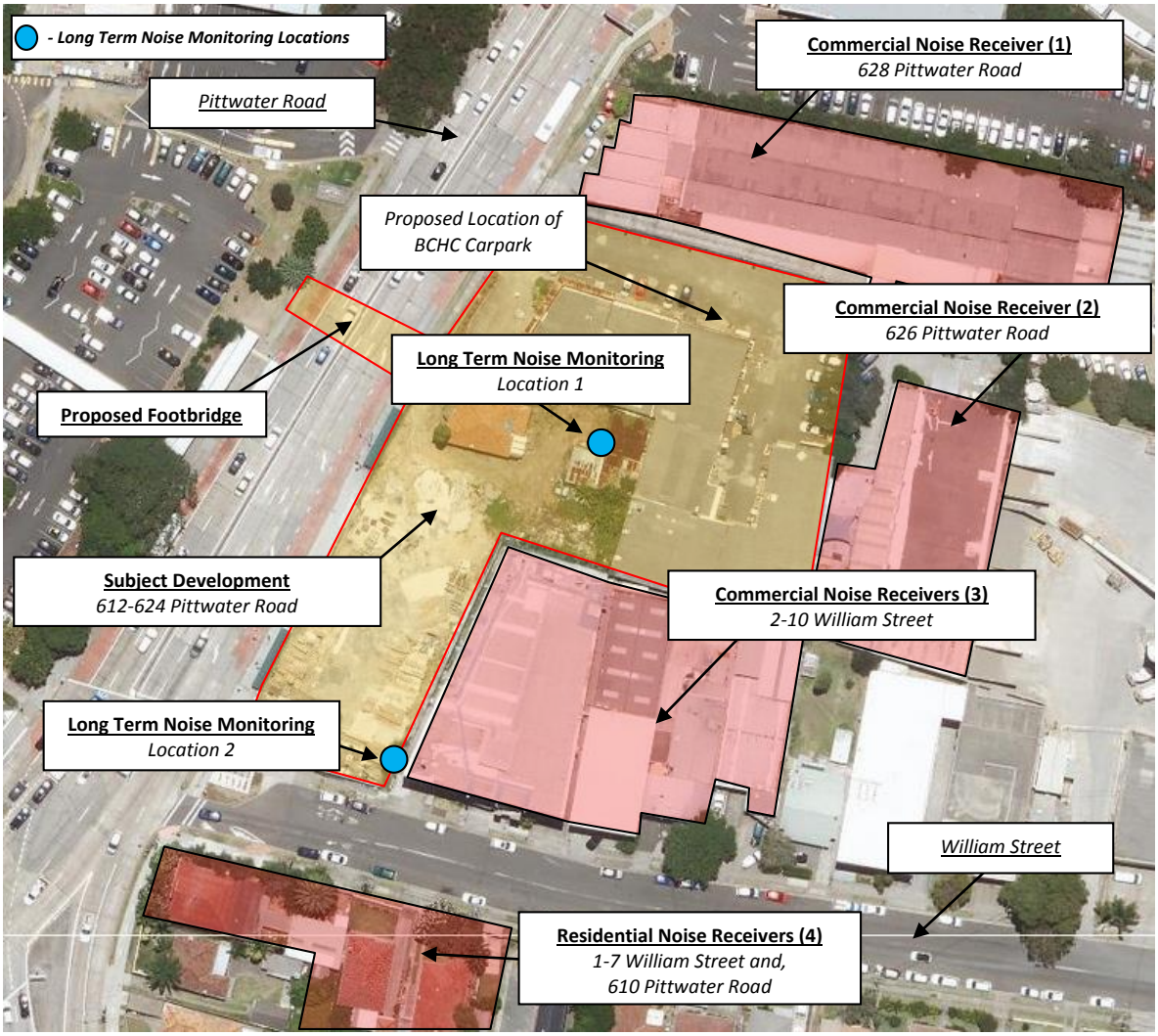


Figure 2.1 – Brookvale Community Health Centre – Site Plan

3 NOISE DESCRIPTORS

Environmental noise constantly varies. Accordingly, it is not possible to accurately determine prevailing environmental noise conditions by measuring a single, instantaneous noise level.

To accurately determine the environmental noise a 15-20 minute measurement interval is utilised. Over this period, noise levels are monitored on a continuous basis and statistical and integrating techniques are used to determine noise description parameters.

In analysing environmental noise, three-principle measurement parameters are used, namely L_{10}, L_{90} and L_{eq}.

The L_{10} and L_{90} measurement parameters are statistical levels that represent the average maximum and average minimum noise levels respectively, over the measurement intervals.

The L_{10} parameter is commonly used to measure noise produced by a particular intrusive noise source since it represents the average of the loudest noise levels produced by the source.

Conversely, the L_{90} level (which is commonly referred to as the background noise level) represents the noise level heard in the quieter periods during a measurement interval. The L_{90} parameter is used to set the allowable noise level for new, potentially intrusive noise sources since the disturbance caused by the new source will depend on how audible it is above the pre-existing noise environment, particularly during quiet periods, as represented by the L_{90} level.

The L_{eq} parameter represents the average noise energy during a measurement period. This parameter is derived by integrating the noise levels measured over the 15 minute period. L_{eq} is important in the assessment of traffic noise impact as it closely corresponds with human perception of a changing noise environment; such is the character of environmental noise.

4 BACKGROUND NOISE MONITORING

Unattended background noise monitoring was undertaken by this office from the 29th May 2015 – 5th June 2015 using two Acoustic Research Laboratories noise monitors. The monitors were located in the positions detailed in Figures 2.1.

The monitor was programmed to store 15-minute A-weighted statistical noise levels throughout the monitoring period. The monitor was calibrated at the beginning and end of the measurement period using a RION NC-73 sound level calibrator with no significant drift detected. All noise measurements were taken on A-weighted fast response mode. Noise logger data is provided in Appendix 1.

Attended background noise monitoring to supplement the unattended monitoring data was conducted around the site on 5th June 2015.

Table 4.1 summarises the background noise levels determined at the monitoring locations at the 612-624 Pittwater Road site.

Table 4.1 – Measured Background Noise Levels

Monitor Location	Background noise level dB(A)$L_{90(15minutes)}$		
	Daytime (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am)
Location 1 – North	53	49	46
Location 2 – South	51	48	38

ALC notes that the measured background noise level surrounding the Health Centre is driven primarily by road traffic noise from Pittwater Road.

5 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

This section of report addresses noise impact associated with the proposed demolition, excavation and construction of the Brookvale Community Health Centre development.

5.1 HOURS OF WORK

Table 1 in section 2.2 of the Environment Protection Authority (EPA) Interim Construction Noise Guideline lists the recommended standard hours of construction and section 2.3 outlines the situations, where construction work may need to be undertaken outside these hours.

Table 5.1 – Recommended Standard Hours for Construction Work

Work Type	Recommended Standard Hours of Work
Normal Construction	Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays
Blasting	Monday to Friday 9am to 5pm Saturday 9am to 1pm No work on Sundays or public holidays

Situations, where construction work may need to be undertaken outside these hours are:

- The delivery of oversized plant or structures that police or other authorities determine require special arrangements to transport along public roads;
- Emergency work to avoid the loss of life or damage to property, or to prevent environmental harm;
- Maintenance and repair of public infrastructure where disruption to essential services and/or considerations of worker safety do not allow work within standard hours;
- Public infrastructure works that shorten the length of the project and are supported by the affected community; and
- Works where a proponent demonstrates and justifies a need to operate outside the recommended standard hours.

5.2 CONSTRUCTION NOISE AND VIBRATION CRITERIA

The following section outlines the noise and vibration emission criteria for the construction phase of the development based on part 10 of the Secretary's Environmental Assessment Requirements (App No: SSD 6980) for the Brookvale Community Health Centre project. See the specific condition from the SEAR's presented below:

10. Noise and Vibration

> *Identify and provide a quantitative assessment of the main noise and vibration generating sources during construction and operation. Outline measured to minimise and mitigate the potential noise impacts on surrounding occupiers of land.*
>
> *→ Relevant Policies and Guidelines:*
>
> - *NSW Industrial Noise Policy (EPA)*
> - *Interim Construction Noise Guidelines (DECC/EPA)*
> - *Assessing Vibration: A Technical Guideline 2006*

The applicable criteria and the application of these criteria is discussed in the following sections.

5.2.1 Construction Noise

The relevant construction noise emission guidelines applicable to the site are:

- The EPA Interim Construction Noise Guidelines, and;
- Australian Standard 2436.

5.2.1.1 DECC (EPA) Interim Construction Noise Guideline

This guideline nominates acceptable external and internal management levels for noise emissions from construction activities, based on the existing background noise level in the area and type of receiver. For projects within the recommended standard hours, the guideline recommends a noise level of 10 dB(A) above the background – this level is referred to as the "noise affected level", for residential receivers. The noise emission goals for the nearby affected receivers are presented below:

Table 5.2 – Noise Emission Goals

Location	Time of Day	Measured Background Levels – dB(A)L_{90}	Noise Affected Level Background + 10dB(A)$L_{eq(15min)}$
Residential Dwellings across William Street	Recommended standard hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays	51	61
Commercial Tenancies located along William Street		51	61
Commercial Tenancies located along Pittwater Road		53	63

Where noise from the construction works is above the "noise affected level", the proponent should apply any feasible and reasonable work practices to minimise noise.

If noise emissions are likely to exceed 75 dB(A)$L_{eq(15min)}$, the receiver is deemed to be "highly noise affected". Introduction of management controls such as scheduling of noisy periods, or respite periods is recommended.

5.2.1.2 Australian Standard 2436-1981 "Guide to Noise Control on Construction Maintenance and Demolition Site".

Where compliance with EPA cannot be achieved, noise emissions are to be managed in accordance with principles in AS2436:

- That reasonable suitable noise criterion is established (i.e. – adopt Council guidelines).
- That all practicable measures be taken on the building site to regulate noise emissions, including the siting of noisy static processes on parts of the site where they can be shielded, selecting less noisy processes, and if required regulating construction hours.
- The undertaking of noise monitoring where non-compliance occurs to assist in the management and control of noise emission from the building site.

5.2.2 Construction Vibration

Vibration caused by construction should be limited to:

- For structural damage vibration, German Standard DIN 4150-3 *Structural Vibration: Effects of Vibration on Structures; and*
- For human exposure to vibration (amenity), the evaluation criteria presented in the British Standard BS 6472:1992 *Guide to Evaluate Human Exposure to Vibration in Buildings (1Hz to 80Hz)* for low probability of adverse comment. We note the provisions of the DECC's (now EPA) – "*Assessing Vibration: a technical guideline"* is based on this standard.

The criteria and the application of this standard are discussed in separate sections below.

5.2.2.1 Structure Borne Vibrations

German Standard DIN 4150-3 (1999-02) provides vibration velocity guideline levels for use in evaluating the effects of vibration on structures. The criteria outlined in DIN 4150-3 (1999-02) are presented in Table .3.

It is noted that the peak velocity is the absolute value of the maximum of any of the three orthogonal component particle velocities as measured at the foundation, and the maximum levels measured in the x- and y-horizontal directions in the plane of the floor of the uppermost storey.

Table 5.3 – DIN 4150-3 (1999-02) Safe Limits for Building Vibration

TYPE OF STRUCTURE		PEAK PARTICLE VELOCITY (mms^{-1})			
		At Foundation at a Frequency of			**Plane of Floor of Uppermost Storey**
		< 10Hz	**10Hz to 50Hz**	**50Hz to 100Hz**	**All Frequencies**
1	Buildings used in commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8

5.2.2.2 Assessing Amenity

The EPA's "Assessing Vibration: A Technical Guideline" (Feb 2006) is based on the guidelines contained in BS 6472:1992. This guideline provides procedures for assessing tactile vibration and regenerated noise within potentially affected buildings.

The recommendations of this guideline should be adopted to assess and regulate vibration within the construction site. Where vibration exceeds, or is likely to exceed, the recommended levels then an assessment of reasonable and feasible methods for the management of vibration should be undertaken.

Table 5.4 – EPA Recommended Vibration Criteria

		RMS acceleration (m/s^2)		**RMS velocity (mm/s)**		**Peak velocity (mm/s)**	
Place	Time	Preferred	Maximum	Preferred	Maximum	Preferred	Maximum
Continuous Vibration							
Critical working areas (e.g. hospital operating theatres, precision laboratories)	Day or Night-time	0.005	0.01	0.1	0.2	0.14	0.28
Offices	Day or Night-time	0.02	0.04	0.4	0.8	0.56	1.1
Residences	Daytime	0.01	0.02	0.2	0.4	0.28	0.56
Impulsive Vibration							
Critical working areas (e.g. hospital operating theatres, precision laboratories)	Day or Night-time	0.005	0.01	0.1	0.2	0.14	0.28
Offices	Day or Night-time	0.64	1.28	13.0	26.0	18.0	36.0
Residences	Daytime	0.3	0.6	6.0	12.0	8.6	17.0

5.3 EVALUATION OF NOISE AND VIBRATION IMPACTS

Potential noise and vibration impacts are reviewed below.

5.3.1 Noise impacts

Noise impacts from the construction of the Brookvale Community Health Care development on nearby development will be dependent on the type of construction activities and the relative location of the works on site. Excavation and piling works tend to be the loudest typical activity. Work close to the southern boundary will have greatest impact on the surrounding residential dwellings while work along the eastern/northern boundary of the site will have greatest impact on existing commercial tenancies surrounding the development.

Initial analysis indicates:

- Excavation/soil retention phase - Primary noise emissions occur during excavation and earth retention (piling), with equipment items typically having sound power levels of approximately 115dB(A)$L_{eq(15min)}$. Excavators (dozers with bucket, saws or hammers) and piling works are typically the loudest activity during construction. Noise levels of 65-70dB(A) at the nearest residents (at the boundary) will potentially be generated, indicating that EPA acoustic criteria (refer to table 5.2) may be exceeded from time to time, with higher noise levels generated when working near the southern boundary of the site.

- During erection of structures, it is cranes and the use of hand tools (angle grinders etc.) and concrete pumps which are the loudest typical activity (sound power levels of approximately 105dB(A)$L_{eq(15min)}$). Noise emission levels of 55-60dB(A) at the nearest residents will potentially be generated, indicating that the EPA acoustic criteria (refer to tables 3 and 4) may be exceeded from time to time, with higher noise levels generated when working near the southern boundary of the site.

- Once construction of the building shell is complete, noise from hand tools will be relatively low, as the new building façade will provide considerable noise attenuation. Once the building shell is largely complete, use of hand tools in internal areas is unlikely to exceed EPA recommended levels.

Noise impacts can be minimised using the following:

- Selection of equipment and process.
- Location of static plant (particularly concrete pumps and cranes) away from receivers
- Use of screens or enclosures (typically only feasible for static plant).
- Scheduling of noisy activities and provision of respite periods.

The following potential site specific treatments are being proposed at this stage, however these will be updated as details about construction planning are available:

- The utilisation of 2.4m high solid Class-A perimeter hoarding should be adopted on the southern boundary of the site as a barrier for lower level receivers across William Street to the south.

- As the excavation reaches depths, the surrounding retention systems will act as barriers to noise generation equipment within the excavation.

- Where practicable, position major mobile temporary plant such as concrete crushers, concrete pumps, concrete trucks and the like as far as possible from sensitive receptors. The strategic positioning of these items can result in construction noise levels not exceeding the applicable noise goals for the site.

- Where feasible, begin morning site works at the northern boundary of the site furthest from the residential receivers and progressively advance towards the residential receivers throughout the day. In this way, noise impacts from the site will be reduced whilst residents are at home.

Detailed construction noise planning is typically undertaken after engagement of a builder and a construction program is prepared and therefore, detailed planning is not possible at this stage.

In light of the above, we recommend:

- On completion of the construction program, acoustic review of proposed construction activities and plant/methods should be undertaken to identify work items likely to exceed EPA guidelines.

- For those noise intensive activities, the analysis should identify where on the construction site are the areas likely to result in high noise levels. This will then assist in determining the likely time period for which high noise levels will occur at nearby properties.

- Identify feasible acoustic controls or management techniques (use of screens, scheduling of noisy works, notification of adjoining land users, respite periods) when excessive levels may occur.

- For activities where acoustic controls and management techniques still cannot guarantee compliant noise levels, implement a notification process whereby nearby development is made aware of the time and duration of noise intensive construction processes.

Through adoption of the above, noise impacts on nearby development can be suitably managed to prevent excessive impact.

5.3.2 Vibration Impacts

Excavation and earth retention works (piling) are the primary vibration generating activities.

Due to its proximity, vibration impacts on the residential properties to the south are unlikely to be higher than the levels of vibration to be generated at the boundary of the adjacent commercial buildings to the north and east of the site.

In particular, if excavating in rock or installing driven piles in close proximity to the façade of the commercial buildings. We recommend:

- Consultation with the commercial tenancies prior to excavation/construction to determine if there is any particularly vibration sensitive equipment items on site boundaries in order to determine appropriate vibration criteria (if required).

- Where practicable, excavation in rock should be done using rock saws as opposed to pneumatic hammers.

- If piling is required, use of augured or vibro-piling should be used rather than impact piling.

- For the initial stages of excavation and piling, vibration monitoring within areas of the surrounding structures (commercial *and* residential) should be conducted to ensure excessive levels of vibration are not recorded. Any monitoring system should allow for rapid feedback to the contractor (for example, SMS notification) in the event that excessive levels are reached.

Adoption of the above will provide a framework to ensure that appropriate systems for monitoring and management of vibration can be implemented.

6 OPERATIONAL NOISE ASSESSMENT

6.1 NOISE EMISSION LIMITS – NOISE GENERATED ON THE SITE

The following section outlines the noise and vibration emission criteria for the operational use of the development based on point 10 of the Secretary's Environmental Assessment Requirements (App No: SSD 6980) for the Brookvale Community Health Centre project.

The applicable criteria and the application of these criteria is discussed in the following sections.

6.1.1 EPA – Industrial Noise Policy

The Environment Protection Authority (EPA), Industrial Noise Policy (INP) provides guidelines for assessing noise impacts from development sites. The recommended assessment objectives vary depending on the potentially affected receivers, the time of day, and the type of noise source. The EPA's Industrial Noise Policy has two requirements which both have to be complied with, namely an amenity criterion and an intrusiveness criterion. In addition, the EPA in its Environmental Noise Control Manual states that noise controls should be applied with the general intent to protect residences from sleep arousal.

For land use developments with the potential to create additional traffic on local roads the development should comply with the requirements detailed in the EPA NSW Road Noise Policy.

6.1.1.1 EPA Intrusiveness Criterion

The EPA guideline is intended to limit the audibility of noise emissions at residential receivers and requires that noise emissions measured using the L_{eq} descriptor not exceed the background noise level by more than 5 dB(A). Where applicable, the intrusive noise level should be penalised (increased) to account for any annoying characteristics such as tonality.

6.1.1.2 EPA Amenity Criterion

The EPA guideline is intended to limit the absolute noise level from all industrial noise sources to a level that is consistent with the general environment.

The EPA's Industrial noise policy sets out acceptable noise levels for various localities. Table 2.1 on page 16 of the policy indicates 4 categories to distinguish different residential areas. They are rural, suburban, urban and urban/industrial interface.

Table 5 of the INP provides the recommended ambient noise levels for the suburban residential receivers for the day, evening and night periods. For the purposes of this condition:

- Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays;
- Evening is defined as the period from 6pm to 10pm; and
- Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays.

Table 6.1 – EPA Recommended Amenity Industrial Noise Levels

Type of Receiver	Time of day	Recommended Acceptable Noise Level dB(A) L_{eq}	Recommended Maximum Noise Level dB(A) L_{eq}
Residential	Day	55	60
	Evening	45	50
	Night	40	45
Commercial	When in Use	65	70

6.1.1.3 Sleep arousal

To minimise the potential for sleep arousal the $L_{1\ (1\ minute)}$ noise level of any specific noise source does not exceed the background noise level (L_{90}) by more than 15 dB(A) outside a resident's bedroom window between the hours of 10pm and 7am. The L_1 noise level is the level exceeded for 1 per cent of the time and approximates the typical maximum noise level from a particular source. Where the typical repeatable existing L_1 levels exceed the above requirement then the existing L_1 levels form the basis for, sleep disturbance criteria.

6.1.1.4 Summary of Assessment Criteria

The EPA INP intrusiveness, amenity and sleep arousal criteria for this project have been determined using these guidelines and the noise monitoring results. These are summarised below for the Day, Evening and Night periods.

6.1.1.4.1 Day Time Period

The following table sets out the measured L_{90} background noise levels, and the assessment criteria based on the suburban criteria. The day period applies between 7am and 6pm Monday to Saturday; and 8am to 6pm Sundays and public holidays.

Table 6.2 – Measured L_{90} Noise Levels and Criteria - Daytime

Sensitive Noise Receiver Location	Measured L90 Noise Level dB(A)	Amenity Criterion dB(A) L_{eq}	Intrusiveness Criterion dB(A) L_{eq}
Receiver 1 / Receiver 2 / Receiver 3 - Commercial	53	65	N/A
Receiver 4 - Residential	51	55	56

6.1.1.4.2 Evening Period

The following table sets out the measured L_{90} background noise levels, and the assessment criteria based on the suburban criteria. The evening period applies between 6pm and 10pm.

Table 6.3 – Measured L_{90} Noise Levels and Criteria - Evening

Sensitive Noise Receiver Location	Measured L90 Noise Level dB(A)	Amenity Criterion dB(A) L_{eq}	Intrusiveness Criterion dB(A) L_{eq}
Receiver 1 / Receiver 2 / Receiver 3 - Commercial	49	65	N/A
Receiver 4 - Residential	48	45	53

6.1.1.4.3 Night Time Period

The night period (that is, between 10pm and 7am) is the period where noise emissions can have the most significant effect on residential amenity. In addition to the quasi-steady state criteria the L_1 noise emission level should not exceed the background noise level by more than 15 dB(A) to prevent sleep arousal from intermittent events. The night time period applies between 10pm and 7am.

Table 6.4 – Measured L_{90} Noise Levels and Criteria - Night Time Period

Sensitive Noise Receiver Location	Measured L90 Noise Level dB(A)	Amenity Criterion dB(A) L_{eq}	Intrusiveness Criterion dB(A) L_{eq}
Receiver 1 / Receiver 2 / Receiver 3 - Commercial	46	65	N/A
Receiver 4 - Residential	38	40	43

6.2 CAR PARK NOISE EMISSION ASSESSMENT

The proposed multi-level carpark is to be located at the north-eastern corner of the development, with access to the carpark available via an entry off Pittwater Road along the northern boundary of the site.

The surrounding development most likely to be affected by the use of the carpark is any development surrounding the northeast corner of the site; namely the commercial development located along the northern boundary of the site at 628 Pittwater Road (Receiver 1) and the commercial tenancy located at 626 Pittwater Road (Receiver 2) to the east of the development and also the commercial tenancies located at 2-10 William Street (Receiver 3) to the south of the carpark.

The operational noise emissions will be assessed below. The assessment of the following noise sources will be undertaken:

- Average noise from the use of cars manoeuvring and parking will be assessed with reference to the provisions of the EPA's Industrial Noise Policy.

- Peak noise from the use of car park (cars starting, doors closing) will be assessed with reference to the EPA's Industrial Noise Policy and be reviewed for the potential to cause sleep disturbance.

6.2.1 Average Noise

Noise associated with the use of the car park will likely consist of:

- Cars entering and exiting the car park;

- Cars manoeuvring within the car park; and

- Cars parking

Predictions will be made based on the following data/assumptions:

- A car when driving in a car park has a sound power level of approximately 84dB(A) L_{eq};

- Relative position of noise source and noise receiver, taking into account distance attenuation, air absorption, adverse weather and noise screening (where appropriate); and

- During a peak hour during the day (7am to 10pm) period, there will be no more than 200 entrances/exits.

- During a peak hour during the night (10pm to 7am) period, there will be no more than 50 car entrances or exits.

- ALC notes the preliminary design of the car-park is to include a solid concrete balustrade surrounding 3 sides (north east and west) of the carpark while the southern façade will be constructed of a solid precast concrete wall with no openings at the façade. Given this, the assessment considers car movements are from the top level of the car-park to present a worst case scenario.

Operational noise levels are predicted and assessed against relevant criteria from the NSW EPA Industrial Noise Policy. All predicted levels are based on the implementation of treatments nominated in Section 6.2.3.

Table 6.5 - Car Park Noise Emission Assessment - Day Period

Receiver Location	Noise Source	Predicted Noise Level – dB(A)$L_{eq(1\ hour)}$	Acoustic Criteria Day dB(A)$L_{eq(1\ hour)}$	Complies?
Receiver 1 / Receiver 2 / Receiver 3 – Commercial	Cars entering/exiting via Pittwater Road and manoeuvring within the car park/parking	51dB(A) $L_{Aeq(1hr)}$	65dB(A) $L_{Aeq(1hr)}$	Yes
Receiver 4 – Residential		<40dB(A) $L_{Aeq(1hr)}$	53dB(A) $L_{Aeq(1hr)}$	Yes

Table 6.6 - Cark Par Noise Emission Assessment - Night Period

Receiver Location	Noise Source	Predicted Noise Level – dB(A)$L_{eq(15min)}$	Acoustic Criteria Night dB(A)$L_{eq(15\ min)}$	Complies?
Receiver 1 / Receiver 2 / Receiver 3 – Commercial	Cars entering/exiting via Pittwater Road and manoeuvring within the car park/parking	46dB(A) $L_{Aeq(1hr)}$	65dB(A) $L_{Aeq(1hr)}$	Yes
Receiver 4 – Residential		<40dB(A) $L_{Aeq(1hr)}$	43dB(A) $L_{Aeq(1hr)}$	Yes

6.2.2 Peak Noise Events (Sleep Arousal)

As the car park may be used between 10pm and 7am, an assessment of potential sleep arousal at the nearest residential properties will be undertaken.

The loudest peak noise source with the potential for sleep arousal is a car door slamming. This has been has been measured by the office have a sound power level of 92dB(A) $L_{Max.}$

All predictions take into account the relative position of noise source and noise receiver, distance attenuation, air absorption and noise screening (where appropriate). All predictions are based on a "windows open" scenario at the receivers' location.

Predicted noise levels are as follows:

Table 6.7 - Sleep Arousal Test

Receiver Location	Noise Source	Predicted Noise Level	Sleep Disturbance Criteria
Receiver 4 – Residential	Car door shutting on north southern end of carpark (all levels)	<45dB(A) L_{Max}	53dB(A)L_{Max}

All peak noise events associated with the operation of cars within the car park comply with NSW EPA's Industrial Noise Policy sleep disturbance goals.

6.2.3 Recommendations for Minimising Noise Impact from Car Park

The following development controls should be incorporated to ensure that the noise emissions from the car park comply with the criteria outlined above.

- The car park pavement shall be smooth and level to ensure minimal vertical displacement and potential for noise generated by wheel to concrete impacts. The surface finish shall be of a type that minimises squealing of car tyres.
- Concrete to have a broom finish or similar, to prevent tyre squeal.
- Signs reminding staff and visitors to minimise noise at night shall be installed at entry and exit points from the car park.
- Traffic calming devices should be applied to control vehicle speeds 20km/Hour.
- No speed humps are to be installed within the car park.
- Grates and any cover plates are to be fixed flush and tight.

6.4 NOISE FROM INCREASED TRAFFIC GENERATION ON PUBLIC STREETS

The following section discusses the potential for increased noise generation from traffic entering and exiting the Brookvale Community Health Centre facility. The assessment has been conducted with reference to the guidelines typically applied in the EPA's Road Noise Policy and the traffic generation report conducted by Taylor Thomson Whiting (TTW) titled *"Brookvale Community Health Centre – 612-624 Pittwater Road, Brookvale – Transport and Accessibility Assessment Report"* dated 19th October 2015 (ref: 121211-K).

6.4.1 Assessment Guidelines – EPA

For land use developments with the potential to create additional traffic, the requirements of the EPA Road Noise Policy are typically applied. Noise emission guidelines as a result of road traffic generated by the site (as measured at the façade of a nearby residence) is presented below.

Table 6.8 – Criteria for Traffic Noise Generated by New Developments

Road Type	Time of day	Criteria for Acceptable Traffic Noise Level Local Roads
Local road	Day (7am to 10pm)	55dB(A)$L_{eq(1hr)}$
	Night (10pm to 7am)	50dB(A)$L_{eq(1hr)}$

However, we note that if existing noise levels exceed those in the table above, the provisions of section 3.4 of the Road Noise Policy will apply. Section 3.4 of the Road Noise Policy states that noise on public roads as a result of increased traffic generation should not result in an increase in traffic noise level of more than 2dB(A). In this regard, the Policy relevantly states the following:

> "*an increase of up to 2dB represents a minor impact that is considered barely perceptible to the average person*".

6.4.2 Existing Traffic Noise Environment

Extensive noise monitoring surrounding the site has been conducted to determine the existing noise environment in the area. The existing noise level at the façade of the surrounding residential development across William Street to the south of the site caused predominantly from road traffic along William Street and Pittwater Road has been determined to be higher than 55dB(A) during the day-time (and night time) period.

The table below shows the existing noise levels at 1m from the façade of the Residential Dwellings along William Street during the day and night periods based on the measurements conducted on site.

Table 6.9 – Existing Traffic Noise Levels along William Street

Location	Period	Measured / Corrected Existing Noise Level
Local road – William Street	Day (7am to 10pm)	66dB(A)$L_{eq(1hr)}$
	Night (10pm to 7am)	64dB(A)$L_{eq(1hr)}$

As such, noise as a result of road traffic generated by the site should not result in an increase of 2dB above the noise levels presented above.

We note from the traffic engineering report developed for the site by TTW states that the existing traffic volumes along William Street are as follows:

> *"A turning movement survey was undertaken on 12 October 2011 during the AM and PM peak hours for the intersection of Pittwater Road and William Street. This identified that nominally 3,500 vehicle turning movements occurred at the intersection during each peak hour."*

6.4.3 Noise from Increased Traffic on Public Streets

We note from the traffic engineers' report that the site is anticipated to generate up to 450 vehicle movements during morning and evening peak hours in addition to the existing vehicle movements stated in section 6.4.2.

The section below presents the predicted increase in noise level at the façade of the residential dwellings located across William Street to the south of the development based on the existing traffic volumes as presented in 6.4.2, existing noise levels measured at the site as presented in table 6.9 and the predicted increase in traffic flow as determined in the traffic engineers report for the site.

The noise levels presented below are also based on the following assumptions:

- The average sound power of a car driving on a public street at approximately 30km/h (as determined in previous traffic noise generation analysis conducted by this office) is 94dB(A)L_{max}.

- The average sound power of a car at idle (as determined in previous traffic noise generation analysis conducted by this office) is 80dB(A)L_{eq}.

- Vehicles travelling at 30km/h from the exit of the Health Centre and waiting at the lights for approximately 42 seconds (determined from the traffic engineers report where at this LoS operating speeds are still reasonable and acceptable delays are experienced).

Noise generation as a result of additional traffic alone is expected to generate noise levels up to 60dB(A) during peak hours at the façades of the William Street residences. When combined with the existing traffic noise level experienced at the site, the total increase in traffic noise level is 1dB(A) at the William Street residents indicating compliance with the EPA's Road Noise Policy as presented in section 6.4.1.

6.5 MECHANICAL NOISE ASSESSMENT

As detailed plant selections for the development are not available at this stage it is not possible to carry out a detailed examination of the ameliorative measures that may be required to achieve the noise targets outlined in section 6.1.

All plant can be satisfactorily attenuated to levels complying with noise emission criteria through appropriate location and (if necessary) standard acoustic treatments such as noise screens, enclosures, in-duct treatments (silencers/lined ducting) or similar.

Plant will be acoustically treated to prevent noise emissions from adversely impacting the surrounding properties in conjunction with the criteria detailed in section 6.1. This may include selecting the quietest plant practicable, or treating the plant with enclosures, barriers, duct lining and silencers, etc. as required to comply with the sound level recommendations.

Experience with similar projects indicates that it would be possible to achieve the requirement with appropriate treatment of the plant. General requirements for a number of potential plant items on the site are expanded on below.

6.5.1 AHU Plant Room – Level 4

We note that there is an AHU plant room located on level 4 at the southern end of the building facing the William Street residences to the south.

Typically, AHU plant rooms will have an internal sound pressure level of approximately 65-70dB(A).

Based on the assumption that the level 4 AHU plant room operates at approximately 70dB(A) (assuming open outside air) and the distance from the untreated plant room façade to the façade of the nearest residential façade across William Street, the noise level at the façade of the nearest resident would be 37db(A) with distance attenuation alone indicating compliance with the noise emission criteria presented in section 6.1. This is without the addition of any treatment to the AHU outside air intakes.

It is noted that a 70dB(A) assumption as in internal sound pressure level within an AHU plantroom is a conservative estimate and noise levels are likely to be significantly lower than the predictions, especially given that potential screening losses and air absorption have not been included within the predicted compliant noise emission level of 37dB(A).

Once AHU plant for the development has been selected, detailed analysis of noise emissions from the plant will be conducted to confirm specific acoustic treatments.

6.5.2 Supply / Exhaust fans

Supply and exhaust fans may be located within the underground plant rooms or in rooftop plant areas. These units typically emit high noise levels and may require acoustic treatment such as silencers and internal lined ductwork. Silencer requirements would be determined once fan selections have been completed.

6.5.3 Minor Plant

Other minor plant items, such as bathroom or kitchen exhaust fans, may also be required. These items typically emit relatively low noise levels and may require minimal acoustic treatment of a standard nature, such as internally lining of ductwork.

6.5.4 Major Plant

It is at the construction design stage that consideration should be given to the placement of equipment including intake and discharge air locations. In addition to the location of the equipment acoustic treatments to the major plant items may include silencers, treatment to ducting, time control, operational limitations, vibration isolation and the like.

7 CONCLUSION

This report provides the results of the noise and vibration Impact Assessment for the Brookvale Community Health Centre development located at 612-624 Pittwater Road, Brookvale.

In accordance with relevant acoustic standards for the site, noise at the site has been measured and noise goals have been set with reference to the requirement 10 of the Secretary's Environmental Assessment Requirements (SEAR's) for the project dated 16th April 2015 (Application Number: SSD 6980).

The following has been also been addressed within the report:

- An assessment of noise emissions from the excavation and construction phase of the development;

- Operational noise associated with the development such as mechanical plant noise and noise associated with the health centre carpark.

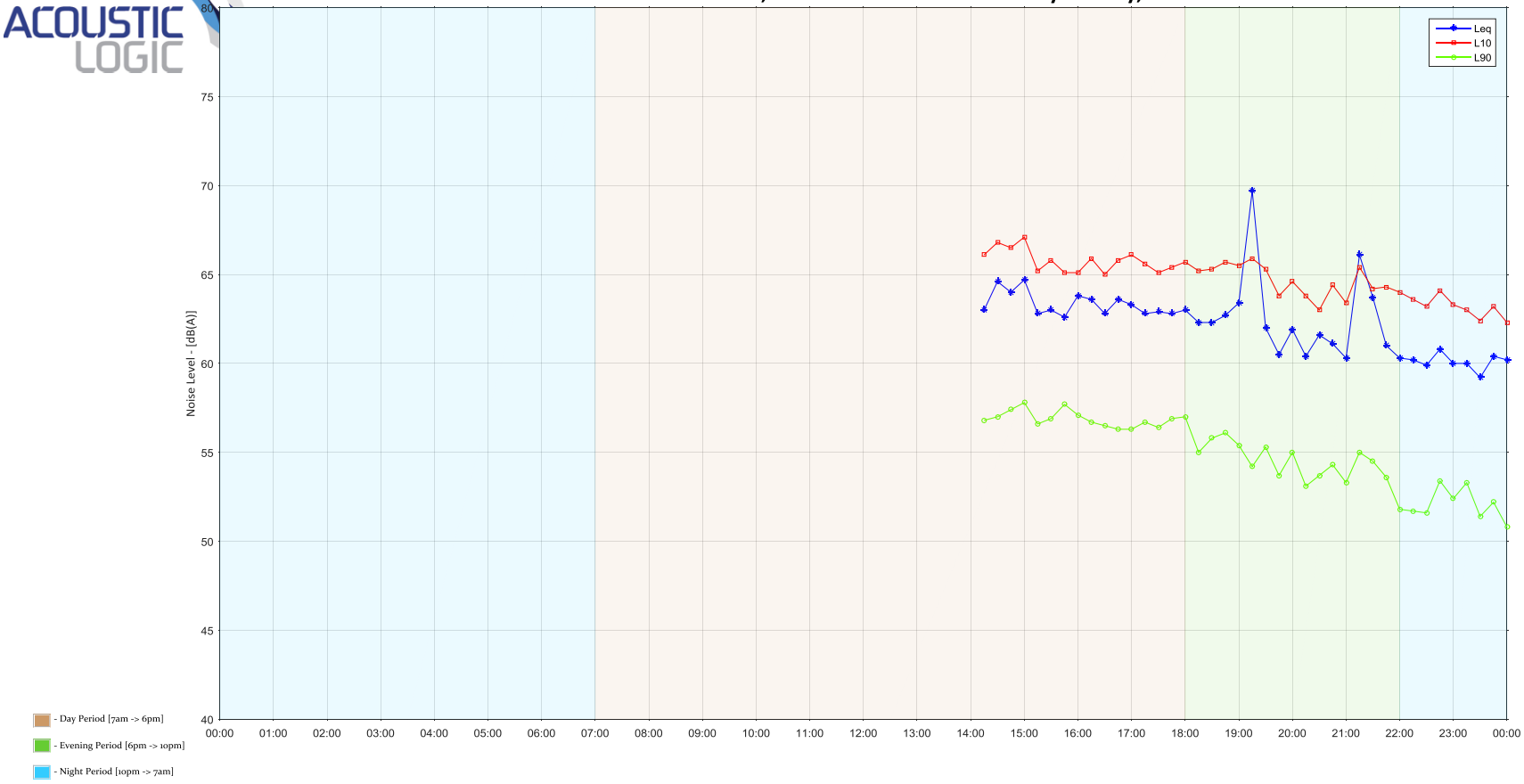
We trust this information is satisfactory. Please contact us should you have any further queries.

Yours faithfully,

Acoustic Logic Consultancy Pty Ltd
Jeff Robinson

APPENDIX A – NOISE MONITORING DATA

A.1: LOCATION 1 – NORTH


612-624 Pittwater Road, Brookvale - Location 1: Friday 29 May, 2015
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Noise Level - [dB(A)]
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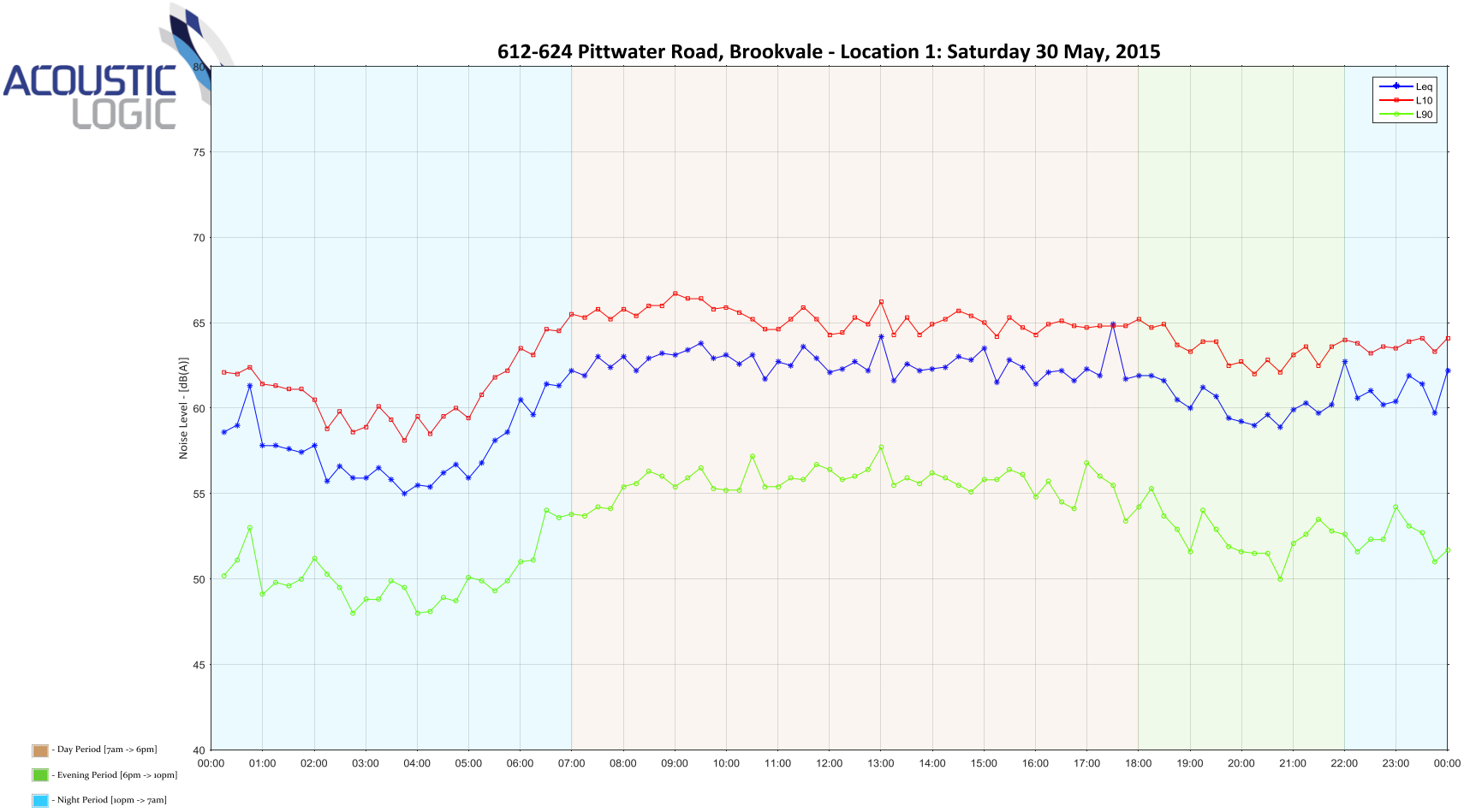
612-624 Pittwater Road, Brookvale - Location 1: Saturday 30 May, 2015
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Noise Level - [dB(A)]
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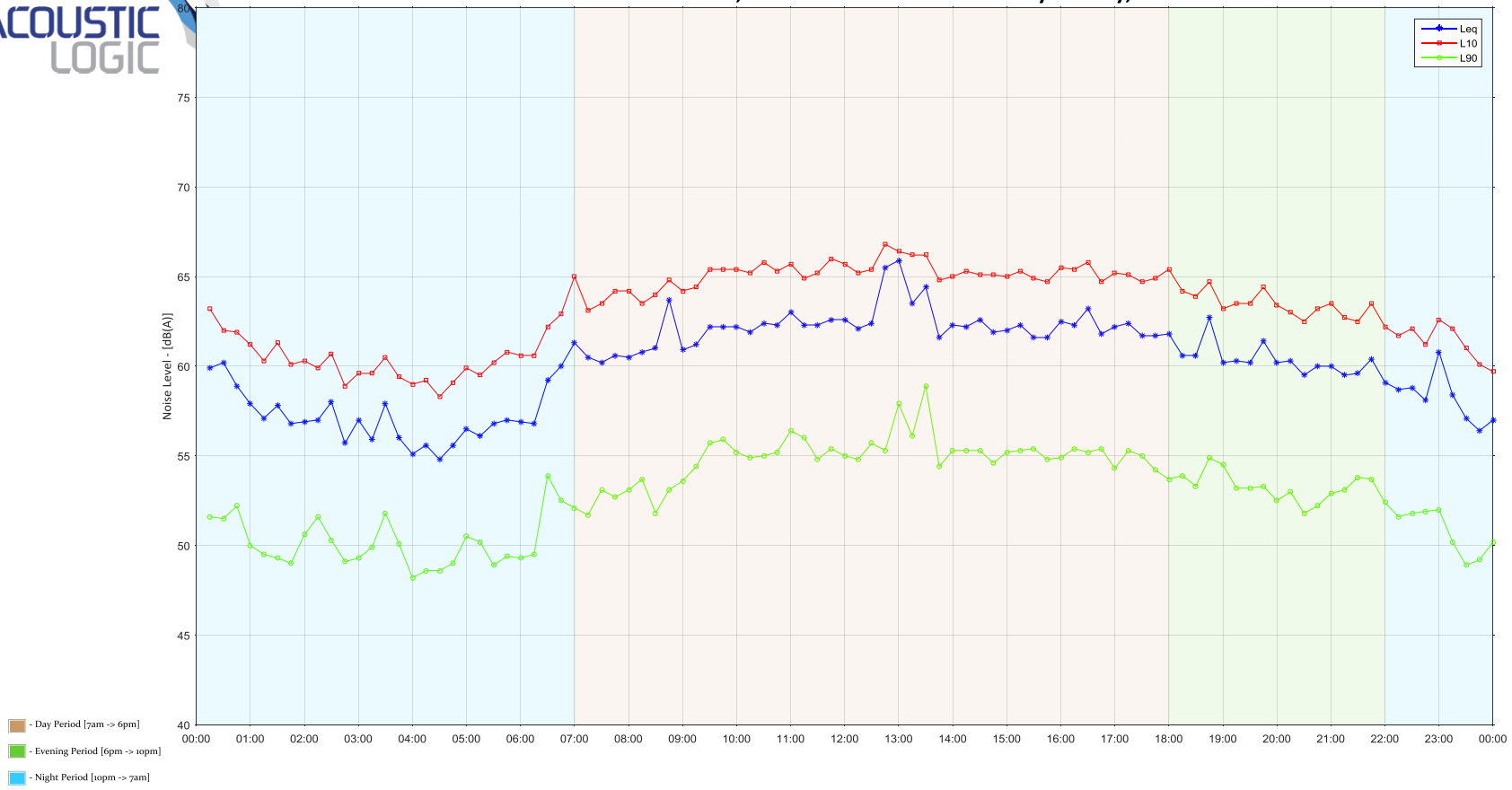
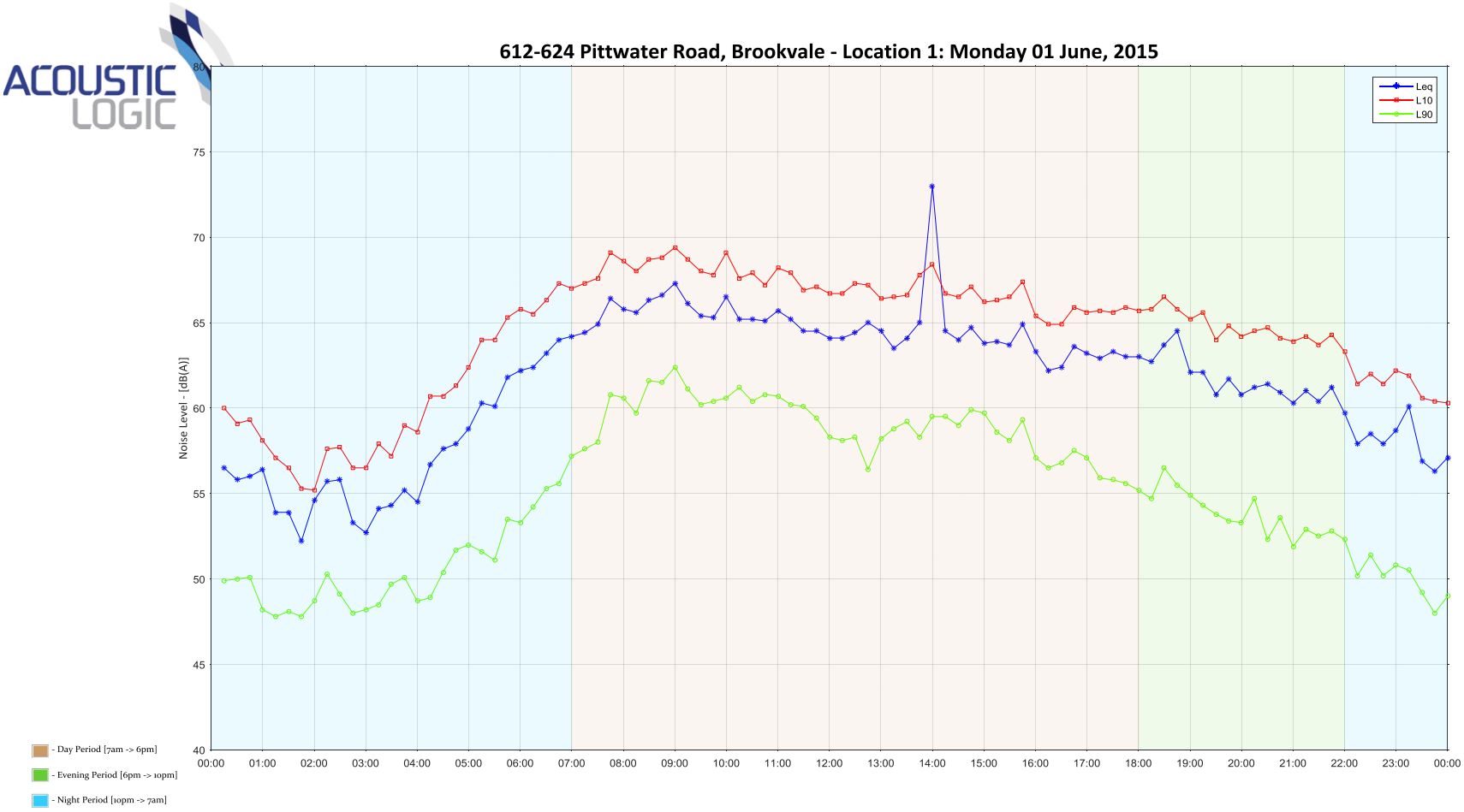
612-624 Pittwater Road, Brookvale - Location 1: Sunday 31 May, 2015




612-624 Pittwater Road, Brookvale - Location 1: Monday 01 June, 2015
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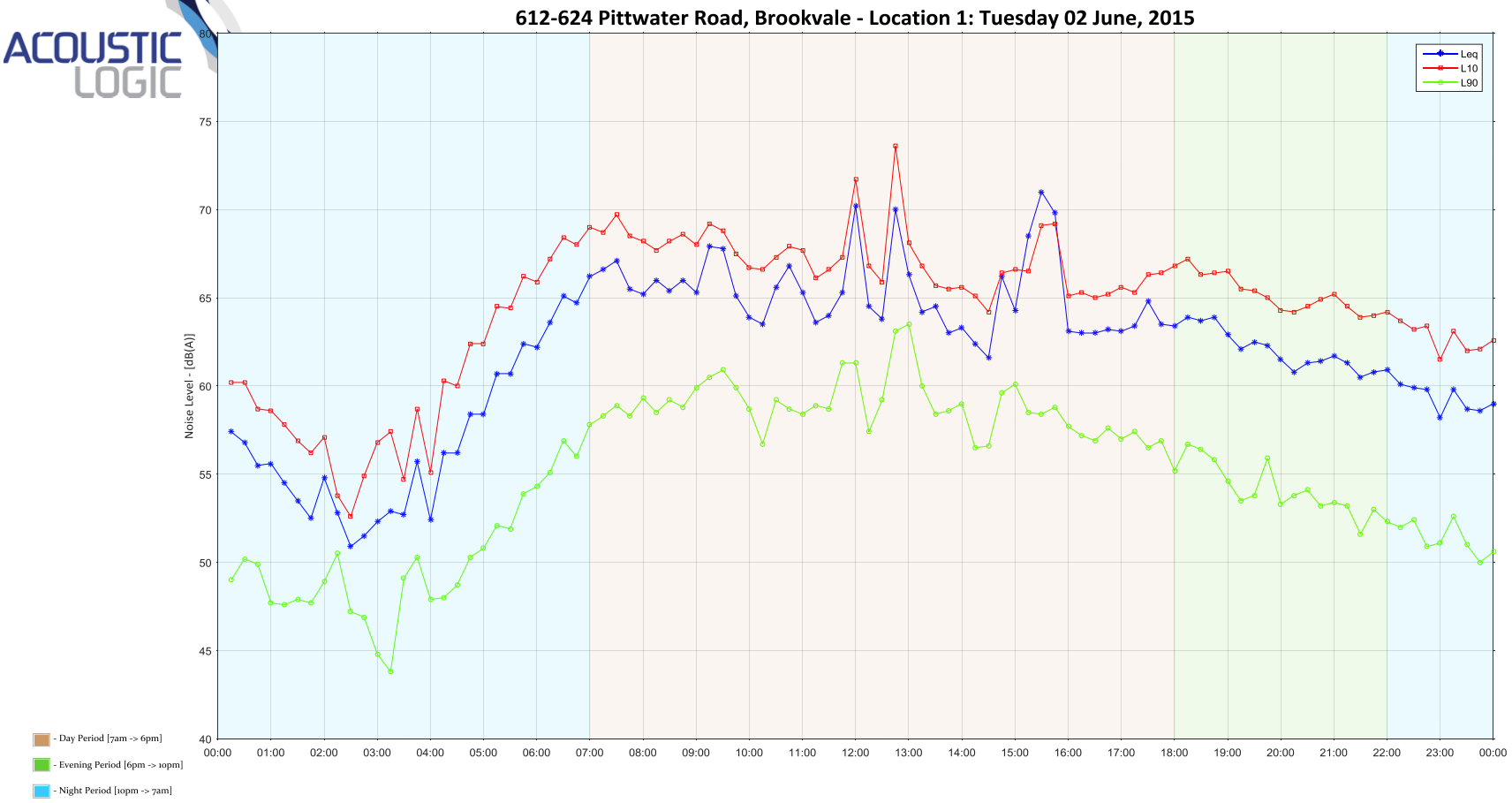
612-624 Pittwater Road, Brookvale - Location 1: Tuesday 02 June, 2015
Noise Level - [dB(A)]
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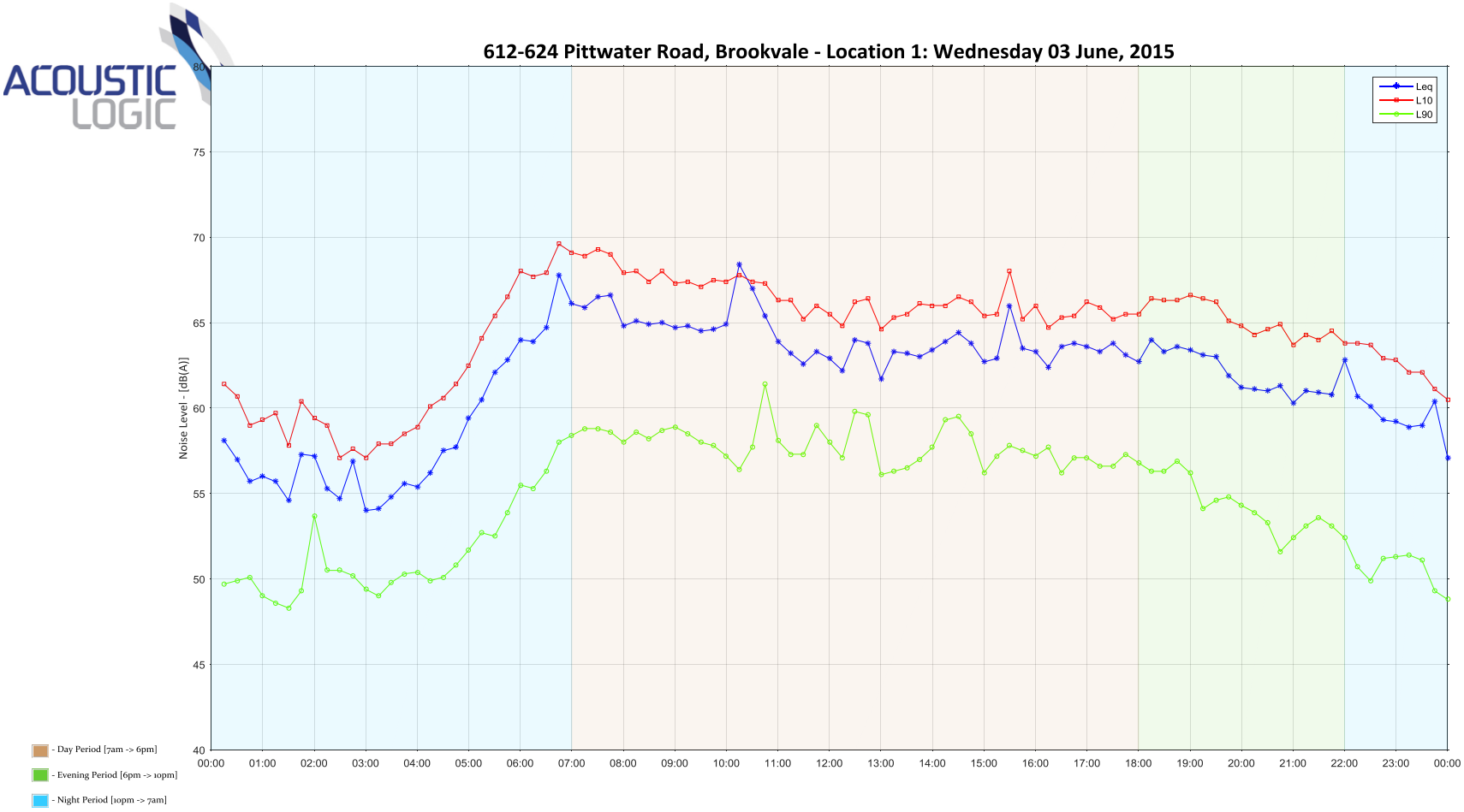
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Noise Level - [dB(A)]
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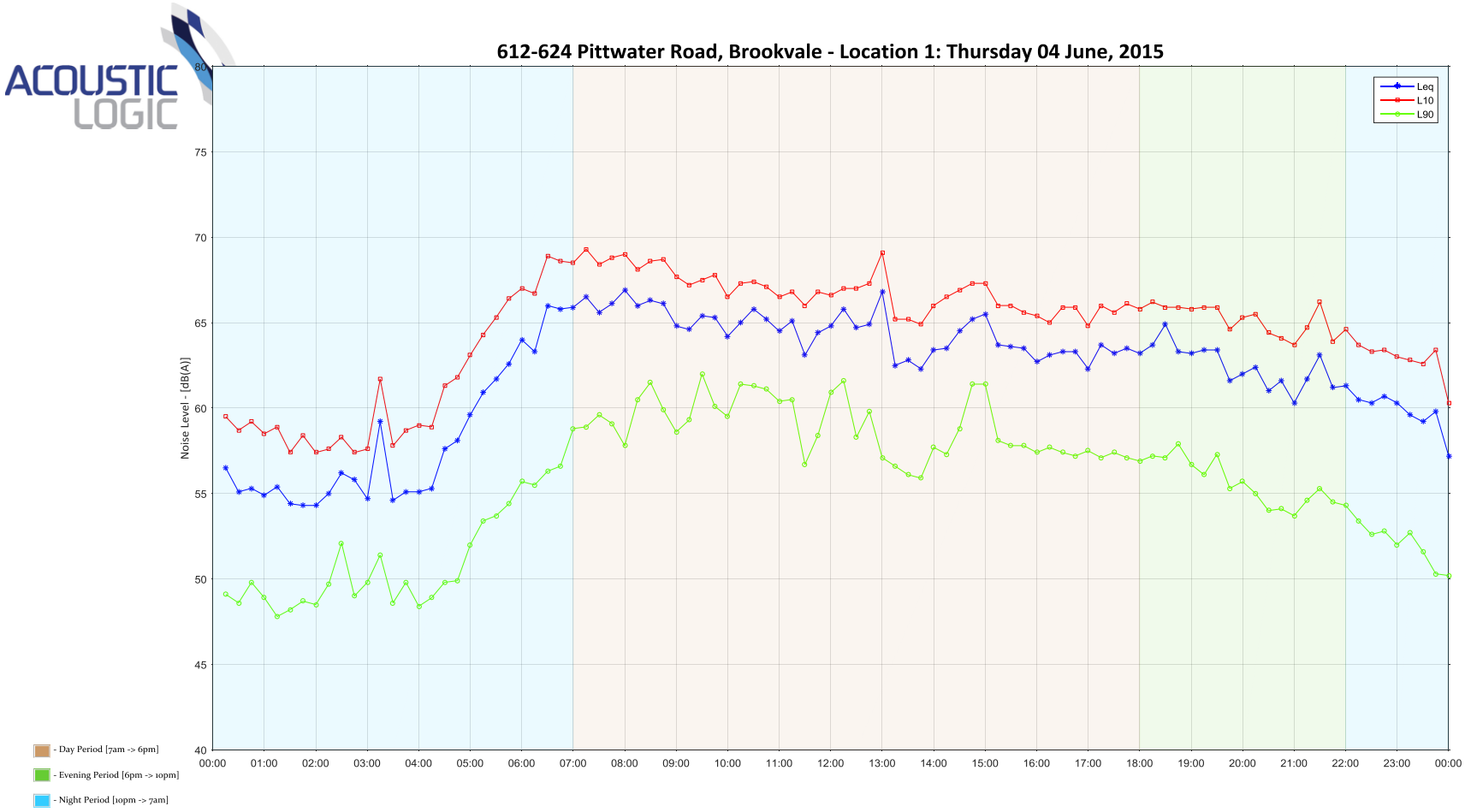
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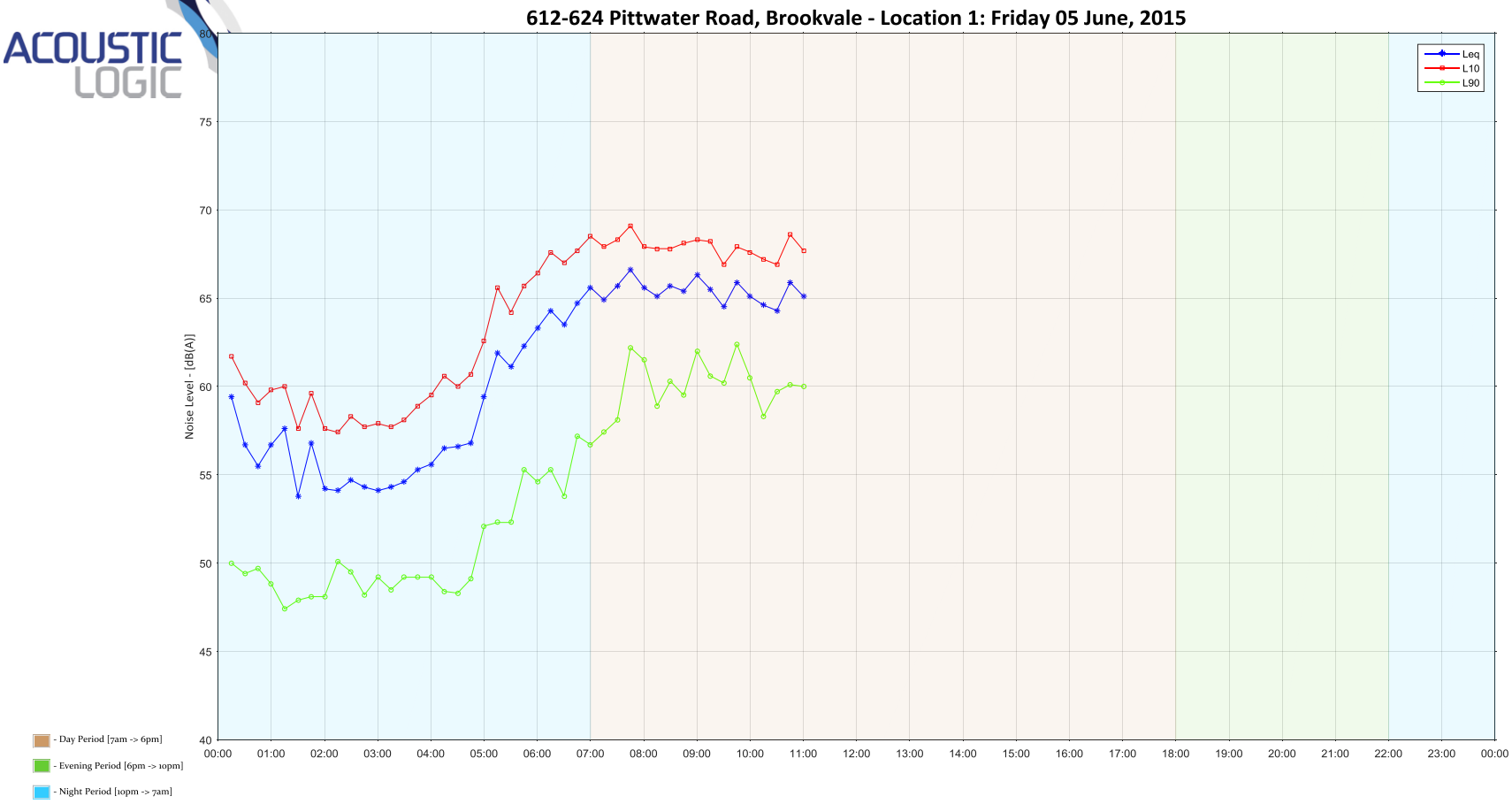
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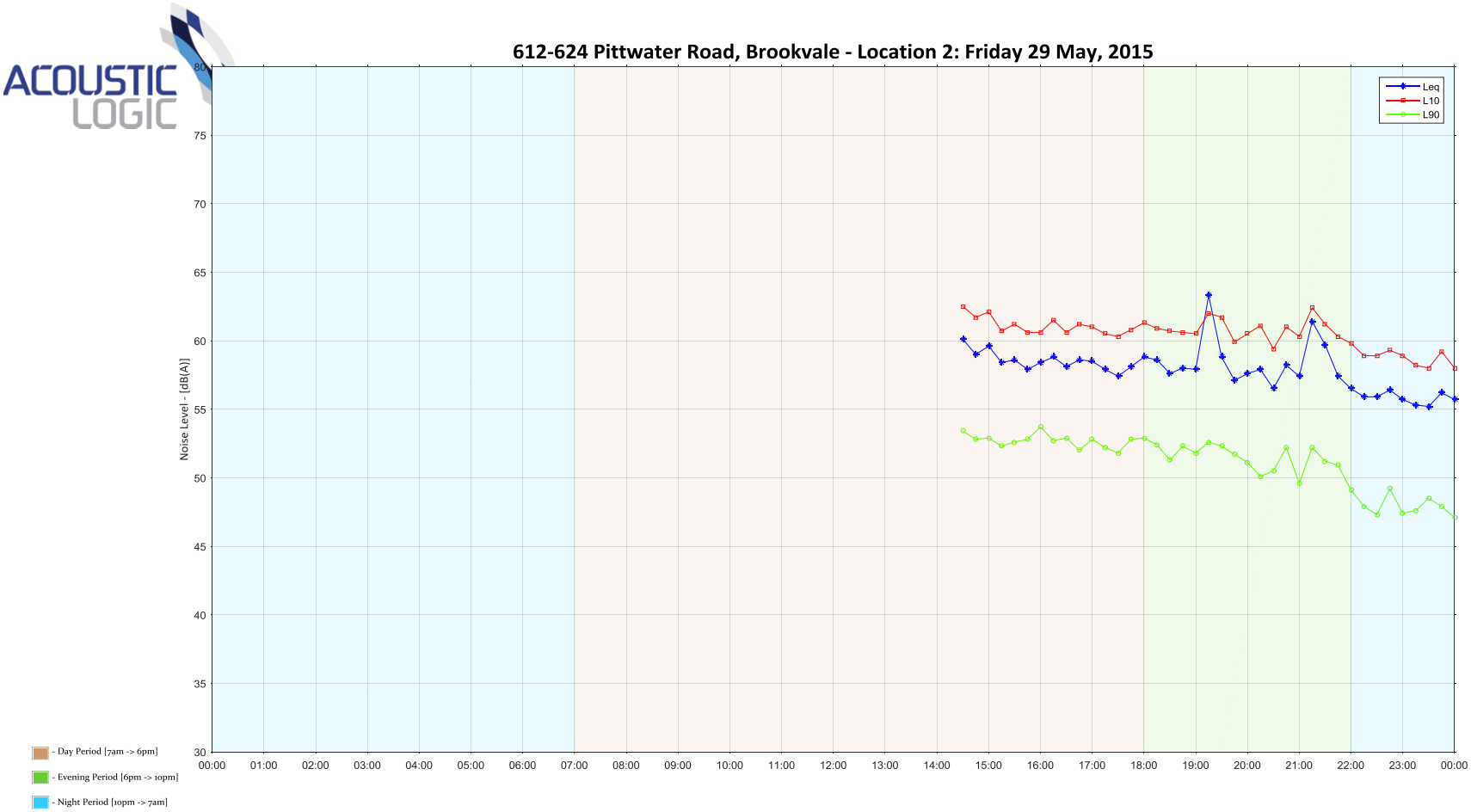
A.2: LOCATION 2 – SOUTH


612-624 Pittwater Road, Brookvale - Location 2: Friday 29 May, 2015
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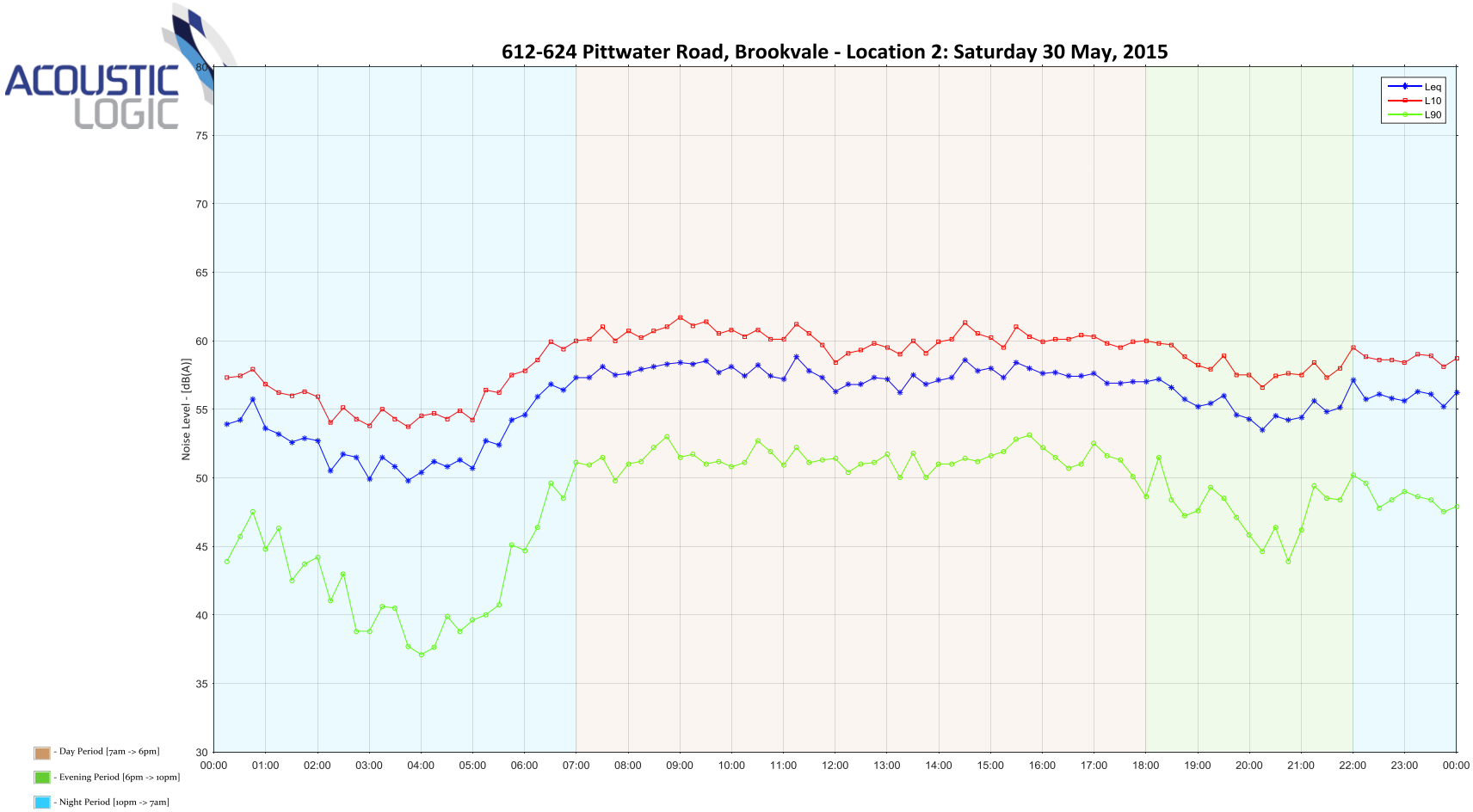
612-624 Pittwater Road, Brookvale - Location 2: Saturday 30 May, 2015
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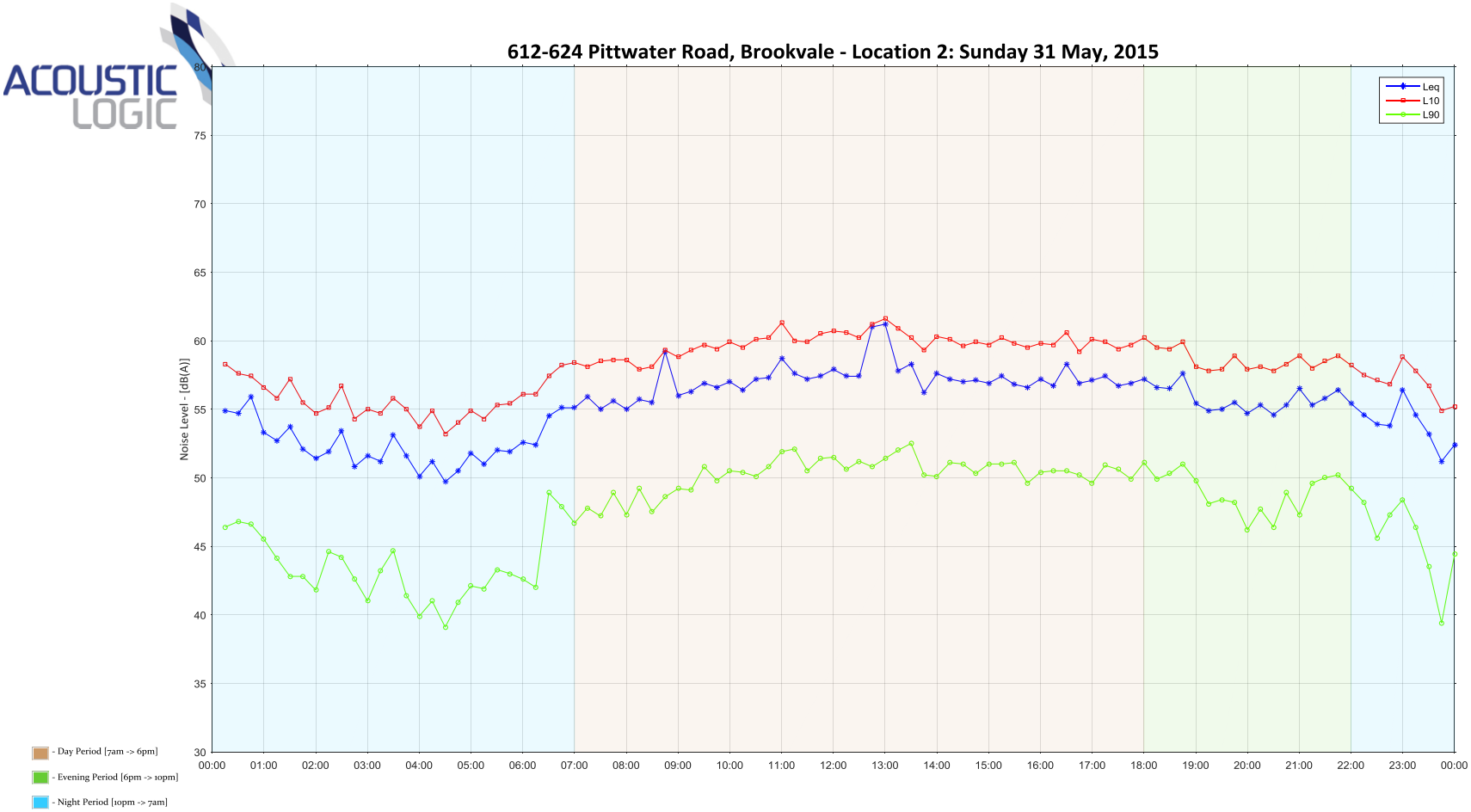
612-624 Pittwater Road, Brookvale - Location 2: Sunday 31 May, 2015
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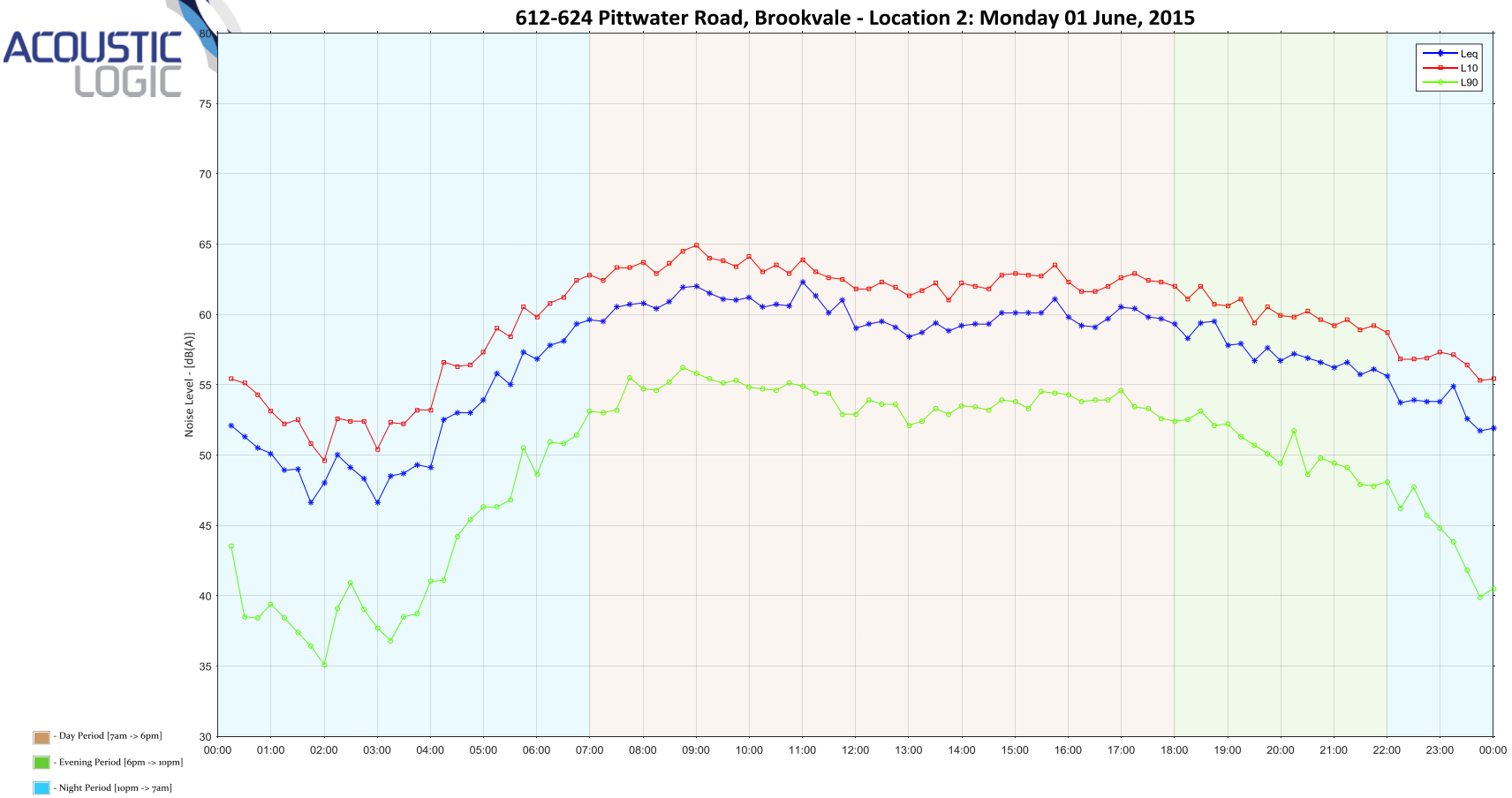
612-624 Pittwater Road, Brookvale - Location 2: Monday 01 June, 2015
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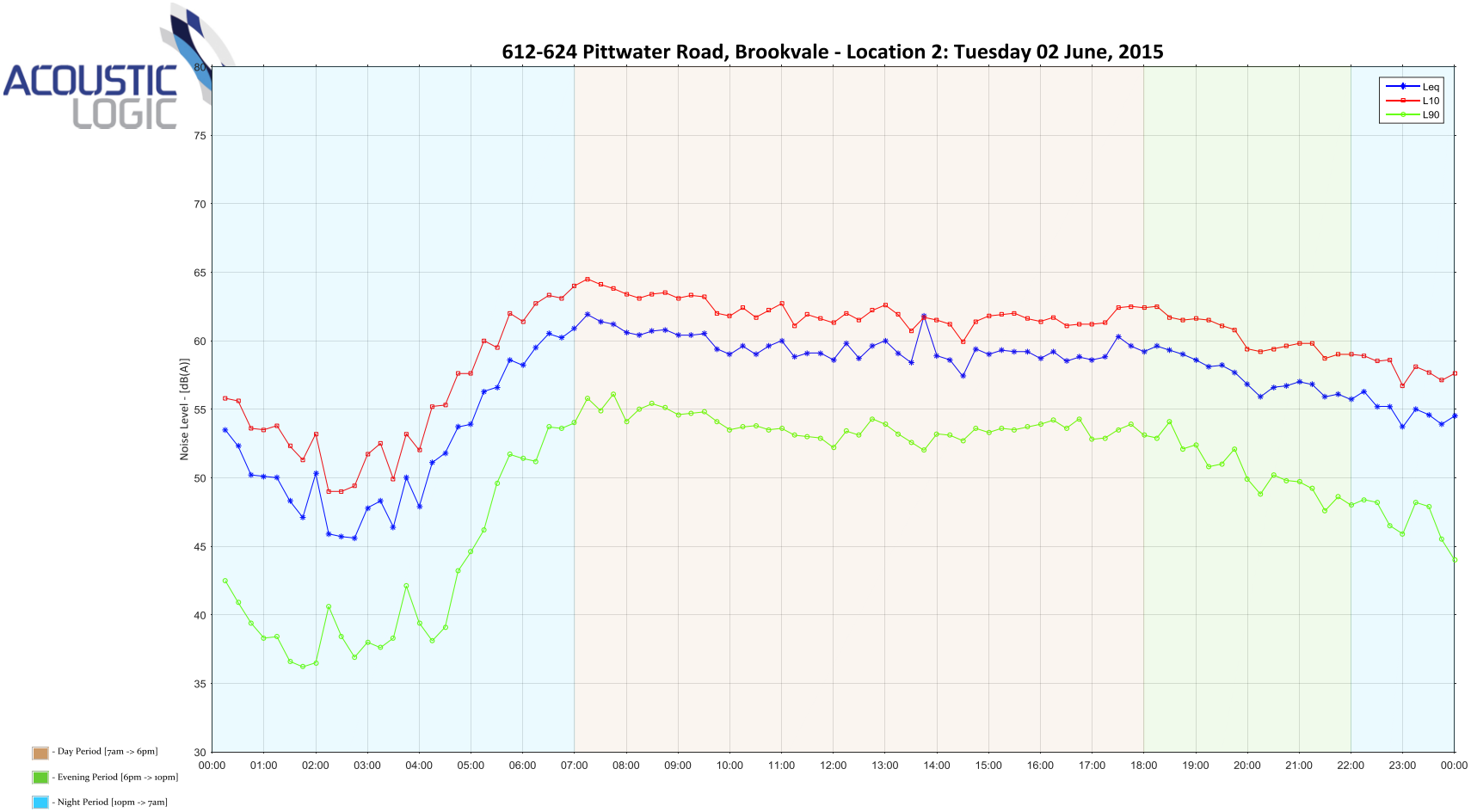
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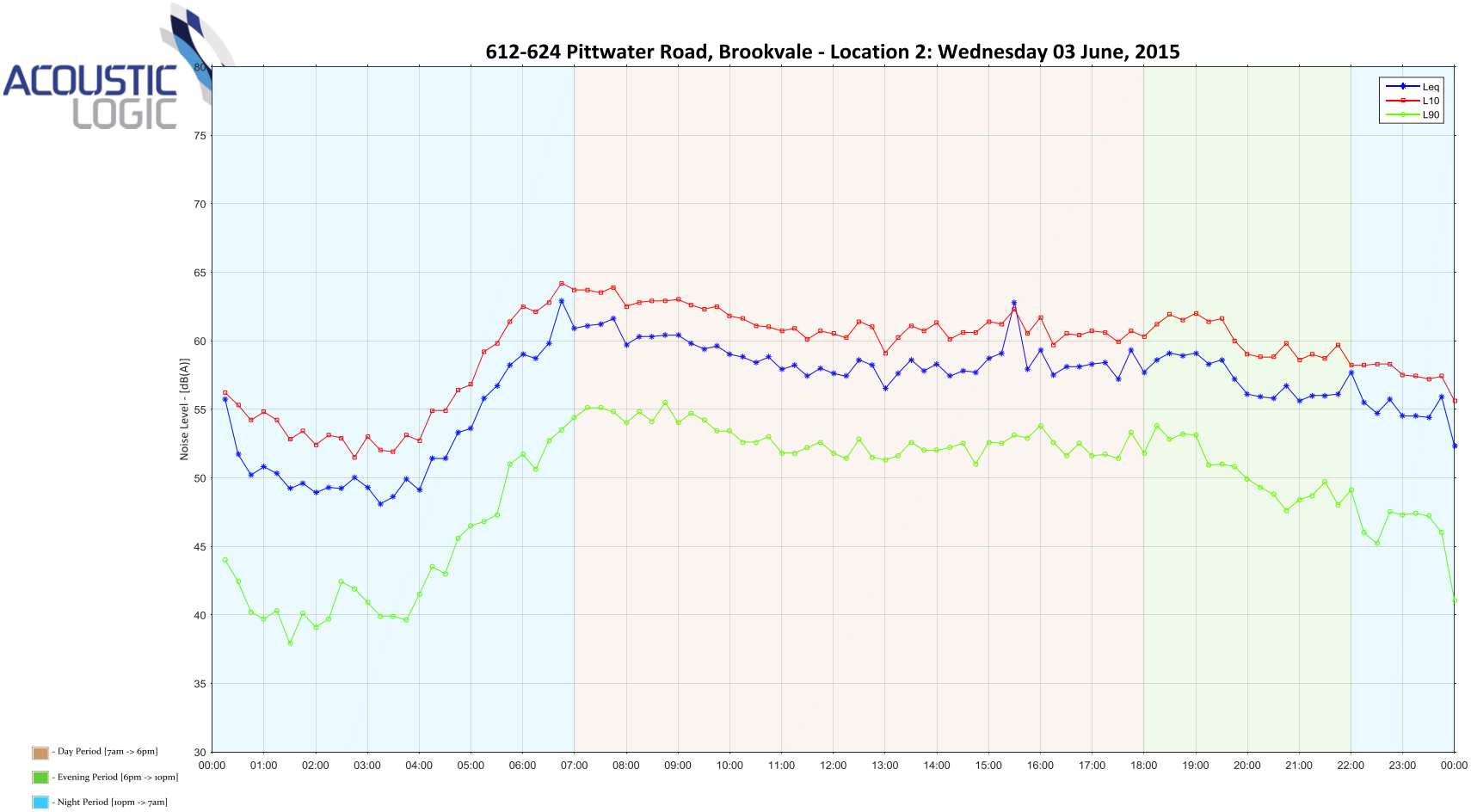
612-624 Pittwater Road, Brookvale - Location 2: Wednesday 03 June, 2015
Noise Level - [dB(A)]
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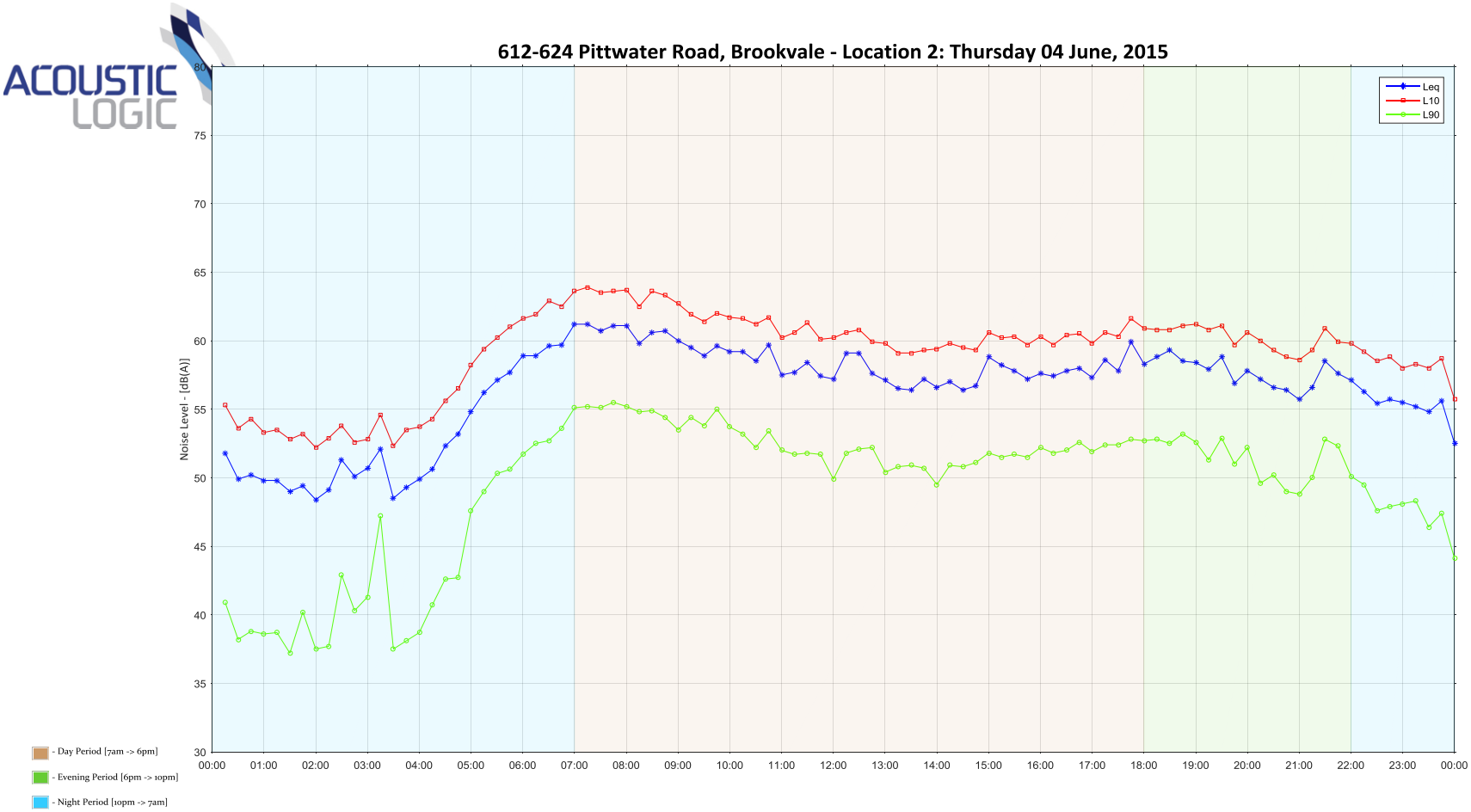
612-624 Pittwater Road, Brookvale - Location 2: Thursday 04 June, 2015
Noise Level - [dB(A)]
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- Day Period [7am -> 6pm]
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- Night Period [10pm -> 7am]


612-624 Pittwater Road, Brookvale - Location 2: Friday 05 June, 2015
Noise Level - [dB(A)]
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- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]