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Noise Impact Assessment

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1 INTRODUCTION

Acoustic Logic Consultancy have been engaged to conduct an acoustic assessment of noise impacts associated with the proposed University of Sydney F23 administration building as part of the Camperdown Campus, City Road.

This assessment discusses potential noise impacts associated with development, which will typically include:

- Function and exhibitions;
- Delivery and staff vehicle movements on the site;
- Traffic noise generation;
- Mechanical plant operation; and
- Noise associated with the construction of the proposed development.

This assessment has been undertaken using the architectural drawing set provided by Warren and Mahoney architects.

Noise impacts have been addressed in accordance with the following standards and regulations as detailed in the Secretary's Environmental Assessment Requirements (SEARs) requirement number 4 & 7.

- New South Wales Environmental Protection Authority –
 - *Industrial Noise Policy.*
 - *Interim Construction Noise Guideline.*
 - *Assessing Vibration: A Technical Guideline 2006*

Further guidance on the assessment of noise impacts associated with the site has been adopted from the following:

- State Environment Planning Policy (Infrastructure) 2007
- *EPA Road Noise Policy*

This assessment indicates that the construction and ongoing operation of the proposed administration building can comply with the aforementioned requirements.

2 DEVELOPMENT PROPOSAL

The proposed site encompasses the South-west portion of the University of Sydney allotment bordering the Western boundary of St Pauls College, Camperdown.

2.1 PROPOSED STRUCTURES

The proposed structure is to include the following:

- Two levels of basement car parking with associated loading area;
- Café on the ground floor with indoor and outdoor seating.
- Reception, function and exhibition space on the ground floor;
- Four levels of office space to be used for:
 - o University administration and offices on levels 2-5;
 - o Function space on Level 5.
- Rooftop level 6 plant.

2.2 PROPOSED OPERATION

The use of the development be primarily associated with:

- Administration and offices for university staff;
- Meeting rooms and offices for executive level staff and vice-chancellor.
- Function spaces.

The proposed hours of operation are as follows:

- Standard office hours for the administration component of the development;
- Up to 12am at night for the operation of the function spaces;
- Daytime operation for the café, typically between 7am and 6pm.

2.3 SURROUNDING USES AND NOISE SENSITIVE RECEIVERS

The site is bounded by the following uses:

- University buildings to the South across City Road;
- St Pauls College oval to the West;
- University buildings to the East and North.

The nearest most affected noise sensitive receivers will include the following:

Receiver 1. Approved St Pauls College 'Academic House' student accommodation housing to the Northwest of the proposed site (refer to Figure 1).

Receiver 2. Existing St Pauls College student accommodation house to the West of the proposed site.

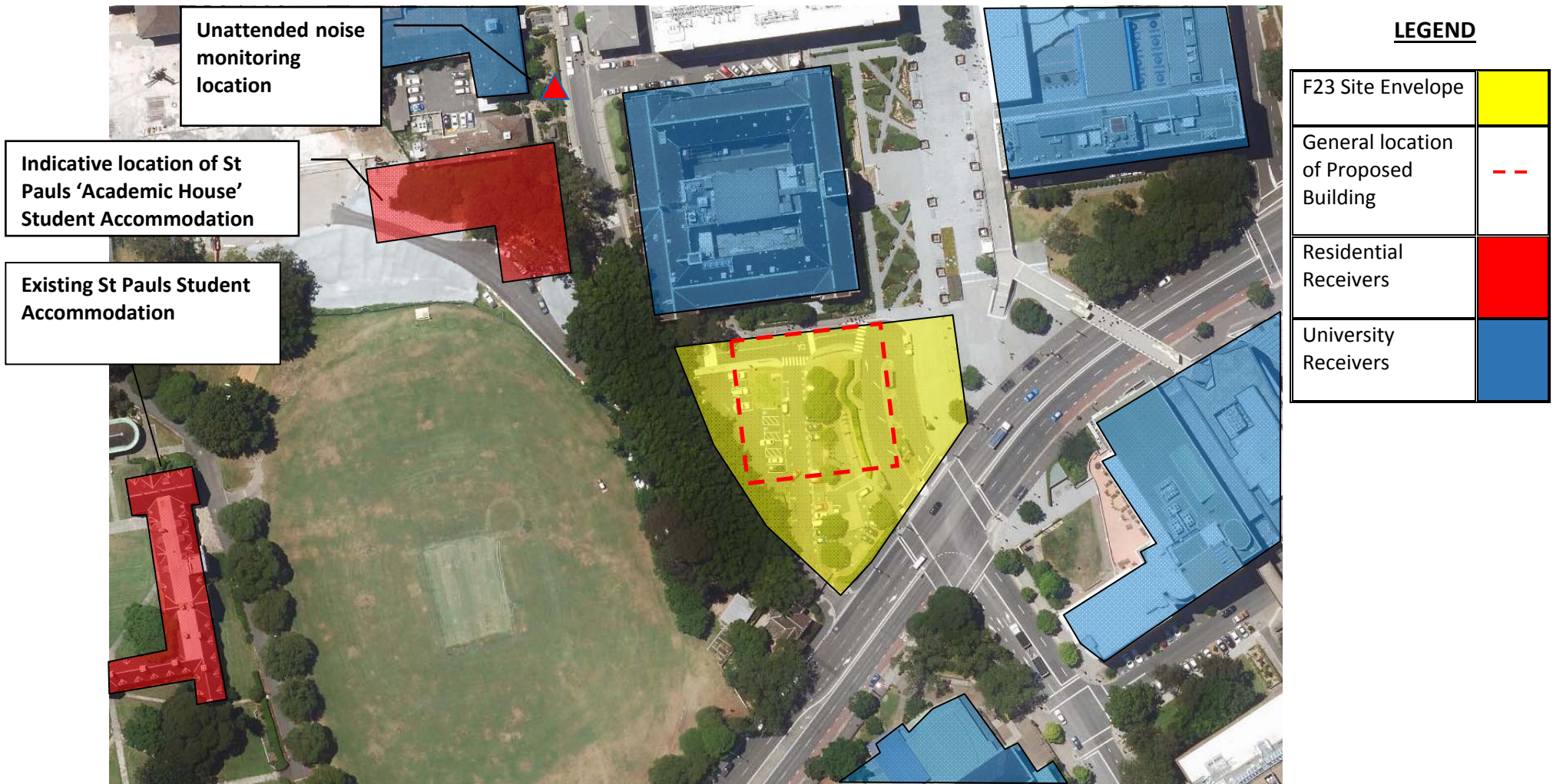


Figure 1: Site Survey and Monitoring Positions

3 EXISTING ACOUSTIC ENVIRONMENT

The acoustic environment is categorised by moderate background noise levels during the day, evening and night associated with latent traffic noise from City Road and mechanical plant servicing University buildings.

3.1 ENVIRONMENTAL 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 environmental noise impact as it closely corresponds with human perception of a changing noise environment; such is the character of environmental noise.

3.2 BACKGROUND NOISE LEVELS

Background noise levels which will be used as a basis for this assessment are detailed in the following sections.

3.2.1 Measurement Equipment

Unattended noise monitoring was conducting using Acoustic Research Laboratories Pty Ltd noise logger. The logger was programmed to store 15-minute statistical noise levels throughout the 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.

3.2.2 Measurement Location

Noise logging was conducted within the Edward Ford Building garden fronting Fisher Road. This location will be representative of background noise levels for the surrounding receivers.

3.2.3 Measurement Period

The logger was on site from 21st July to 28th July, 2015. Refer to Appendix 1 for unattended long term noise monitoring data.

3.2.4 Ambient Noise Levels

The ambient noise levels established from the unattended noise monitoring are detailed in the Table below.

Table 1 – Rating Background Noise Level

Time of Day	Rating Background Noise Level dB(A) L₉₀	Existing Noise Level dB(A) L_{eq}
Day (7am to 6pm)	46	55
Evening (6pm to 10pm)	44	51
Night (10pm to 12am)	44	51
Night (10pm to 7am)	43	50

3.2.5 Weather Affected Noise Data

Weather affected noise data (as determined by Sydney Observatory – Observatory Hill) has been used to determine potentially affected weather data. Rain affected noise data has been removed from the data set.

For the most part, there is negligible difference between the recorded background noise levels during winds exceeding 5m/s and winds less than 5m/s. This is due to the fact that the monitor was shielded from the majority of wind.

On this basis, ALC would deem the background noise data acceptable.

4 NOISE CRITERIA

Noise emissions from the site will be assessed in accordance with the requirements of the Secretary's Environmental Assessment Requirements (SEARs) associated with application number SSD 7055.

The assessment of traffic noise impacts are addressed in Section 4.4.

4.1 SEARS REQUIREMENTS

Item 4 and 7 of the SEARs are relevant to the assessment of noise from the construction and operation of the site.

4. Environmental Amenity

Detail amenity impacts including solar access, acoustic impacts, visual privacy, view loss, overshadowing, lighting impacts and wind impacts. A high level of environmental amenity for any immediately adjacent residential land uses must be demonstrated.

Item 7 of the SEARS provides guidance for assessing noise and vibration from the site.

7. Noise and Vibration

Identify and provide a quantitative assessment of the main noise and vibration generating sources during construction and operation. Outline measures to minimise and mitigate the potential noise impacts on surrounding occupiers of land.

→ *Relevant Policies and Guidelines:*

- o *NSW Industrial Noise Policy (EPA)*
- o *Interim Construction Noise Guideline (DECC)*
- o *Assessing Vibration: A Technical Guideline 2006*

The aforementioned guidelines will be used as a basis for the assessment.

4.2 EPA - INDUSTRIAL NOISE POLICY

The INP 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 INP has two requirements which both have to be complied with, namely an amenity criterion and an intrusiveness criterion.

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).

Rating background noise levels for the area have been established from long term unattended noise monitoring as detailed in Section 3.2. Intrusive criteria based on the noise monitoring conducted at the site are detailed in Table 2.

Table 2 – INP Intrusiveness Criteria

Time of day	Background Noise Level dB(A)_{L90}	Intrusiveness Criteria (Background+5dB(A)) dB(A)_{Leq}
Day	46	51
Evening	44	49
Night (10pm to 12am)	44	49
Night (12am to 7am)	43	48

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 Industrial Noise Policy sets out acceptable noise levels for various land uses. Table 2.1 on Page 16 of the policy has four categories to distinguish different residential areas. They are rural, suburban, urban and urban/industrial interface.

Pursuant to Section 2.2.1 of the INP, 'Suburban' and 'Urban' are defined as areas which have acoustical environments which incorporate the following characteristics.

Suburban - An area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This area often has the following characteristics:

- Decreasing noise levels in the evening period (1800-2200); and/or
- Evening ambient noise levels defined by the natural environment and infrequent human activity.

Urban - an area with an acoustical environment that:

- Is dominated by 'urban hum' or industrial source noise
- Has through traffic characteristically heavy and continuous traffic flows during peak periods
- Is near commercial districts or industrial districts
- Has any combination of the above,

Where 'urban hum' means the aggregate sound of many unidentifiable, mostly traffic-related sound sources.

ALC would determine the site an 'Urban' noise environment given that:

- The receiver site is within 150m to City Road, which carries heavy and continuous traffic flows during peak periods, and
- Whilst there is a minor decrease in the evening background noise level (drops 2dB(A) from the day) the evening ambient noise levels would not be defined by the natural environment and infrequent human activity.

The corresponding Amenity Criteria noise emission goals are presented below.

Table 3 – INP Amenity Acceptable Noise Levels

Type of Receiver	Indicative Noise Amenity Area	Time of day	Recommended Acceptable Noise Level dB(A) L_{eq}
Residence	Urban	Day	60
		Evening	50
		Night	45
Commercial premises	All	When in use	65
Active recreation area	All	When in use	55

The aforementioned acceptable levels are to be adjusted in accordance with Section 2.2 of the INP. The existing L_{eq} noise levels (including industrial sources and road traffic) recorded at the site are as follows:

- Day – 55dB(A) L_{eq}
- Evening – 51dB(A) L_{eq}
- Night – 50dB(A) L_{eq}

In relation to the aforementioned noise levels, ALC notes the following:

- The contribution from industrial noise sources, that being mechanical plant associated with the adjoining University of Sydney science buildings was 43dB(A) L_{eq} .
- The resultant L_{eq} noise level in the vicinity of the site is largely controlled by latent traffic noise from City Road and sporadic car movements along Fisher Road.

Utilising the modification factors in Table 2.2 of the INP, the amenity criteria becomes the following:

Table 4 – INP Adjusted Amenity Noise Criteria

Time of Day	Acceptable noise level, dB(A) L_{eq} (period)	Existing L_{eq} noise level from industrial noise sources, dB(A)	Modification factor	Adjusted Amenity criterion, dB(A) L_{eq} (period)
Day	60	43	N/A	60
Evening	50	43	N/A	50
Night	45	43	Acceptable noise level minus 4	41

4.3 NOISE FROM INCREASED TRAFFIC GENERATION ON PUBLIC STREETS

For land use developments with the potential to create additional traffic on public streets the development should comply with the EPA Road Noise Policy.

Noise levels generated by traffic should not exceed the noise levels set out in the Table below when measured at a nearby property.

Table 5 – Criteria for Traffic Noise Generated by New Developments

Road Type	Time of day	Permissible Noise Generation
Arterial (City Road)	Day (7am to 10pm)	60dB(A) _{Leq(15hr)}
	Night (10pm to 7am)	55dB(A) _{Leq(9hr)}

However, if existing noise levels exceed those in the table above, Section 3.4 of the Road Noise Policy is applicable, which requires noise impacts are reduced through feasible and reasonable measures. However, in determining what is feasible/reasonable, the Policy notes that an increase of less than 2dB(A) is a minor impact and would be barely perceptible.

4.4 STATE ENVIRONMENT PLANNING POLICY (INFRASTRUCTURE) 2007

The SEPP (Infrastructure) 2007 provides guidance for traffic noise impact on developments located near major roads. Clause 102 states the following:

Clause 102 - Impact of road noise or vibration on non-road development

(1) *This clause applies to development for any of the following purposes that is on land in or adjacent to the road corridor for a freeway, a tollway or a transit way or any other road with an annual average daily traffic volume of more than 40,000 vehicles (based on the traffic volume data published on the website of the RTA) and that the consent authority considers is likely to be adversely affected by road 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.*

Whilst the proposed use does form part of an educational establishment it is not used for educational purposes. On this basis, traffic noise intrusion need not be considered any further for compliance with Clause 102 of the SEPP (Infrastructure) 2007.

5 ASSESSMENT OF NOISE IMPACTS

Noise emissions from the general operation of the proposed administration building have been addressed for the following noise sources:

- Noise associated with function and exhibition spaces.
- Vehicular noise on site (use of car park and loading area).
- Noise created on public roads as a result of traffic generated by the site.
- A preliminary assessment of noise from mechanical plant.

A preliminary assessment of construction noise has also been included.

5.1 FUNCTION AND EXHIBITION SPACES

The development incorporates a function spaces on the Ground floor and Level 5.

5.1.1 Ground Floor – Informal Exhibition Space

For operation during daytime hours only. No amplified music or voices is expected for these spaces.

5.1.2 Ground Floor – The Symposium Suite

May be used for formal functions or conferences. There are no external balconies associated with the symposium. Amplified speech will generally be utilised internally. No amplified music or voices is expected externally.

5.1.3 Ground Floor – Café

The ground floor café incorporates indoor and outdoor seating. The majority of noise from this use will be associated with the outdoor seating area. No loud amplified music is proposed for this use.

5.1.4 Level 5 –Function Room

May be used for formal functions or cocktail parties. The function room has an associated outdoor terrace which faces toward the East. Amplified speech and music may be utilised internally. Amplified speech is not expected externally. Background lounge music may be played on the external terrace.

5.1.5 Other Outdoor Terraces

The terraces from the executive lounge and meeting spaces will typically be used as a breakout space for the occupants using these spaces. No formal functions or conventions are proposed for these spaces and as such no amplified music or speech is proposed either indoor or outdoor.

5.1.6 Assumed Noise Levels

The operation of the indoor function rooms have been assessed against the following assumptions.

Table 6 – Assumed Noise Levels and Operation for Internal Spaces

Space	Hours of Operation	Amplified Music	Amplified Speech	Internal Sound Pressure Level, dB(A) L_{eq}
Ground	7am to 6pm	No	No	70
Cafe	7am to 6pm	No	No	65
Symposium	7am to 10pm	Presentation music	Yes	85
Level 5 Function Room	7am to 12am	Yes	Yes	90
Level 5 Lounge	7am to 10pm	No	No	65

The operation of the outdoor terraces and balconies have been assessed against the following assumptions.

Table 7 – Assumed Noise Levels and Operation for Outdoor Areas / Balconies

Space	Hours of Operation	Amplified Music Sound Pressure Level, dB(A) L_{eq}	Number of Patrons on Balcony	Patron Sound Power Level, dB(A) L_{eq}
Café	7am to 6pm	No	50 1 in 3 talking	74
Level 5 Function Room	7am to 12am	60dB(A)	100 1 in 3 talking	74
Level 5 Lounge	7am to 10pm	No	10 1 in 3 talking	70

Note: Amplified music measured at 3m from any external speaker.

5.2 VEHICLE MOVEMENTS ON SITE

Noise associated with vehicle movements on site have been addressed for:

- Staff vehicles entering and exiting the basement carpark via the entrance off Fisher Road.
- Vehicles using the loading area.

5.2.1 Passenger Vehicle Noise

Noise from vehicles entering and exiting the carpark have been assessed using the following noise levels established from previous measurements conducted by ALC. Corrections have been made for the reverberant nature of the carpark.

Table 8 – Operational Sound Power Levels

Noise Source	Sound Power Level
Car Engine at 20km/h	87dB(A) _{Leq}
Car Engine Idling	80dB(A) _{Leq}
Car Starting	92dB(A) _{L₁(1min)}
Car Door Closing	92dB(A) _{L₁(1min)}

ALC have assumed that the carpark will empty within a worst one hour period during the day, constituting 140 vehicle movements.

5.2.2 Loading Area Noise

The loading area is located on the West façade of the development fronting Fisher Road. It is expected that only vans or light rigid vehicles will access the loading area to service the café on the ground floor and catering for the function rooms.

ALC have assessed noise from the loading area based on the following assumptions:

- A light rigid vehicle with a sound power level of 95dB(A) will access the loading area;
- It is expected that a maximum 1 delivery will occur in each 15 minute period.
- Vehicles are not expected to idle longer than 2 min within the loading area.

The predicted worst 1 hour noise level from the loading area operation is detailed below.

5.3 PREDICTED NOISE LEVELS

The assessment has been assessed for the expected worst case operation for each time period as per Table 9.

Predicted noise levels from the operation of the proposed development have been assessed for the cumulative noise level from all components of the development respective to the time of day.

Table 9 – Worst Case Operational Activities

Time of Day	Noise sources assessed
Day 7am to 6pm	All function rooms (including café) operating – Refer to Section 5.1 All vehicles entering / existing the development – Refer Section 5.2.1 Delivery via loading area – Refer to Section 5.2.2
Evening 6pm to 10pm	Symposium and function room operating – Refer to Section 5.1
Night 10pm to 12am	Function room operating – Refer to Section 5.1

Note: Operation does not include mechanical plant which will be assessed at a later stage upon selection of mechanical plant (refer to Section 5.4 of this report).

The predicted noise levels are presented in the following Table.

Table 10 – Worst Case Operational Activities

Time of Day	Receiver Location	Predicted Noise Level, dB(A) $L_{eq\ 15min}$	Noise Emission Objectives ¹ , dB(A) $L_{eq\ 15min}$
Day 7am to 6pm	Receiver 1 – ‘Academic House’ Student Accommodation	38	51
	Receiver 2 – Existing St Pauls Student Accommodation	27	51
Evening 6pm to 10pm	Receiver 1 – ‘Academic House’ Student Accommodation	32	49
	Receiver 2 – Existing St Pauls Student Accommodation	21	49
Night 10pm to 12am	Receiver 1 – ‘Academic House’ Student Accommodation	< 20	41
	Receiver 2 – Existing St Pauls Student Accommodation	< 20	41

Note¹: Noise emission objectives based on the strictest noise criteria out of the intrusiveness and amenity criterion respective to the period of the day.

5.3.1 Traffic Noise Generation

The potential for traffic noise generation due to vehicle movements generated by the site has been assessed against the requirements of the EPA Road Noise Policy (RNP).

As per Section 4.3 of this report, the RNP requires that noise from a development in conjunction with existing traffic noise associated with arterial roads should not exceed 60dB(A) $L_{eq(15\text{hour})}$ during the day and 55dB(A) $L_{eq(9\text{hour})}$ during the evening/night. In the event that the traffic noise levels already exceed the aforementioned criteria, noise associated with traffic generated by a site should not raise the existing traffic noise level by more than 2dB(A).

Access to the site is provided via City Road adjoining the Southern boundary which carries in excess of 40,000 vehicles per day based on the RTA 'Traffic Volume Maps for Noise Assessment for Building on Land Adjacent to Busy Roads'.

On this basis, traffic noise generation from the site on City Road will be negligible and as such acoustically compliant with the Road Noise Policy.

5.4 NOISE FROM MECHANICAL PLANT

Detailed acoustic design of mechanical plant cannot be undertaken at approval stage, as plant selections and locations are not finalised. However, an indicative assessment of primary plant items is presented below.

Primary plant items will include:

- Cooling towers (located on roof top of the building).
- Air handling plant (air handling units, supply/exhaust/outside air fans).
- Chillers.

With respect to the above, we note:

- Cooling tower.
 - o The cooling tower plant deck is set within the roofing cavity, which will act as an acoustic screen around the cooling tower.
 - o Based on the preliminary selection of the cooling tower with a sound power level of 94dB(A) running at 100% speed, predicted noise levels at the 'Academic House' receivers will comply with the noise emission criteria for all periods of the day. There will be slightly less impact at the existing student accommodation.

- Water Cooled Chillers
 - o Chillers are proposed to be located in the basement level 2 plant room. Given that the plant room is fully enclosed, chillers will have no acoustic impact on surrounding receivers.
 - o Any ventilation openings or fans will be acoustically treated to satisfy the noise emission requirements.
- Fans and air-handling units.
 - o Detailed acoustic review of all plant rooms to be undertaken following equipment selection, in particular if there are louvres facing the West or North. Ideally, fans/air handling units will be ducted to the external louvre (with the remainder of the louvre blanked off to prevent noise escape) as opposed to the being large louvre areas open directly into the plant room (which may necessitate acoustic louvres).
 - o Air handling units do not typically require extensive acoustic treatment to ensure compliant noise emissions at nearby properties.
 - o Air handling unit exhaust and outside air ducting (both of which are typically ducted to outside) are to be acoustically reviewed following layout design by mechanical engineer/contractor to determine whether internal lining to this ductwork is required.
 - o Major fans (typically with a sound power over 85(A) – major toilet exhaust and major relief air fans) may require acoustic treatment if located externally. This treatment would include internal lining to any external ductwork. Potentially acoustic treatment of fan casing will also be required. Review of all external fans (including fans ducted to external locations) must be conducted once selected to ensure compliant noise emissions to external areas.

Cumulative assessment of both plant noise with other noise sources is recommended when conducting acoustic design of plant items. This is particularly important for plant noise near the western property boundary, where cumulative assessment with the car park/vehicle noise is to be considered.

Compliance with INP acoustic criteria as set out in Section 5.2 will be achievable, provided that detailed acoustic review of plant items is undertaken once plant is selected, and acoustic treatments similar to those outlined above are adopted.

5.5 OPERATIONAL VIBRATION IMPACTS

Sources of vibration associated with the development will be generally attributed to sporadic vehicle movements in and out of the carpark/loading area and the operation of mechanical plant servicing the development. In this regard, ALC note the following:

- Vibration associated with vehicle movements on site will have negligible impact on surrounding receivers (specifically the future 'Academic House' residents) given their proximity to the site. In any case, vibration impacts will be no greater than that associated with movements along Fisher Road.
- Mechanical plant will be located within the site and will have no vibration impact on surrounding receivers.

On this basis, the development will be fully compliant with the criteria detailed in the EPA document '*Assessing Vibration: A Technical Guideline 2006*'.

6 CONSTRUCTION IMPACTS

This section presents processes to manage noise and vibration impacts associated with the proposed construction activities for the facility and the potential for noise and vibration impact to surrounding receivers.

The principal objective of this study is to undertake an evaluation of works to be performed during the operation of the various activities during construction and develop a management plan to ensure noise and vibration:

1. Does not excessively impact on the sensitive receivers.
2. Is minimised to all surrounding receivers.
3. Does not exceed OH&S standards at surrounding receivers.
4. Is monitored when potentially high noise and vibration generating activities are being used.

This assessment will formulate/present the relevant noise and vibration objectives for which construction activities should be managed to comply with. Additionally, effective mitigation measures have been recommended where possible to ensure noise and vibration objectives are achieved and impacts are minimised.

The principal issues to be addressed in this Section are:

- Identification of the noise and vibration standards which will be applicable to this project.
- Formulation of a strategy for construction activities to comply with the standards identified in the above point.
- Development of demolition and excavation methods which will minimise the impact on surrounding uses.

The expected activities can be expected to include:

1. Excavation of soil and soft sand stone.
2. Construction of proposed facility.

6.1 CONSTRUCTION NOISE MANAGEMENT LEVELS

Noise emanating from the construction site has been assessed in accordance with the recommendations of the EPA *Interim Construction Noise Guideline*.

The guideline reflects on feasible and reasonable mitigation strategies, management controls and public liaising in the effort to reach realistic compromises between construction sites and potential noise affected receivers.

Residential dwellings are discussed in Section 4.1.1 of the ICNG.

Table 11 – Construction Noise Management Levels

Management level, L_{Aeq} (15min)	How to apply
Noise affected RBL + 10dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured L_{Aeq} (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
Highly noise affected 75 dB(A)	• The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences) 2. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

Section 4.1.2 of the ICNG provides guidance on construction noise management levels for sensitive uses other than residential dwellings. These uses as detailed in the following Table.

Table 12 – Construction Noise Management Levels

Land Use	Management level, L_{Aeq} (15min) (applies when properties are being used)
Active recreation areas	65dB(A)

A summary of noise emission goals for both standard hours of construction and outside standard hours are presented.

Table 13 – Construction Noise Emission Objectives

Location	“Noise Affected” Level dB(A) L_{eq} (15min)	“Highly Noise Affected” Level dB(A) L_{eq} (15min)
Residences	56 (Standard Construction Hours)	75
Commercial Development	70	N/A
Active Recreation Areas	65	N/A

6.2 CONSTRUCTION VIBRATION

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 14 – Construction Vibration Objectives

Location	Time	Peak velocity (mm/s)	
		Preferred	Maximum
Continuous Vibration			
Residences	Daytime	0.28	0.56
Commercial	When in use	0.56	1.12
Impulsive Vibration			
Residences	Daytime	8.6	17
Commercial	When in use	18	36

6.3 ASSESSMENT OF CONSTRUCTION NOISE

With respect to general construction noise, the impacts on nearby development will be dependent on the activity in question and where on the site the activity is undertaken. Excavation and piling works tend to be the loudest typical construction activity. Work close to the northern and western boundaries will have greatest potential impact on nearby residents.

It should be noted that given that the 'Academic House' development has yet to begin construction, these receiver locations may not be occupied during the demolition, excavation and construction processes.

Notwithstanding, noise has been provided in principle to these receivers and also to existing St Pauls buildings to the West of the site across the cricket oval.

6.3.1 Demolition and Excavation Works

Demolition of the existing on grade carpark and excavation of fill for the basement levels may require rock hammering which would likely present the loudest typical noise events associated with the construction period.

- During the demolition and excavation periods, it is the use of rock hammers, excavators and concrete saws which will present the loudest sources of noise to surrounding receiver locations.
 - Noise levels exceeding EPA "Noise Effected"/"Background+10dB(A)" are likely to occur at the Academic House receiver, given its proximity (although exceedances of the "Highly Noise Effected" level if 75dB(A) is unlikely.
 - Noise levels exceeding EPA "Noise Effected"/"Background+10dB(A)" noise levels may occur at the existing student accommodation receiver during hammering works, but will be unlikely to exceed for the remainder of works. Exceedances of the "Highly Noise Effected" level if 75dB(A) is highly unlikely.

6.3.2 General Construction Works

- During erection of structure, it is the use of hand tools (angle grinders etc.) and concrete pumps which are the loudest typical activity (sound power levels of approximately 105dB(A)_{Leq(15min)}).
 - Noise levels exceeding EPA "Noise Effected"/"Background+10dB(A)" noise levels are not likely to occur at Academic House. Exceedances of the "Highly Noise Effected" level if 75dB(A) is also highly unlikely.
 - Noise levels exceeding EPA "Noise Effected"/"Background+10dB(A)" noise levels are not likely to occur at the existing student accommodation. Exceedances of the "Highly Noise Effected" level if 75dB(A) is highly unlikely.
- Work zones are likely to occur on located on the front portion of the site, with some access via Fisher Road. Noise from construction vehicles and material handling will negligible impact on surrounding residences provided that construction vehicles do not continue along Fisher Road past the site.

- Slab finishing works (use of helicopter floats or similar) will potentially extend into the evening depending on the size of the slab and weather conditions. Noise levels exceeding the “Highly Noise Effected” level of 75dB(A) at the residences is unlikely to occur.
- 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 at any sensitive receiver locations.

6.4 DISCUSSION

In light of the above, we recommend:

- Use of augured rather than driven or vibratory piling will be considered if feasible.
- Location of crane as far as practicable from Fisher Road.
- Location of the concrete pump away from Fisher Road if practical. If this is not possible, in the event of complaint, temporary screening of the pump should be considered (plywood hoarding, or plywood sheet fixed to temporary fencing).
- For activities where acoustic controls and management techniques still cannot guarantee compliance with “Noise Management”/“Background+10dB(A)” noise levels, implement a notification process whereby nearby development is made aware of the time and duration of noise intensive construction processes. This may include days of heavy hammering and excavation works.
- Implementation of a noise monitoring program (attended noise measurements during key stages of construction) during construction to provide feedback back to the Builder to ascertain whether construction noise goals are being exceeded and determine additional management strategies. This would be expected at commencement of excavation works.

Through adoption of the above, noise impacts on nearby development can be suitably managed to prevent unreasonable impact. Management processes for dealing with construction noise complaints and response procedures are addressed in Section 6.6.

6.5 CONSTRUCTION VIBRATION

Given the proximity to surrounding receiver locations, there will be no significant vibration impact associated with the construction works.

6.6 NOISE AND VIBRATION MONITORING, REPORTING AND RESPONSE PROCEDURES

Noise and vibration monitoring may either consist of manned and/or unmanned measurements. Active monitoring may be undertaken during the construction work phase of the project if required in the event complaints are received from neighbours. In the event complaint are received from neighbours the following process will be followed:

1. Determining the offending plant/equipment/process
2. Locating the plant/equipment/process further away from the affected receiver(s) if possible.
3. Implementing additional acoustic treatment in the form of localised barriers, silencers etc.
4. Selecting alternative equipment/processes

Where monitoring is required and indicates exceedances of the noise limits immediate action should be taken to identify any further controls as required to reduce noise emissions so that the noise limits are complied with. Monitoring of the activities following the implementation of these additional controls will be undertaken to confirm compliance.

6.6.1 Reporting requirements

The following shall be kept on site:

1. A register of complaints received/communication with the local community shall be maintained and kept on site with information as detailed below.
2. Where noise/vibration complaints require noise/vibration monitoring, results from monitoring shall be retained on site at all times.
3. Any noise exceedances occurring including, the actions taken and results of follow up monitoring.
4. A report detailing complaints received and actions taken shall be presented.
5. All monitoring and reporting shall be conducted in conjunction with the conditions of consent.

6.6.2 Response procedures

Complaints associated with noise and vibration generated by site activities shall be recorded on a Noise Complaint Form. The person(s) responsible for complaint handling and contact details for receiving of complaints shall be established on site prior to construction works commencing. A sign shall be displayed at the site indicating the Site Manager and the general public and their contact telephone number

If a noise complaint is received the complaint should be recorded on a Noise Complaint Form. The complaint form should list:

- The name and address of the complainant (if provided).
- The time and date the complaint was received.
- The nature of the complaint and the time and date the noise was heard.
- The name of the employee who received the complaint.
- Actions taken to investigate the complaint, and a summary of the results of the investigation.
- Indicate what operations were occurring on site at the time of the complaint.
- Required remedial action, if required
- Validation of the remedial action.
- Summary of feedback to the complainant.

6.6.3 Control of Construction Noise

The flow charts that follow illustrate the process followed to assess construction activities prior to the start of work on site and well as the ongoing investigation into noise during the construction period.

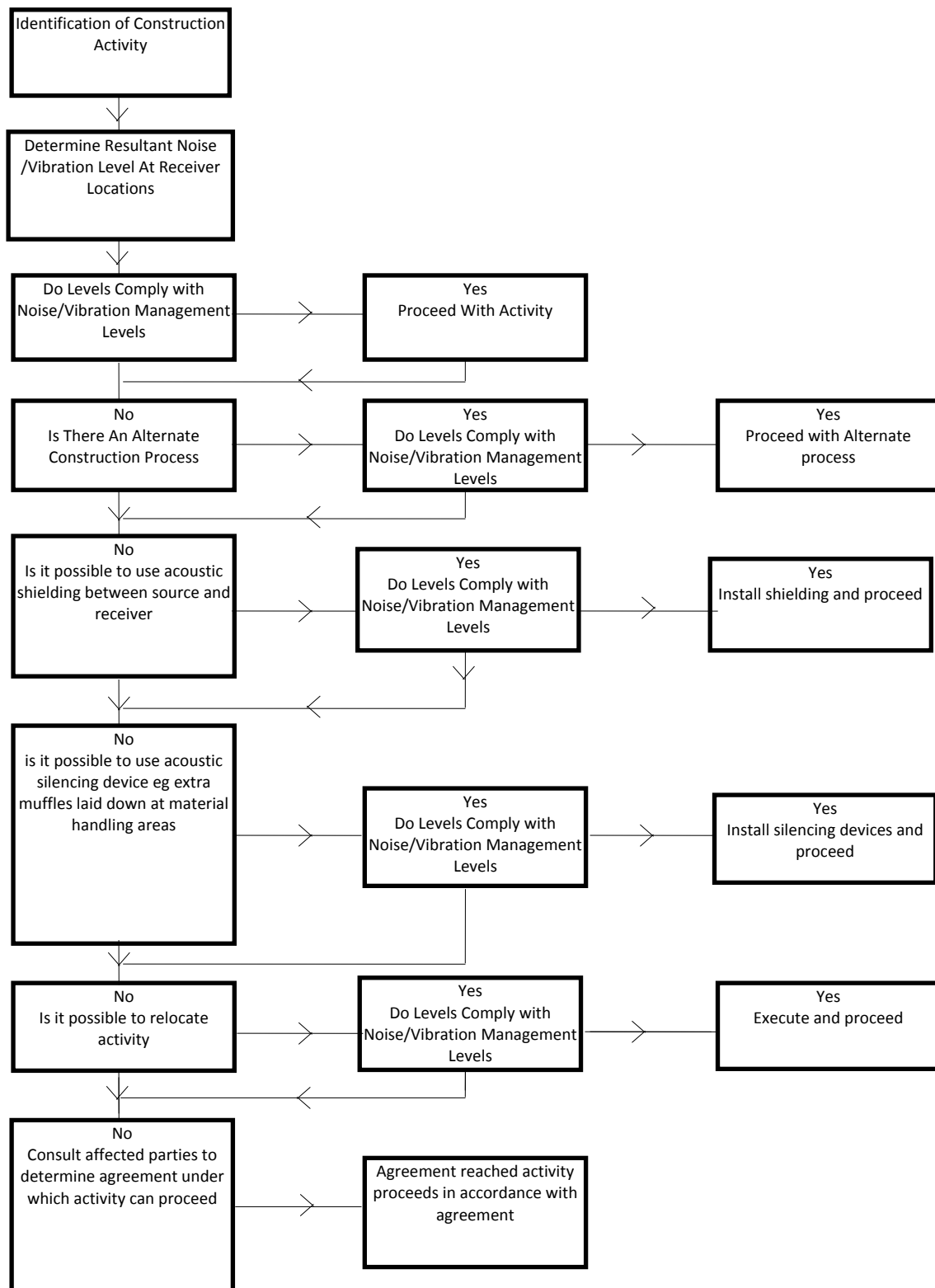


Figure 2 – Process Flowchart

6.7 NOISE CONTROL METHODS

The determination of appropriate additional noise control measures will be dependent on the particular activities and construction appliances identified as requiring future acoustic treatments to those already identified in this report. This section provides an outline of available methods which have previously been used on similar construction sites and may be possible on this site.

6.7.1 Selection of Alternate Appliance or Process

Where a particular activity or construction appliance is found to generate noise levels that exceed the criteria, it may be possible to select an alternative approach or appliance. For example; the use of a hydraulic hammer on certain areas of the site may potentially generate high levels of noise. By carrying this activity by use of pneumatic hammers, bulldozers ripping and/or milling machines lower levels of noise will result.

6.7.2 Acoustic Barriers

The placement of barriers at the source is generally only effective for static plant (tower cranes). Placing barriers at the source cannot effectively attenuate equipment which is on the move or working in rough or undulating terrain.

The degree of noise reduction provided by barriers is dependent on the amount by which line of sight can be blocked by the barrier. If the receiver is totally shielded from the noise source reductions of up to 15 dB(A) can be effected. Where only partial obstruction of line of sight occurs, noise reductions of 5 to 8 dB(A) may be achieved. Where the barrier does not obstruct line of sight, generally no noise reduction will occur.

As barriers are used to provide shielding and do not act as an enclosure, the material they are constructed from should have a noise reduction performance which is approximately 10dB(A) greater than the maximum reduction provided by the barrier. In this case the use of a material such as 10 or 15mm plywood would be acceptable for the barriers. A double paled or lapped and capped fencing construction is recommended for such barriers.

6.7.3 Silencing Devices

Where construction process or appliances are noisy, the use of silencing devices may be possible. These may take the form of engine shrouding, or special industrial silencers fitted to exhausts.

6.7.4 Treatment of Specific Equipment

In certain cases it may be possible to specially treat a piece of equipment to dramatically reduce the sound levels emitted.

6.7.5 Establishment of Site Practices

This involves the formulation of work practices to reduce noise generation. This includes locating fixed plant items as far as possible from residents as well as rotating plant and equipment to provide respite to receivers.

7 RECOMMENDATIONS

We recommend the following acoustic treatments/management controls to ensure compliance with EPA noise emission guidelines.

- Detailed acoustic review of all external plant items following equipment selection and duct layout design. Initial analysis (Section 5.4) indicates that with acoustic treatment, all plant items will be capable of meeting noise emission requirements. However this may require:
 - o Acoustic treatment to fan casing and lining of external ducting for major external fans.
 - o Upgrade of light weight plant room wall for any plant room housing chiller plant.
 - o Detailed acoustic review of external louvres for any plant room to determine whether acoustic louvres/attenuators are required.
- Construction noise and vibration should be managed using the procedures nominated in Section 6.

8 CONCLUSION

Noise emissions associated with the proposed University of Sydney F23 Administration Building has been assessed with reference to relevant EPA acoustic guidelines in order to comply with Secretary of the Environment Requirements 4 & 7.

An analysis of typical operational noise (functions, vehicles, mechanical equipment) indicates that the site is capable of complying with relevant noise emission criteria.

Detailed acoustic review of mechanical plant will be undertaken once the design is further progressed (plant selections finalised etc.). In-principal review indicates that acoustic treatment to major plant items may be required (screens, in-duct attenuation and enclosures) however through appropriate treatment, noise emissions are capable of complying with EPA Industrial Noise Policy and Council requirements.

Similarly, detailed noise management practices will be implemented for the control of construction noise. In principle, the acoustic review indicates that heavy excavation works such as hammering may have the potential to exceed EPA Interim Construction Noise Policy guidelines, particularly when working in areas near the western property boundary. Noise mitigation through work scheduling and equipment selection will be considered. This should be implemented via a Noise/Vibration Management Plan, which should be determined once a construction program is complete.

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

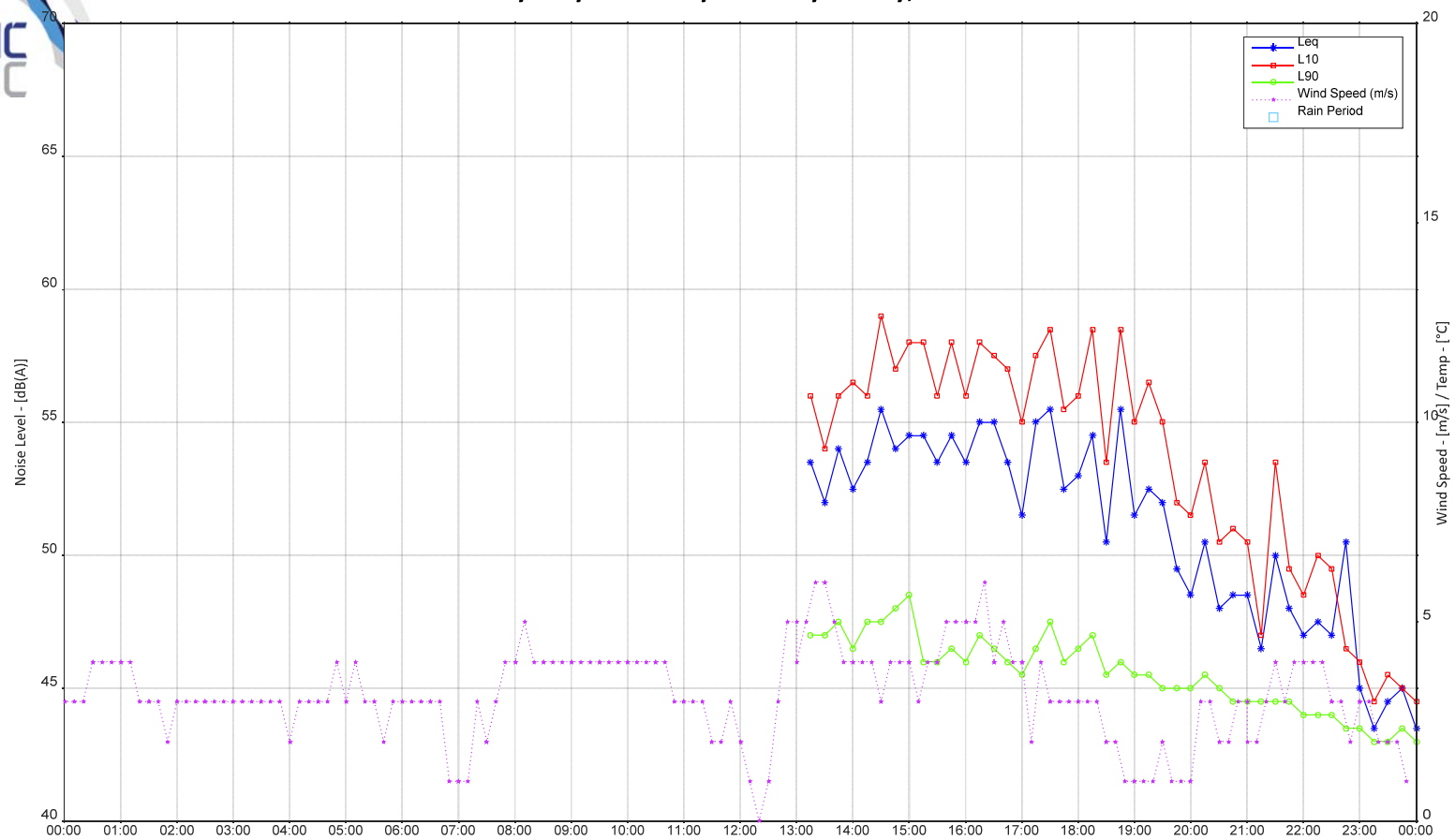
Yours faithfully,



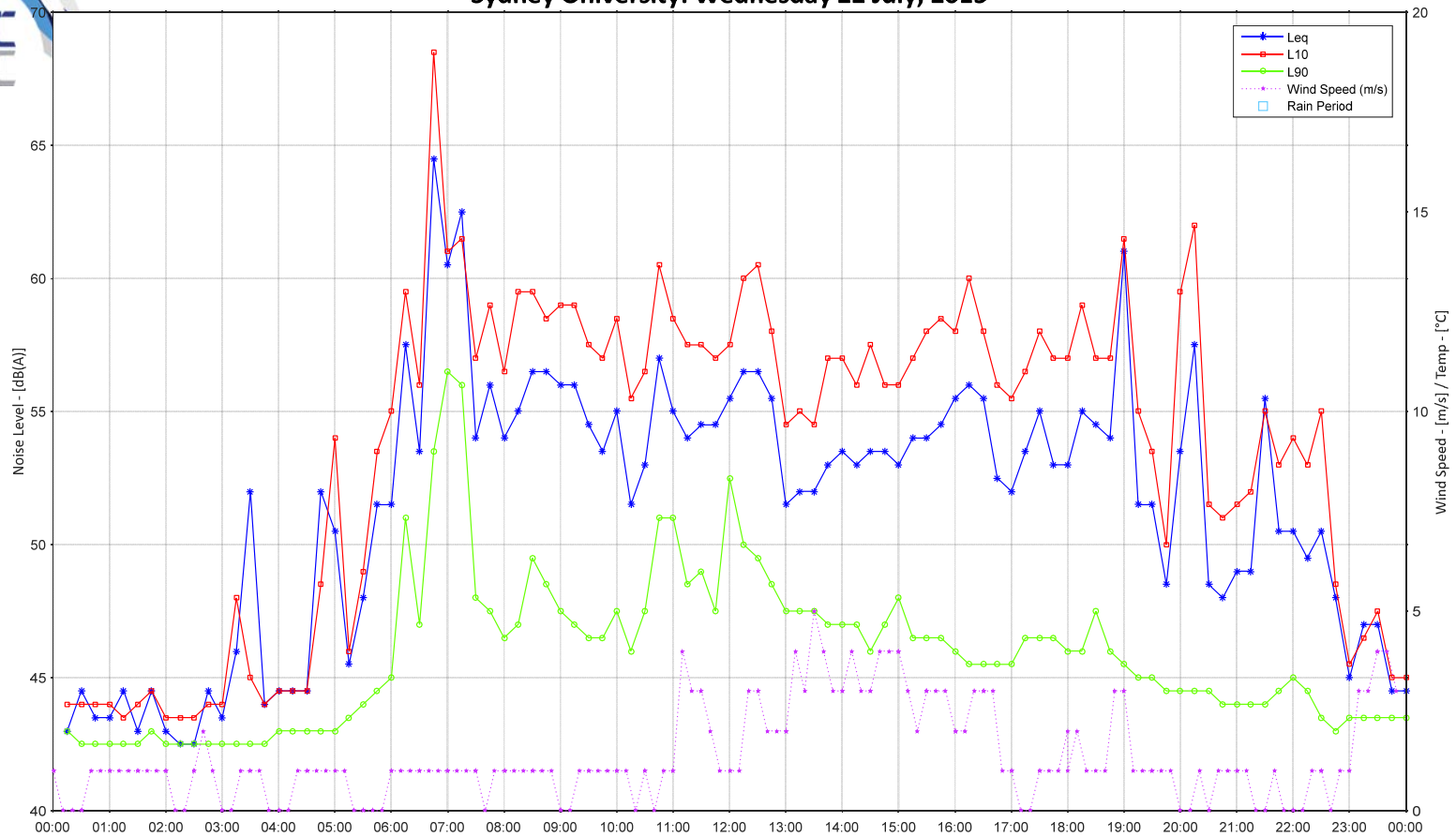
Acoustic Logic Consultancy Pty Ltd
James Small

APPENDIX ONE – UNATTENDED NOISE MONITORING DATA

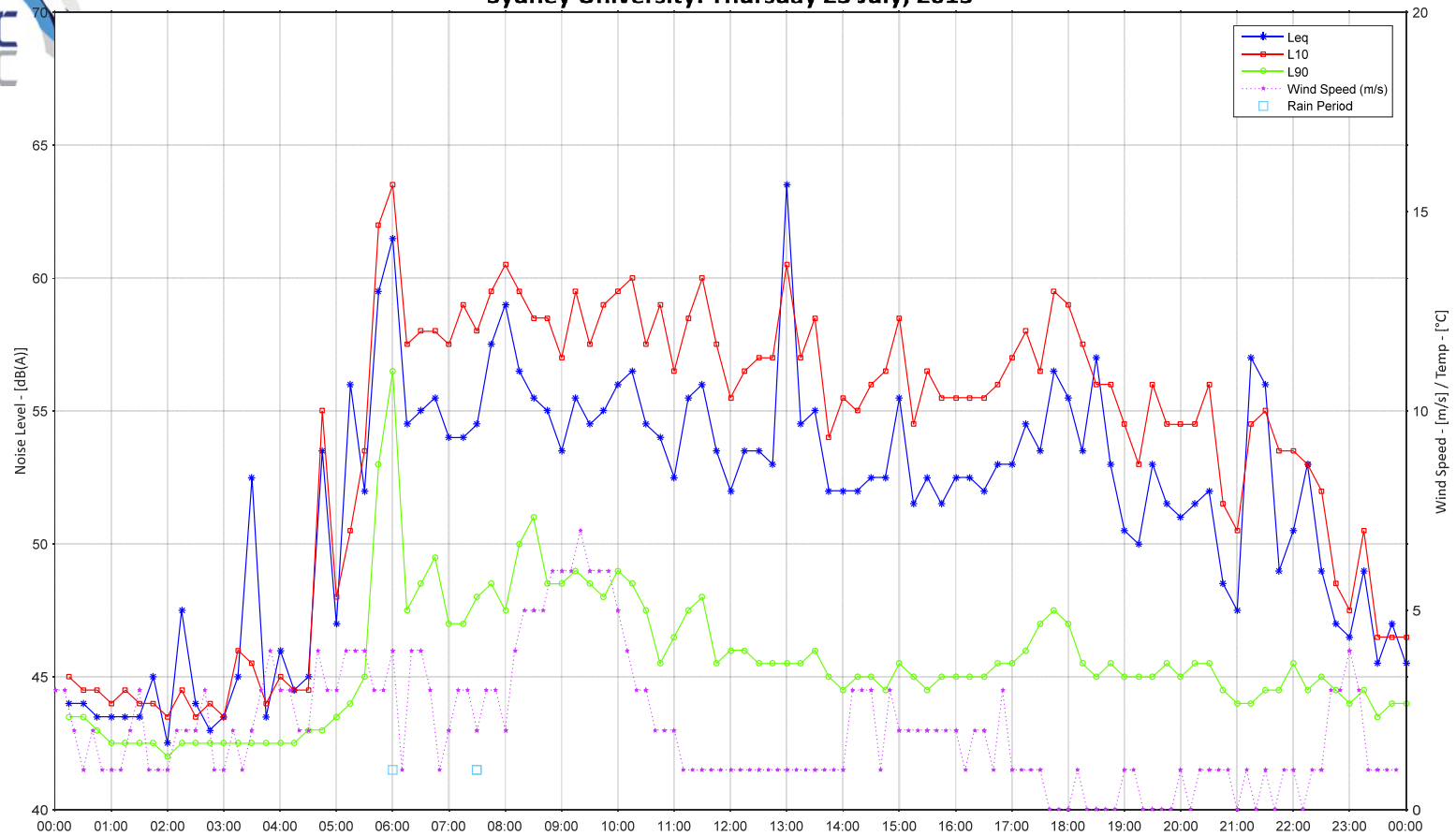
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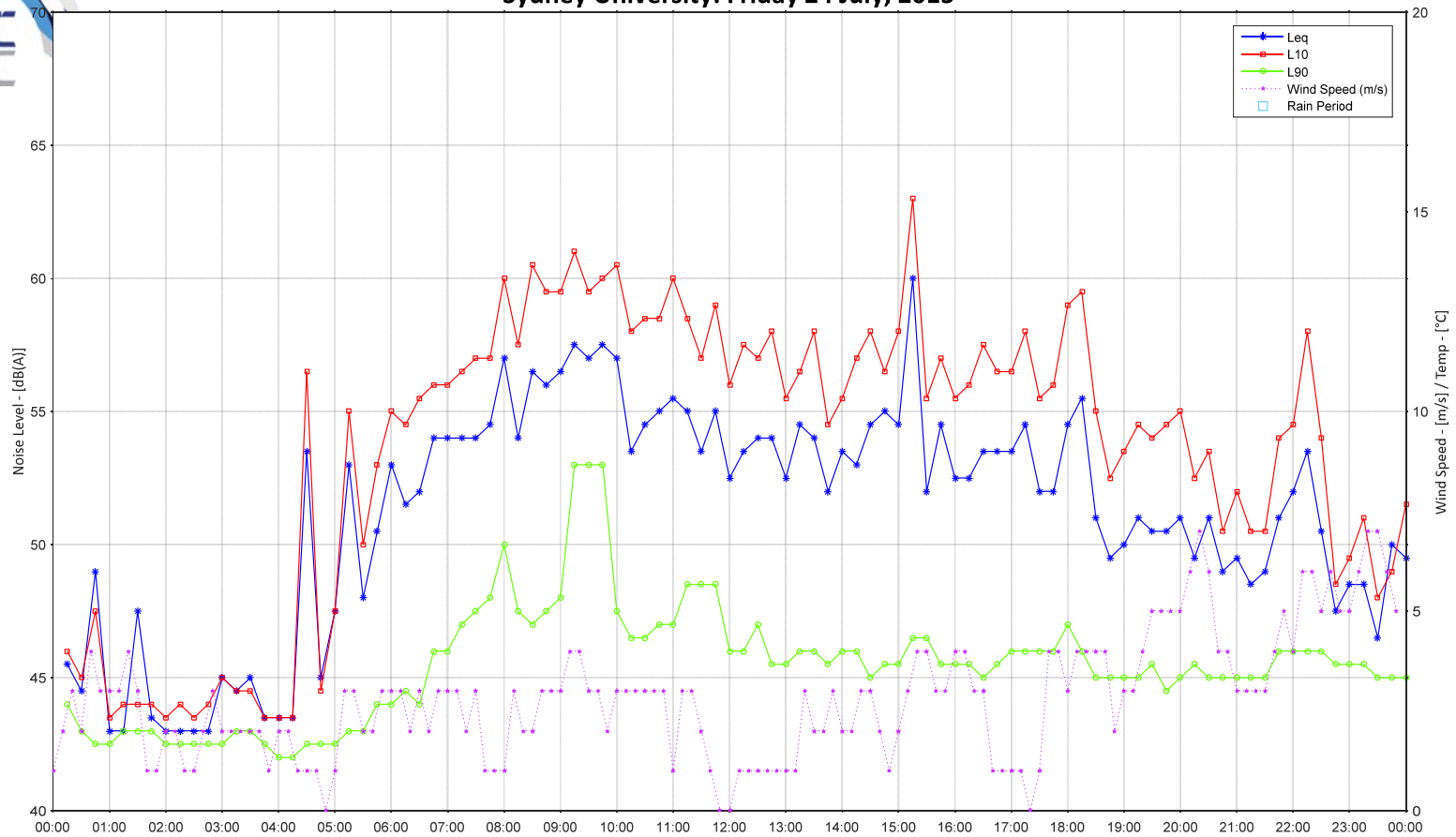
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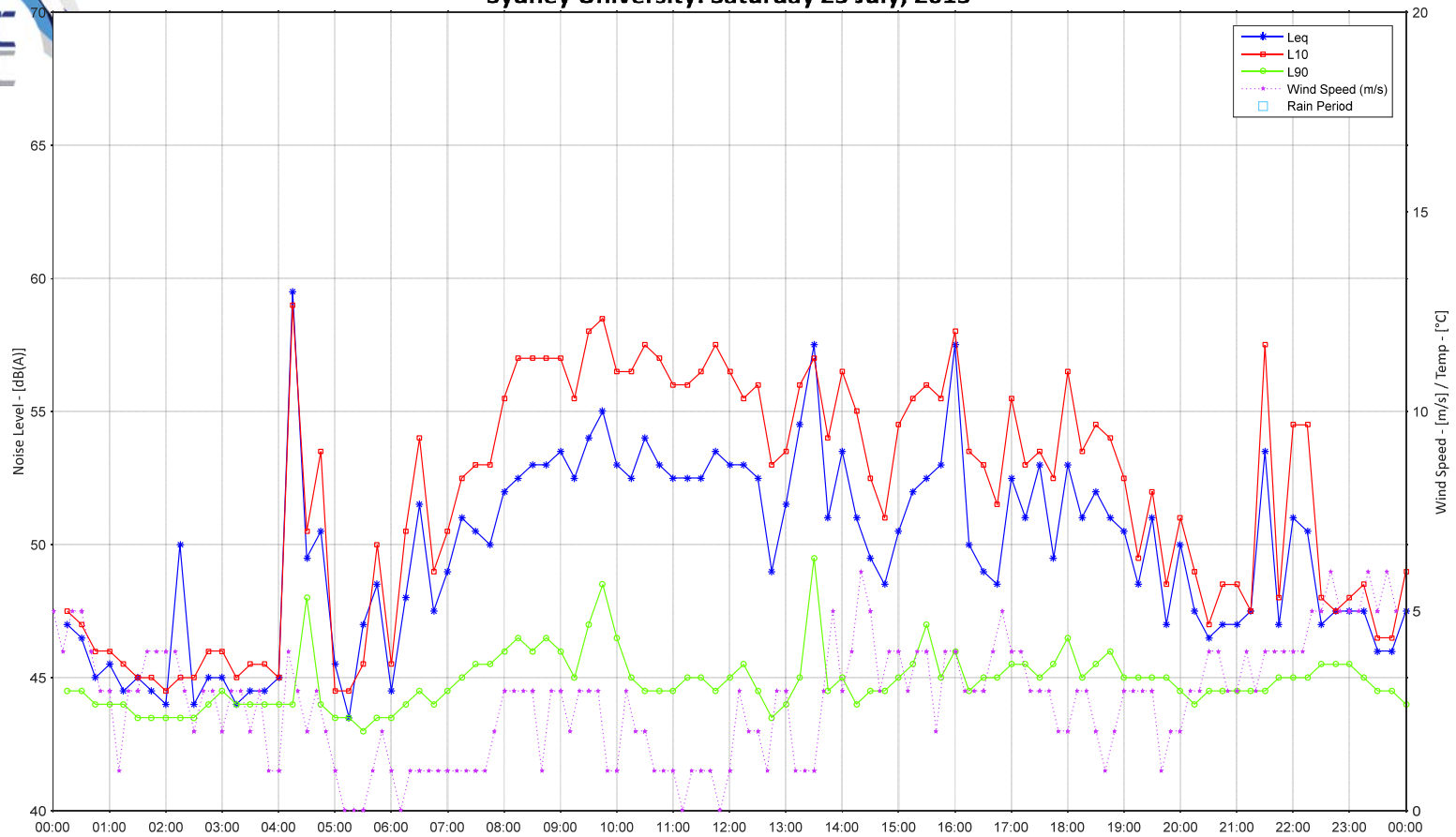
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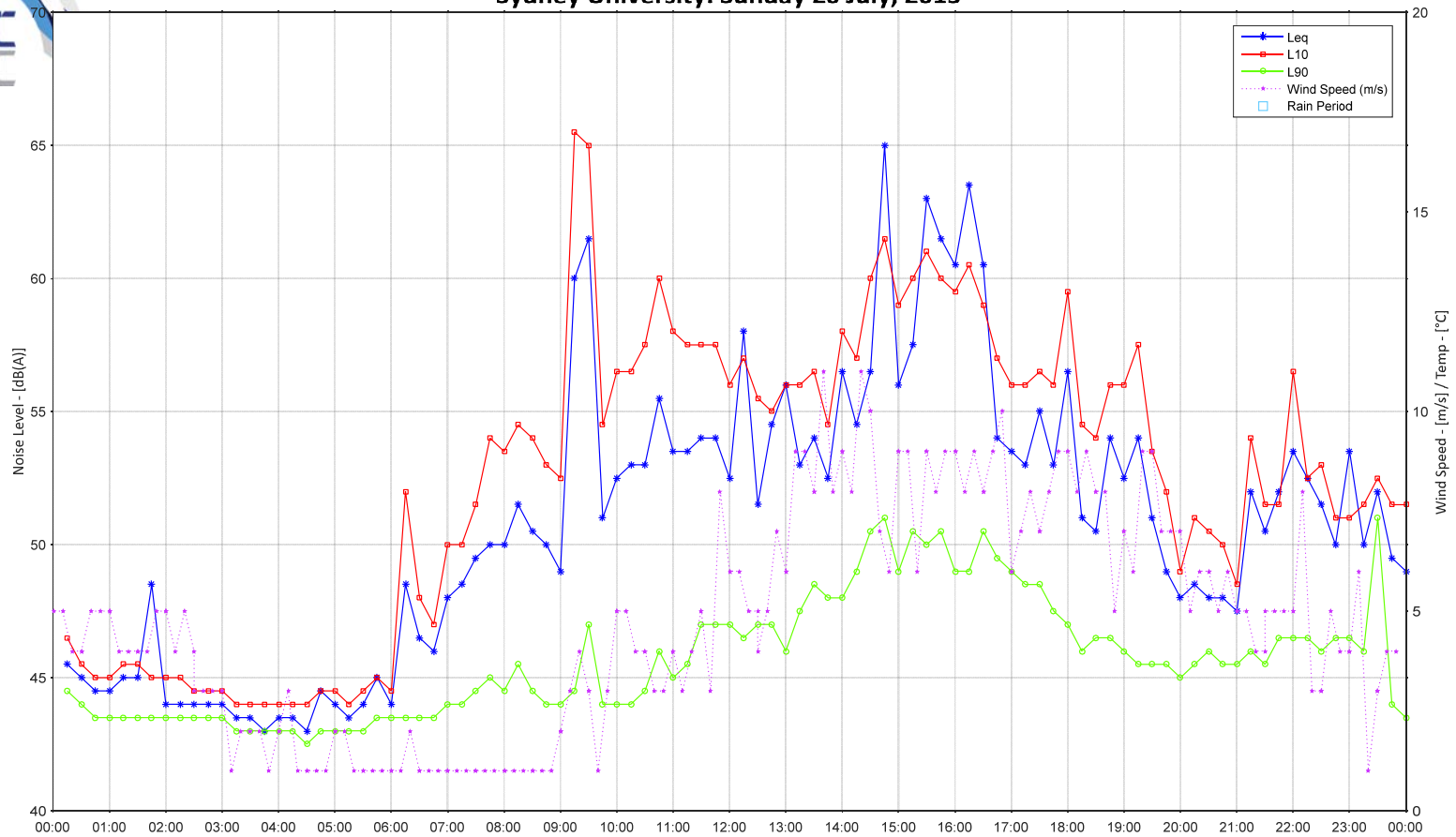
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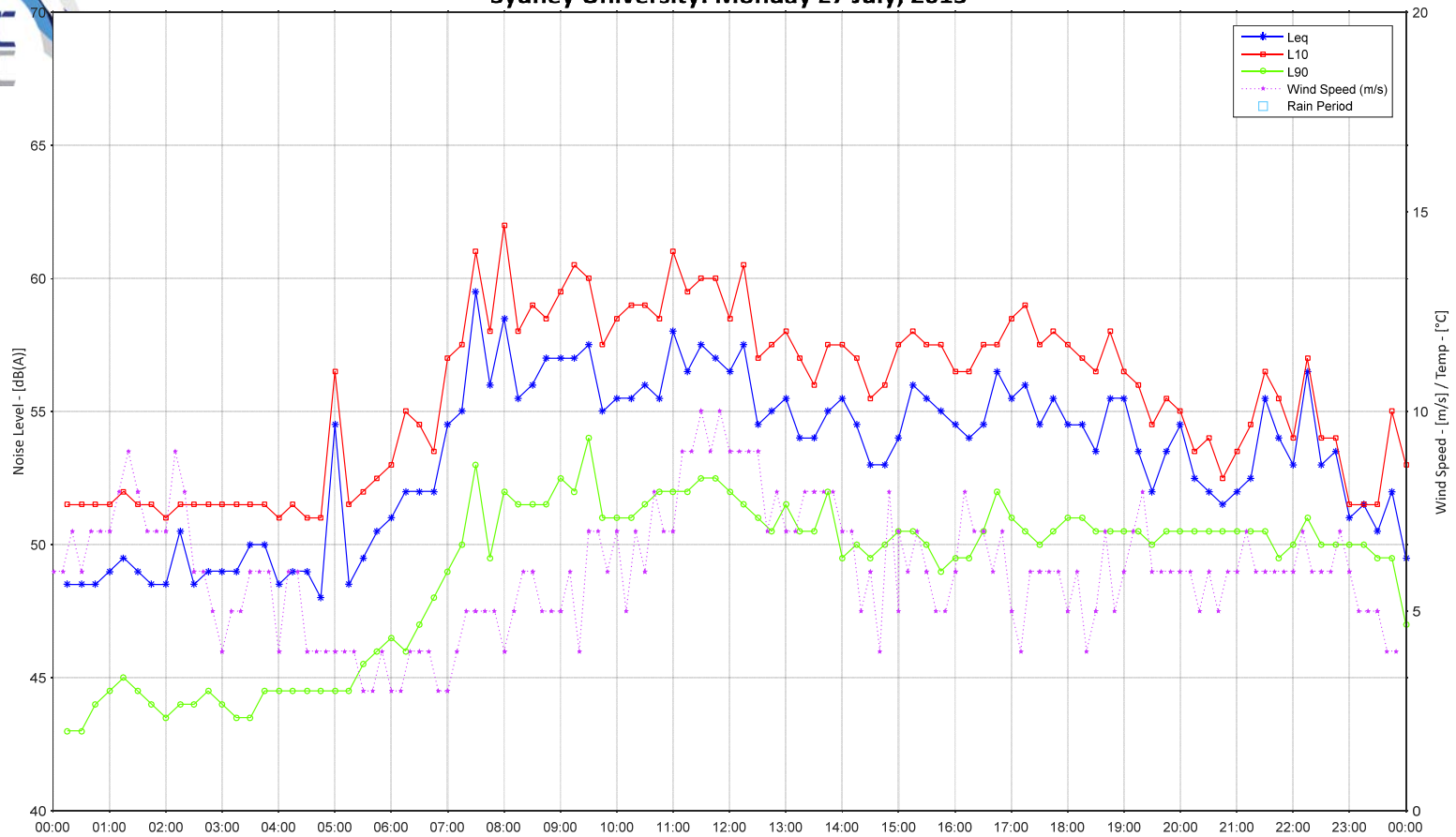
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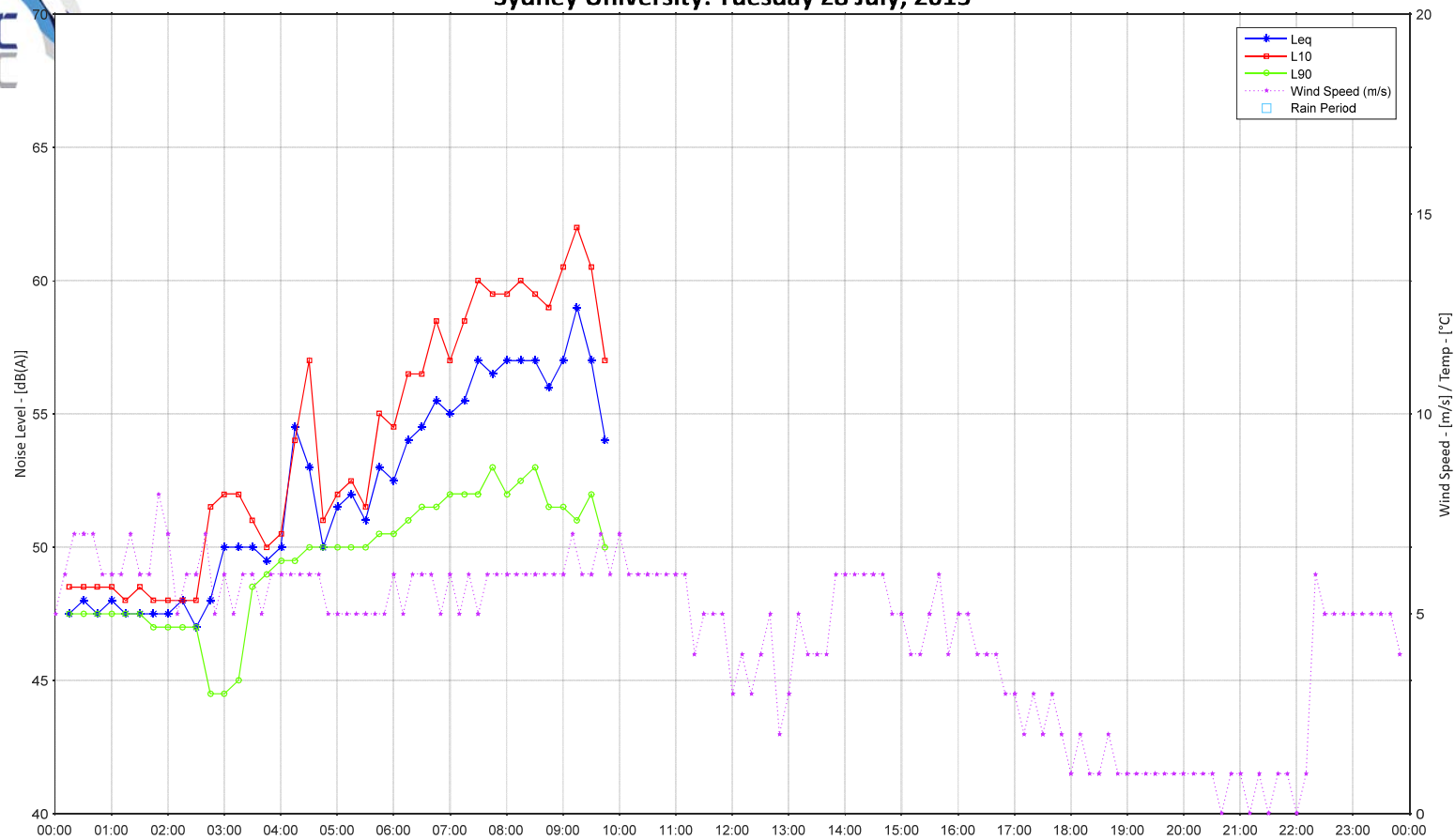
Sydney University: Sunday 26 July, 2015



Sydney University: Monday 27 July, 2015



Sydney University: Tuesday 28 July, 2015



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20160172.1/2904A/R2/JS

29/04/2016

Lend Lease
The Bond
30 Hickson Road
MILLERS POINT NSW 2000

Email: Via Aconex

ATTN: LEONIE SO

University of Sydney F23 Administration Building - Response to Department of Planning Requests for Information

Acoustic Logic Consultancy (ALC) have conducted an assessment of potential noise impacts associated with the proposed University of Sydney F23 Administration building to be located along City Road. The outcomes of this investigation were provided in the ALC report (ref: 20160172.1/0704A/R2/JS).

The NSW Department of Planning has raised the following query regarding the report. ALC's response is presented below.

Department of Planning

Additional justification must for the location of the noise logger, noting that it was positioned further away from the location of the approved future St Pauls college accommodation building

ALC Response

As indicated by Figure 1 of the submitted acoustic report, the noise logger was located on University of Sydney grounds approximately 15m to the North of the approved St Paul's College student accommodation.

SYDNEY

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This location was selected due to the following reasons:

- The noise logger could be sufficiently secured in minimising potential risk of interference and/or theft.
- The location is representative of background noise levels at the future location of the student accommodation.
- Furthermore, given the location is in fact further away from City Road, it is expected that background noise levels may be slightly higher toward the front (South facade) of the future student accommodation building. In this regard, the location of the noise logger has provided a slightly more conservative noise level for assessment

On this basis, noise levels recorded as a result of the selected logger location will be representative of background noise levels for the future St Paul's student accommodation building and as such is acoustically acceptable in the formulation of noise emission criteria to govern impacts to this sensitive receiver.

Noise impacts have been assessed against the noise emission criteria established using the background noise level as discussed above and will have no adverse acoustic impacts on the future occupants of the student accommodation as detailed in our report.

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

Yours faithfully,

A handwritten signature in black ink, appearing to read 'JS', is positioned above the printed name of the signatory.

Acoustic Logic Consultancy Pty Ltd
James Small