Ivanhoe Estate Masterplan, Macquarie Park

DA Acoustic Assessment

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1 EXECUTIVE SUMMARY

Acoustic Logic Consultancy has been engaged to prepare this acoustic assessment report to support a Concept Development Application for the Ivanhoe Estate Masterplan.

The Masterplan DA is the first step of the planned redevelopment of the Ivanhoe Estate and will create an integrated neighbourhood including social housing mixed with affordable and private housing, as well as seniors housing, a new school, child care centres, community facilities and retail development.

The proposed development is assessed based on requirements below:

- City of Ryde Development Control Plan 2014;
- NSW Department of Planning and Environment's Document – '*Developments near Rail Corridors or Busy Roads – Interim Guideline';*
- Australian and New Zealand AS/NZS 3671:1989 *'Acoustics—Road traffic noise intrusion—Building siting and construction'*;
- Australian and New Zealand AS/NZS 2107:2016 *'Recommended design sound levels and reverberation times for building interiors'* and;
- NSW EPA Noise Policy for Industry 2017.
- Association of Australian Acoustical Consultants "Technical Guideline Child Care Centre Noise Assessment" 2013

2 INTRODUCTION

This report presents our assessment for Concept Development Application for the Ivanhoe Estate Masterplan, Macquarie Park. The assessment is based on the Masterplan briefing document provided to this office.

3 SITE DESCRIPTION

The development of a new mixed tenure community in Sydney's Macquarie Park will integrate and social, affordable and market housing together to provide a sustainable and inclusive neighbourhood for people from all walks of life.

The project site will be completed in eight stages including social market dwellings, social ILUs, A high school, 2 child care centres, and a small amount of convenience retail space. The proposed development of each stage is listed below:

Table 1 – Details of the Proposed Development

BLOCK	DWELLINGS
A1	269
A2	109
A3	244
B1	86
B1.2/3/4	102
B2	
B3	156
C1	474
C2	183
C3	165
C4	415
D1	362
D2	218
D3	260
D4	438
TOTAL	3,481

Immediately to the north of the site are a series of four storey residential apartment buildings. On the north-western boundary, the site fronts Herring Road which is the six-lane road with a lot of bus movements and a property lot which is currently vacant and is likely to be subject to redevelopment. Epping Road which is the six-lane road carries high traffic volume runs along the south-western boundary of the site and Shrimptons Creek, an area of public open space, runs along the south-eastern boundary. Vehicle access to the site is via Herring Road. Detailed site map and noise monitor locations refer to Figure below:

Unattended noise monitor locations

Manned noise monitor locations

Figure 1 Site Map and Noise Monitor Locations

4 MAJOR ACOUSTIC ISSUES RELATED TO THE PROPOSED DEVELOPMENT

Acoustic investigation has been carried out and the following acoustic issues are related to the proposed development and will be addressed in this report:

- Traffic noise intrusion into the project site from Epping Road and Herring Road.
- Traffic Noise Increase Generated by the proposed development.
- Operational noise from commercial buildings across Shrimptons Creek into project buildings.
- External noise emission from the proposed School, Childcare Centres and plant service project buildings.
- Noise emission from construction of project site.

5 TRAFFIC NOISE INTRUSION INTO PROPOSED DEVELOPMENT

5.1 NOISE DESCRIPTORS

Traffic noise constantly varies in level, due to fluctuations in traffic speed, vehicle types, road conditions and traffic densities. Accordingly, it is not possible to accurately determine prevailing traffic noise conditions by measuring a single, instantaneous noise level. To accurately determine the effects of traffic 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. These parameters are used to measure how much annoyance would be caused by a particular noise source.

In the case of 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 at the source.

Conversely, the L_{10} 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 measurement 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 traffic noise.

5.2 INTERNAL NOISE CRITERIA

The traffic noise intrusion into the project site shall satisfy the requirements below:

- City of Ryde Development Control Plan 2014

- NSW Department of Planning and Environment's Document " Development near Rail Corridors and Busy Roads Interim Guideline"
- NSW Department of Planning and Environment's document – *'State Environmental Planning Policy (SEPP) (INFRASTRUCTURE) 2007'.*
- Australian and New Zealand AS/NZS 3671:1989 'Acoustics—Road traffic noise intrusion—Building siting and construction'
- Australian and New Zealand AS/NZS 2107:2016 'Recommended design sound levels and reverberation times for building interiors'

5.2.1 City of Ryde Development Control Plan 2014 (Traffic Noise Intrusion)

The City of Ryde Development Control Plan 2014 does not state traffic noise criteria, therefore; the following documents and their criteria are recommended.

5.2.2 NSW Department of Planning and Environment's Document – 'Developments near Rail Corridors or Busy Roads – Interim Guideline'

Section 3.5 of the NSW Department of Planning's 'Development near Rail Corridors and Busy Roads (Interim Guideline)' states:

"The following provides an overall summary of the assessment procedure to meet the requirements of clauses 87 and 102 of the Infrastructure SEPP. The procedure covers noise at developments for both Road and Rail.

- *If the development is for the purpose of a building for residential use, the consent authority must be satisfied that appropriate measures will be taken to ensure that the following L_{Aeq} levels are not exceeded:*

  - *in any bedroom in the building: 35dB(A) at any time 10pm-7am*

  - *anywhere else in the building (other than a garage, kitchen, bathroom or hallway): 40dB(A) at any time."*

5.2.3 NSW Department of Planning and Environment's document – *'State Environmental Planning Policy (SEPP) (INFRASTRUCTURE) 2007'* (Traffic Noise Intrusion)

RTA Map No. 11 of the traffic volume maps referenced by the SEPP (INFRASTRUCTURE) on the RTA website (see below), classifies the section of Epping Road where the development is located adjacent to as a road where a noise intrusion assessment is mandatory under clause 102 of the SEPP Infrastructure 2007. See RTA average annual daily road traffic volume map number 11 and the approximate location of the site below.

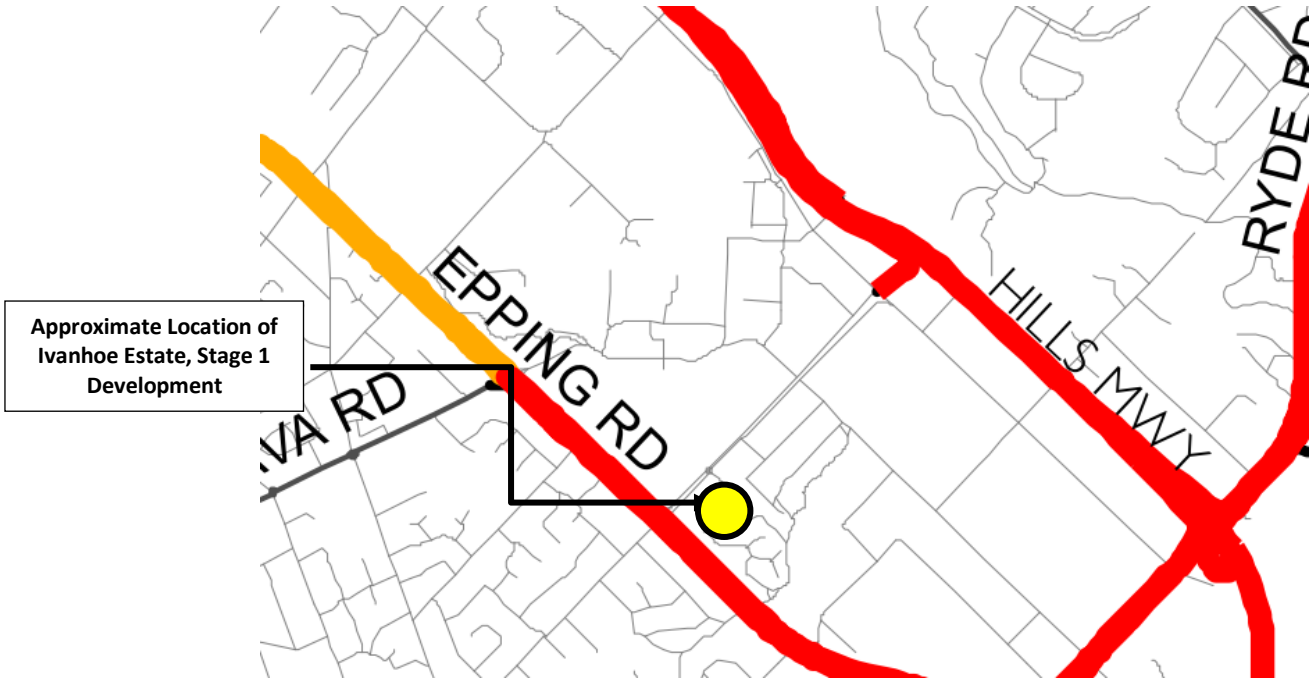


Figure 2 – RTA Map No. 11 and Approximate Location of Proposed Development

Clause 87 - Impact of rail noise or vibration on non-rail development

(1) This clause applies to development for any of the following purposes that is on land in or adjacent to a rail corridor and that the consent authority considers is likely to be adversely affected by rail noise or vibration:

(a) a building for residential use,

(b) a place of public worship,

(c) a hospital,

(d) an educational establishment or child care centre.

(3) If the development is for the purposes of a building for residential use, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following L_{Aeq} levels are not exceeded:

(a) in any bedroom in the building--35 dB(A) at any time between 10.00 pm and 7.00 am,

(b) anywhere else in the building (other than a garage, kitchen, bathroom or hallway)--40 dB(A) at any time.

Clause 102

- *If the development is for the purpose of a building for residential use, the consent authority must be satisfied that appropriate measures will be taken to ensure that the following L_{Aeq} levels are not exceeded:*

  - *in any bedroom in the building: 35dB(A) at any time 10pm-7am*

- *anywhere else in the building (other than a garage, kitchen, bathroom or hallway): 40dB(A) at any time."*

5.2.4 Australian and New Zealand AS/NZS 3671:1989 *'Acoustics—Road traffic noise intrusion—Building siting and construction'*

Australian Standard AS 3671-1989 notes the following in relation to traffic noise:

- Internal noise levels should be determined in accordance with the relevant standard.
- Australian Standard AS/NZS 2107:2016 'Acoustics – Recommended design sound levels and reverberation times for building interiors', is the industry adopted standard.
- A suitable descriptor should be adopted relevant to the use of the development. As AS2107:2016 adopts the L_{eq} descriptor, ALC shall also use this descriptor.
- AS3671 does not specifically recommend a time interval. On this basis, ALC have adopted the interval used by the EPA Road Noise Policy for main/arterial roads, that being:
    - Day – 7am to 10pm (15 hour); and
    - Night – 10pm to 7am (9 hour).

Internal noise levels have been selected in accordance with AS 2107:2016.

5.2.5 Australian and New Zealand AS/NZS 2107:2016 *'Recommended design sound levels and reverberation times for building interiors'*

Australian Standard AS 2107-2016: Recommended design sound levels and reverberation times for building interiors specifies allowable internal noise levels for internal spaces within residential and commercial buildings. Table 1, in Section 5 of AS 2107-2016, gives the following maximum internal noise levels for commercial buildings and residential buildings near major roads.

Table 2 - Recommended Design Sound Level

Space /Activity Type	Recommended Maximum Design Sound Level dB(A) L_{eq}
Living Areas	40-45 dB(A)$L_{eq,\ 24\ hours}$
Sleeping Areas	35 dB(A)$L_{eq(night\ time)}$
Bathrooms, Ensuites, Laundry	45 dB(A)L_{eq}

5.2.6 Summary of Internal Noise Criteria

The governing project criteria for traffic noise intrusion is presented in the Table below.

Table 3 – Summary of Internal Noise Level Criteria

Space	Internal Traffic Noise Criteria dB(A)L_{eq}
Bedroom	35dB(A)$L_{eq(9hour)}$; 40dB(A)$L_{eq(15hour)}$
Living Space	40dB(A)$L_{eq(24hour)}$
Bathroom	45dB(A)$L_{eq(When\ in\ use)}$

5.3 EXTERNAL NOISE MEASUREMENTS

This section of the report details noise measurements conducted at the site to establish traffic and surrounding environmental noise levels impacting the development.

Manned and Unmanned Noise Measurements have been carried out around project site.

5.3.1 Manned Noise Measurements

Attended short term measurements of traffic noise which were undertaken by this office, to supplement the unattended noise monitoring. Measurements were conducted using a Norsonic 140 Sound Analyser. The analyser was set to fast response and calibrated before and after the measurements using a Norsonic Sound Calibrator type 1251. No significant drift was noted.

Noise measurements were undertaken between the hours of 3:30pm and 5:30pm on Wednesday, 25th October, 2017.

Detailed measurement location and the measured noise levels are below:

Table 4 – Manned Traffic Noise Measurement Results

Location	Measured Noise Level dB(A)Leq
Epping Road- at 7m distance from kerb (Figure 1)	69
Herring Road- at 5m distance from kerb (Figure 1)	71

5.3.2 Unattended Noise Measurements

Four unattended noise monitors have been used to measure the traffic noise around project site. Three of them were located along Epping Road and One of them were located along Herring Road. Detailed noise monitor locations have been marked on Figure 1 afore.

Unattended noise monitoring was conducting using four Acoustic Research Laboratories Pty Ltd noise loggers. The loggers were programmed to store 15-minute statistical noise levels throughout the monitoring period. The equipment was calibrated at the beginning and the end of each measurement using a Rion NC-73 calibrator; no significant drift was detected. All measurements were taken on A-weighted fast response mode.

5.3.3 Measurement Period

Monitors 1; 3; 4-Unattended noise monitoring was conducted from Wednesday, 25th October, 2017 to Wednesday, 1st November, 2017.

Monitor 2—Unattended noise monitoring was conducted from 11th of September to 18th September 2017.

5.3.4 Measured Traffic Noise Measurements

Unattended noise measurements have been summarised below for each location.

Table 5 – Unattended Traffic Noise Measurement Results

Measurement	Location	Measured Traffic Noise Level dB(A)L_{eq}	
		Day (7am-10pm)	Night (10pm-7am)
1	20m distance from kerb of Epping Rd	**70**	**66**
2	10m distance from kerb of Epping Rd	**69**	**66**
3	13m distance from kerb of Epping Rd	**69**	**66**
4	18m distance from kerb of Herring Rd	**63**	**56**

5.4 FUTURE TRAFFIC NOISE

5.4.1 Traffic Study Results

Future traffic volumes along roads adjacent to the project site have been forecasted in "Transport Management and Accessibility Plan" prepared by Asong Group with reference number: 0421r02 dated 30/10/2017 which have been repeated below:

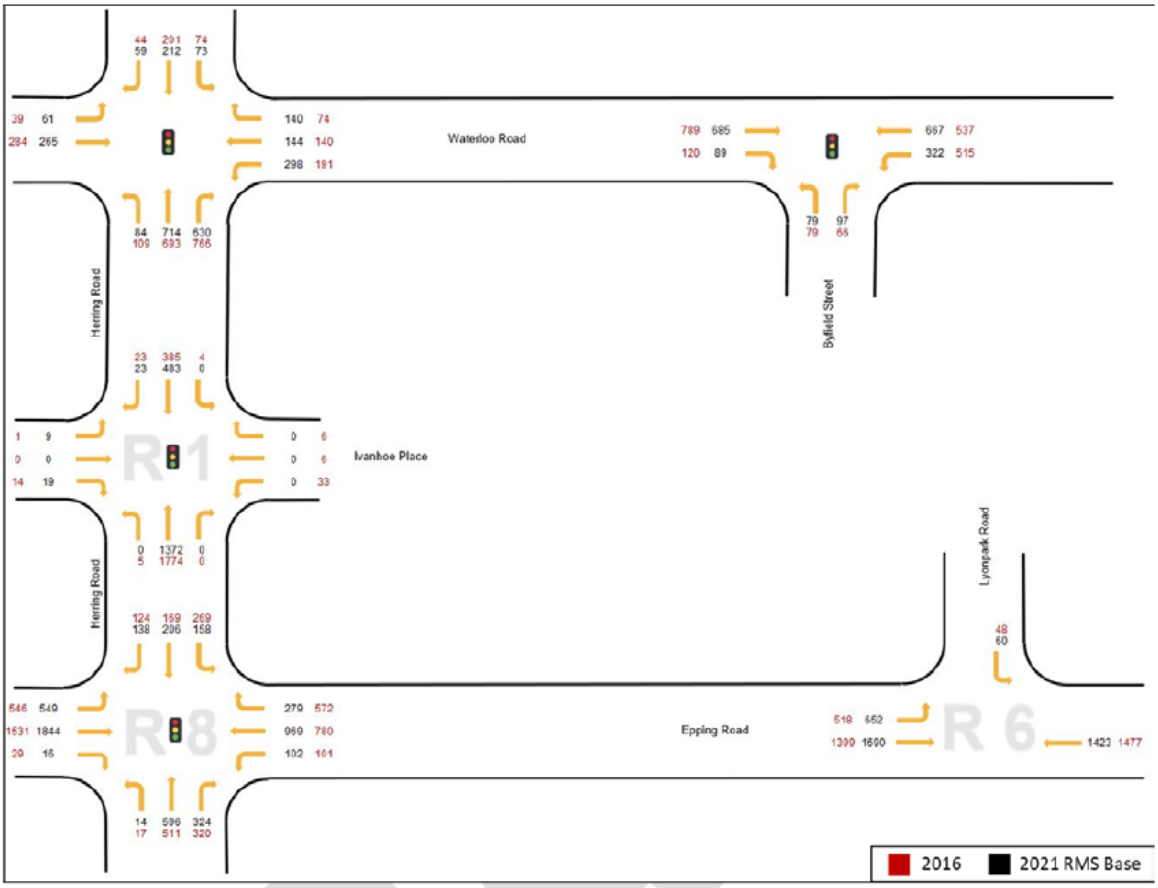


Figure 24: Comparison of 2016 Base with 2021 RMS Base Model Volumes (AM)

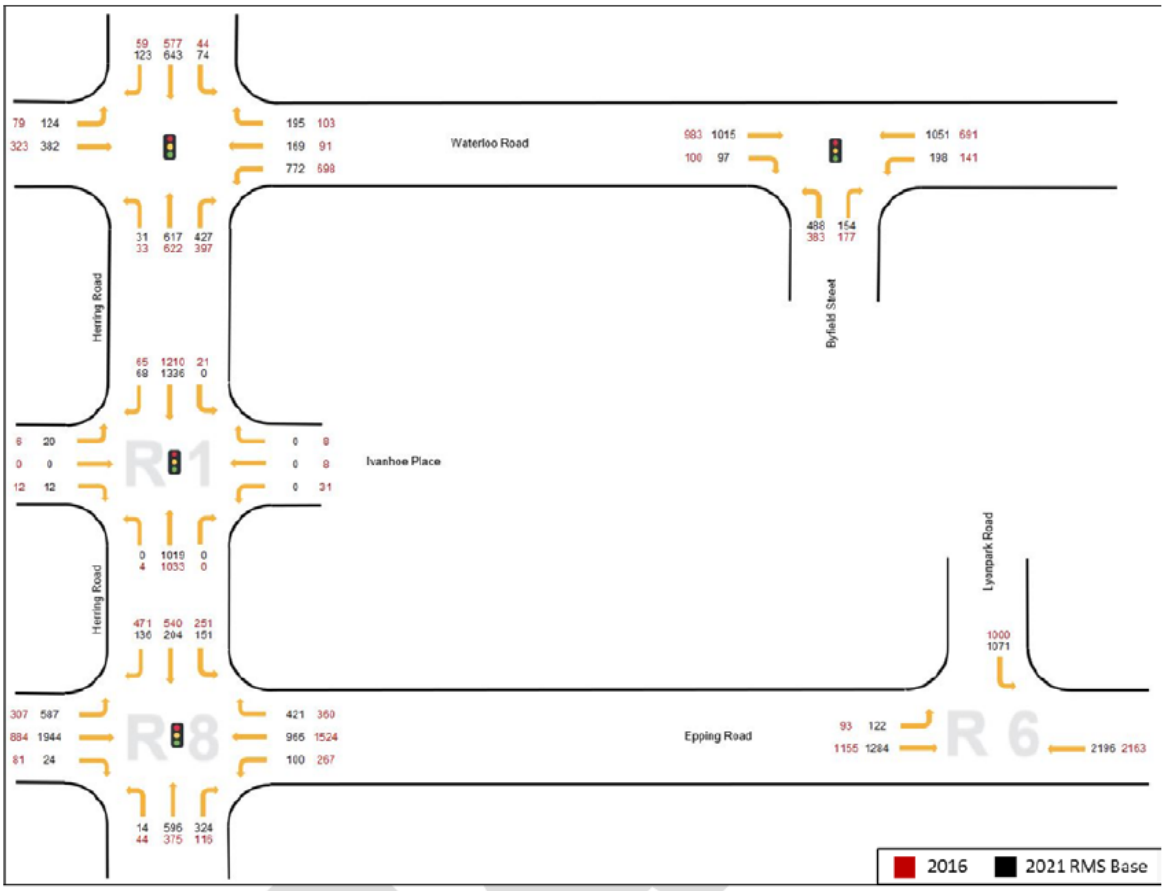


Figure 25: Comparison of 2016 Base with 2021 RMS Base Model Volumes (PM)

Summarised peak hour traffifc volume is below:

Table 6 – Summarised Current /Future Traffic Volume

Location	Time	Traffic Volume 2016	Predicted Traffic Volume 2021
Epping Rd (between R6 & R8)	AM	3370	3692
	PM	3399	2893
Herring Rd (between R8 & R1)	AM	2341	1874
	PM	2299	1510

5.4.2 Predicted Future Traffic Noise Levels

The predicted future traffic noise level increase is below based on traffic volume forecasted in Table below:

Table 7 – Predicted Traffic Noise Increase

Location	Traffic Noise Increase
Epping Rd	+ 0.3 dB(A)
Herring Rd	0

6 NOISE FROM NEIGHBOURING COMMERCIAL SITES

6.1 INTERNAL NOISE CRITERIA

The noise intrusion from the operation of commercial sites immediately across creek shall satisfy the requirements of Australian Standard AS2107-2016.

Australian Standard AS 2107-2016: Recommended design sound levels and reverberation times for building interiors specifies allowable internal noise levels for internal spaces within residential and commercial buildings. Table below gives the following maximum internal noise levels for commercial buildings and residential buildings near major roads.

Table 8 - Recommended Design Sound Level

Space /Activity Type	Recommended Maximum Design Sound Level dB(A) L_{eq}
Living Areas	40-45 dB(A)$L_{eq,\ 24\ hours}$
Sleeping Areas	35 dB(A)$L_{eq(night\ time)}$
Bathrooms, Ensuites, Laundry	45 dB(A)L_{eq}

6.2 MEASURED NOISE LEVELS

Manned and unmanned noise measurements have been carried out along eastern boundary of project site.

Attended short term noise measurements were carried out on 1st November 2017 to supplement the unattended noise monitoring. Measurements were conducted using a Norsonic 140 Sound Analyser. The analyser was set to fast response and calibrated before and after the measurements using a Norsonic Sound Calibrator type 1251. No significant drift was noted.

Unmanned noise measurement was carried out by setting up a noise monitor along creek (faces away from traffic). The monitor was programmed to store 15-minute statistical noise levels throughout the monitoring period. The equipment was calibrated at the beginning and the end of each measurement using a Rion NC-73 calibrator; no significant drift was detected. All measurements were taken on A-weighted fast response mode.

Measured noise levels are summarised below:

Table 9 – Operational Noise from Neighbouring Commercial Sites

Location	Time	Measured Noise Level dB(A)L_{eq}
Location #6 along eastern boundary	Day	56
	Night	52

7 EXTERNAL NOISE INTRUSION ANALYSIS AND RECOMMENDATIONS

External noise intrusion into the proposed development was assessed using the measured and predicted noise levels above.

Calculations were undertaken taking into account the orientation of windows, barrier effects *(where applicable)*, the total area of glazing, facade transmission loss and room sound absorption characteristics. In this way, the likely interior noise levels can be predicted.

7.1 RECOMMENDED CONSTRUCTIONS

7.1.1 Glazed Windows and Doors

The following constructions are recommended to comply with the project noise objectives. Aluminium framed/sliding glass doors and windows will be satisfactory provided they meet the following criteria. All external windows and doors listed are required to be fitted with Q-lon type acoustic seals. (**Mohair Seals are unacceptable**).

Thicker glazing may be required for structural, safety or other purposes. Where it is required to use thicker glazing than scheduled, this will also be acoustically acceptable.

The recommended constructions are listed in the table below.

Table 10 – Recommended Glazing Construction

Stage	Building	Façade	Room	Glazing Thickness	Acoustic Seals
01	A1	Herring Rd	Bedroom	12.38mm Lam	Yes
			Living Room with glazing area $\leq 8m^2$	12.38mm Lam	
		Remaining Facades	Bedroom	10.38mm Lam	
			Living Room	10.38mm Lam	
	C1.1/C1.3	all	all	6.38mm Lam	
02	A2	Herring Rd	Bedroom	Heavy single glazing	
			Living Room	Heavy single glazing	
		Remaining Facades	All	Medium single glazing	
	C2/C3	all	all	Medium single glazing	
03	A3.1/D1.2/D1.1/D1.3	Epping Rd	Bedroom with glazing $\leq 4m^2$	12.38mm Lam	
			Living Room with glazing $\leq 8m^2$	12.38mm Lam	
		Remaining Facades	All	Heavy single glazing	
04/05/06	D2/D3.2/D3.1/D4.1/D4.2	Epping Rd	Bedroom with glazing $\leq 4m^2$	12.38mm Lam	
			Living Room with glazing $\leq 8m^2$	12.38mm Lam	
	D4.4	Remaining Facades	All	Heavy single glazing	Yes
		All	All	Heavy single glazing	
07	All	All	All	Medium single glazing	
08	All	All	All	Medium single glazing	

It is recommended that only window systems having test results indicating compliance with the required ratings obtained in a certified laboratory be used where windows with acoustic seals have been recommended.

In addition to complying with the minimum scheduled glazing thickness, the R_w rating of the glazing fitted into open-able frames and fixed into the building opening will require the use of acoustic seals around the full perimeter of open-able frames and the frame will need to be sealed into the building opening using a flexible sealant.

Table 11- Minimum R_w of Glazing (with Acoustic Seals)

Glazing Assembly	Minimum R_w of Installed Window
5mm	28
6mm	29
6.38m Lam	31
10mm	33
10.38mm Lam	34
12.38mm Lam	36

7.1.2 External Roof/Ceiling

External roof construction will be constructed from concrete or masonry elements, this proposed structure will not require any further acoustic upgrading. In the event that any penetrations are required through the external skin, an acoustic grade sealant should be used to minimise all gaps.

7.1.3 External Walls

External wall construction will be constructed from concrete and masonry elements, this proposed structure will not require any further acoustic upgrading. In the event that any penetrations are required through the external skin, an acoustic grade sealant should be used to minimise all gaps.

7.1.4 Entry Doors

External opening entry doors shall have glazing thicknesses equal to those recommended in section 7.1.1 Recommended Glazing Construction, and are to have Raven RP10 to the top and sides, and Raven RP38 to the underside of the door.

7.1.5 Mechanical Ventilation

With respect to natural ventilation of the dwelling, the NSW Department of Planning document "Development near Busy Roads and Rail Corridors - Interim Guideline" dictates that:

- *"If internal noise levels with windows or doors open exceed the criteria by more than 10dB(A), the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also to meet the ventilation requirements of the Building Code of Australia."*

With windows open, the allowable internal noise goal is permitted to be 10dB(A) higher than when the windows are closed (ie – allowable level in bedrooms becomes 45dB(A), and 50dB(A) in living rooms).

Requirements of ventilation for each individual apartment will be reviewed at CC stage with detailed floor plans /elevations available.

8 NOISE EMISSION FROM PROJECT SITE

The major noise sources generated by operation of project site are below:

- Plant service project buildings.
- Operation of School
- Operational noise for the proposed Child Care Centre

8.1 BACKGROUND NOISE LEVELS

Background noise measurements have been carried out by setting up two noise monitors along northern boundary of project site (faces away from traffic).

8.1.1 equipment used

Background noise was recorded using an Acoustic Research Laboratories Pty Ltd noise logger. The logger was programmed to store 15-minute statistical noise levels throughout the unmanned monitoring period. The equipment was calibrated at the beginning and the end of the measurement using a Rion NC-73 calibrator; no significant drift was detected. All measurements were taken on A-weighted fast response mode.

8.1.2 Measurement time period

Unmanned measurements were conducted between 16th and 23rd May 2012. Figure 1 details the measurement position.

8.1.3 Measured Rating Background Noise Level

The measured background noise levels dB(A)L_{90} for day, evening and night time periods are shown in the table below.

- 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 12 – Rating Background Noise Levels

Location	Time	L_{90} dB(A)
Unattended noise monitor at Location 5 (Figure 1)	Day	42
	Evening	39
	Night	34
Unattended noise monitor at Location 6 (Figure 1)	Day	46
	Evening	46
	Night	43

Note: the lowest RBL of each time period will be adopted to setup noise emission criteria to provide conservative noise emission assessment.

8.2 PLANT NOISE FROM PROJECT SITE

The noise emission from plant service project buildings shall satisfy the requirements below:

- City of Ryde Development Control Plan 2014 and;
- NSW EPA Noise Policy for Industry 2017.

8.2.1 City of Ryde Development Control Plan 2014

3.10 Acoustic Privacy
Controls

f. *"The operating noise level of air conditioners, swimming pool pumps and other mechanical services must not exceed the background noise level by more than 5dB(A)."*

8.3 REQUIREMENTS BY EPA NOISE POLICY FOR INDUSTRY

The Industrial Noise Policy has been superseded by Noise Policy for Industry 2017.

The NPfI 2017 provides guidelines for assessing noise impacts from industrial developments. The recommended assessment objectives vary depending on the potentially affected receivers, the time of day, and the type of noise source. The NPfI has two requirements which both have to be complied with, namely project amenity criterion and an intrusiveness criterion.

8.3.1 Intrusiveness Criterion

The 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).

Intrusive criteria based on the minimum RBL recommended by EPA for project site are detailed in table below.

Table 13 – NPfI Intrusiveness Criteria

Time of day	Background Noise Level dB(A)L_{90}	Intrusiveness Criteria (Background+5dB(A)) dB(A)L_{eq}
Day	42	47
Evening	39	44
Night	34	39

8.3.2 Project Amenity Criterion

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

The NPfI requires Project Amenity Noise Levels to be calculated below:

$L_{Aeq,\ 15\ min}$ = *Recommended Amenity Noise Level – 5 dB(A) + 3 dB(A)*

Pursuant to the NPfI, the residential receivers in the vicinity would be considered suburban. Corresponding Project Amenity Criteria noise emission goals are presented below.

Table 14 –NPfI Project Amenity Criteria

Type of Receiver	Time of day	Recommended Amenity Noise Level dB(A) L_{eq}	Project Amenity Noise Level dB(A)$L_{eq, 15min}$
Residential (suburban)*	Day	50	48
	Evening	45	43
	Night	40	38
Commercial Boundary	when in use	65	

8.3.3 Sleep Arousal Criteria

Section 2.5 of NPfI 2017 recommended the following noise limit to mitigate sleeping disturbance:

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

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

A detailed maximum noise level even assessment should be undertaken.

Table 15 - Sleep Arousal Emergence Criteria (Night)

Location	Rating Background Noise Level (Night) - dB(A)L_{90}	Emergence Level
All Potentially Affected Residential Properties	34	39 dB(A)$L_{eq, 15min}$; 49 dB(A)$L_{max, F}$

8.3.4 Summary of Noise Emission Criteria

The noise emission criteria from plant service project buildings have been summarised below.

Table 16 -Summarised Noise Emission Criteria

Location	Time	Noise Objectives
Residential Boundaries around Project site	Day	47 dB(A)$L_{eq, 15min}$`
	Evening	43 dB(A)$L_{eq, 15min}$
	Night	38 dB(A)$L_{eq, 15min}$ 49 dB(A)$L_{max, F}$
Commercial Boundaries	when in use	65 dB(A)L_{eq}

8.3.5 Plant Service Project Buildings

Plant service project buildings include air conditioning, ventilation fans, etc. Detailed mechanical design and equipment selections are not available at this stage, acoustic controls can be worked out at CC stage to ensure that the overall plant noise emissions satisfy the requirements above.

8.4 NOISE EMISSION FROM THE PROPOSED SCHOOL

The noise emission from the operation of School shall satisfy the requirements below:

- City of Ryde Development Control Plan 2014 and;
- NSW EPA Industrial Noise Policy (Noise Policy for Industry 2017)

8.4.1 City of Ryde Development Control Plan

Ryde City Council DCP does not have specific noise emission criteria for school.

8.4.2 Requirements by EPA INP

The 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).

Intrusive criteria based on the minimum RBL recommended by EPA for project site are detailed in table below. It is assumed that the School generally operates during day time only.

Table 17 – NPfI Intrusiveness Criteria

Time of day	Background Noise Level dB(A)L_{90}	Intrusiveness Criteria (Background+5dB(A)) dB(A)L_{eq}
Day	42	47

8.4.3 Recommendations

The nearest noise receiver is the existing multi storey residential buildings adjacent to northern boundary. Detailed acoustic controls can be determined at CC stage.

8.5 PROPOSED CHILD CARE CENTRES

The two proposed 75 places childcare centre is located within project site. This office has been advised below:

- Operation hours of the proposed childcare centre are 7am to 7pm Monday to Friday.

8.5.1 Noise Objectives

8.5.1.1 Internal Noise Levels

The internal noise levels of the childcare centre shall comply with the requirements Association of Australian Acoustical Consultants "Technical Guideline Child Care Centre Noise Assessment" 2013 which has been detailed below.

Table 18 –Childcare Centre- Internal Noise Criteria

Space	Internal Noise
Sleeping Rooms	40 dB(A) $L_{eq,\ 1\ hour}$
Other rooms	40 dB(A) $L_{eq,\ 1\ hour}$

8.5.1.2 Outdoor Play Area Noise Levels

External ambient noise levels shall comply with the requirements of Association of Australian Acoustical Consultants "Technical Guideline Child Care Centre Noise Assessment" 2013 which has been detailed below.

Table 19 - Childcare Centre- Outdoor Noise Criteria

Space	External Noise
Outdoor Playgrounds and Activity Areas	55 dB(A) $L_{eq,\ 1\ hour}$

8.5.1.3 Environmental Noise Impact Criteria

Association of Australian Acoustical Consultants "Technical Guideline Child Care Centre Noise Assessment" May 2008 states:

Up to 2 hours (total) per day*- The L_{eq}, 15min noise level emitted from outdoor play area shall not exceed the background noise level by more than 10 dB at the assessment location;*

More than 2 hours per day*- The L_{eq}, 15min noise level emitted from the outdoor play area shall not exceed the background noise level by more than 10 dB at the assessment location.*

The noise emission criteria has been summarised below base on the requirements above and measured rating background noise data on site.

Table 20 –Noise Emission Criteria for the Child Care Centre

Noise Receiver	Criteria dB(A) $L_{eq\ 15min}$
1m from the receiver façade	>2 hours play: 47 $\leq$ 2 hours play: 52

8.5.2 Recommendations

The nearest noise receiver is the existing multi storey residential buildings adjacent to northern boundary. Acoustic design for each Childcare Centre shall be carried out at DA for each individual building to ensure that the noise emissions satisfy the requirements above.

9 CONSTRUCTION NOISE AND VIBRATION IMPACT

9.1 SENSITIVE RECEIVERS

The nearest sensitive receivers in the vicinity of the site are as follows:

- Peach Tree Road (R1) – there are several multi storey residential flat buildings along the north-eastern boundary of the project site with frontages on 1-9 Peach Tree Road, Macquarie Park; 155 Herring Road, Macquarie Park; and 3 Lachlan Avenue, Macquarie Park. These properties have openable windows and balconies at the rear of the properties which face the proposed demolition site.

- Properties along Epping Road (R2) - -There exists multiple single dwelling houses across Epping Road on the south-western boundary of the project site. The frontages for these residential properties are 172-208 Epping Road, Macquarie Park and 13 Booth St, Marsfield. Epping Road is a classified road under SEPP legislation. These properties have front yards and openable windows which face the proposed construction site. It should also be noted that a majority of these properties have masonry barrier fences along the Boundary adjacent to Epping Road.

- Properties along Herring Road (R3) – There are multi storey residential flat buildings situated between construction sites located at 116 Herring Road, Macquarie Park. These properties have openable windows and balconies at the front of the properties which face the proposed demolition site.

- Commercial receivers along the eastern boundary of the site – There are various multi storey commercial buildings along the eastern boundary of the site, past Shrimptons Creek. The frontages for these buildings are 123 Epping Road, Macquarie Park; 2-10 Lyonpark Rd, Macquarie Park; and 2-8 Byfield Street Macquarie Park.

- Properties on corner of Herring Road and Epping Road – Vacant properties are located on the corner of Herring Road and Epping Road.

9.2 NOISE MANAGEMENT LEVEL

Establishment of criteria for construction noise requirements will be in accordance with the following documents.

- Ryde Council Development Control Plan 2014

- Australian Standards AS2436:2010 *Guide to Noise Control on Construction, Maintenance and Demolition Sites*

- NSW Environmental Protection Agency Interim Construction Noise Guideline

9.2.1 Ryde Council Development Control Plan 2014

9.2.1.1 Part 8.1 – Construction Activities

Section 2.6.1 a) of the Ryde DCP 2014 states:

> *All works shall be carried out in accordance with the requirements of AS2601 – 1991 The Demolition of Structures.*

Section 1.7.2.3 – Noise Control of AS2601 states:

> *Noise shall be minimised, as far as practicable, by the selection of appropriate methods and equipment, and by the use of silencing devices. Attention is drawn to the recommendations contained in AS2436*

9.2.1.1.1 Section 4.6 – Hours of Operation

Section 4.6 a) of the Ryde DCP 2014 states:

> *All demolition and/or construction and associated work is the be restricted to between the hours of 7am and 7pm Mondays to Fridays and between 8am and 4pm on Saturday. No work is to be carried out on Sundays or public holidays*

9.2.2 Australian Standard AS2436:2010 "Guide to noise control on construction, maintenance and demolition sites

Australian Standard AS2436 provides guidance on noise and vibration control in respect to construction and demolition sites, and the preparation of noise and vibration management plans, work method statements and impact studies. The Standard states that:

- "Some construction and demolition activities are by their very nature noisy. The authorities responsible for setting noise level criteria for essential works will take note of the constraints imposed by such activities, especially when they are of short duration."

- Construction, demolition and maintenance works pose different problems of noise and vibration control when compared with most other types of industrial activity, since

  (a) they are mainly carried on in the open;

  (b) they are often temporary in nature although they may cause considerable disturbance whilst they last;

  (c) the noise and vibration arise from many different activities and kinds of plant, and their intensity and character may vary greatly during different phases of the work, and;

  (d) the sites cannot be separated by planning control, from areas that are sensitive to noise and vibration.

The Standard provides advice and guidelines for the prediction of impacts and the methods available to manage impacts. It guideline promulgates feasible and reasonable mitigation strategies and controls, and stakeholder liaison, in the effort to reach a realistic compromise between site activities and impacts on neighbouring properties.

Based on these criteria the following procedure will be used to assess noise emissions:

- Predict noise levels produced by typical construction activities at the sensitive receivers.
- Develop a suitable noise criterion based on the NSW Environmental Protection Agencies Interim Construction Noise Guideline.
- Adopt management conditions as per AS 2436 in the event of a non-compliance.

9.2.3 NSW EPA Interim Construction Noise Guideline

Given the scale of the proposed works, the "quantitative" assessment procedure, as outlined in the Interim Construction Noise Guideline (ICNG) will be used (as opposed to the more simple "qualitative" assessment method outlined in the guidelines). The quantitative assessment method requires:

- Determination of noise generation goals (based on background noise levels on site).
- Prediction of operational noise levels at nearby development.
- If necessary, recommendation of noise controls strategies in the event that compliance with noise emission goals is not possible.

9.2.3.1 At Residential Receivers

EPA guidelines adopt differing strategies for noise control depending on the predicted noise level at the nearest residences:

- *"Noise affected" level*. Where construction noise is predicted to exceed the "noise affected" level at a nearby residence, the proponent should take reasonable/feasible work practices to ensure compliance with the "noise affected level". For residential properties, the "noise affected" level occurs when construction noise exceeds ambient levels by more than 10dB(A)$L_{eq(15min)}$.
- "*Highly noise affected level".* Where noise emissions are such that nearby properties are "highly noise affected", noise controls such as respite periods should be considered. For residential properties, the "highly noise affected" level occurs when construction noise exceeds 75dB(A)$L_{eq(15min)}$ at nearby residences.

9.2.3.2 Construction Noise Management Levels

Construction noise management levels applicable to the development have been determined based on the minimum background noise level recorded and the construction noise management level detailed in of this report. Noise management Level for the construction period of the site are detailed in table below**Error! Reference source not found.**.

Table 21 – Construction Noise Management Levels

Receiver	Category	Time of Day	Background Noise Level dB(A) L_{90}	Construction Noise Management Level dB(A)$L_{eq(15min}$	"Highly Noise Affected" Level dB(A)$L_{eq(15min)}$
Peach Tree Road Properties (R1)	Monday to Friday	0700 - 1800	42	52	75
	Monday to Friday	1800-1900	39	49	75
	Saturday	0800 - 1600	38	48	75
Epping Road Properties (R2)	Monday to Friday	0700 - 1800	57	67	75
	Monday to Friday	1800-1900	55	65	75
	Saturday	0800 - 1600	56	66	75
Herring Road Properties (R3)	Monday to Friday	0700 - 1800	57	67	75
	Monday to Friday	1800-1900	55	65	75
	Saturday	0800 - 1600	56	66	75
Across Creek R4	Monday to Friday	0900-1700	-	70	-

9.3 NOISE EMISSION ASSESSMENT

Detailed demolition, excavation and construction methodology are not available at this stage, acoustic analysis will be carried out at CC of each stage based on requirements above to work out noise mitigation solutions.

10 CONSTRUCTION VIBRATION CRITERIA

Vibration caused by construction at any residence or structure outside the subject site must be limited to:

- For amenity criterion, the NSW Environmental Protection Authorities document *Assessing Vibration: A technical guideline*
- For structure borne damage vibration, German Standard DIN 4150-3 *Structural Vibration: Effects of Vibration on Structures*

The criteria and the application of these standards are discussed in separate sections below.

10.1.1 Amenity

Vibration goals for the amenity of nearby land users are those recommended by the EPA document *Assessing Vibration: A technical guideline.* These levels are presented below:

Table 22 –Vibration Goals

Location	Time	Peak velocity (mm/s)	
		Preferred	Maximum
Continuous Vibration			
Residences (R1-R3)	Daytime	0.28	0.56
Commercial	Daytime	0.56	1.1
Impulsive Vibration			
Residences (R1-R3)	Daytime	8.6	17
Commercial	Daytime	18.0	36.0

10.1.2 Structure Borne Vibration (Damage Criteria)

German Standard DIN 4150-3 (1999-02) provides vibration velocity guideline levels for use in evaluating the effects of vibration on structures. The criteria presented in DIN 4150-3 (1999-02) are presented in Table 23.

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 23 - 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

10.1.3 Recommended Vibration Limits

The table below presents the recommended vibration limit at the nearest vibration sensitive receivers.

Table 24 – Recommended Vibration Limit

Vibration Receiver	Recommended Vibration Limits PPV (mm/s)
Residential Receivers R1 to R3	$\leq$ 5mm/s PPV

11 CONCLUSION

Acoustic assessment for Masterplan DA of redevelopment of the Ivanhoe Estate has been carried out. The findings are summarised below:

- Traffic and operational noise from neighbouring commercial buildings intrusion into project site will satisfy the requirements below:
  - City of Ryde Development Control Plan 2014;
  - NSW Department of Planning and Environment's Document – '*Developments near Rail Corridors or Busy Roads – Interim Guideline';*
  - Australian and New Zealand AS/NZS 3671:1989 *'Acoustics—Road traffic noise intrusion—Building siting and construction'*;
  - Australian and New Zealand AS/NZS 2107:2016 *'Recommended design sound levels and reverberation times for building interiors'* and;
- Noise emission from operation of project site will satisfy the requirements below:
  - NSW EPA Noise Policy for Industry 2017.
  - Association of Australian Acoustical Consultants "Technical Guideline Child Care Centre Noise Assessment" 2013
- Construction noise emission management level have been setup based on requirements of NSW Interim Construction Noise Guideline and detailed noise controls will be determined at CC of each stage.
- Construction vibration limit has been setup in in Section 10 based on requirements of DIN 4150 and EPA document Assessing Vibration: A technical guideline. Detailed vibration safeguard system will be determined at CC of each stage.

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

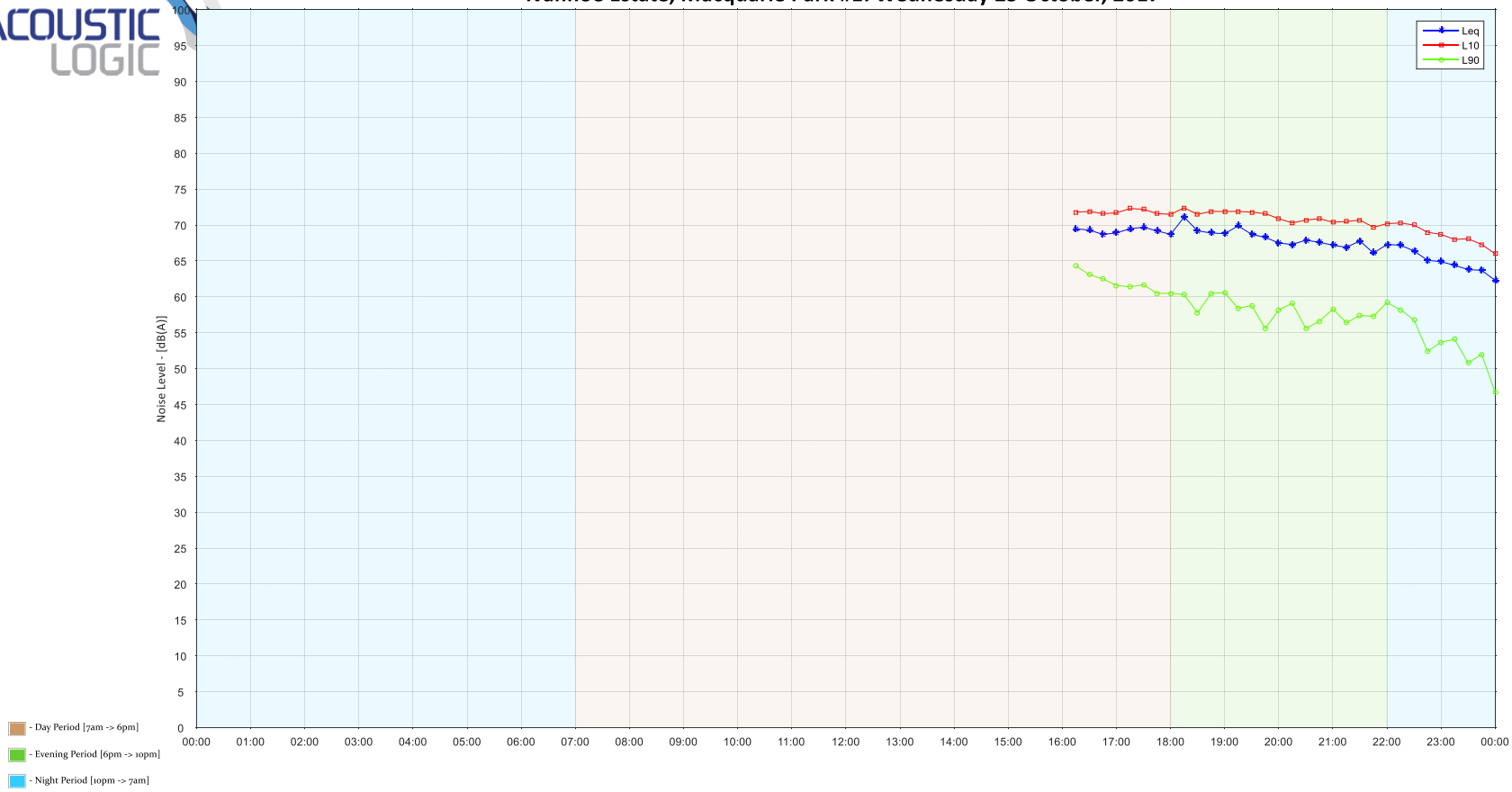
Yours faithfully,

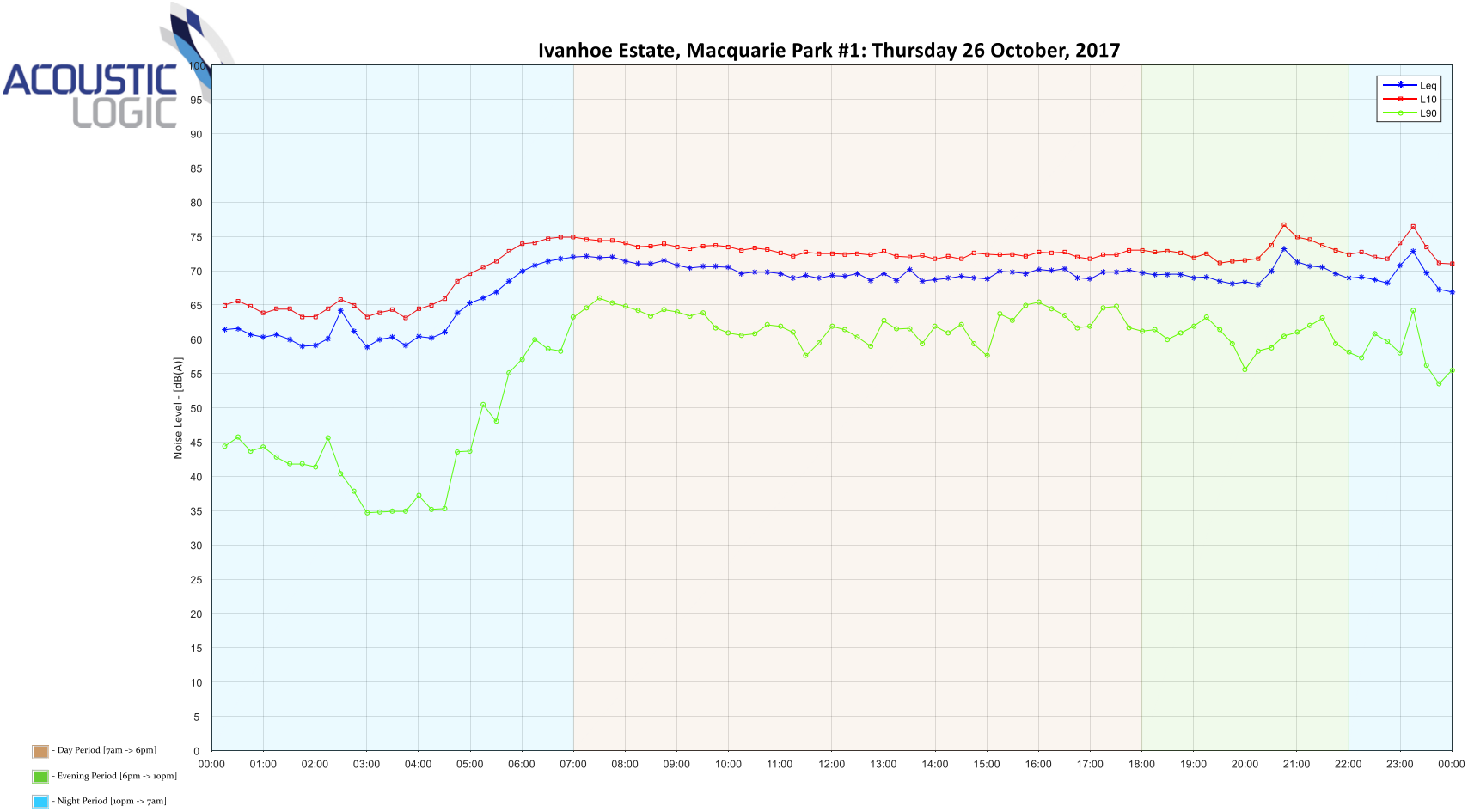
Acoustic Logic Consultancy Pty Ltd
George Wei

Associate Director

Appendix 1- Unattended Noise Data of Location 1

Ivanhoe Estate, Macquarie Park #1: Wednesday 25 October, 2017




Ivanhoe Estate, Macquarie Park #1: Thursday 26 October, 2017
Noise Level - [dB(A)]
Leq
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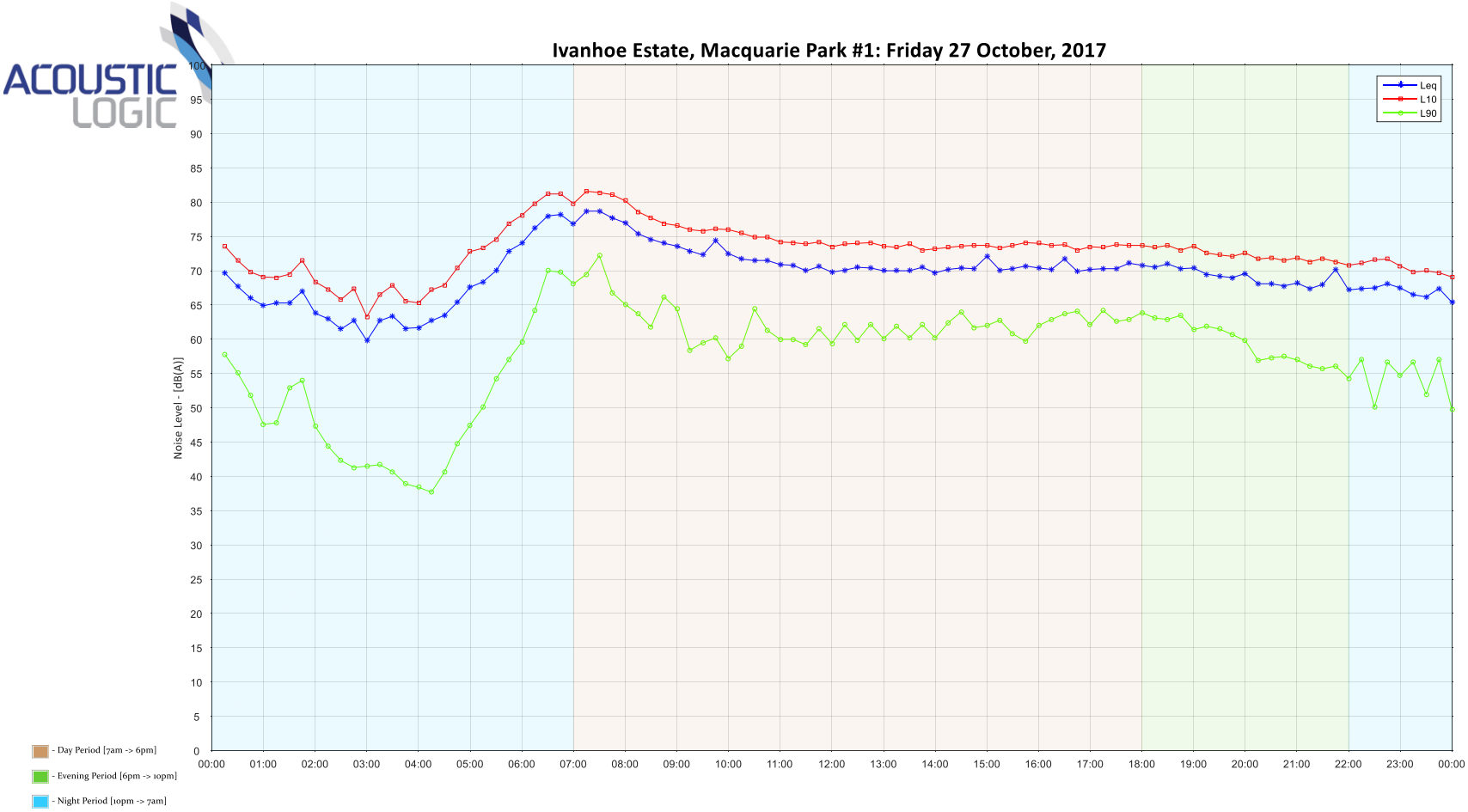
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


Ivanhoe Estate, Macquarie Park #1: Friday 27 October, 2017
Leq
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Noise Level - [dB(A)]
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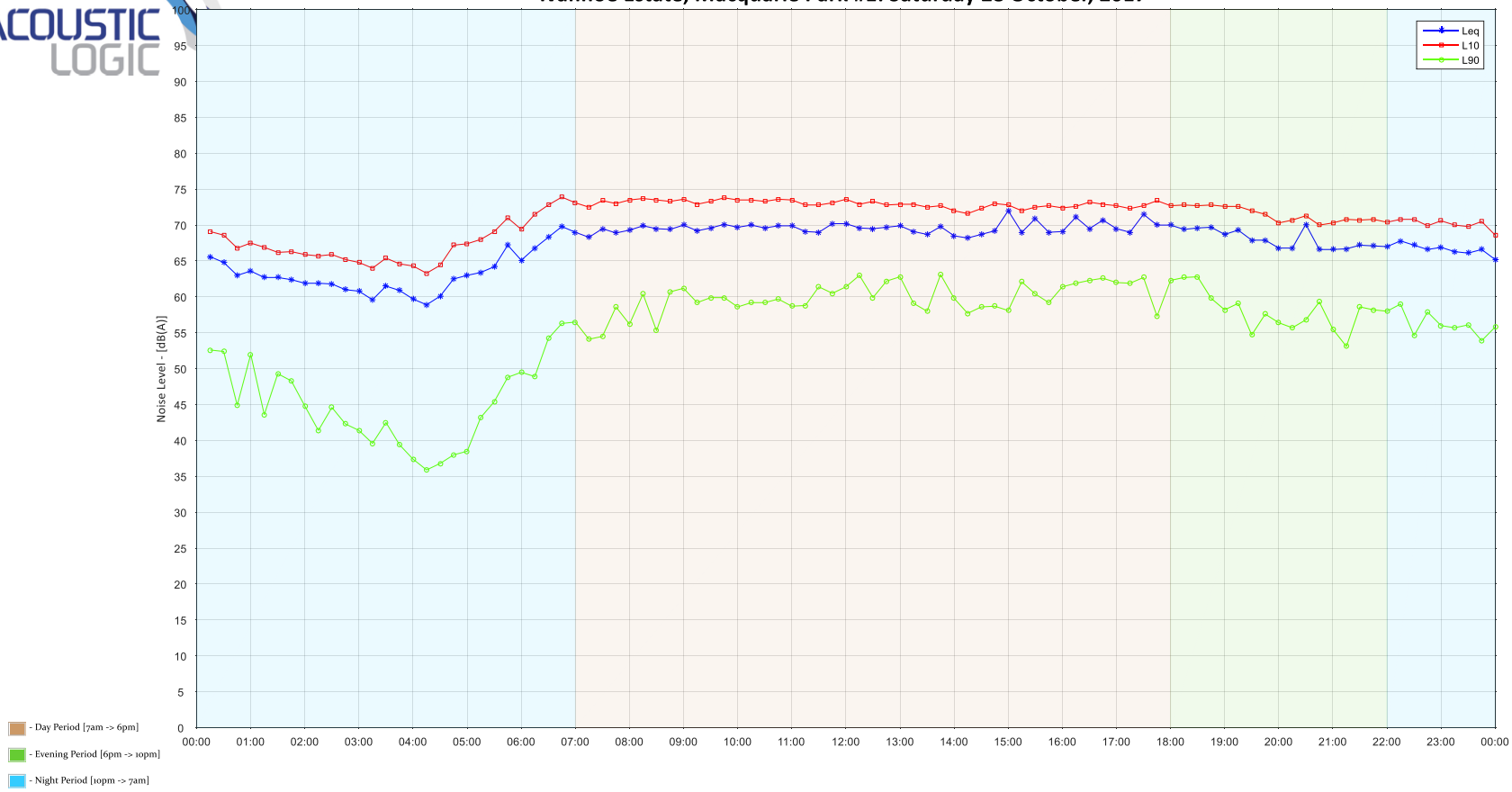
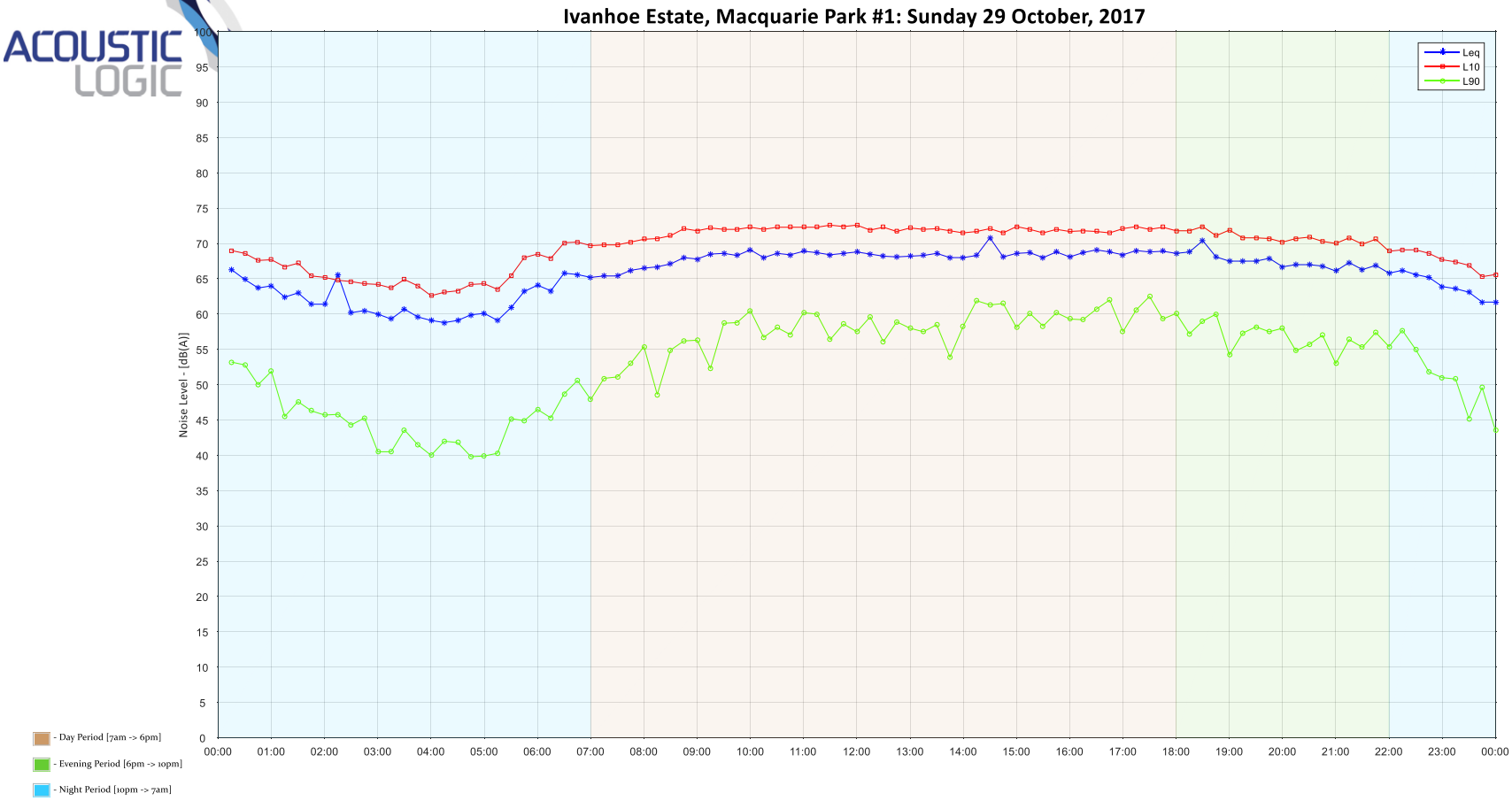
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

Ivanhoe Estate, Macquarie Park #1: Saturday 28 October, 2017




Ivanhoe Estate, Macquarie Park #1: Sunday 29 October, 2017
Noise Level - [dB(A)]
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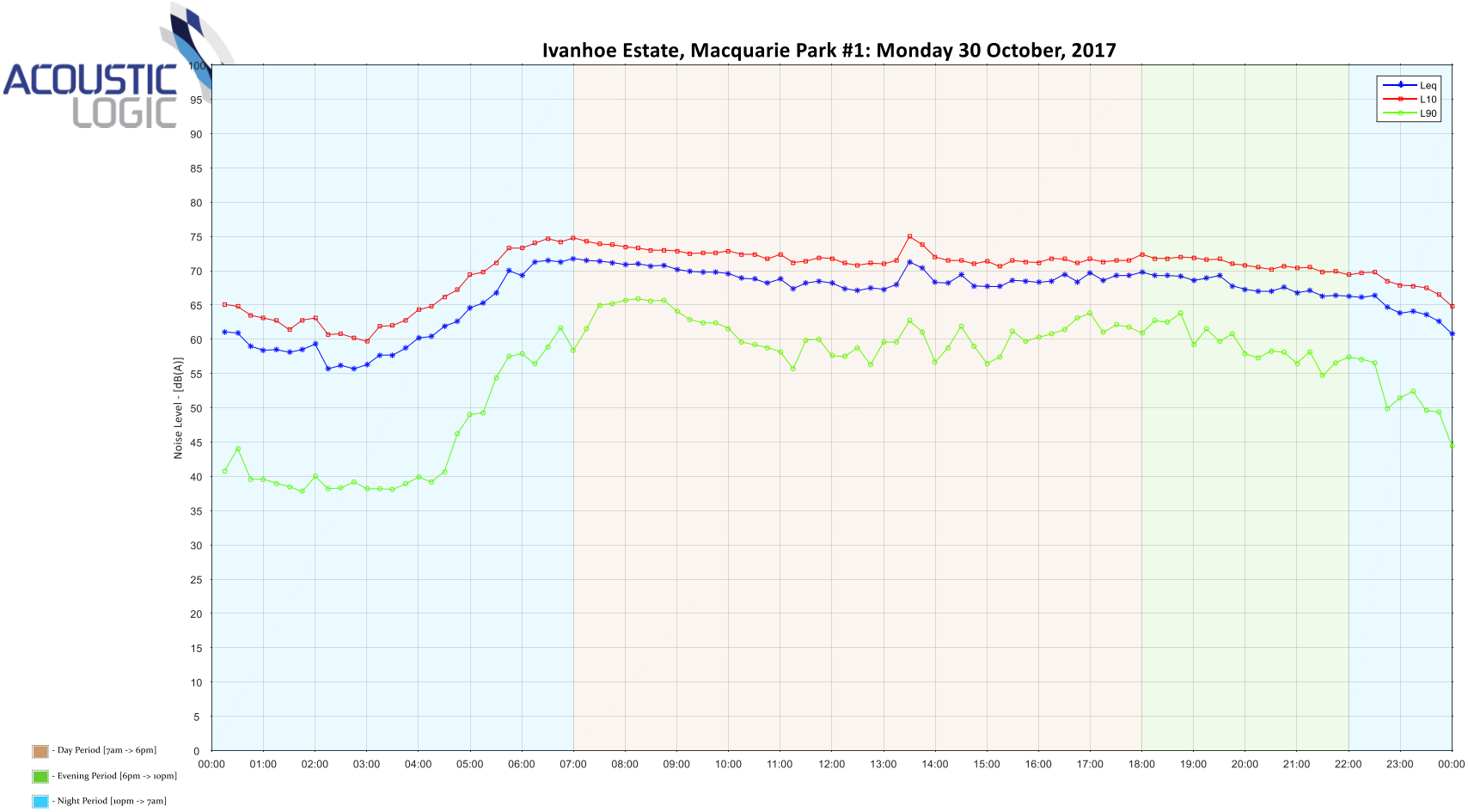
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


Ivanhoe Estate, Macquarie Park #1: Monday 30 October, 2017
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- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
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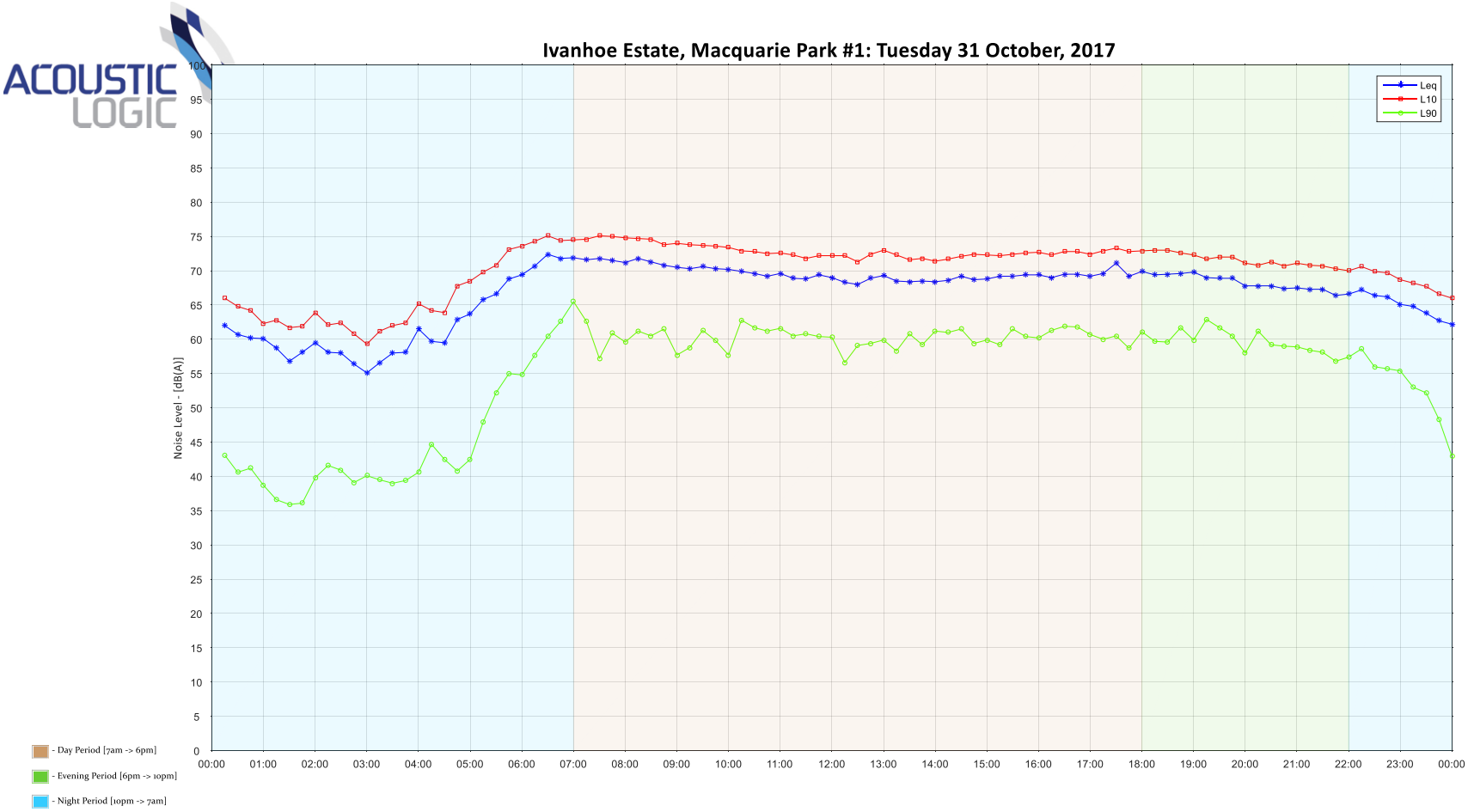
Ivanhoe Estate, Macquarie Park #1: Tuesday 31 October, 2017
Noise Level - [dB(A)]
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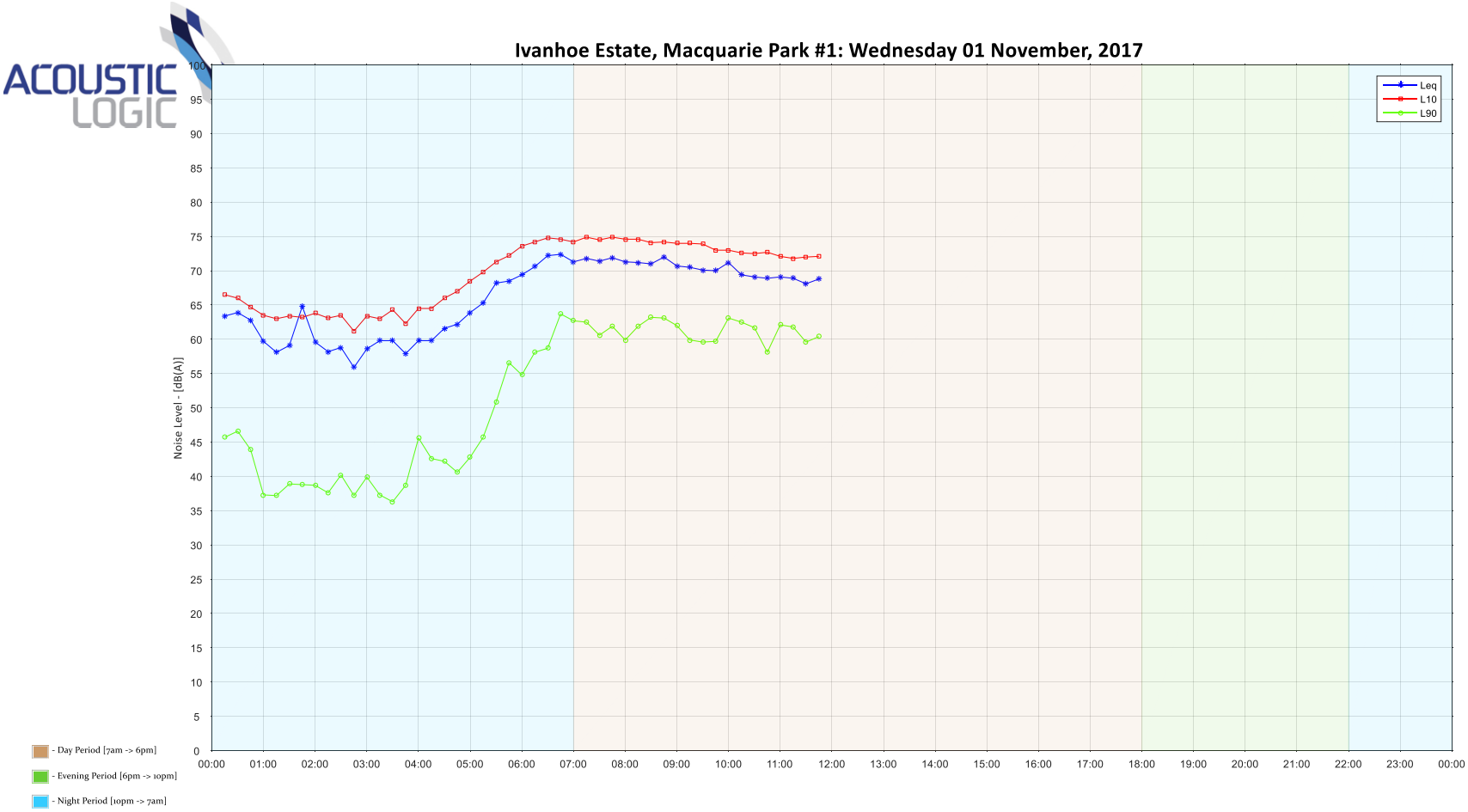
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


Ivanhoe Estate, Macquarie Park #1: Wednesday 01 November, 2017
Noise Level - [dB(A)]
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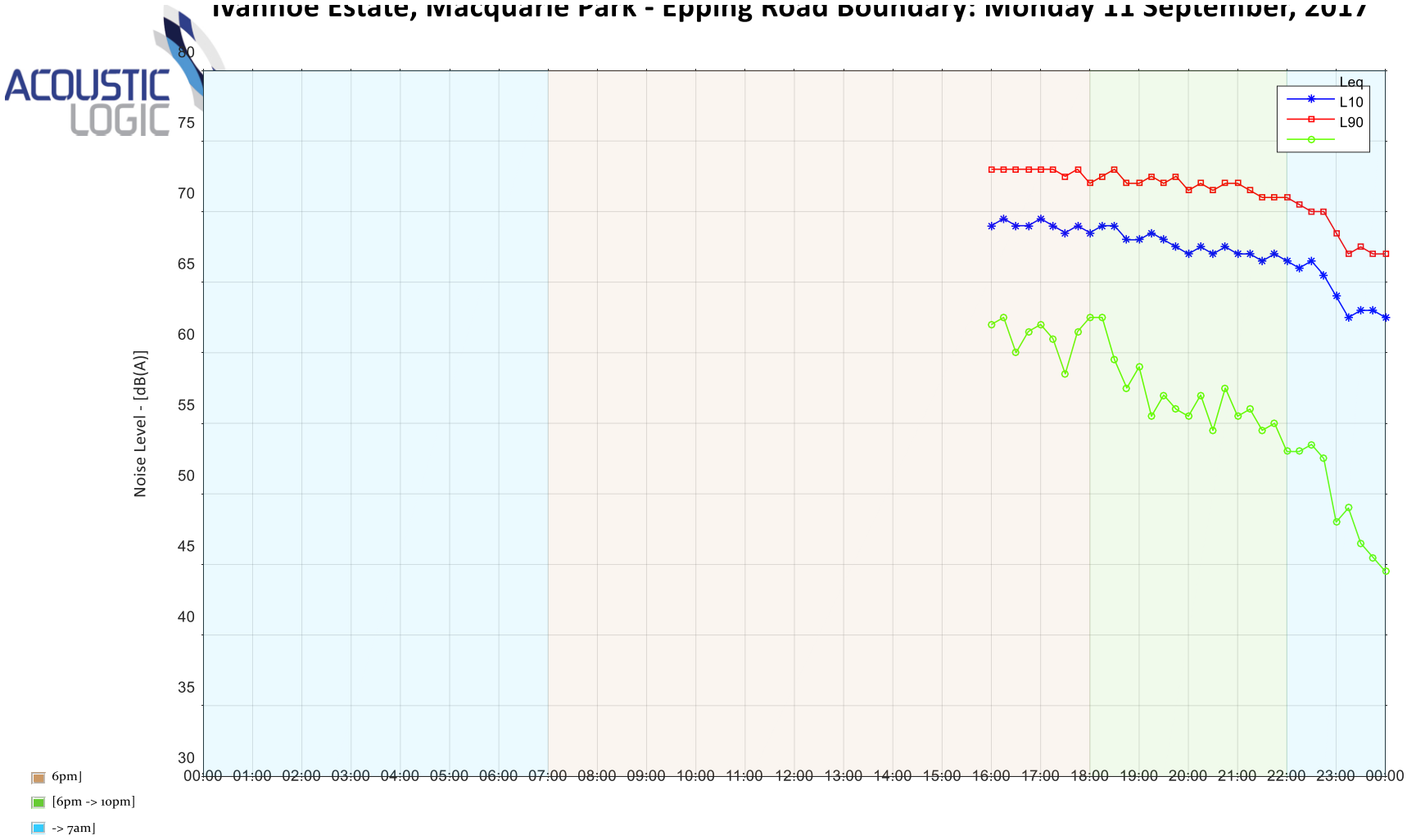
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

Appendix 2- Unattended Noise Data of Location 2


Ivanhoe Estate, Macquarie Park - Epping Road Boundary: Monday 11 September, 2017
Leq
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Noise Level - [dB(A)]
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00:00 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 00:00
6pm]
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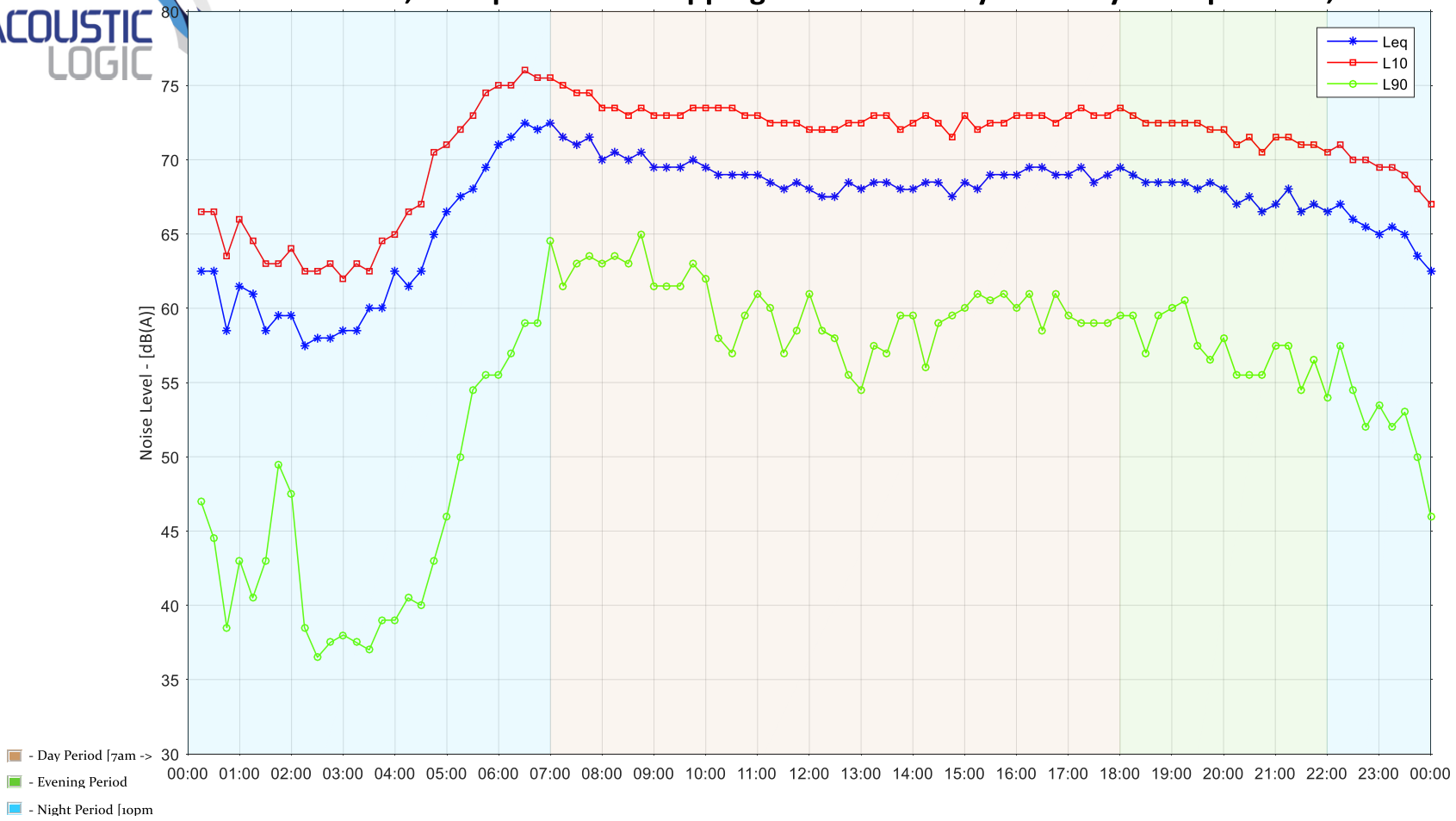
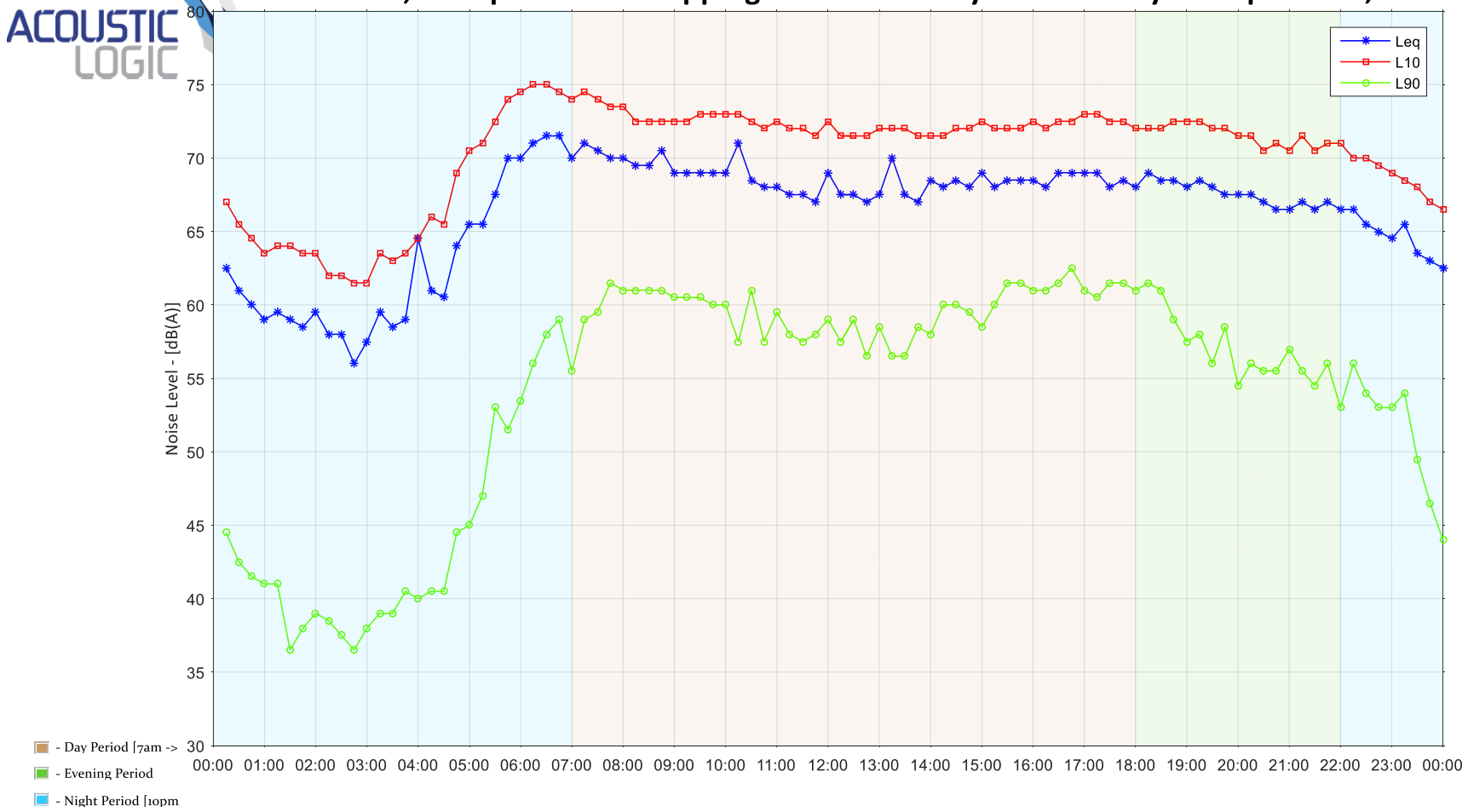
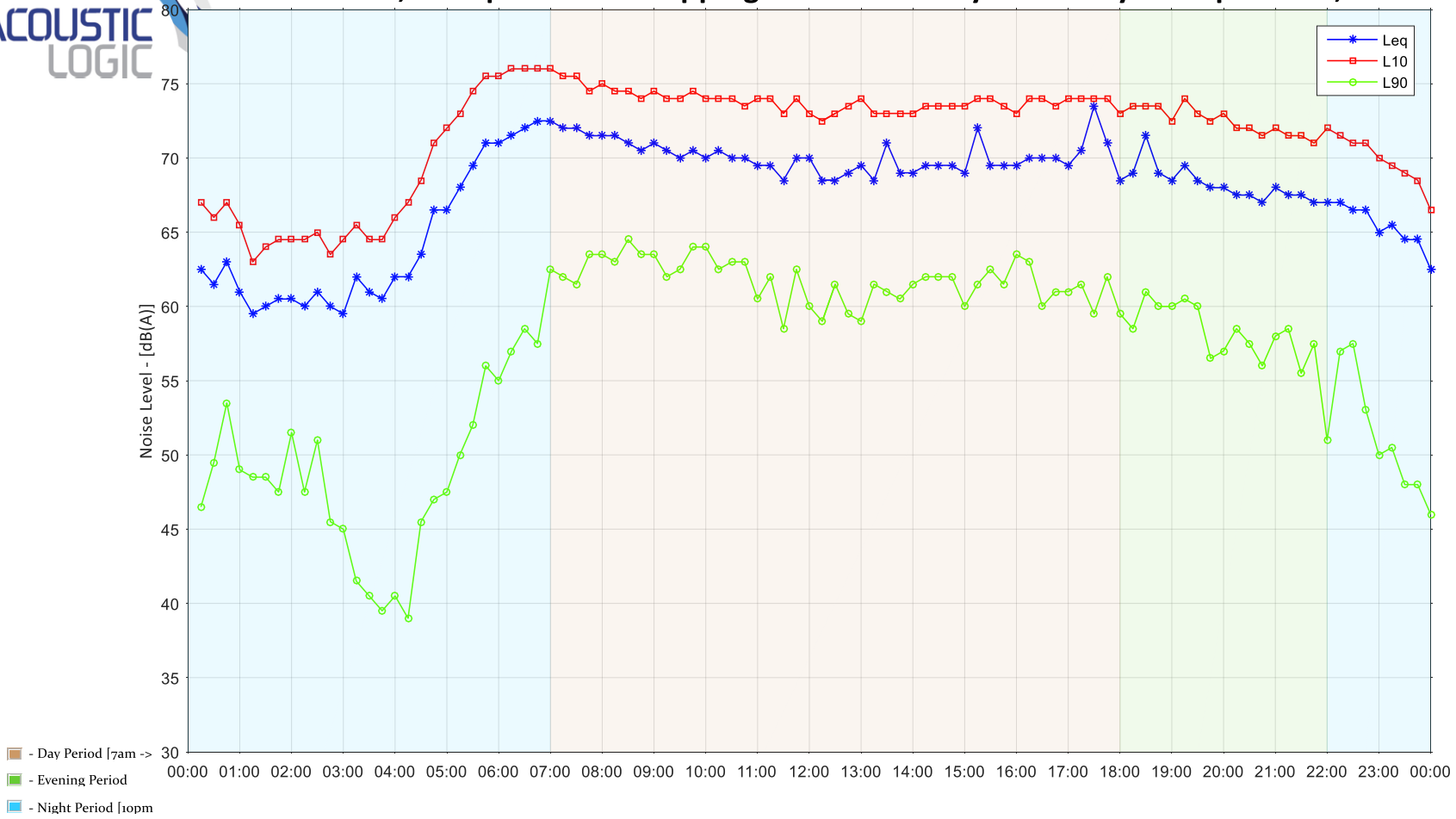
Ivanhoe Estate, Macquarie Park - Epping Road Boundary: Tuesday 12 September, 2017



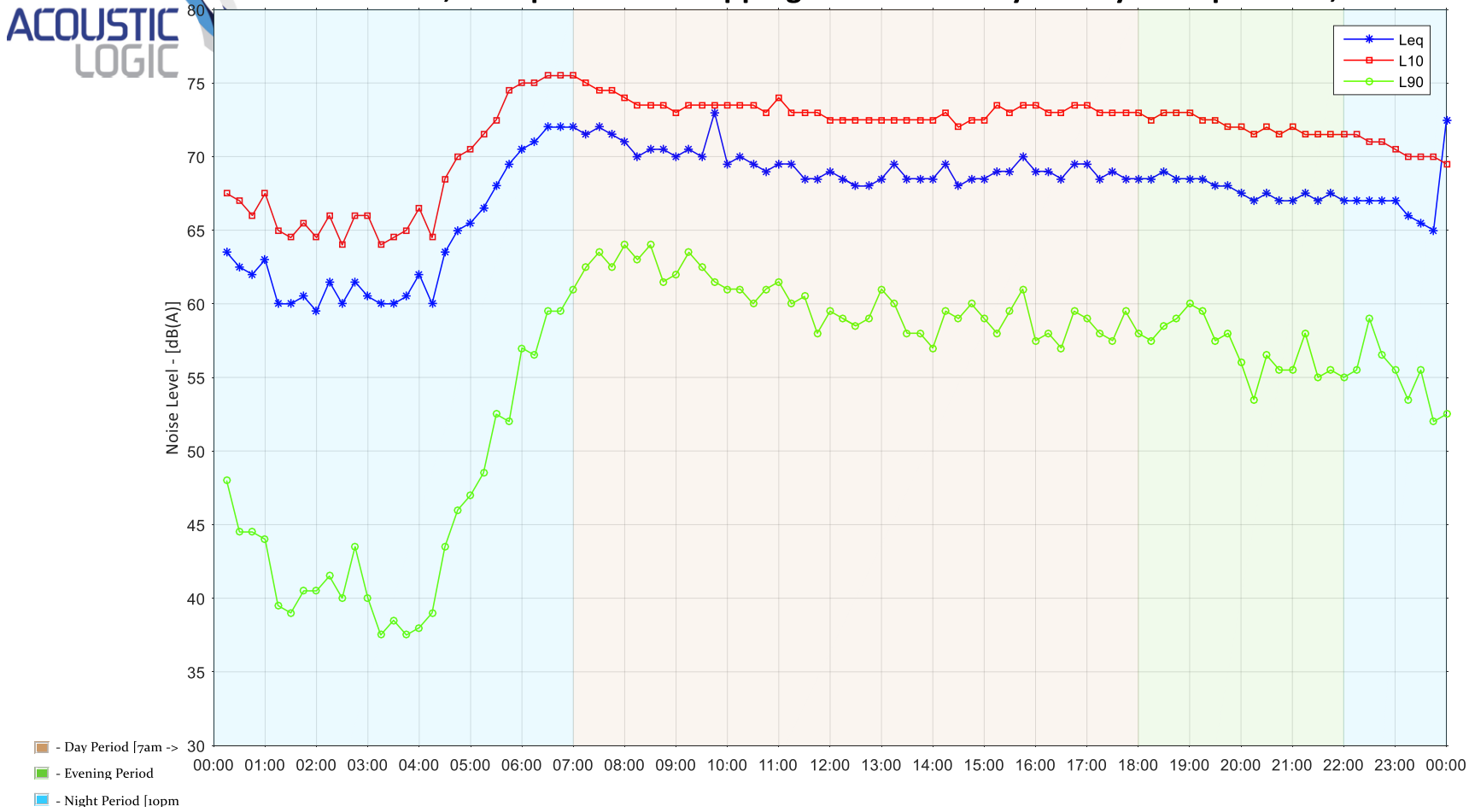
Ivanhoe Estate, Macquarie Park - Epping Road Boundary: Wednesday 13 September, 2017



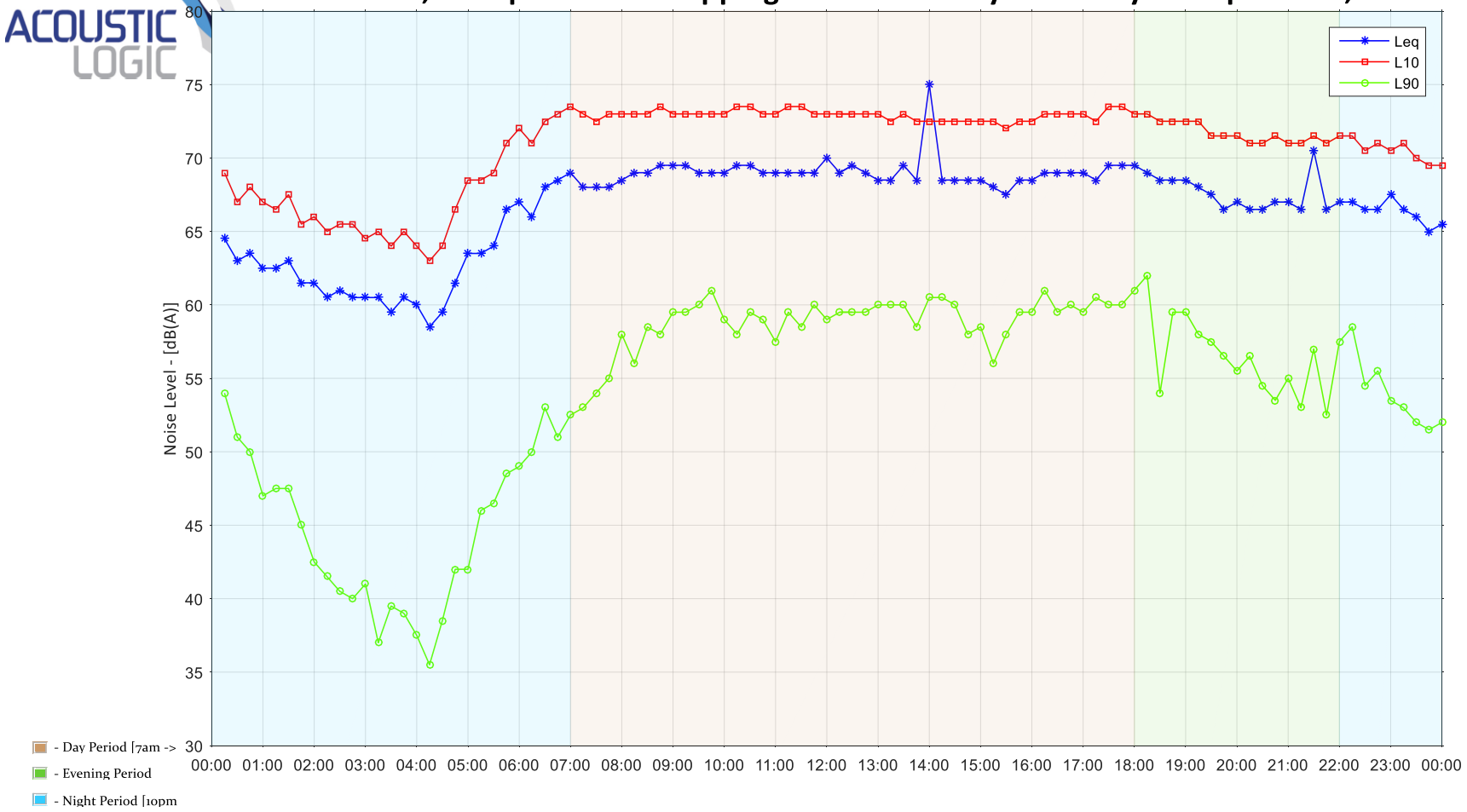
Ivanhoe Estate, Macquarie Park - Epping Road Boundary: Thursday 14 September, 2017



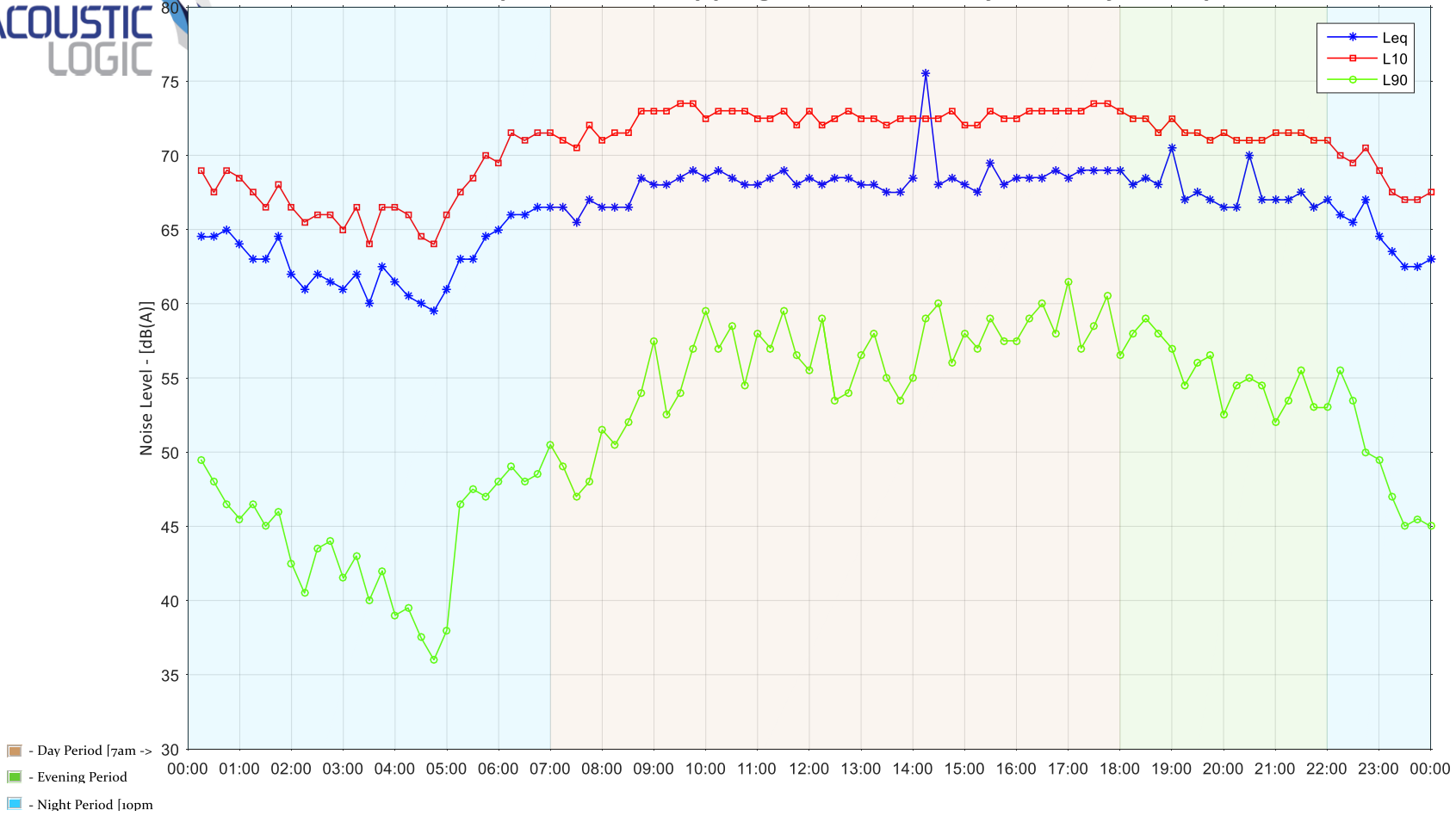
Ivanhoe Estate, Macquarie Park - Epping Road Boundary: Friday 15 September, 2017



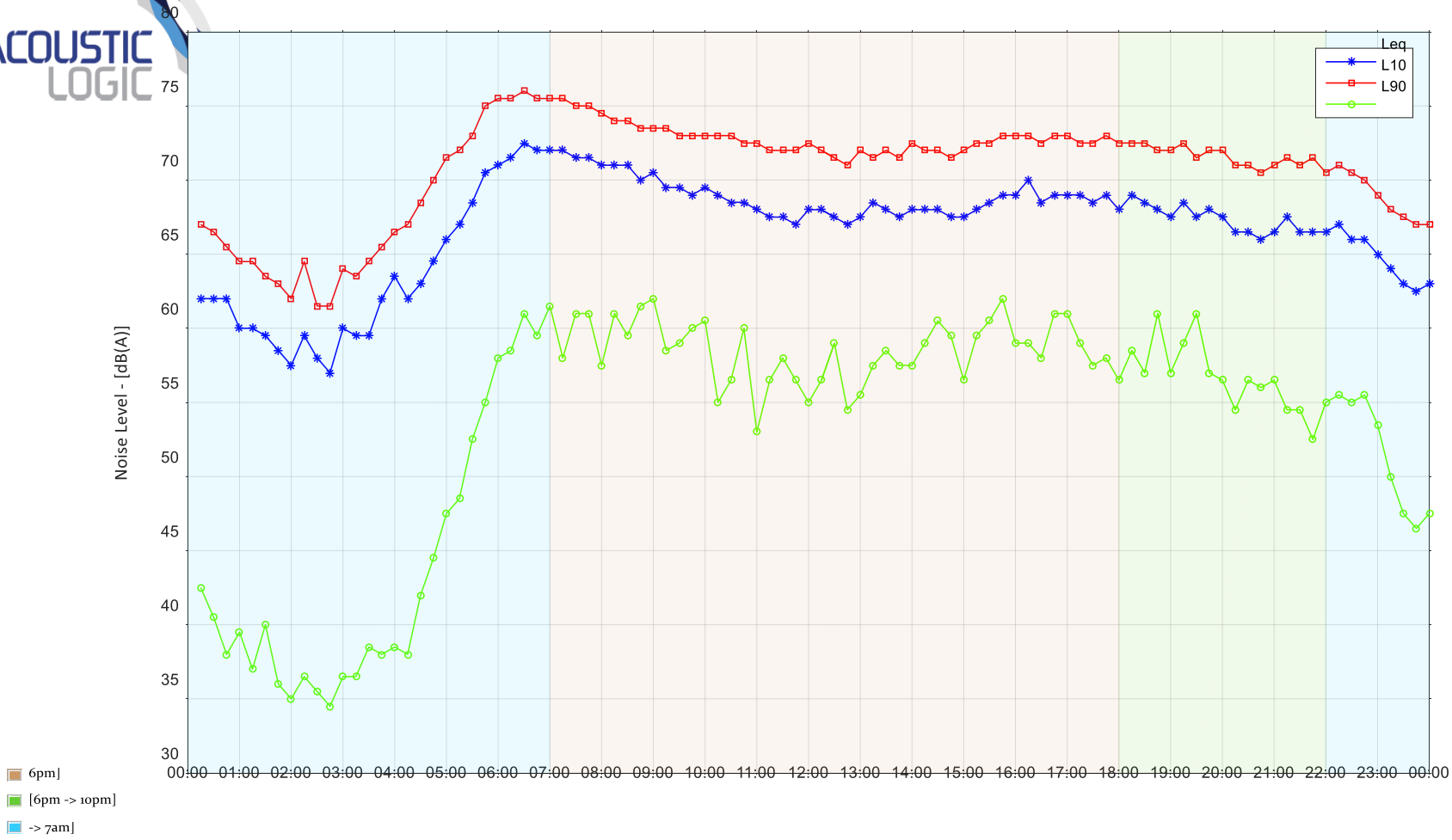
Ivanhoe Estate, Macquarie Park - Epping Road Boundary: Saturday 16 September, 2017



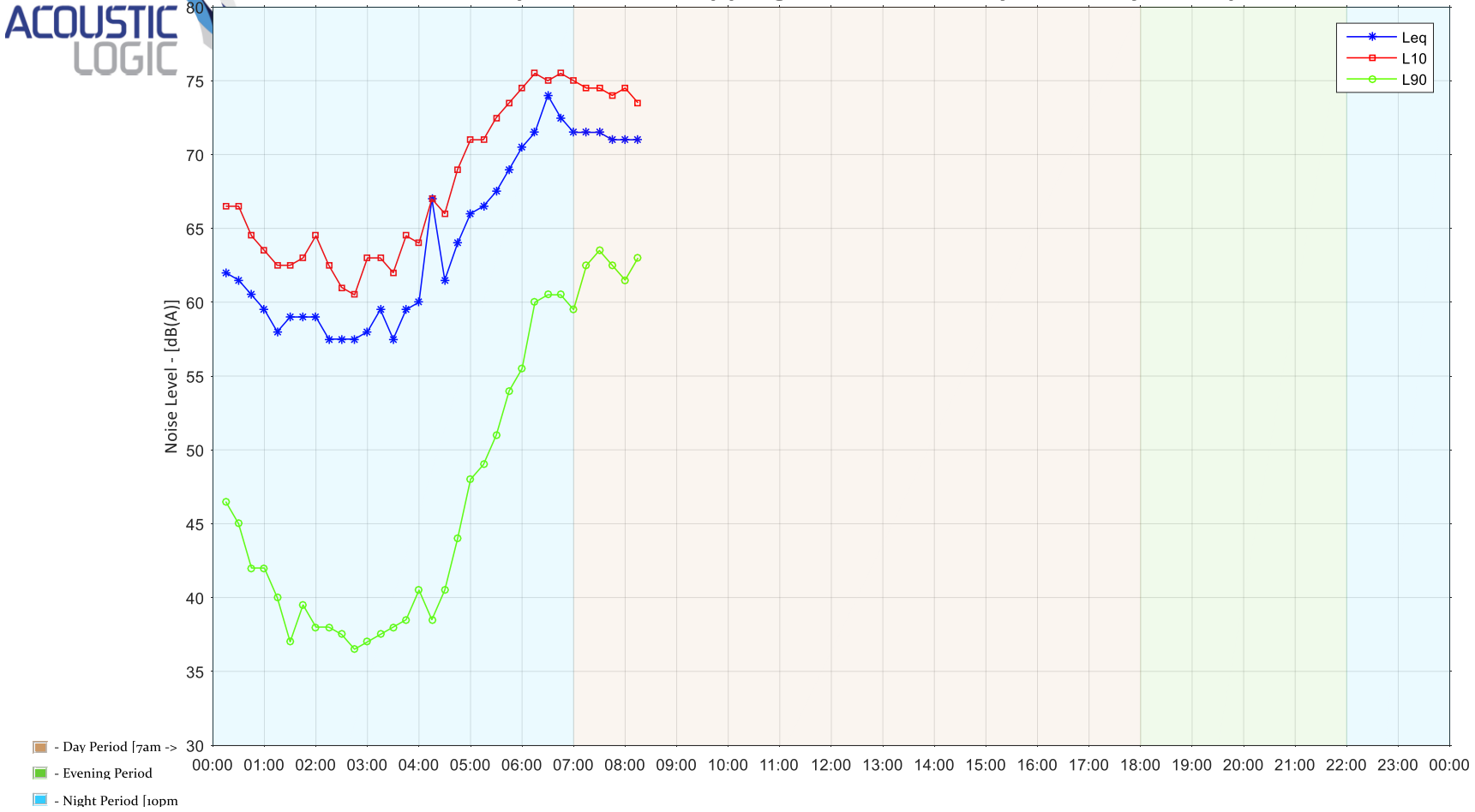
Ivanhoe Estate, Macquarie Park - Epping Road Boundary: Sunday 17 September, 2017



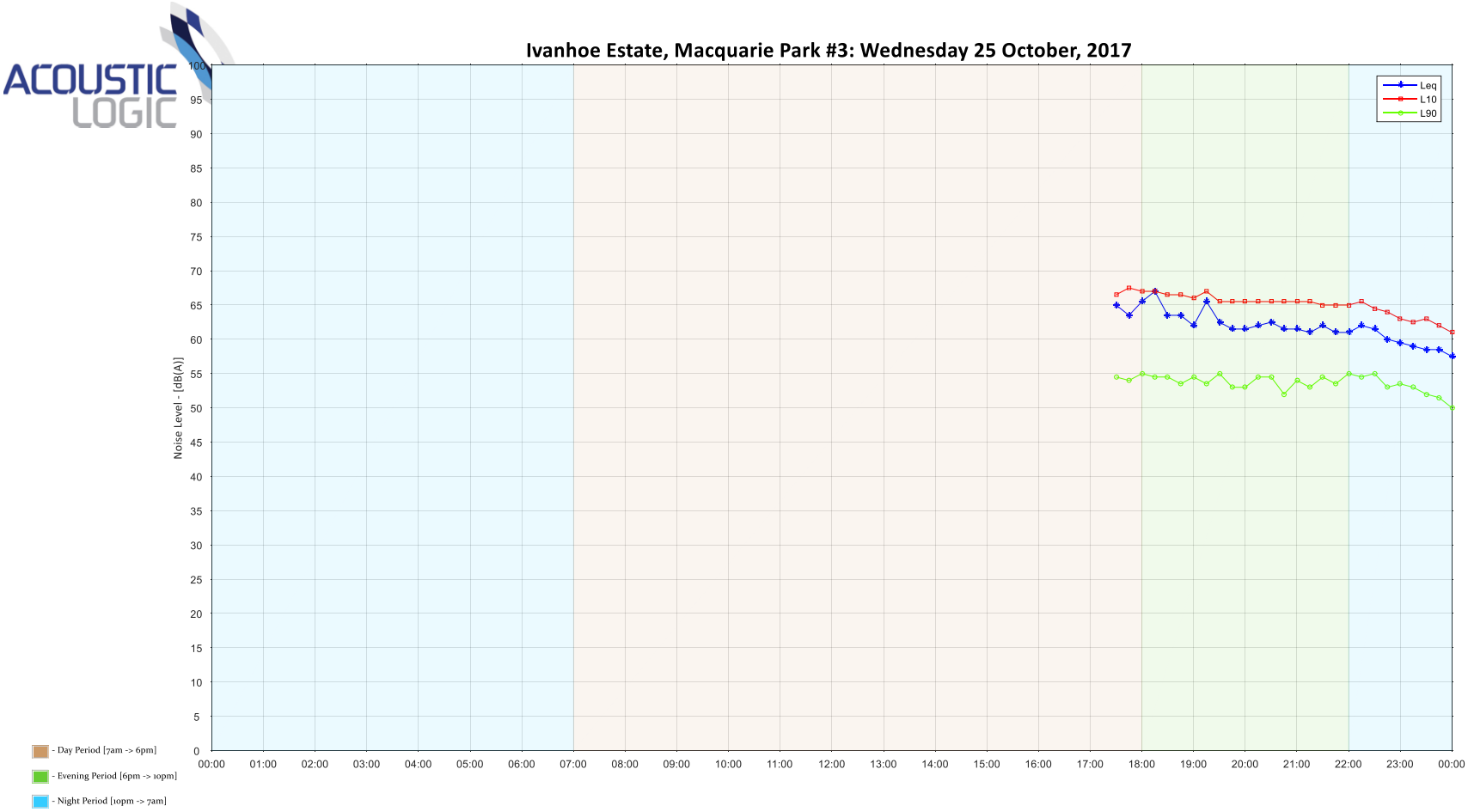
Ivanhoe Estate, Macquarie Park - Epping Road Boundary: Monday 18 September, 2017



Ivanhoe Estate, Macquarie Park - Epping Road Boundary: Tuesday 19 September, 2017



Appendix 3- Unattended Noise Data of Location 3


Ivanhoe Estate, Macquarie Park #3: Wednesday 25 October, 2017
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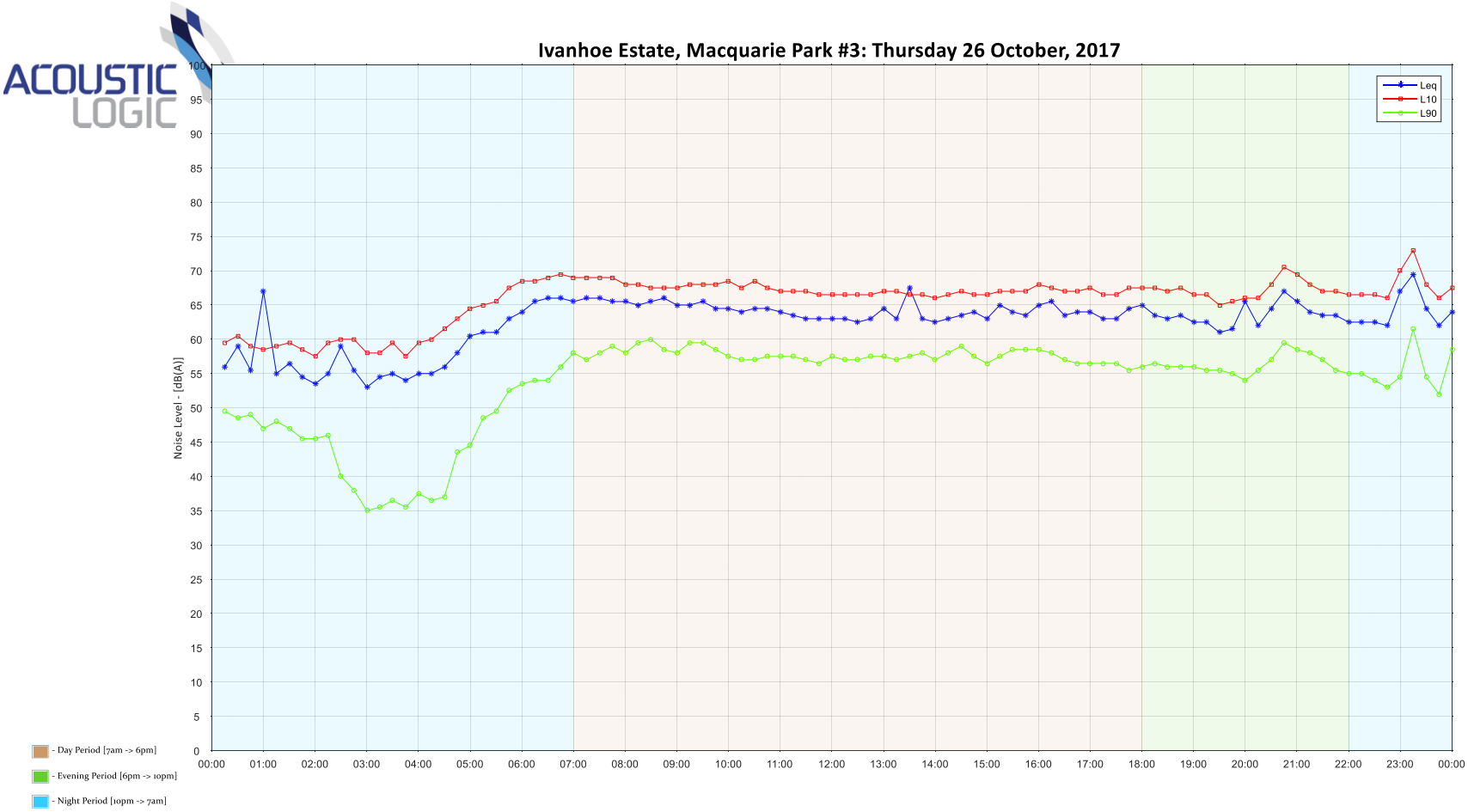
Ivanhoe Estate, Macquarie Park #3: Thursday 26 October, 2017
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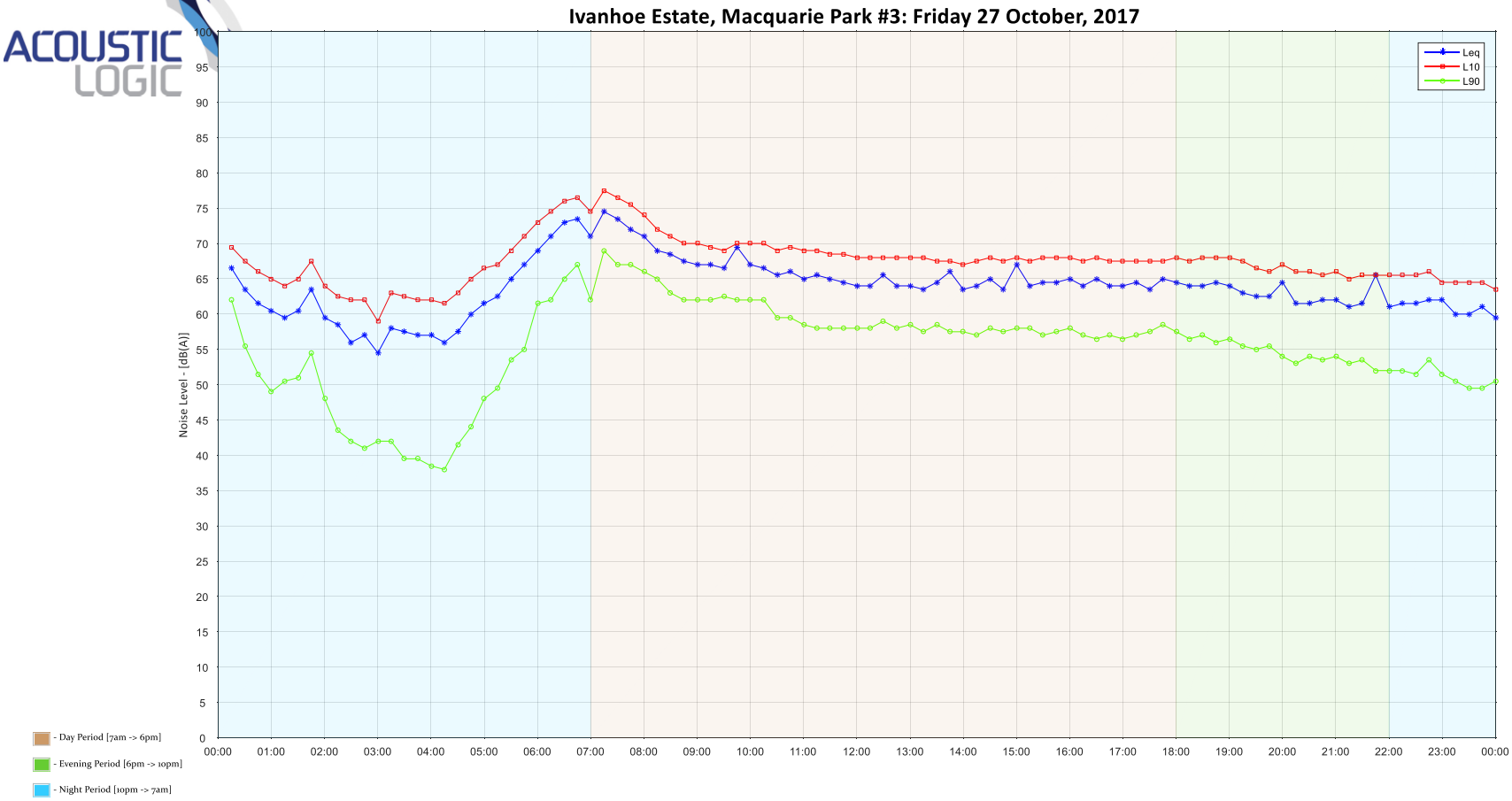
Ivanhoe Estate, Macquarie Park #3: Friday 27 October, 2017
Noise Level - [dB(A)]
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- Night Period [10pm -> 7am]

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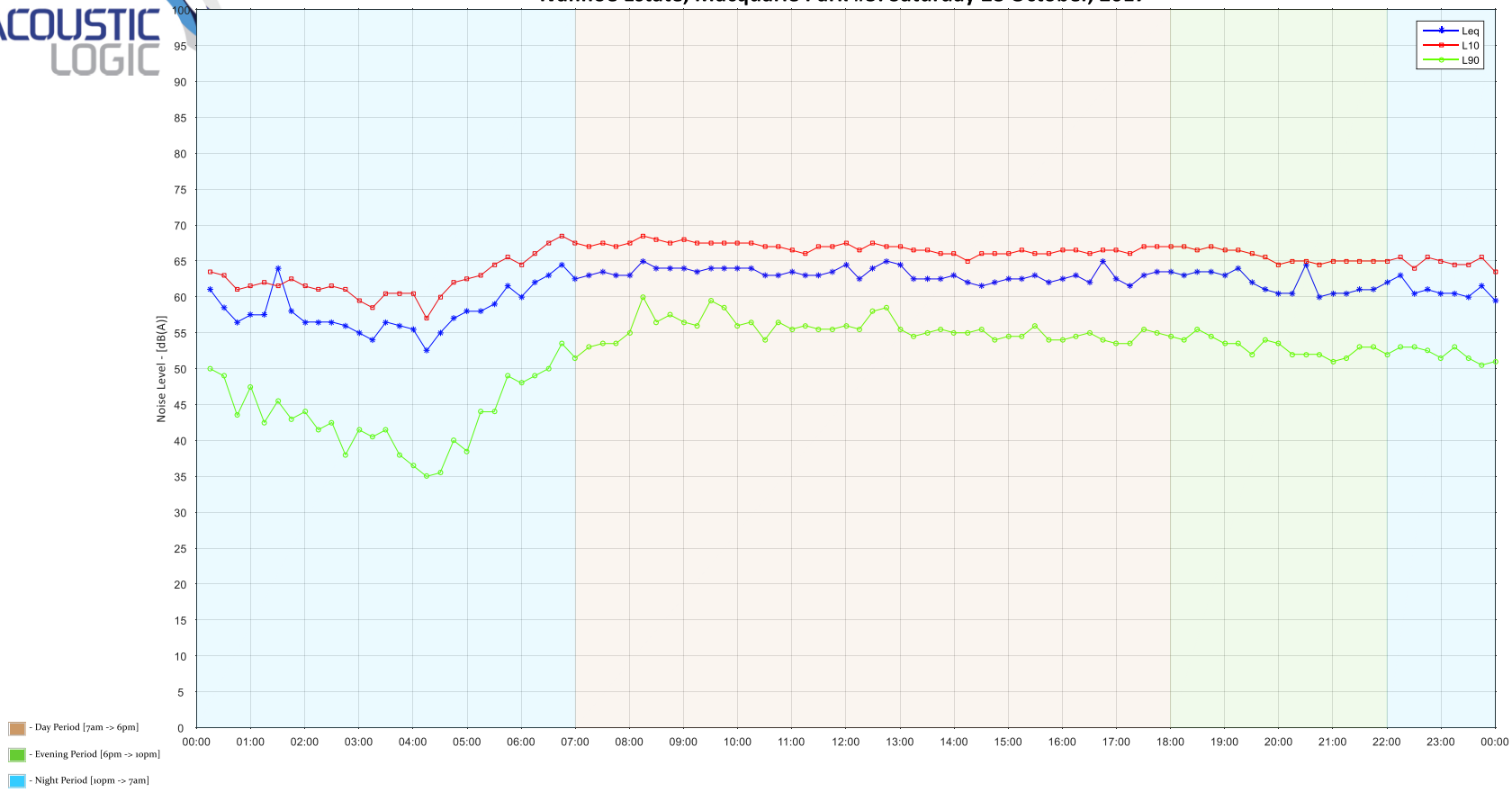

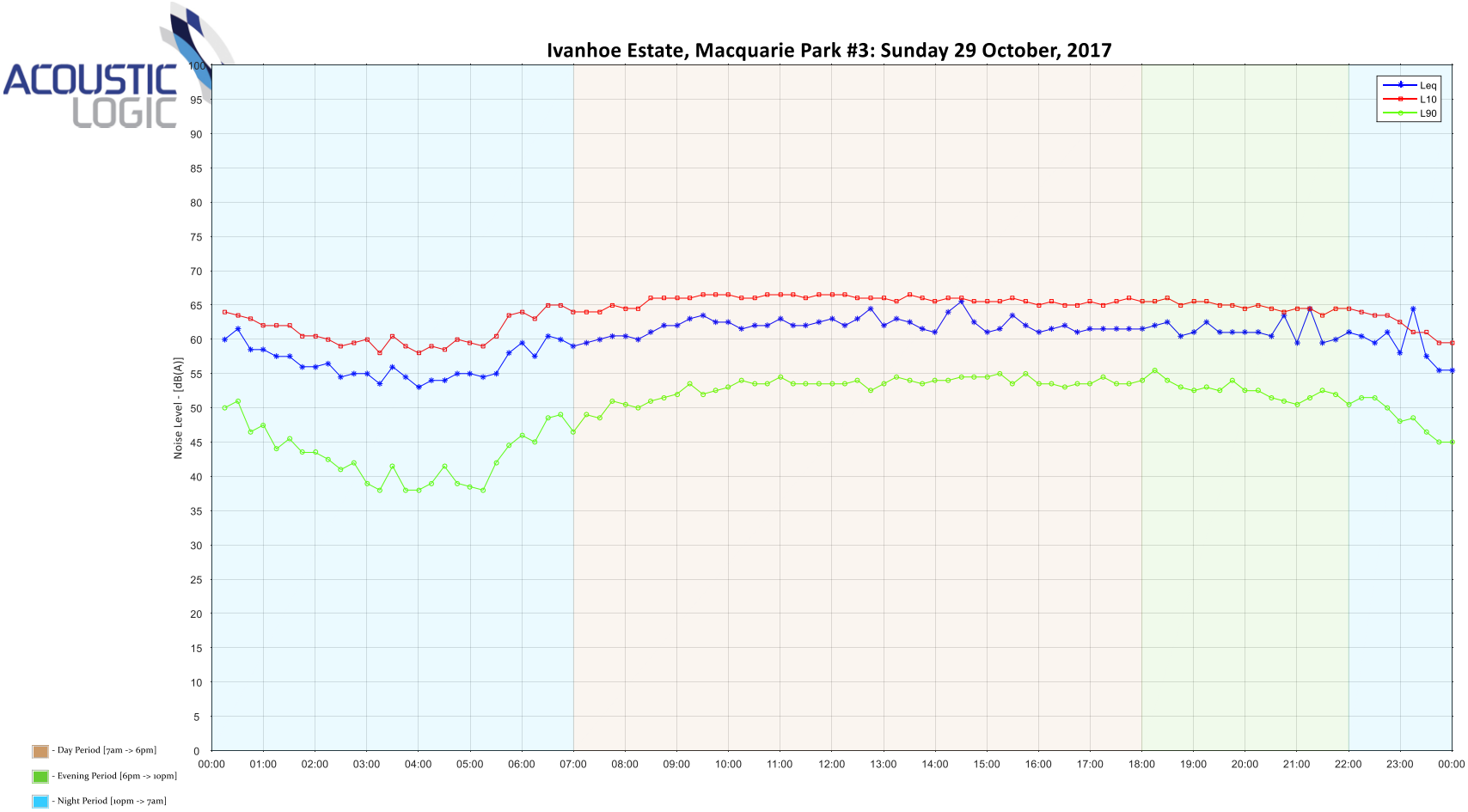
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Noise Level - [dB(A)]
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- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
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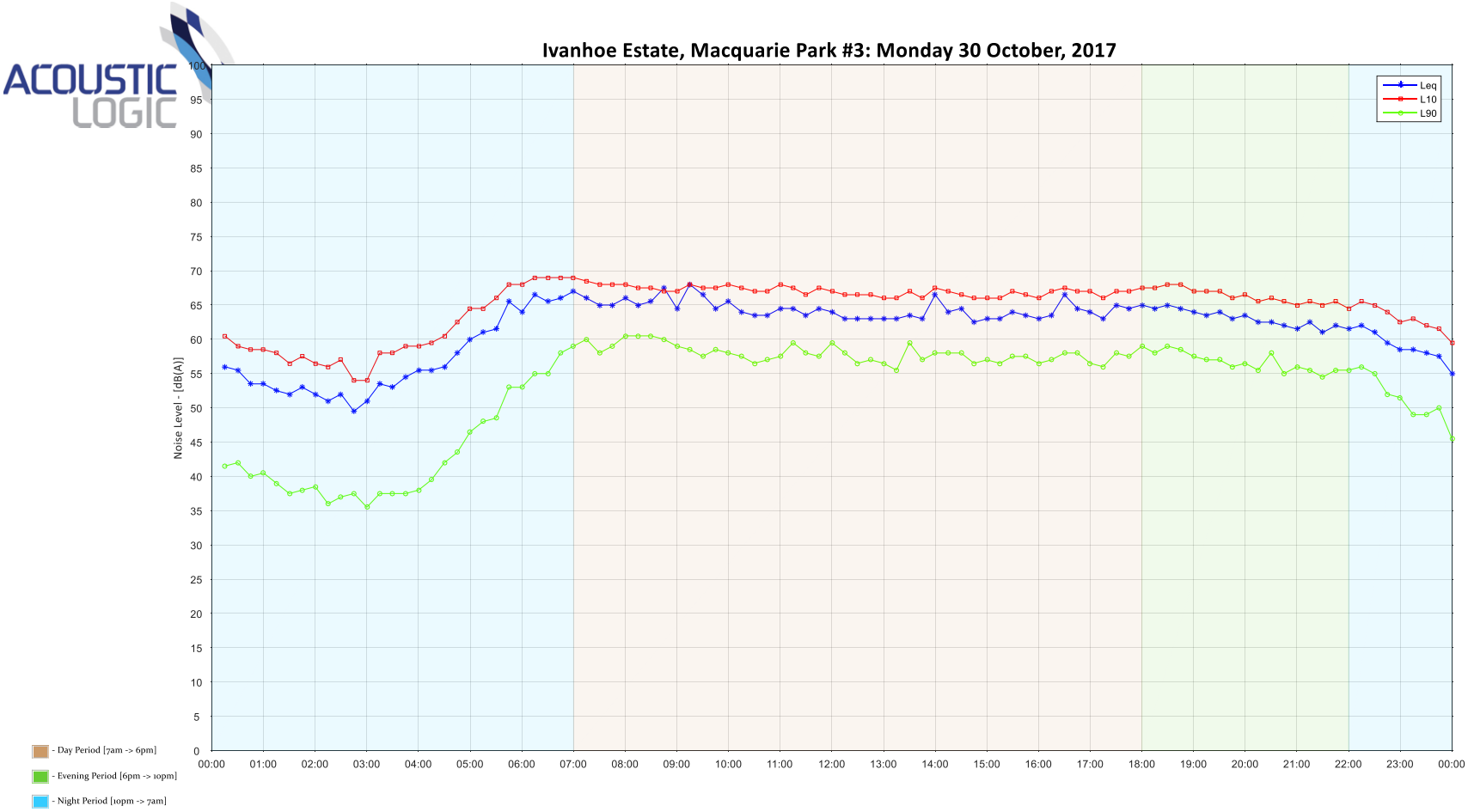
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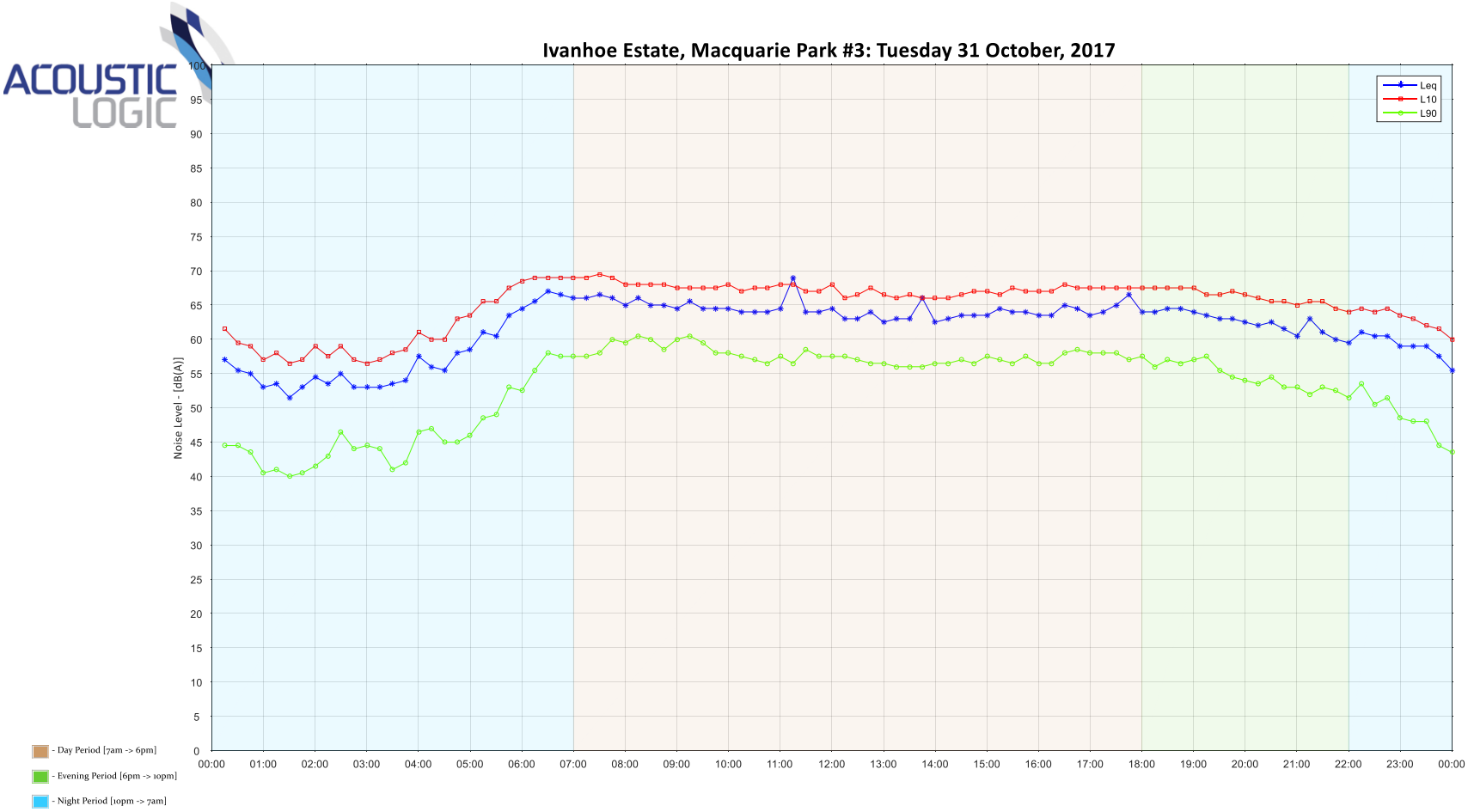
Ivanhoe Estate, Macquarie Park #3: Tuesday 31 October, 2017
Noise Level - [dB(A)]
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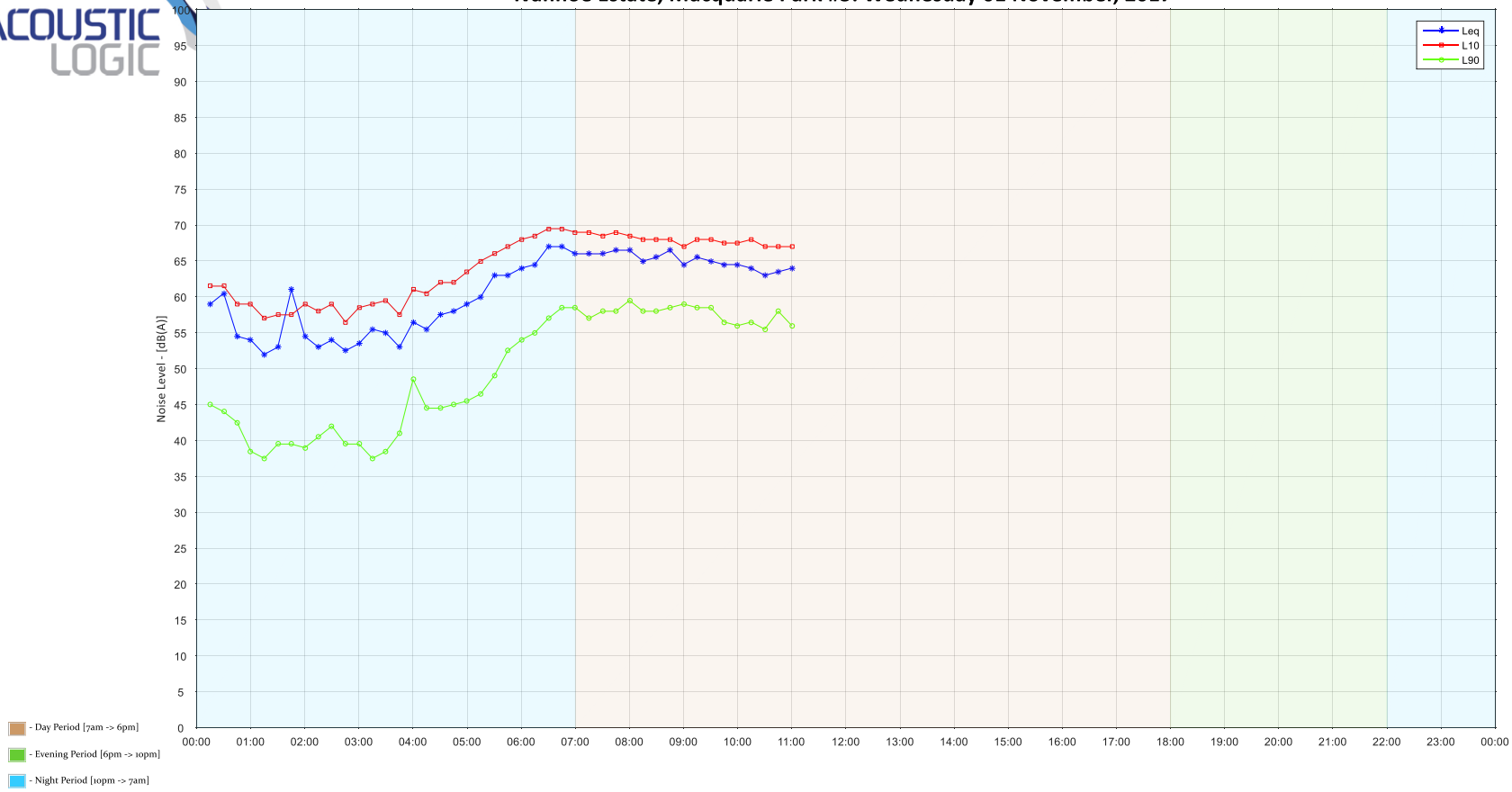
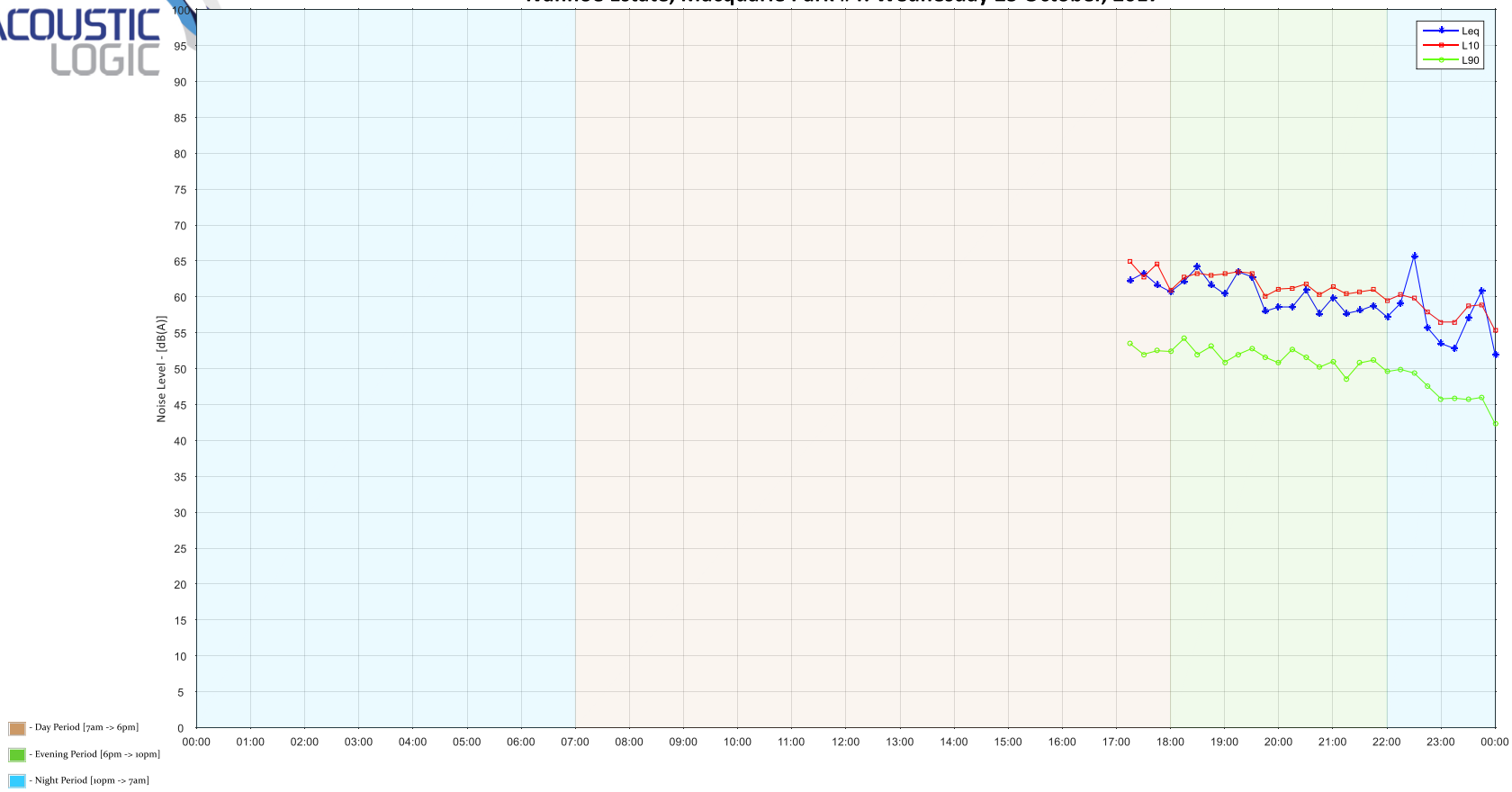
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

Ivanhoe Estate, Macquarie Park #3: Wednesday 01 November, 2017

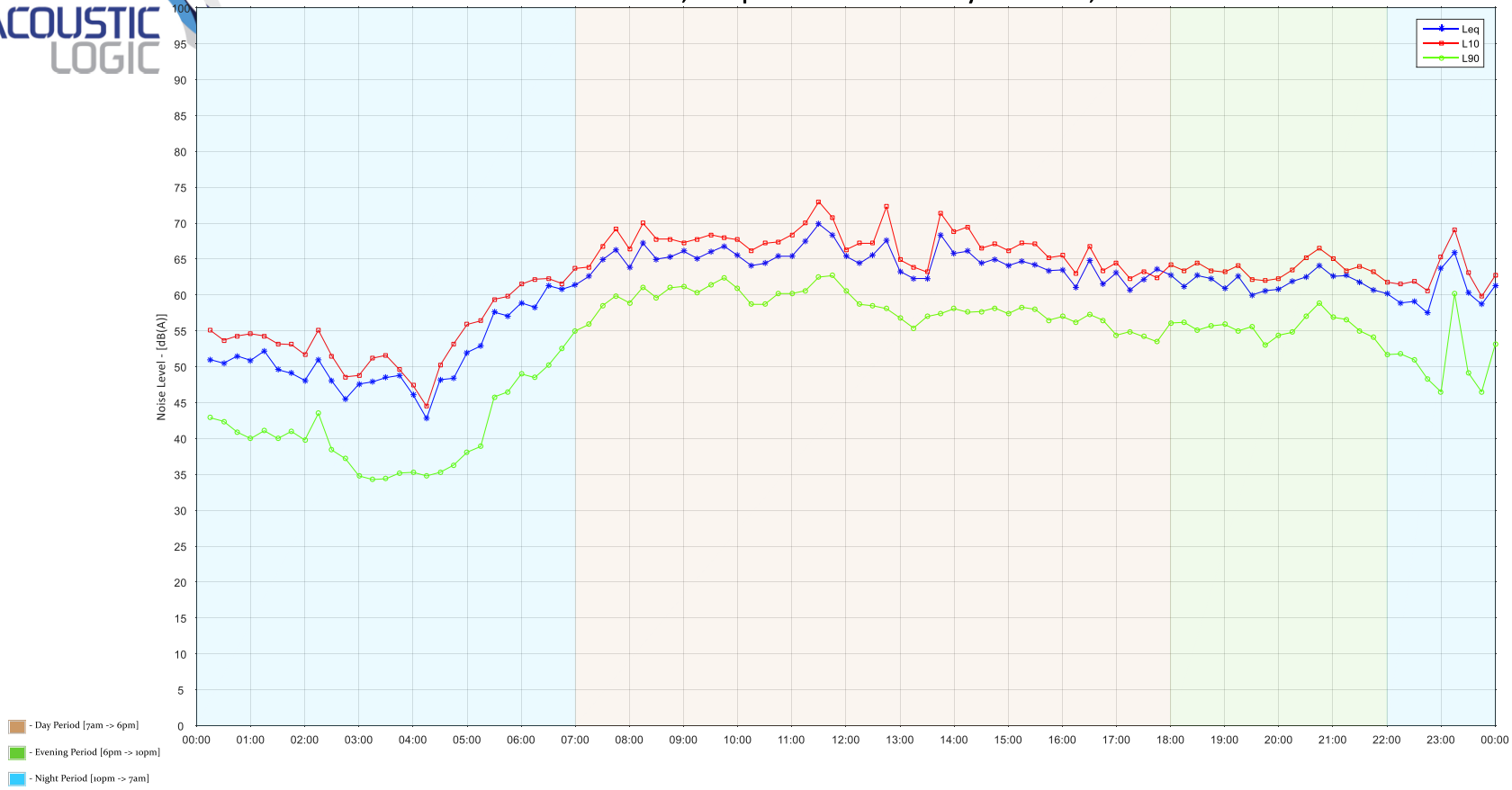


Appendix 4- Unattended Noise Data of Location 4

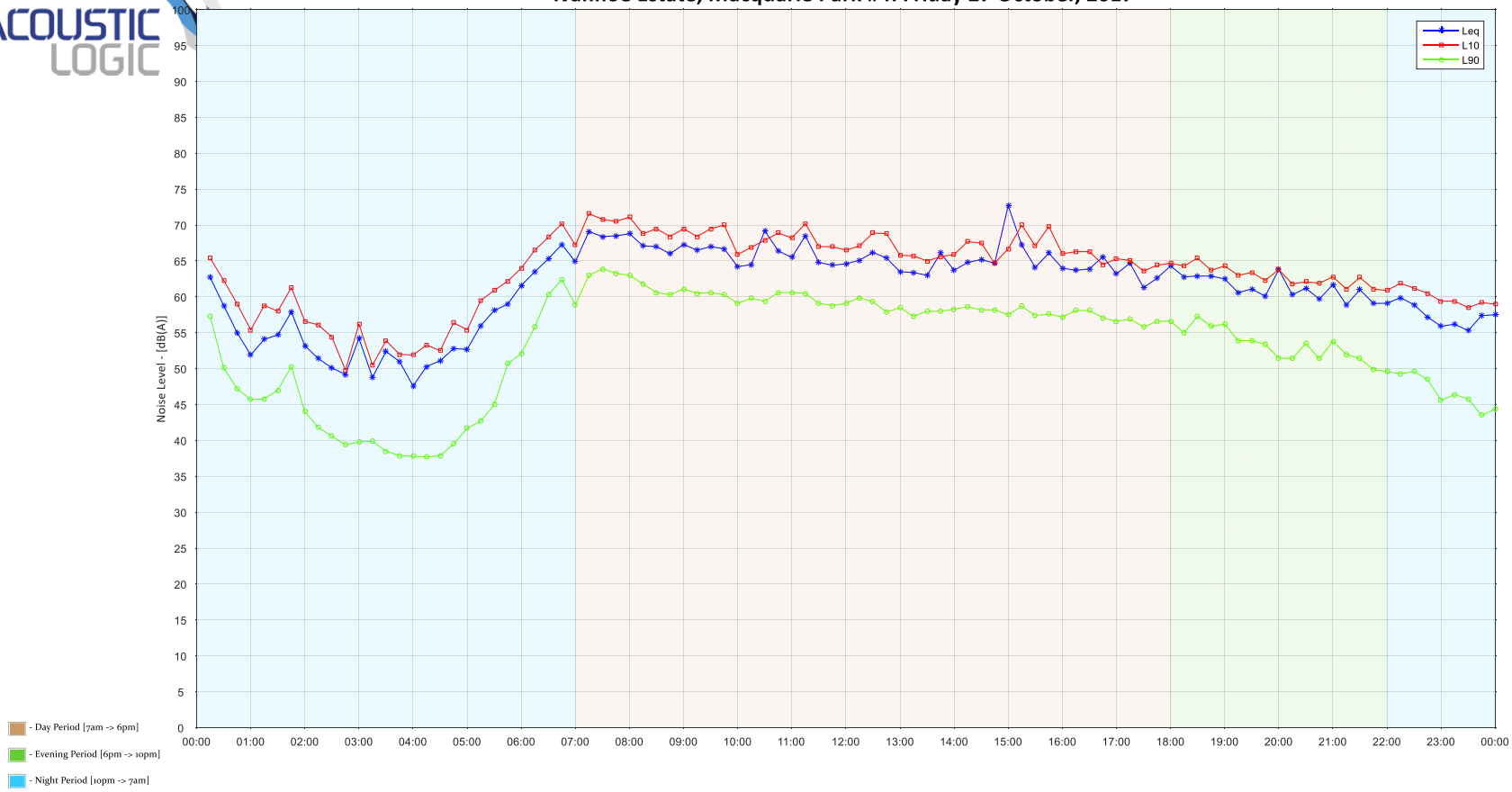
Ivanhoe Estate, Macquarie Park #4: Wednesday 25 October, 2017



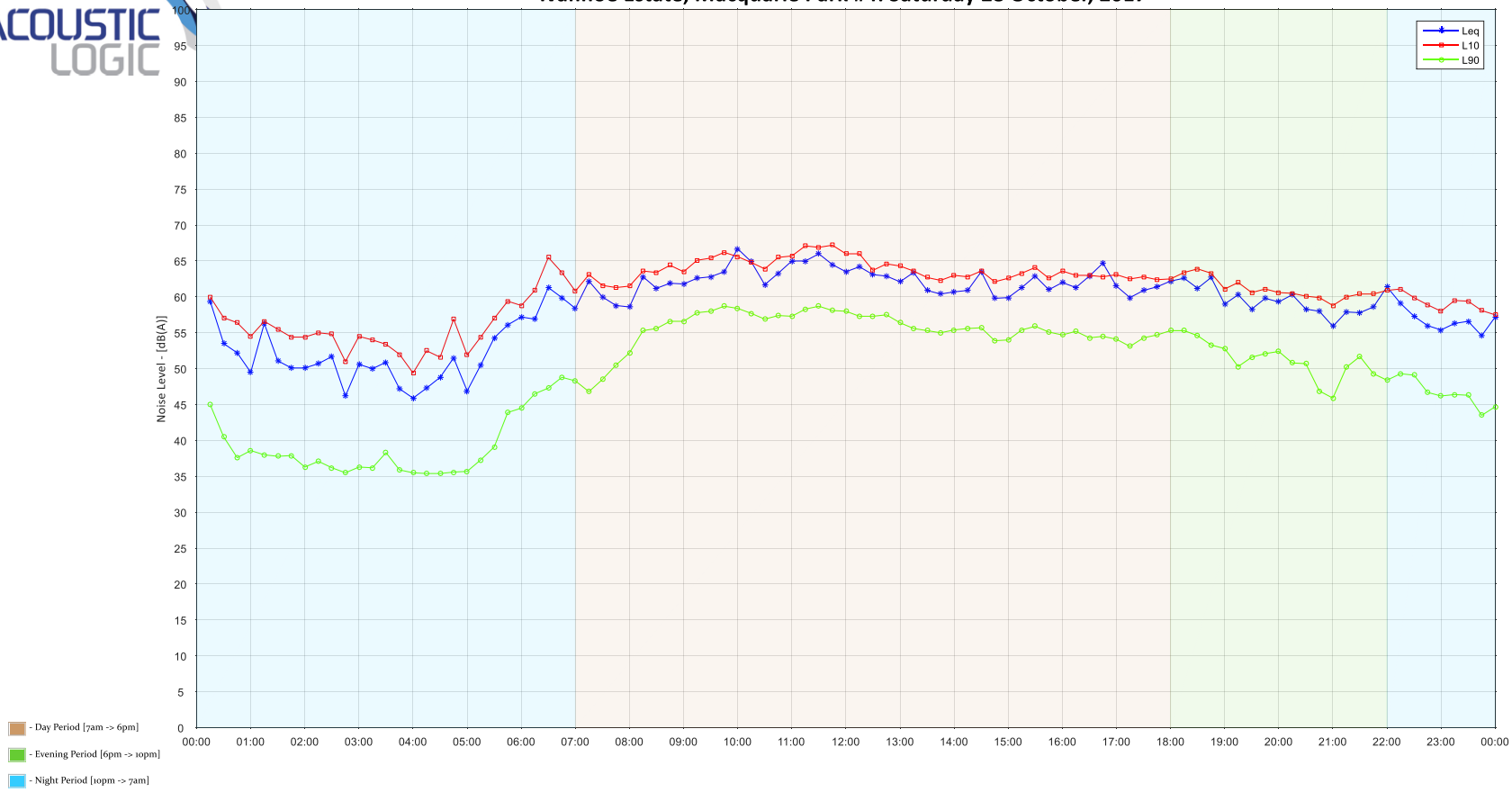
Ivanhoe Estate, Macquarie Park #4: Thursday 26 October, 2017



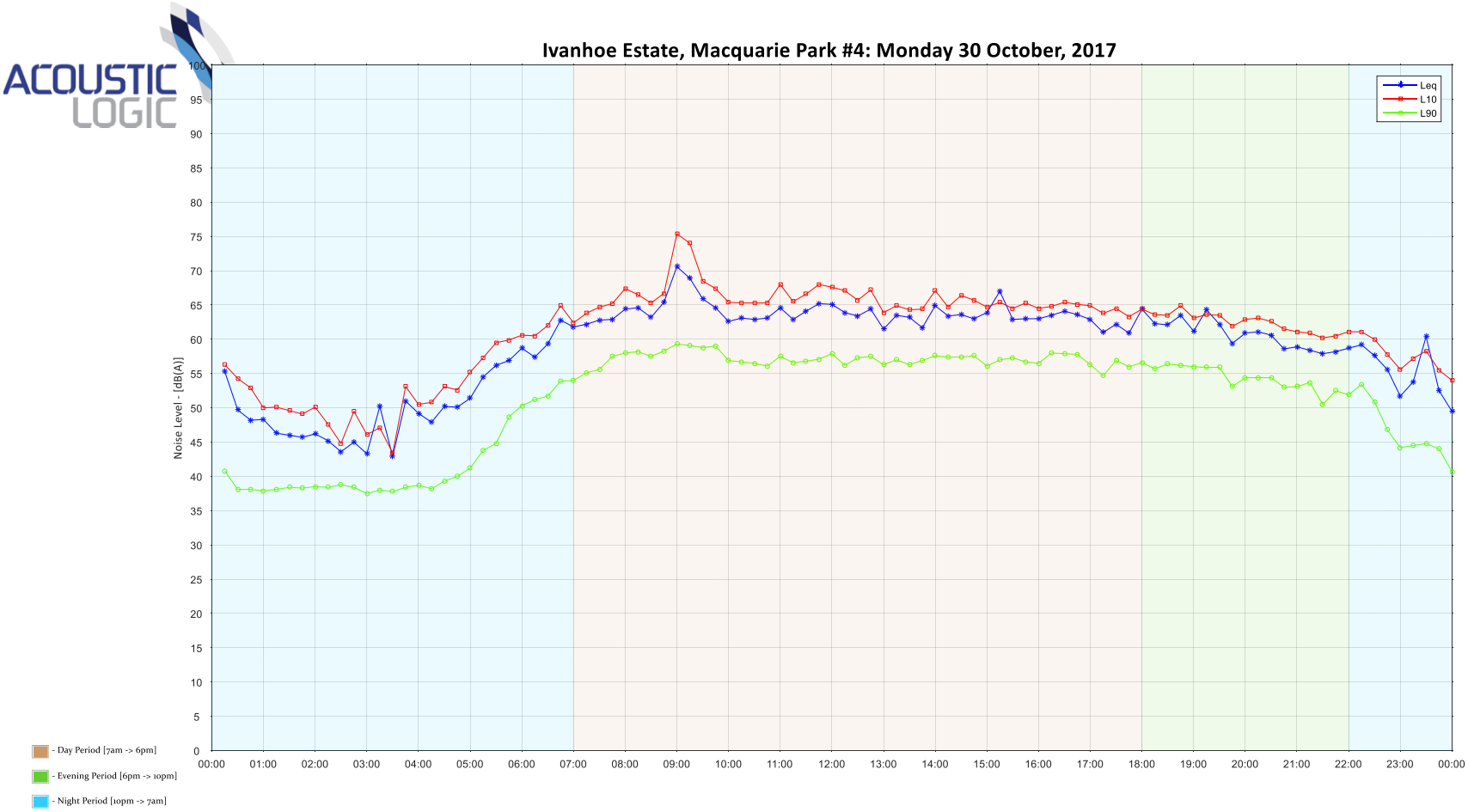
Ivanhoe Estate, Macquarie Park #4: Friday 27 October, 2017

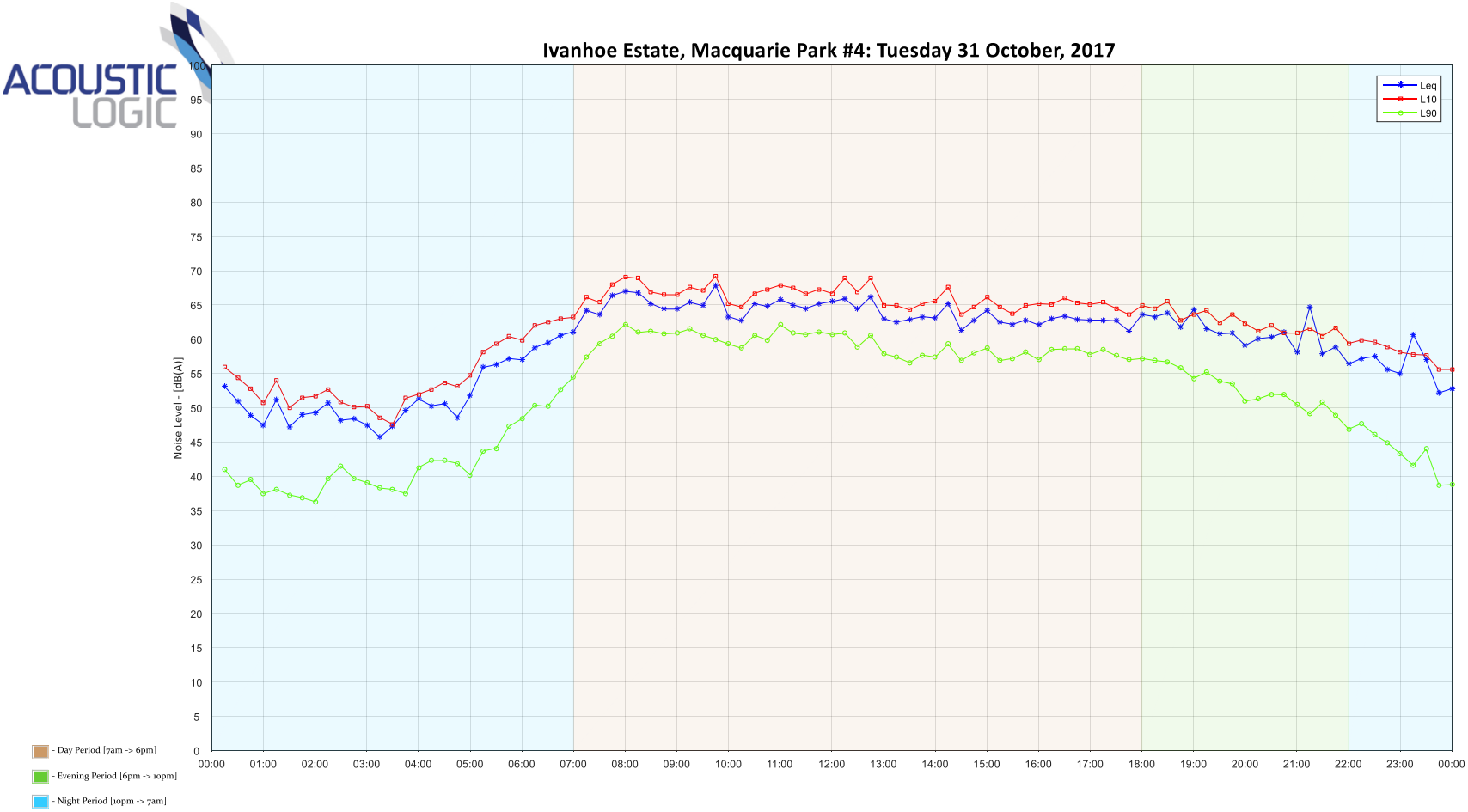


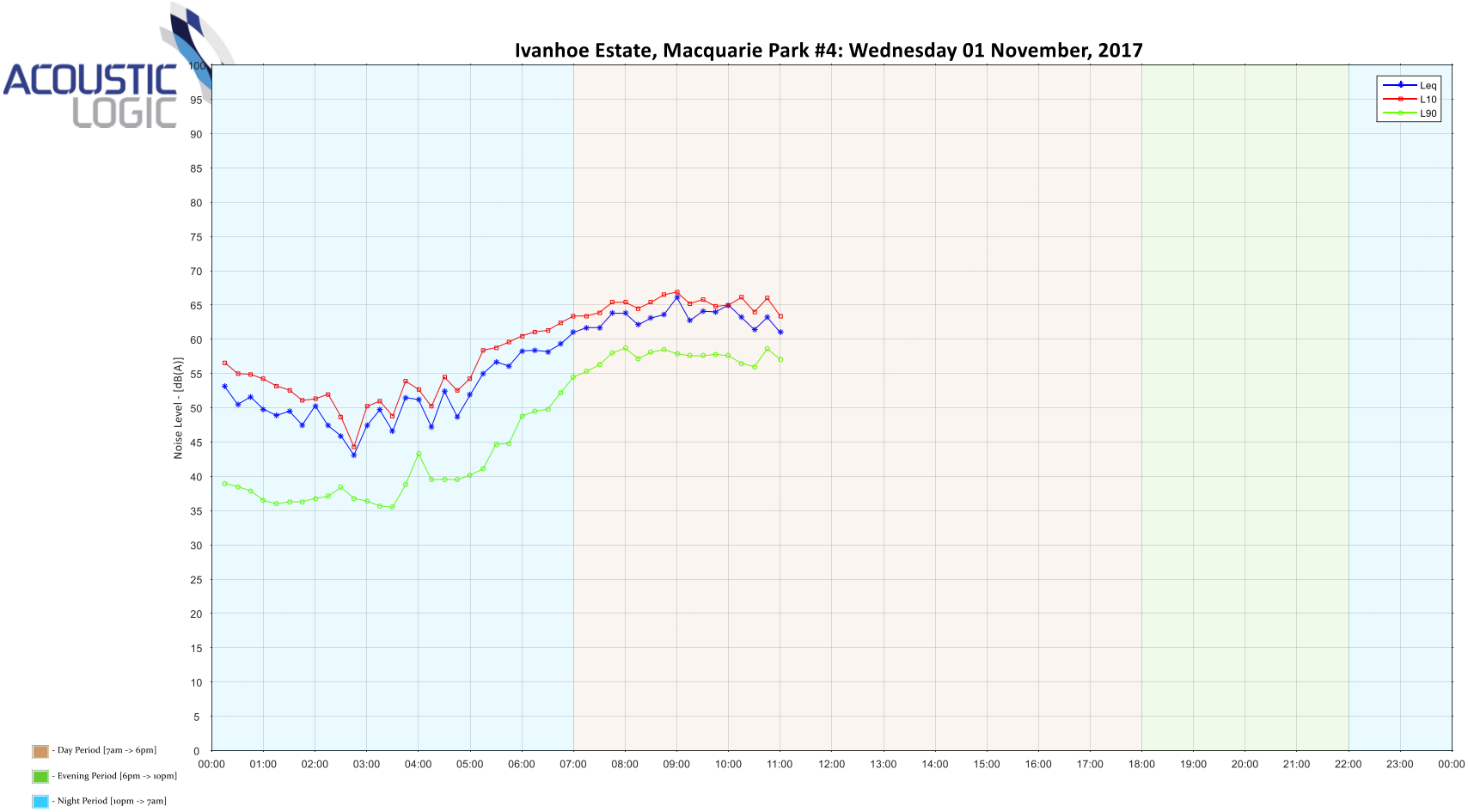
Ivanhoe Estate, Macquarie Park #4: Saturday 28 October, 2017



Ivanhoe Estate, Macquarie Park #4: Sunday 29 October, 2017

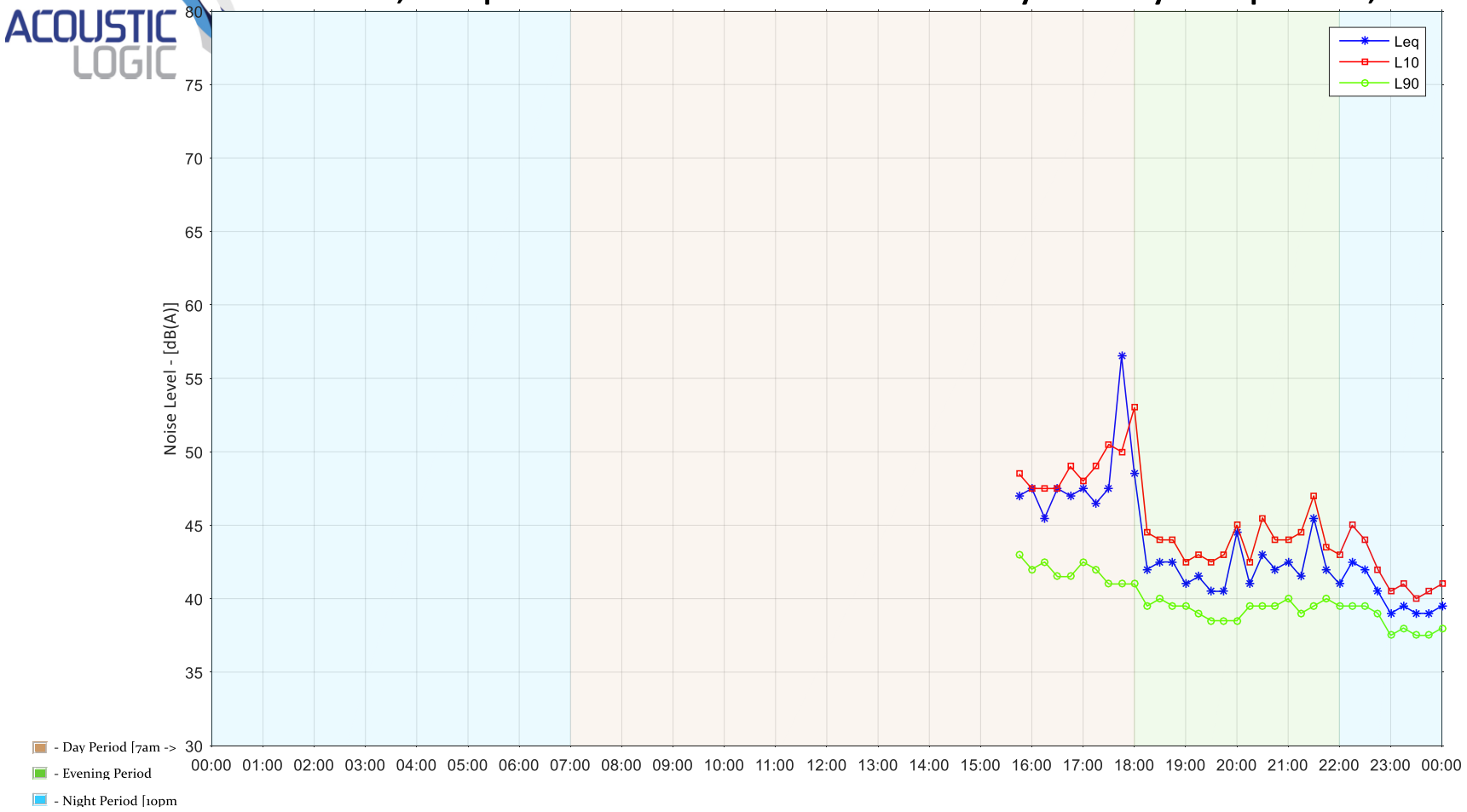

Ivanhoe Estate, Macquarie Park #4: Monday 30 October, 2017
Noise Level - [dB(A)]
Leq
L10
L90
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


Ivanhoe Estate, Macquarie Park #4: Tuesday 31 October, 2017
Noise Level - [dB(A)]
Leq
L10
L90
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

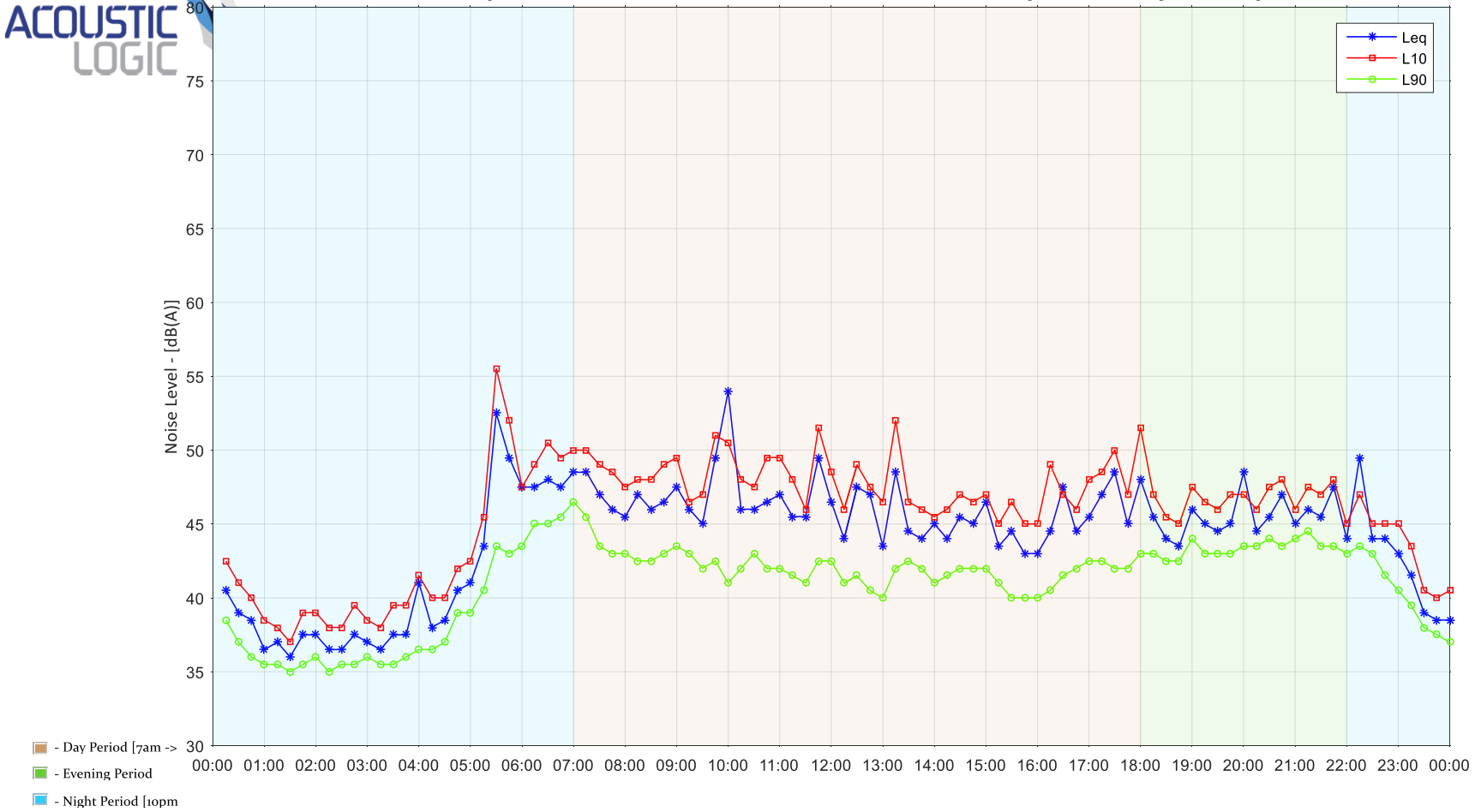

Ivanhoe Estate, Macquarie Park #4: Wednesday 01 November, 2017
Noise Level - [dB(A)]
Leq
L10
L90
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

Appendix 5- Unattended Noise Data of Location 5

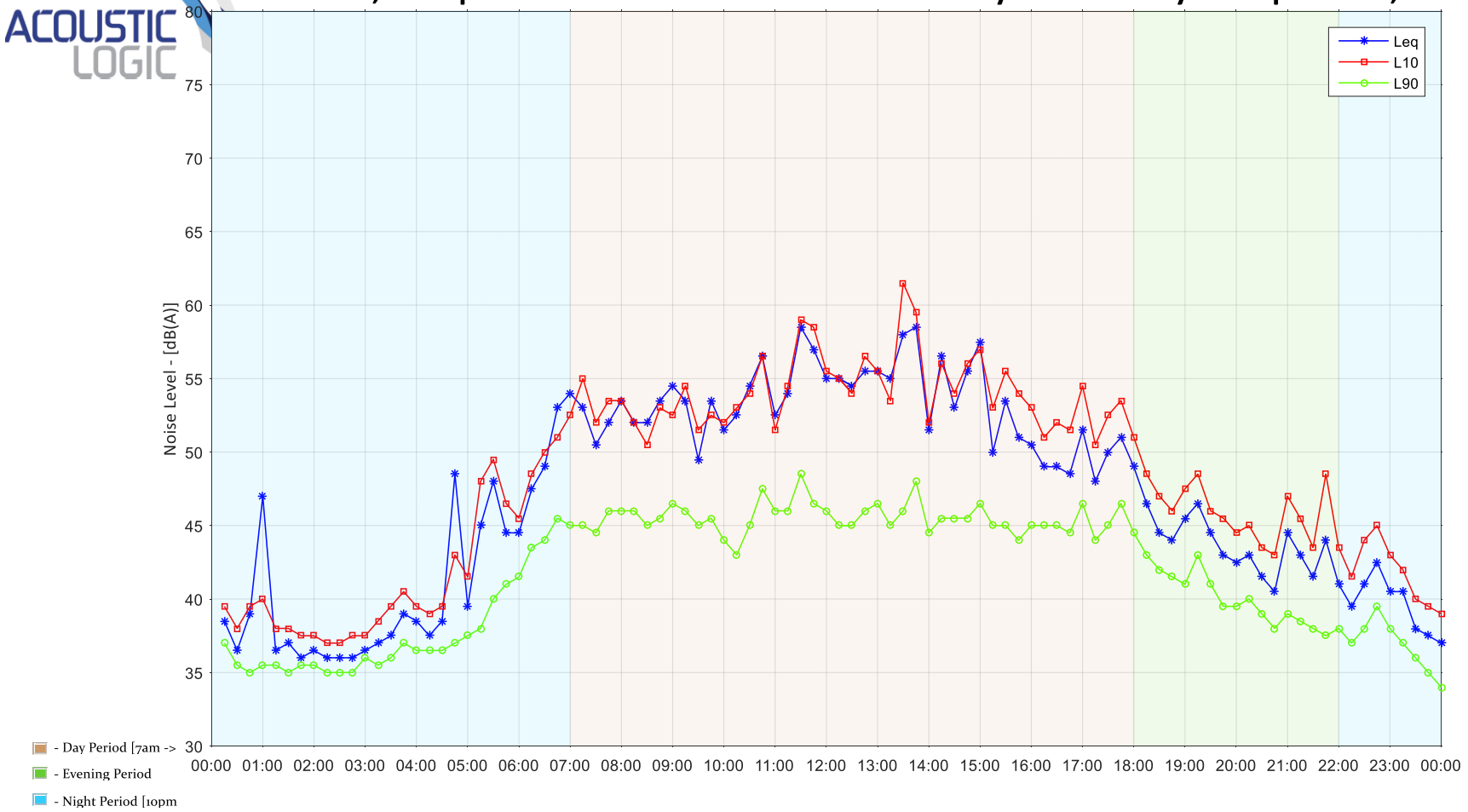
Ivanhoe Estate, Macquarie Park - Peach Tree Road Boundary: Monday 11 September, 2017



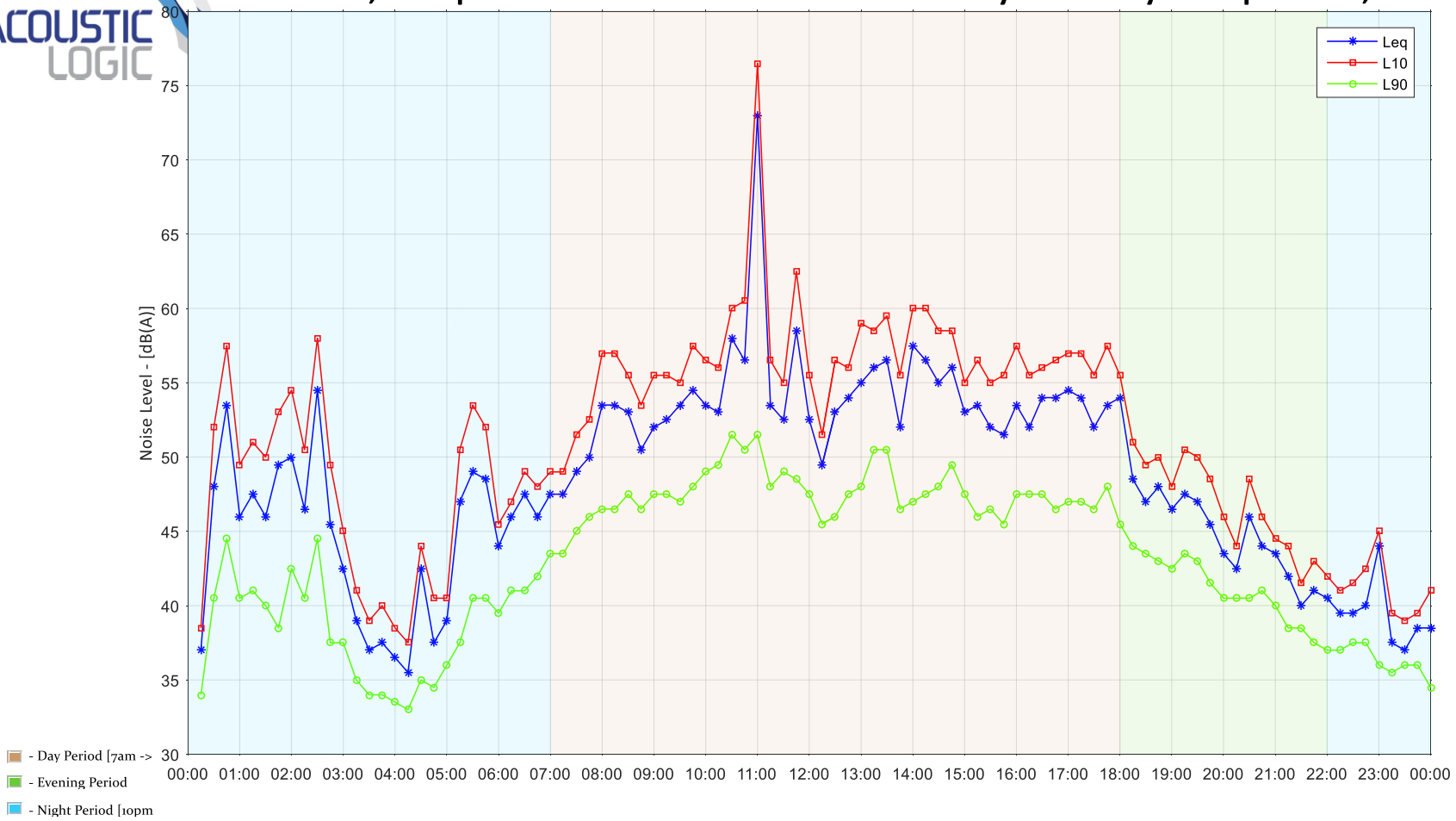
Ivanhoe Estate, Macquarie Park - Peach Tree Road Boundary: Tuesday 12 September, 2017

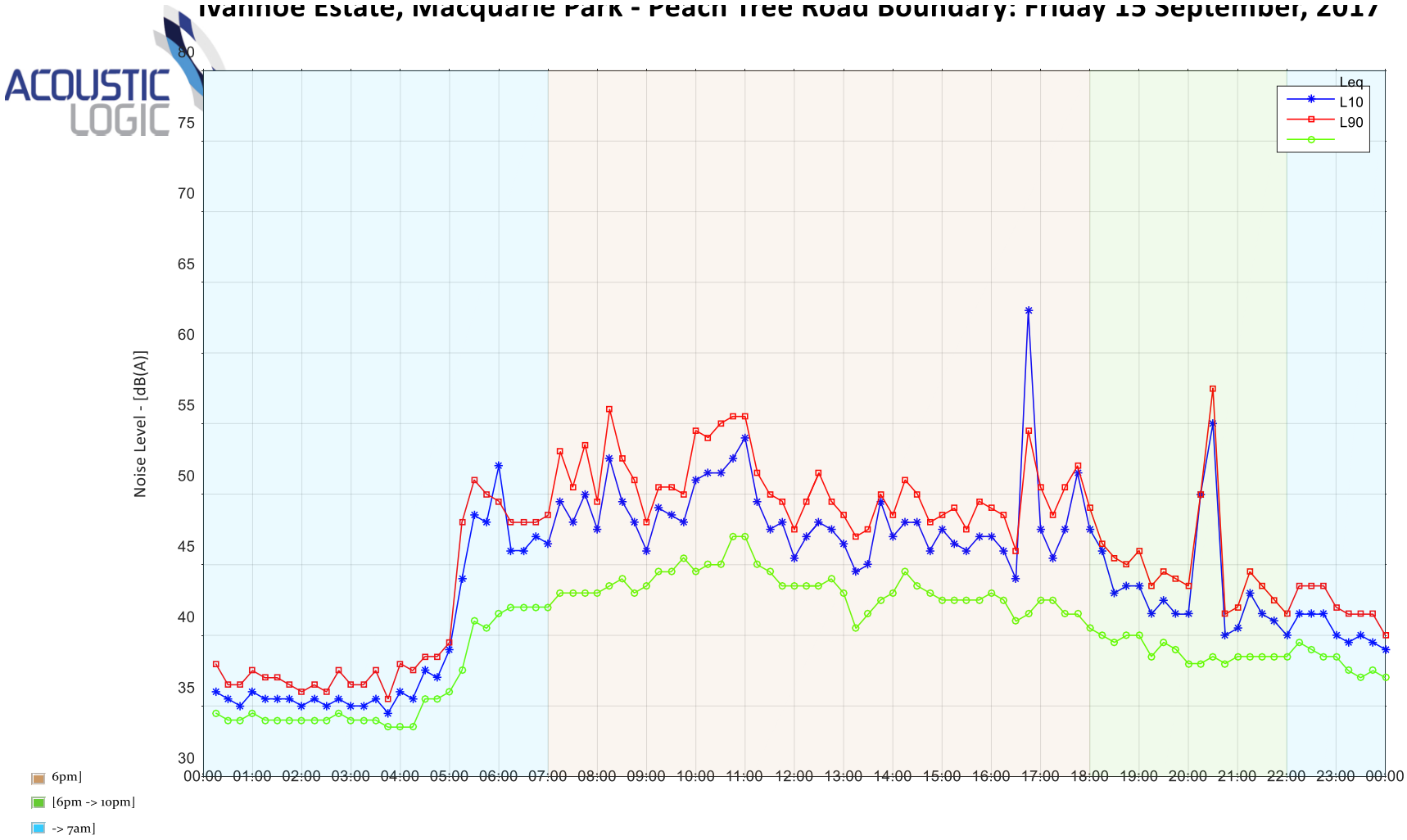


Ivanhoe Estate, Macquarie Park - Peach Tree Road Boundary: Wednesday 13 September, 2017

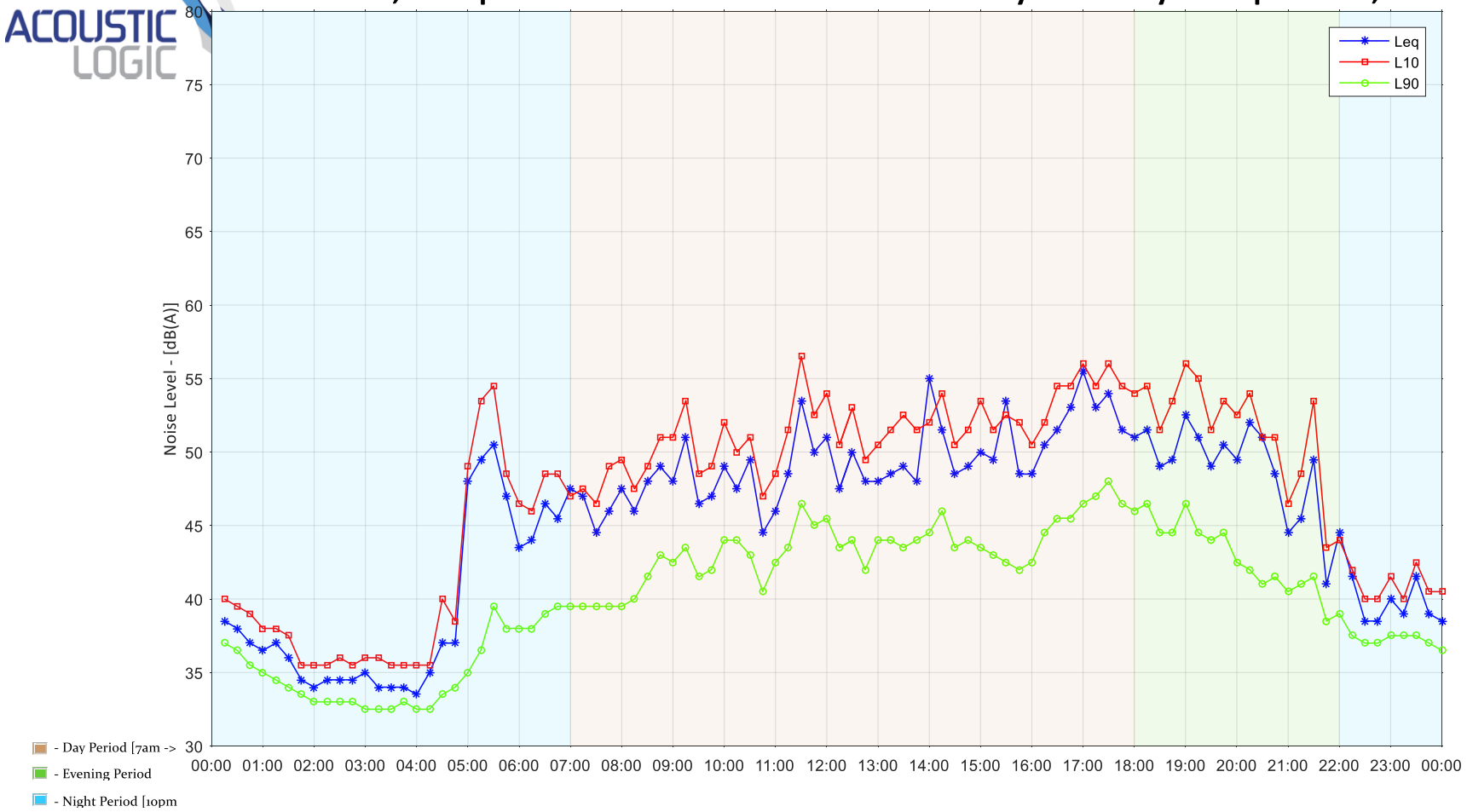


Ivanhoe Estate, Macquarie Park - Peach Tree Road Boundary: Thursday 14 September, 2017

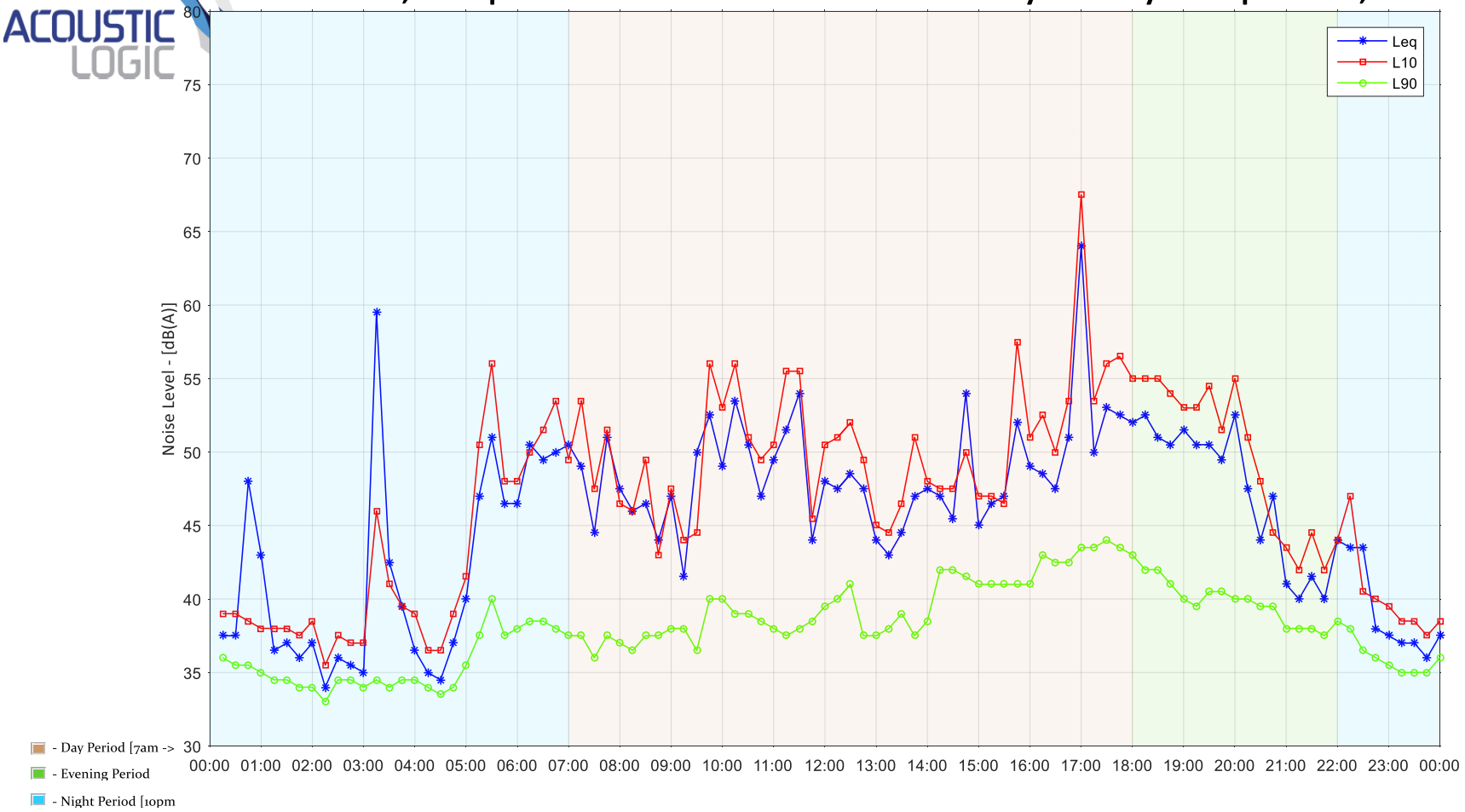



Ivanhoe Estate, Macquarie Park - Peach Tree Road Boundary: Friday 15 September, 2017
Noise Level - [dB(A)]
80
75
70
65
60
55
50
45
40
35
30
00:00 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 00:00
Leq
L10
L90
6pm]
[6pm -> 10pm]
-> 7am]

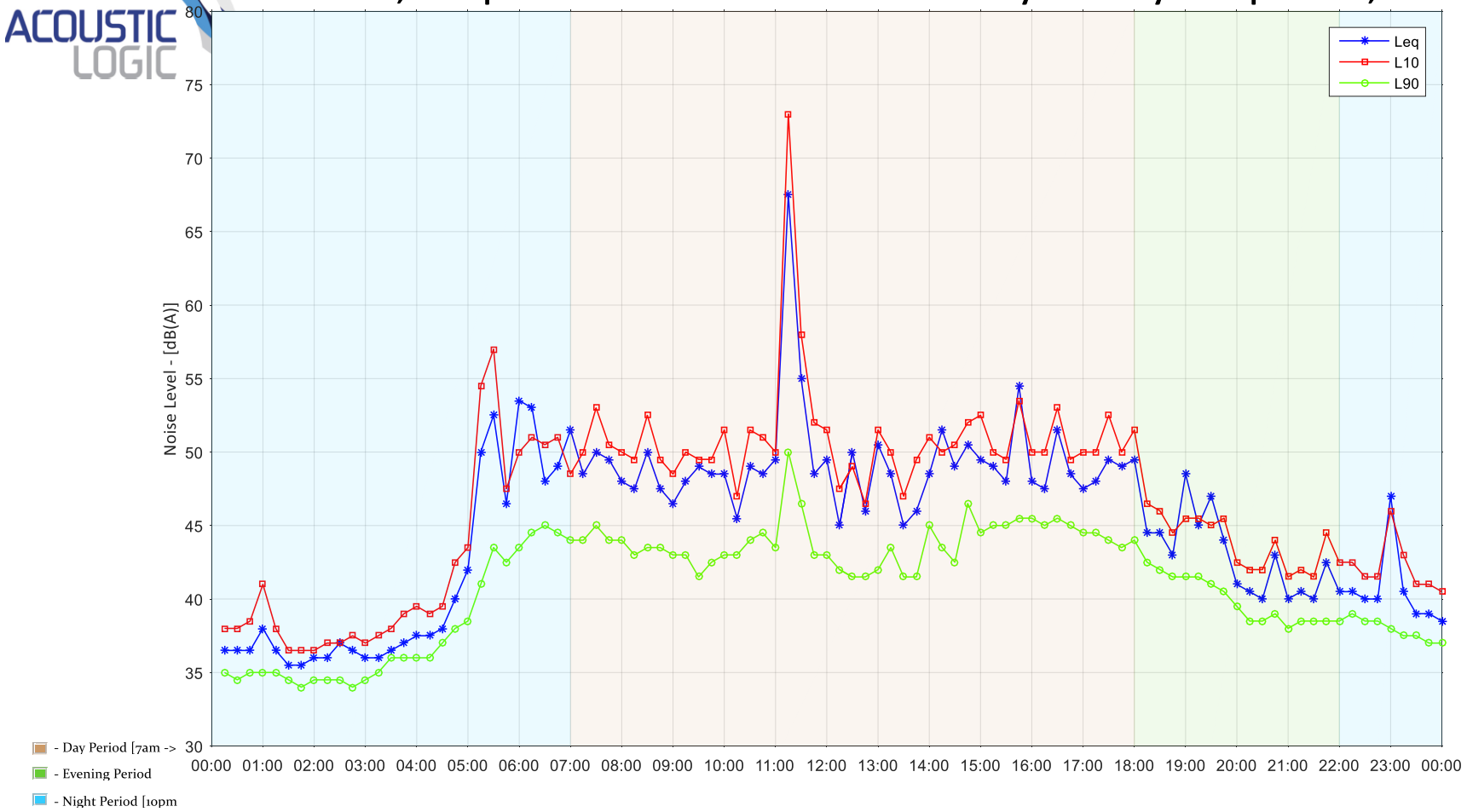
Ivanhoe Estate, Macquarie Park - Peach Tree Road Boundary: Saturday 16 September, 2017



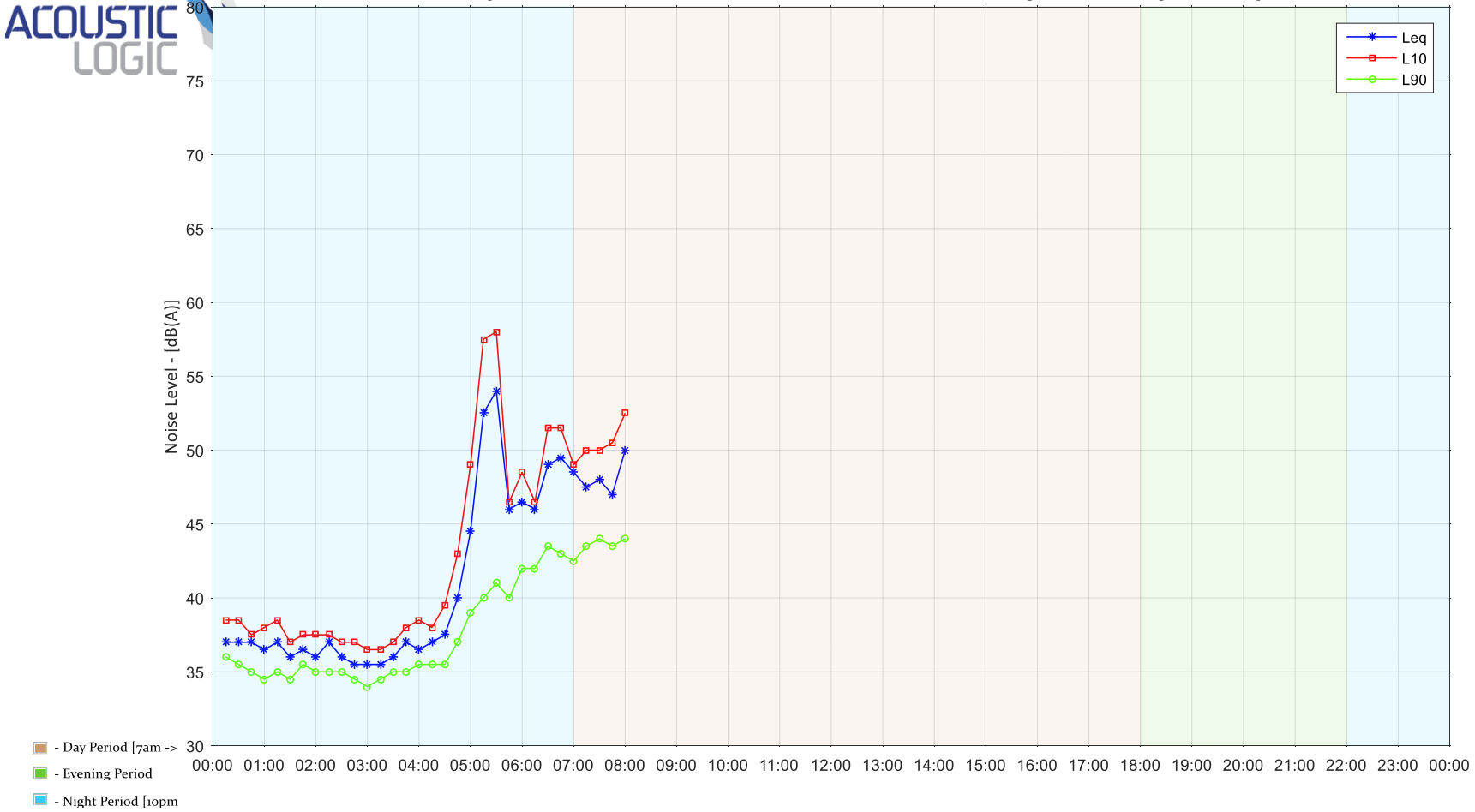
Ivanhoe Estate, Macquarie Park - Peach Tree Road Boundary: Sunday 17 September, 2017



Ivanhoe Estate, Macquarie Park - Peach Tree Road Boundary: Monday 18 September, 2017

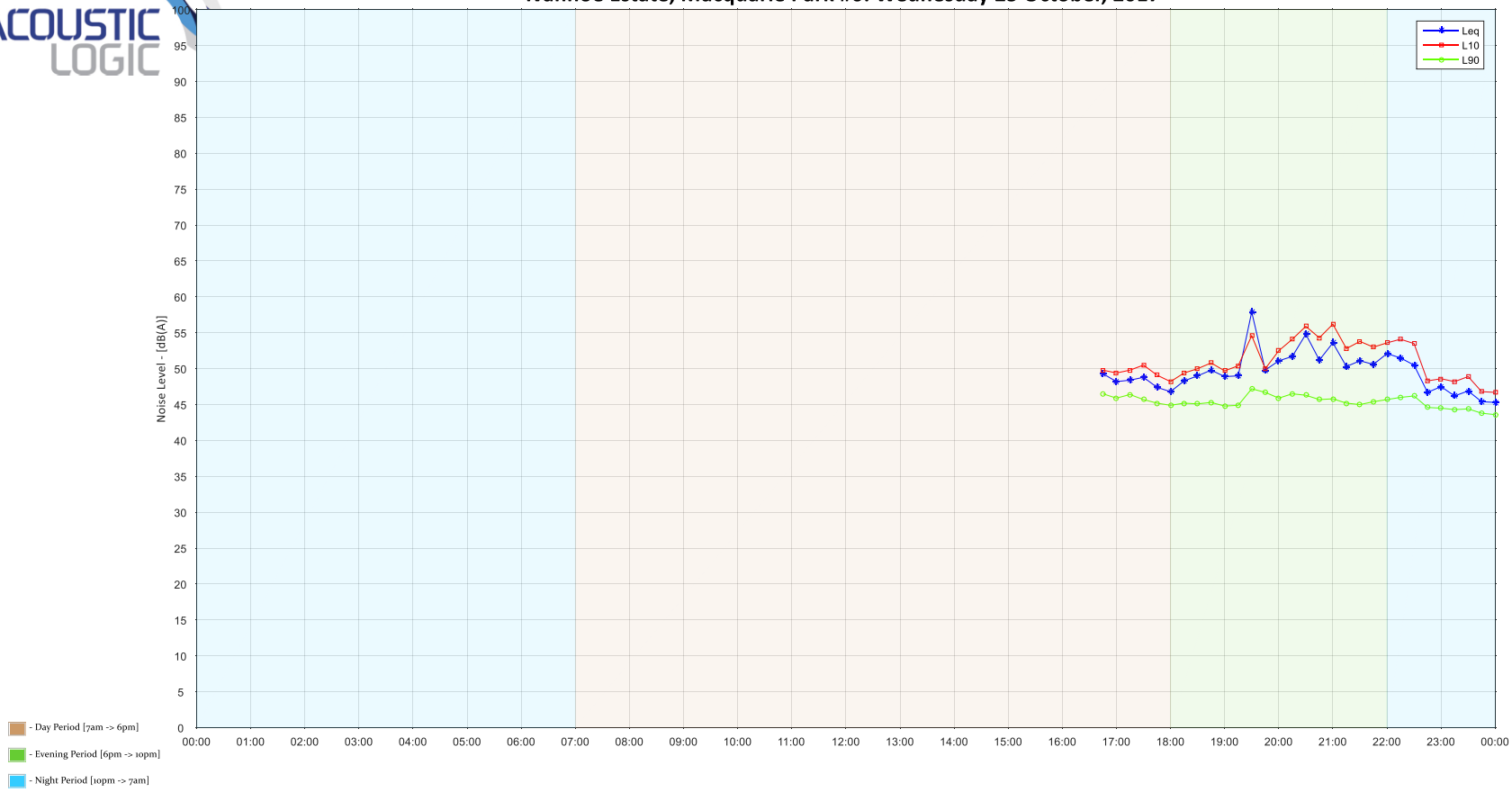


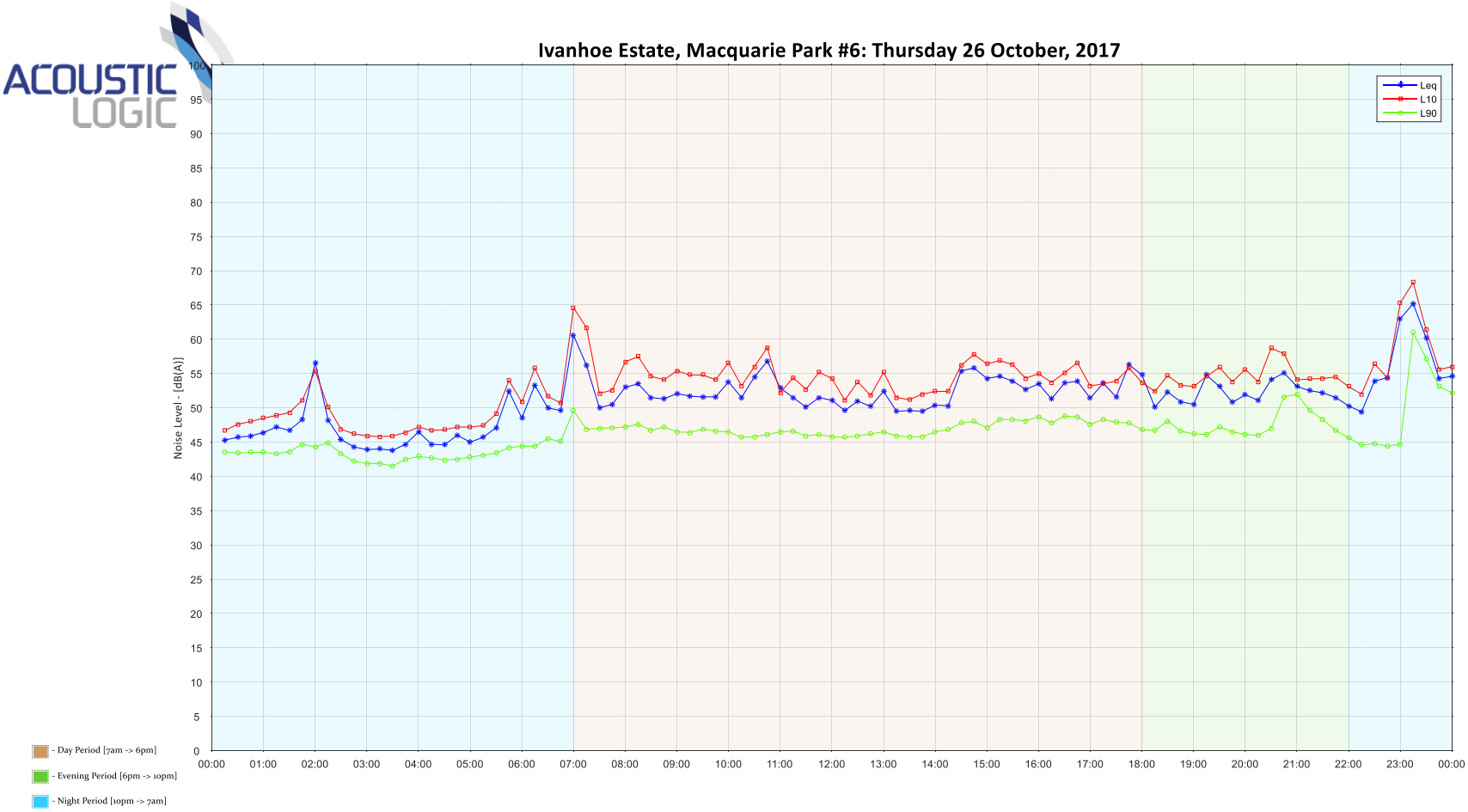
Ivanhoe Estate, Macquarie Park - Peach Tree Road Boundary: Tuesday 19 September, 2017

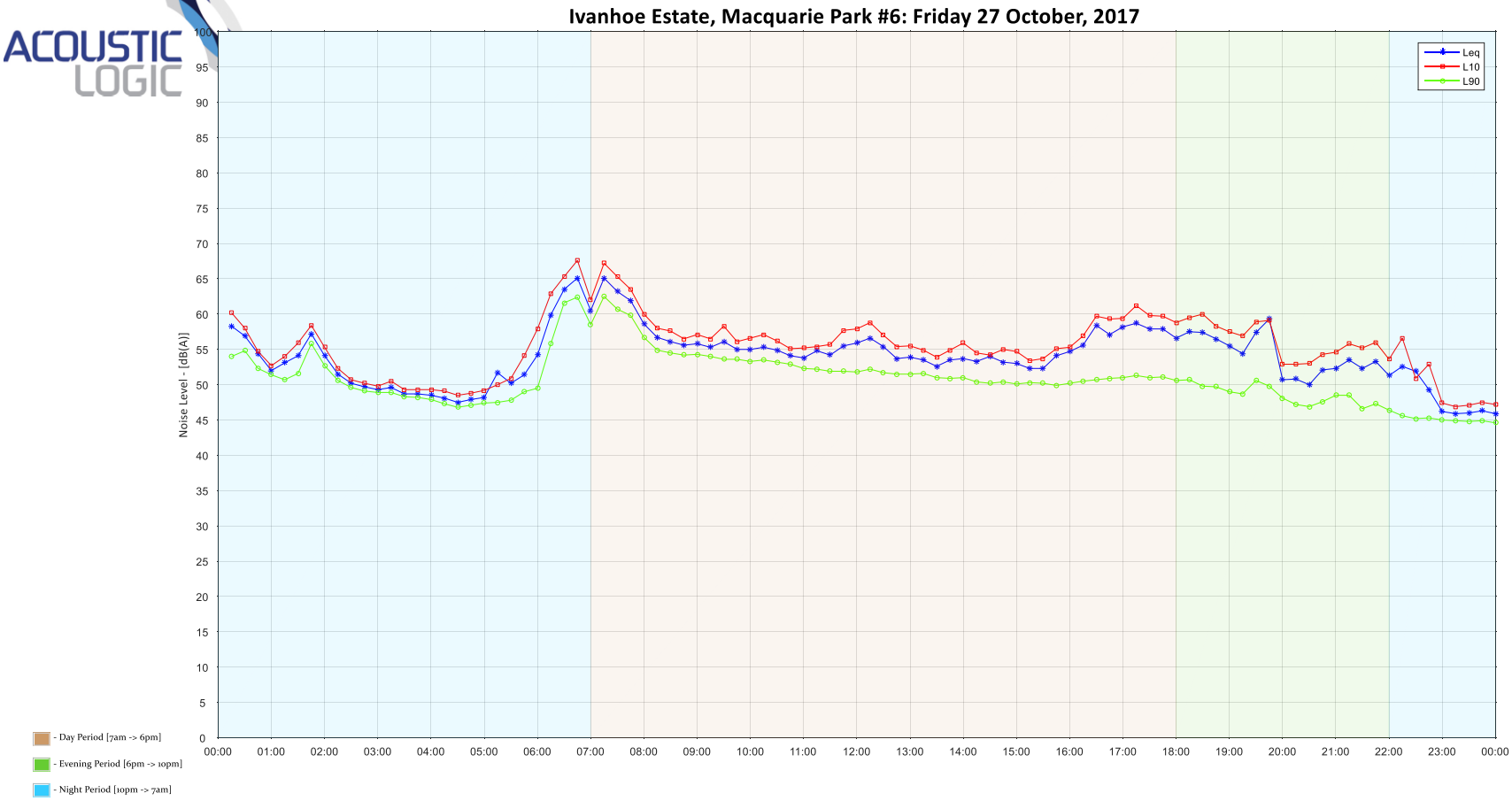


Appendix 6- Unattended Noise Data of Location 6

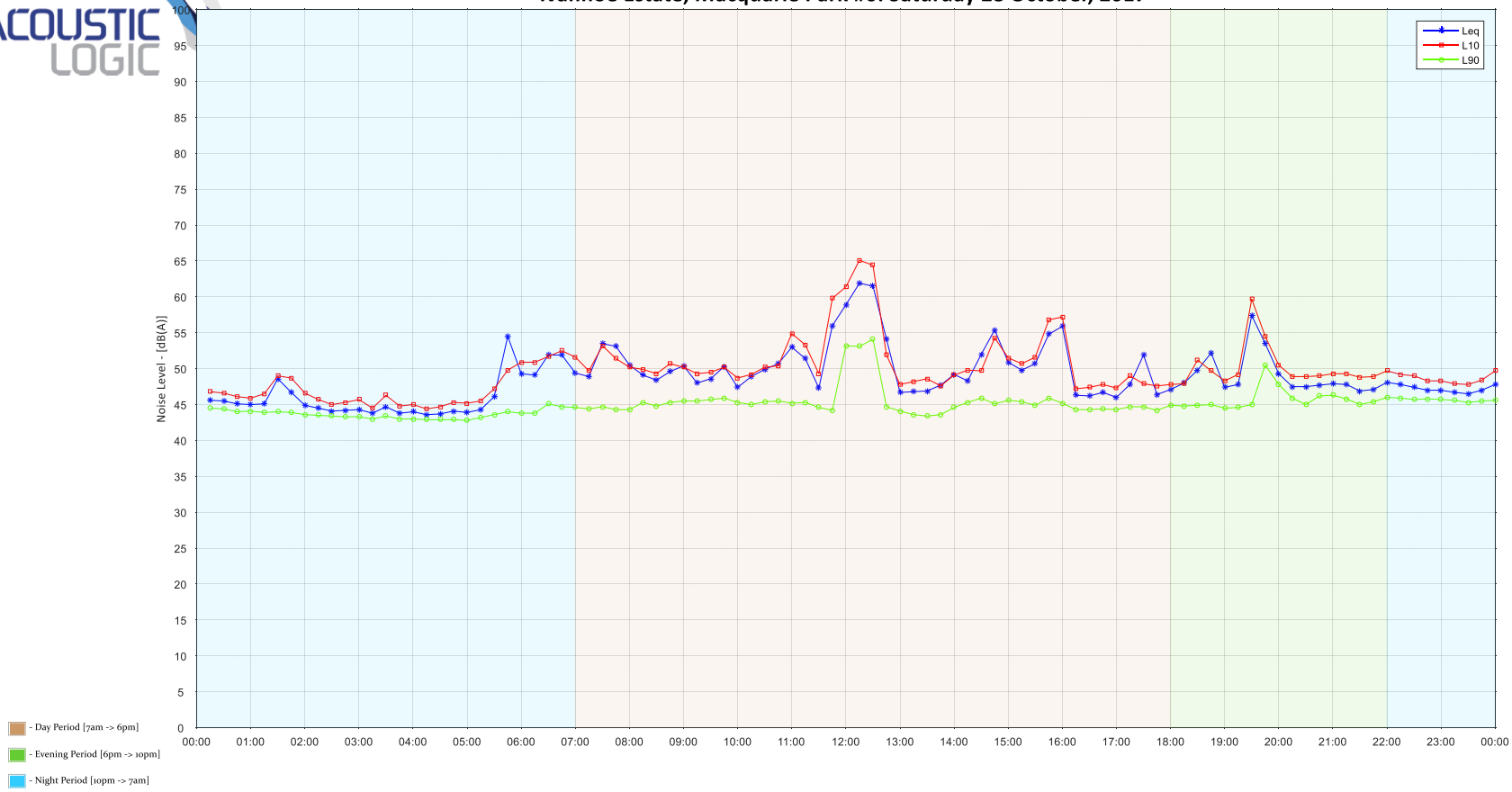
Ivanhoe Estate, Macquarie Park #6: Wednesday 25 October, 2017

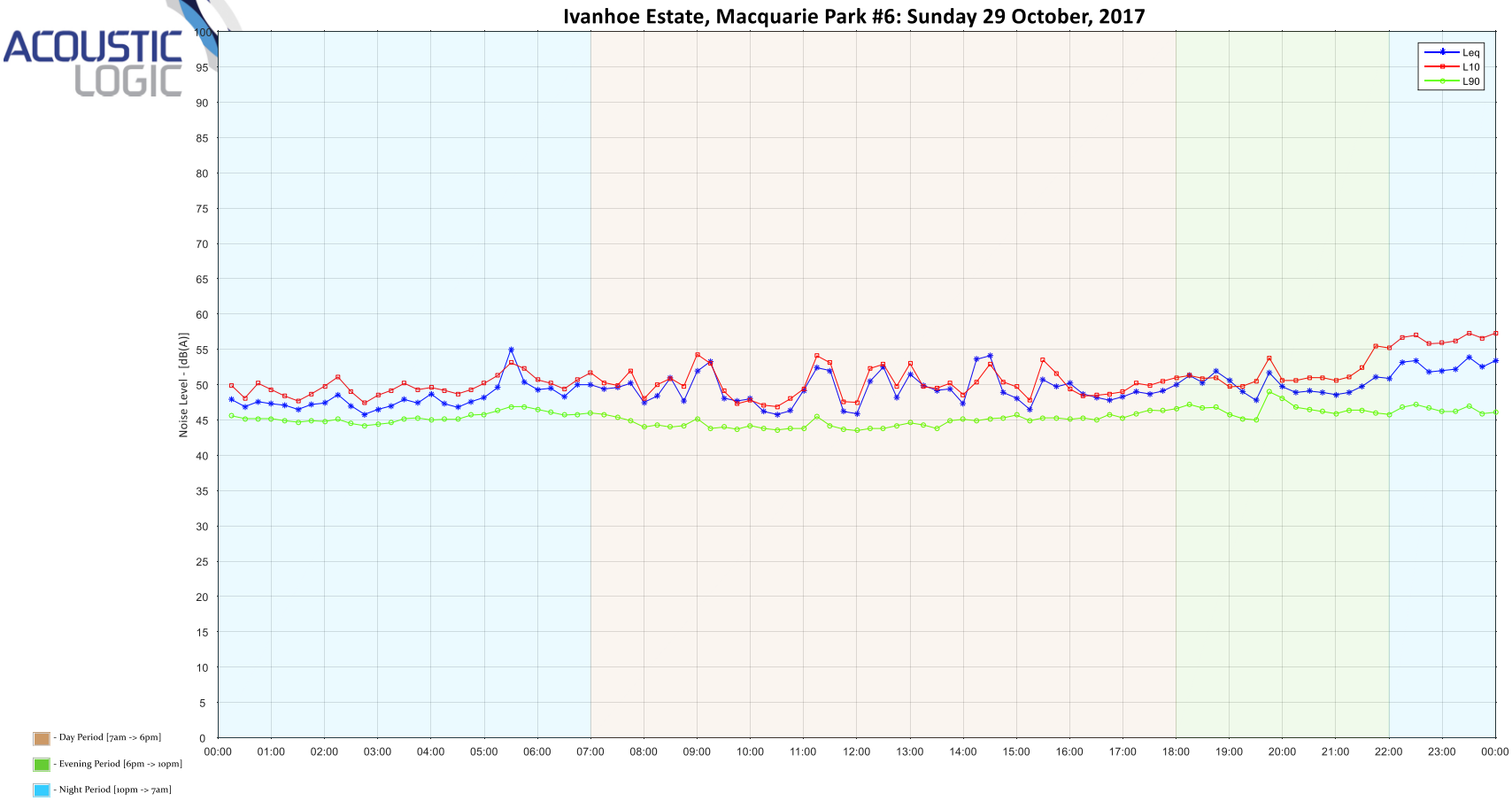



Ivanhoe Estate, Macquarie Park #6: Thursday 26 October, 2017
Noise Level - [dB(A)]
Leq
L10
L90
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


Ivanhoe Estate, Macquarie Park #6: Friday 27 October, 2017
Noise Level - [dB(A)]
Leq
L10
L90
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

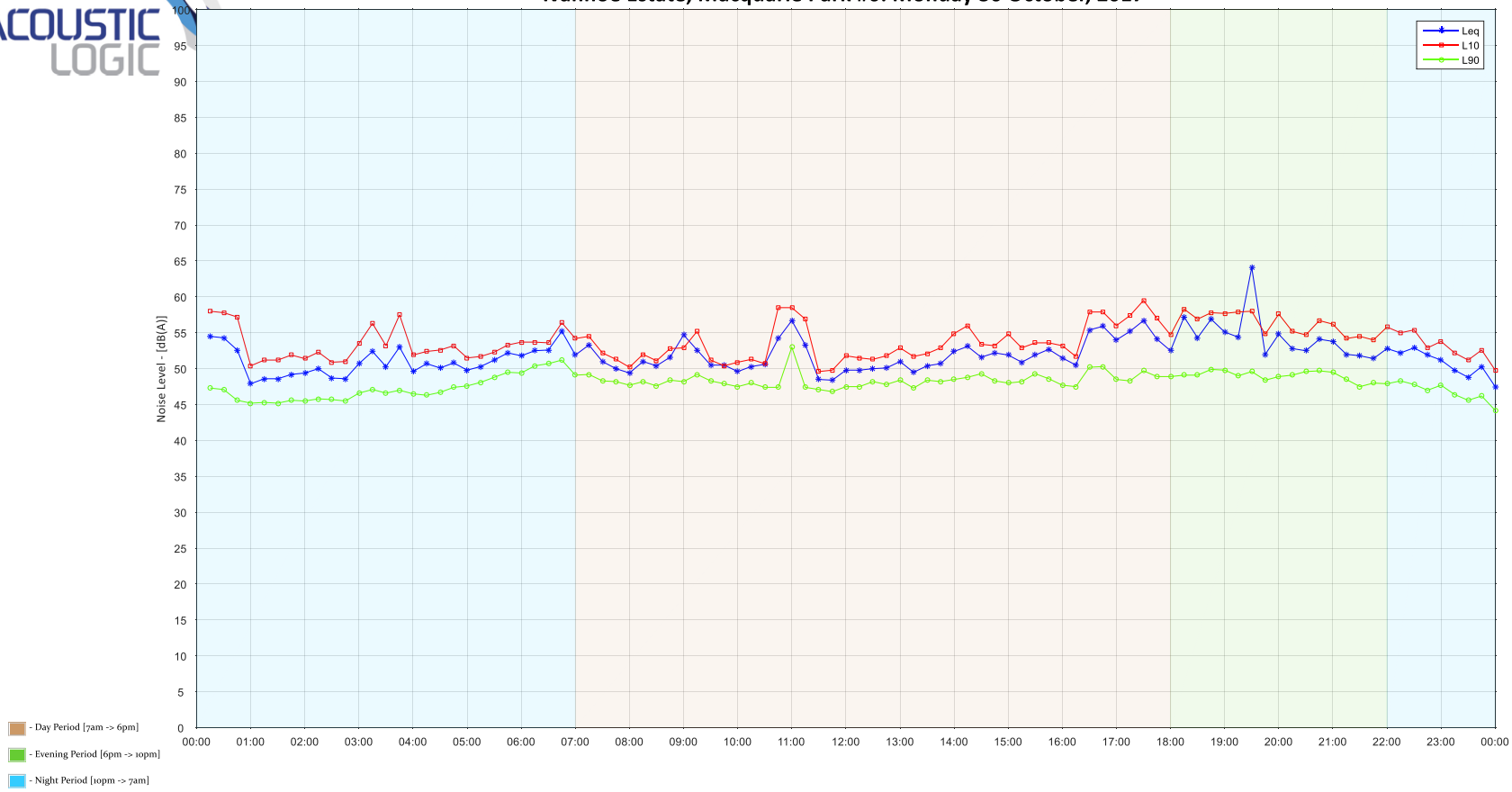
Ivanhoe Estate, Macquarie Park #6: Saturday 28 October, 2017



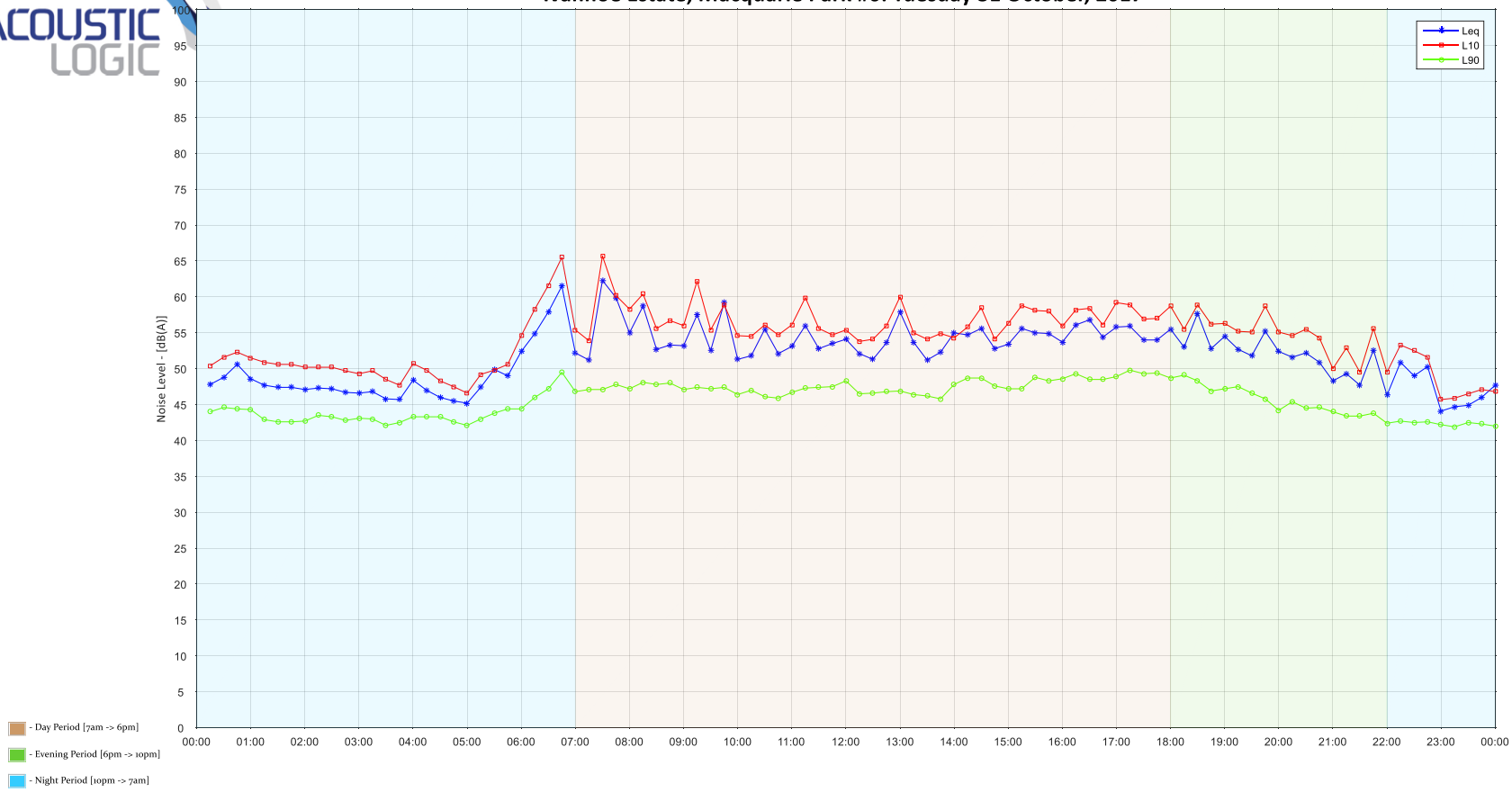

Ivanhoe Estate, Macquarie Park #6: Sunday 29 October, 2017
Noise Level - [dB(A)]
Leq
L10
L90
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

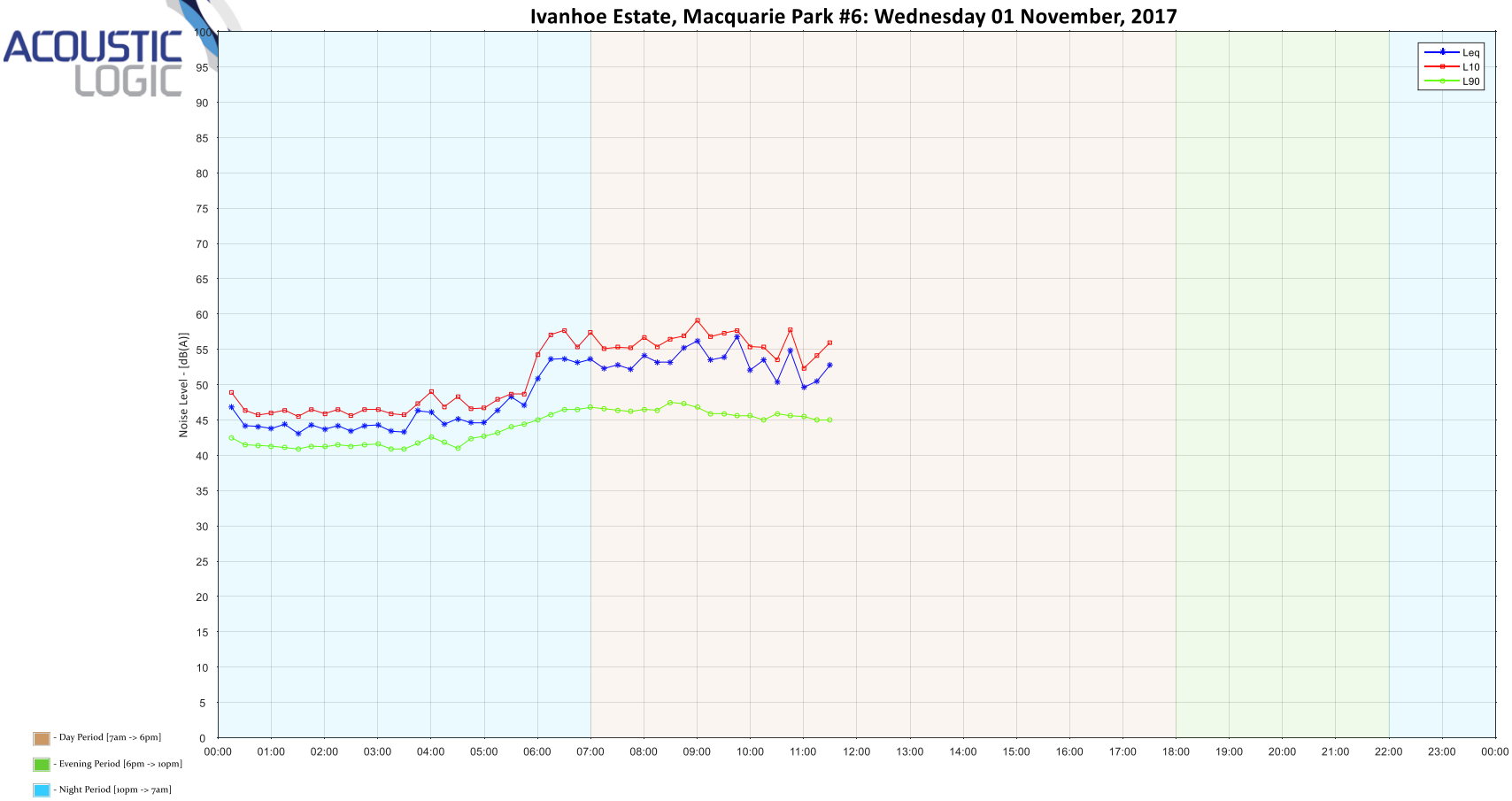
ACOUSTIC LOGIC

Ivanhoe Estate, Macquarie Park #6: Monday 30 October, 2017



Ivanhoe Estate, Macquarie Park #6: Tuesday 31 October, 2017




Ivanhoe Estate, Macquarie Park #6: Wednesday 01 November, 2017
Noise Level - [dB(A)]
Leq
L10
L90
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]