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Acoustic Assessment of Secretary Environmental Assessment Requirements

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1 INTRODUCTION

This report presents an analysis of noise impacts and noise emissions associated with the proposed Biological Sciences building at the University of New South Wales, Kensington Campus.

This report has been prepared to address Secretary's Environmental Assessment Requirement 6 (SEAR Requirement 6) and acoustic concerns raised by the EPA in their letter of 25 September 2014.

In this report the following items are addressed:

- Review of SEAR Requirement 6 and the EPA's acoustic concerns.
- Identification of the relevant noise emission controls applicable to the development (both in the construction phase and during operation).
- Identification of properties in the vicinity of the site which are potentially impacted by noise/vibration.
- Analysis potential noise sources generated by the site and identification of acoustic treatments/management controls necessary to ensure compliance with noise emission requirements.

In addition, the report will include a review of external noise impacts on the site (primarily traffic noise) and recommend acoustic treatments to ensure that a reasonable level of amenity is achieved for future occupants of the building.

2 SITE DESCRIPTION

The Biological Sciences Precinct is located at the eastern end of the University of NSW Kensington Campus.

The new Biological Sciences building is proposed to be constructed on the site of the existing Biological Sciences Theatre, to the south of Building D26.

The proposed new building will consist of:

- Laboratories, teaching spaces areas and offices.
- Ancillary spaces including lower ground floor loading dock.
- Level 6 Vertebrate holding.
- Plant Rooms on lower ground floor and at roof top.

The nearest noise sensitive development to the site consists of:

- Existing university buildings (Building D26, Biological Sciences to the north and west), Wallace Wurth (further north) and the Samuels Building (Building F25) to the south.
- Residential development to the east of the site (on the far side of Botany Street).
- The Royal Hospital for Women and the Sydney Children's Hospital, approximately 180m to the east.

See aerial photograph, overleaf.

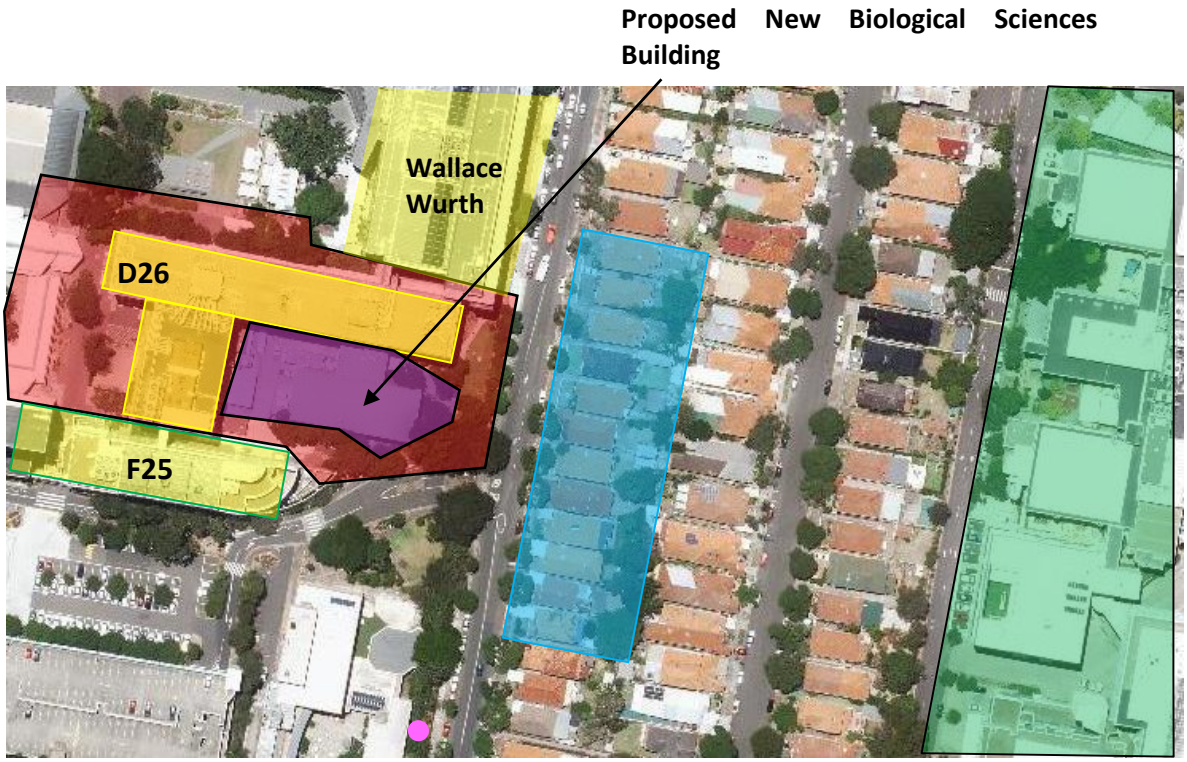


Figure 1 – Aerial view of subject site and surrounding receivers.

Table 1 – Legend for Site Plan

Location	Marking
Subject Site (Biological Sciences Precinct)	
New Biological Sciences Building	
Nearest Residential Receivers	
Nearest University Receivers – Building D26 (Existing Biological Sciences) and F25 (Samuels Building), Wallace Wurth	
Royal Hospital for Women and Sydney Childrens Hospital	
Unattended Noise Monitor	

3 NOISE DESCRIPTORS

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 interval.

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 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.

Current practice favours the L_{eq} parameter as a means of measuring traffic noise, whereas the L_{10} parameter has been used in the past and is still incorporated in some codes.

4 BACKGROUND NOISE MONITORING

Unattended noise monitoring was conducted between 29 October and 3 November 2014 using an Acoustic Research Laboratories monitor set on A-weighted fast response mode. The monitor was calibrated before and after the measurements using a Rion Type NC-73 calibrator. No significant drift was recorded. This unattended monitoring was supplemented by additional attended measurements conducted on site.

The noise monitor location is shown in the aerial photo in section 2. Ambient noise levels measured by the logger will be representative of ambient noise levels at the nearest residences to the site.

Measured background noise levels are presented below. Refer to Appendix 1 for unmanned noise monitoring data.

Table 2 – Measured Background Noise Levels

Location	**Background noise level dB(A)L_{90}**		
	Daytime (7am-6pm)	Evening (6pm-10pm)	Night time (10pm-7am)
Botany Street, Randwick	50	44	42

5 NOISE EMISSION CRITERIA

Secretary Environmental Assessment Requirement 6 states:

> *Identify the main noise and vibration generating sources and activities at all stages of construction, and any noise sources during operation including mechanical plant and ventilation. Outline measures to minimise and mitigate potential noise and vibration impacts on surrounding occupiers of land including but not limited to any potential affected student accommodation, adjacent University Buildings and nearby residential properties.*
>
> *Relevant Policies and guidelines:*
>
> - *NSW Industrial Noise Policy.*
> - *Interim Construction Noise Guideline.*
> - *Development Near Rail Corridors and Busy Roads – Interim Guideline.*
> - *Assessment Vibration: A Technical Guideline.*

In addition, the EPA in its letter to the Department of Planning and Infrastructure dated 25 September 2014 states:

> *(b) Demolition and construction related noise and vibration impacts (included recommended standard construction hours and intra-day respite periods for highly intrusive noise generation work) on noise sensitive receivers such as surrounding residences and the Sydney Children's Hospital, Royal Hospital for Women and surrounding health services precincts.*
>
> *(g) Operational noise and vibration impacts on noise sensitive receivers (especially surrounding residences, the Sydney Children's Hospital, Royal Hospital for Women and surrounding health services precincts arising from operational activities such as waste collection, loading dock activities, mechanical services (especially air conditioning plant) and stand-by generator (if any) testing and operation.*

These criteria are outlined below (with the exception of the *Development Near Rail Corridors and Busy Roads* guideline, which is addressed in section 7.

5.1 OPERATIONAL NOISE - NSW INDUSTRIAL NOISE POLICY (PLANT AND EQUIPMENT, LOADING DOCK)

The EPA Industrial Noise Policy has two requirements which both have to be complied with, the Intrusiveness criterion and the Amenity criterion.

5.1.1 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 5dB(A). Where applicable, the intrusive noise level should be penalised (increased) to account for any annoying characteristics such as tonality.

Background noise levels adopted are presented in Section 4. Noise emissions from the site should comply with the noise levels presented below when measured at a nearby property boundary.

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

For the purposes of this condition:

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

5.1.3 Operational Noise Emission Goals

The projects external noise level criteria based on the INP criteria is detailed in the table below.

Table 3 – EPA Industrial Noise Policy Noise Emission Goals*

Receiver Type	Time of Day	Intrusiveness Noise Objective dB(A)$L_{eq(15min)}$	Amenity Noise Objective dB(A)$L_{eq(Period)}$
Residential Receivers	Day	55	55
	Evening	49	45
	Night	47	40
Commercial and other non-residential UNSW receivers	All times of the day and night	N/A	65
UNSW Teaching Spaces (Internal Areas)	When in Use	N/A	40
Hospitals (external areas)	When in Use	N/A	50

*These criteria are proposed for equipment used during typical operation. Emergency generator to be designed to comply with noise levels 5dB(A) above the levels stated in the table above. Tri/Co-generation plant would not be considered as an emergency use.

5.2 SLEEP AROUSAL ASSESSMENT

Potential sleep arousal impacts should be considered for noise generated before 7am or after 10pm.

Short duration, intermittent noise events are typically assessed for potential sleep disturbance.

Potential impacts are assessed using the recommended procedure in the Application Notes to the EPA Industrial Noise Policy. As recommended in the Application Notes, when assessing potential sleep arousal impacts, a two stage test is carried out:

- Step 1 - An "emergence" test is first carried out. That is, the L_1 noise level of any specific noise source should not exceed the background noise level (L_{90}) by more than 15 dB(A) outside a resident's bedroom window between the hours of 10pm and 7am. If the noise events are within this, then sleep arousal impacts are unlikely and no further analysis is needed. This is consistent with the Noise Guide for Local Government. The guideline level is set out below.

Table 4 – EPA Sleep Arousal (Emergence Criteria)

Location	Background Noise Level (5am-7am) dB(A)$_{L90}$	Emergence Level dB(A) $L_{1(1min)}$
Botany Street	42	57

- Step 2 - If there are noise events that could exceed the emergence level, then an assessment of sleep arousal impact is required to be carried out taking into account the level and frequency of noise events during the night, existing noise sources, etc. This test takes into account the noise level and number of occurrences of each event with the potential to create a noise disturbance. As is recommended in the explanatory notes of the EPA Industrial Noise Policy, this more detailed sleep arousal test is conducted using the guidelines in the EPA Road Noise Policy. Most relevantly, the Road Noise Policy states:

  For the research on sleep disturbance to date it can be concluded that:

  - *Maximum internal noise levels below 50-55dB(A) are unlikely to awaken people from sleep.*
  - *One to two noise events per night with maximum internal noise levels of 65-70dB(A) are not likely to affect health and wellbeing significantly.*

The internal noise level guidelines have also been adopted in this assessment.

5.3 CONSTRUCTION/DEMOLITION WORKS

5.3.1 Construction Noise

Noise emissions from construction works will be managed using the EPA *Interim Construction Noise Guidelines*. 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 ambient noise monitoring).
- 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.

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 effected" level at a nearby residence, the proponent should take reasonable/feasible work practices to ensure compliance with the "noise effected level". For residential properties, the "noise effected" 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 effected", noise controls such as respite periods should be considered. For residential properties, the "highly noise effected" level occurs when construction noise exceeds 75dB(A)$L_{eq(15min)}$ at nearby residences.

A summary of target noise levels is presented below. If these noise levels are likely to be exceeded, reasonable and feasible noise management strategies will be proposed.

Table 5 – Noise Emission Goals – External Areas (Residential Areas)

Location	"Noise Affected" Level - dB(A)$L_{eq(15min)}$	"Highly Noise Affected" Level - dB(A)$L_{eq(15min)}$
Residential Development (Botany Street)	60	75

Table 6 – Noise Emission Goals – University (Internal Areas)

Location	"Noise Affected" Level - dB(A)$L_{eq(15min)}$
Educational Spaces	45

Table 7 – Noise Emission Goals – Hospital (Internal Areas)

Location	"Noise Affected" Level - dB(A)$L_{eq(15min)}$
Hospitals Ward/Theatre	45

5.3.2 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 8 –Vibration Goals

Location	Time	Peak velocity (mm/s)	
		Preferred	Maximum
Continuous Vibration			
Residences	Daytime	0.28	0.56
Commercial Development*	When in use	0.56	1.1
Critical Areas**	All times	0.14	0.28
Impulsive Vibration			
Residences	Daytime	8.6	17
Commercial Development*	When in use	18	36
Critical Areas**	All times	0.14	0.28

*Offices, teaching spaces and similar will be assessed with respect to these criteria.

**It is likely that there will be laboratories/precision equipment located in the Biological Sciences/Samuels Buildings. Target vibration levels outlined above are typically adopted for operating theatres and similar spaces and would typically be suitable for most laboratory equipment. This target will be reviewed as vibration specification sheets for individual equipment items with the University become available.

6 NOISE EMISSION ASSESSMENT

6.1 OPERATIONAL NOISE

Primary noise sources which will be generated at the site will be from:

- Use of mechanical plant and equipment (cooling towers, fans, chillers etc).
- Use of the loading dock.
- Generators.

Detailed review of external mechanical plant is not typically undertaken at project approval stage, as plant selections are typically not finalised. Detailed acoustic review should be undertaken at Detailed Design stage, once locations are finalised and plant size/details are being finalised.

External equipment will have the greatest potential to create a noise impact. Roof top cooling towers/fans and fans with duct connections to external louvres have the greatest potential to impact nearby properties. Schematic stage review is presented below.

6.1.1 Emergency Diesel Generator

One 800kW emergency power back up generator with acoustic enclosure is proposed to be located within a plant room near the eastern façade of level 6. Based on the current selections, the sound rated enclosure limits noise emissions to 75dB(A) at 7m.

Based on initial calculations, in addition to the sound rated enclosure, a 1m allowance should be made for acoustic attenuators on the air intake/discharge louvres. The exhaust gas discharge will also require a muffler to limit noise emissions to a level of not more than 80dB(A) at 1m.

The particular treatments to the generator plant room is to be finalised during detailed design.

6.1.2 Mechanical Plant and Equipment

6.1.2.1 General Mechanical Plant (Fans, Chillers, etc.)

General mechanical plant such as external fans for exhaust/outside air/supply air are proposed at various locations throughout the development. Chillers are proposed to be located in the eastern portion of the lower ground level. The particular treatment will depend on the final plant selection and location. It is likely that any fan with a sound power of more than 80dB(A) will require acoustic treatment in the form of screens or internal ducting lining/attenuators to ensure that that the noise emission requirements in section 5.1.3 are achieved. The detailed acoustic design of all plant should be undertaken during the design development stage, when plant selections and locations are finalised

6.1.2.2 Cooling Towers

These are to be located on the roof top, on top of the building core and lift core. The greatest potential noise impact will be on the Samuels building, adjacent to the site to the south. Noise impact on residences to the east (and on the Hospital Precinct further to the east) may be impacted to a lower degree due to orientation of the building.

The particular plant selections have not yet been finalised, however a schematic stage review has been conducted. Assuming a cooling tower sound power of 90dB(A) and using a variable speed drive it would be typical for towers ramp down to no more than 50% capacity at night time (which is typical in our experience), cooling tower noise levels are predicted as follows:

Table 9 – Cooling Tower Noise Emissions

Receiver Type	Time of Day	Noise Emission Goal dB(A)$L_{eq(Period)}$	Predicted Noise Level dB(A)$L_{eq(Period)}$	Complies
Residential Receivers	Day	55	44	Yes
	Evening	45	44	Yes
	Night (50% fan speed reduction)	40	<40	Yes
Hospital Precinct (External Areas)	All times of the day and night	50	<47	Yes
UNSW Samuels Building (Inside Teaching Space, Northern Facades)	When in Use	40	40*	Yes

*Assuming 20dB(A) noise reduction through closed window.

Final design of acoustic treatments to be undertaken once the tower is selected and typical day/evening/night operational speeds are determined by mechanical engineer.

6.1.3 Loading Dock

Most loading dock use will occur between 7am and 10pm.

We note that at present, there is on average one truck delivery which occurs outside of these times. It is proposed that this early morning delivery will continue to occur in the new development.

Noise impact associated with the loading dock is discussed below.

Given the use of the loading dock in the 10pm-7am period, as assessment will be present of both the *average* noise emission (15 minute average noise, as is consistent with the EPA Industrial Noise Policy) and *peak* noise events (as is consistent with EPA guidelines for sleep disturbance).

6.1.3.1 Average (L_{eq}) Noise Emissions

Use of the loading dock is not expected to be frequent, however noise from truck entry/exit movement and its potential impact on the Samuels Building and Botany Street residences is considered below.

The loading dock located on the Lower Ground Floor on the southern façade, and is accessed via Gate 11 leading from Botany Street. The greatest potential noise impact is on ground floor rooms within the Samuel Building and on residences to the east of the Site, on Botany Street.

Assuming a truck sound power of 100dB(A) (typical for a large flatbed/articulated truck), and that there is no more than one truck entry/exit movement in any 15 minute period, noise emission are predicted as below. Given that the loading dock is an infrequent use, it is appropriate to assess the noise emissions with reference to the EPA Intrusiveness Criteria, which looks at noise impacts over 15 minute intervals. The Amenity criteria is not used as it is assessed using the $L_{eq(Period)}$ noise descriptor (see table 3), which is the noise event averaged over the entire day/evening or night time period and is not an appropriate a descriptor in assessment of discrete, short duration noise events.

The following table presents the predicted noise emissions from the use of the loading dock.

Table 10 –Loading Dock Noise Emissions

Receiver Type	**Time of Day**	**Noise Emission Goal dB(A)$L_{eq(Period)}$**	**Predicted Noise Level dB(A)$L_{eq(Period)}$**	**Complies**
Residential Receivers	Day	55	43	Yes
	Evening	49	43	Yes
	Night	47	43	Yes.
Hospital Precinct (External Areas)	All times of the day and night	50	<35	Yes
UNSW Samuels Building (Inside Teaching Space)	When in Use	40	40*	Yes

*Assuming 20dB(A) noise reduction through closed window.

6.1.3.2 Sleep Disturbance (Peak Noise Events)

Noise events occurring between 10pm and 7am should be assessed for potential sleep disturbance impacts on nearby residents. This is considered below.

Although the loading dock is not typically going to be used between 10pm and 7am, it is anticipated that there will intermittently be one truck movement in the 10pm-7am period. This movement is part of the existing operations and it is proposed to continue in the future.

With respect to noise from use of the loading dock:

- As the dock itself is located away from the site boundaries, the worst case noise generation event will occur as the truck leaves the site on the Botany Street driveway.
- The transient noise assessment will be assessed is based on the following assumptions:
    - Noise from the truck engine as it leaves the site is 100dB(A) SWL.

Noise emissions are assessed against EPA Sleep Disturbance guidelines, as presented below.

Table 11 –Sleep Arousal Assessment

Receiver Location	Noise Source	Predicted Noise Level	Emergence Test Level	Compliance
Botany Street	Truck Entering/Exiting Gate 11	63dB(A)$L_{1(1min)}$	57dB(A)$L_{1(1min)}$	Exceeds BG+15 test

Noise emissions as the truck enters/leaves the site are predicted to be more than 15dB(A) above the background noise level. More detailed assessment is required.

We note:

- During a noise event of 63dB(A)$L_{1(1min)}$ *at the window* of a residence (as predicted above), the noise level *inside* the room is predicted to be approximately 57dB(A)L_1.
- EPA Road Noise Policy notes that one to two noise events per night with maximum internal noise levels of 65-70dB(A) are not likely to affect health and wellbeing significantly.

In our opinion, the noise impact from the late night use of the loading dock will be reasonable, given that:

- the noise generated by the truck movement will be significantly less than the 65-70dB(A) noise level,
- that there is intermittently one truck movement In the night time period and
- the noise associated with the movement is consistent with the existing operation of the University (i.e. the truck movement currently exists).

6.1.4 Comments/Recommendations

Analysis indicates that compliance with noise emission goals is achievable. In order to ensure compliant noise emissions, we recommend:

- detailed acoustic review of all plant items should be undertaken once plant items are selected;

- cooling towers should have variable speed drives to allow reduced speed operation in the evening and night. Detailed review of any tower should be undertaken to determine whether an acoustic attenuator or screen is required to the fan intake/discharge. In the event that the tower sound power exceeds 90dB(A), it is likely that treatment will be required;

- the exact extent of acoustic treatment to the diesel generator will depend on final equipment selection. It is likely that the generator will require acoustic treatment in the form of exhaust silencers, intake acoustic louvres or internal ducting lining/attenuators to ensure that that the noise emission requirements in section 5.1.3 are achieved. Detailed acoustic design of all plant should be undertaken during the design development stage, when plant selections and locations are finalised; and

- external fans (exhaust/outside air/supply air). Exact extent of treatment will depend on final fan selection and location. It is likely that any fan with a sound power of more than 80dB(A) will require acoustic treatment in the form of screens or internal ducting lining/attenuators to ensure that that the noise emission requirements in section 6.1 are achieved. Detailed acoustic design of all plant should be undertaken during the design development stage, when plant selections and locations are finalised.

6.2 CONSTRUCTION STAGE WORKS

6.2.1 Construction Noise - Analysis

The site is located on the UNSW Campus facing Botany Street between existing University buildings F25 (Samuels Building) to the south and Building D26 (the Biological Sciences Building) to the north and west.

The nearest residential receivers are to the east, on the opposite the site of Botany Street.

With respect to 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. During the erection of the structure, the primary noise will be a result of concrete pumps and use of the crane.

Based on initial analysis we note:

- Excavation in sand. The primary noise emissions occur during excavation in sand is from bulldozers with a sound power level of 110dB(A) $L_{eq(15min)}$. The following noise levels are predicted:
    - Botany Street residences – Noise levels will be 45-65dB(A)$L_{eq(15min)}$ depending on work location. Noise emissions are predicted to be generally compliant with the "Noise Management Level" (see section 5.2.1), although intermittent exceedances will occur when working towards the eastern property boundary.
    - Samuels Building and Existing Biological Sciences Building – Noise levels will be 43-59dB(A)$L_{eq(15min)}$ in internal areas depending on work location. Noise levels will intermittently exceed the 45dB(A) target for teaching spaces.
    - NSW Children's Hospital and surrounding health buildings - Noise will be less than 45dB(A) in internal areas, and therefore compliant with EPA Interim Construction Noise Guidelines.
- Soil retention/piling. The primary during this phase will be from CFA piling with a sound power level of 105dB(A) $L_{eq(15min)}$. The following noise levels are predicted from use of the piling rig:
    - Botany Street residences – Noise levels will be 40-60dB(A)$L_{eq(15min)}$ depending on work location. Noise emissions are generally compliant with the "Noise Management Level", although intermittent exceedances will potentially occur when working towards the eastern property boundary.
    - Samuels Building and Existing Biological Sciences Building – Noise levels will be 38-54dB(A)$L_{eq(15min)}$ in internal areas depending on work location. Noise levels will intermittently exceed the 45dB(A) target for teaching spaces.
    - NSW Children's Hospital and surrounding - Noise will be less than 45dB(A) in internal areas, and therefore compliant with EPA Interim Construction Noise Guidelines.

- Use of tower crane (electric). The proposed crane location is approximately 10m from the existing Biological Sciences Building and 50m from Botany Street. The following noise levels are predicted:

    - Botany Street residences – Predicted noise level of 50dB(A)$L_{eq(15min)}$. Noise emissions are predicted to be generally compliant with the "Noise Management Level".

    - Existing Biological Sciences Building– 45-50dB(A) in rooms closest to the crane engine. Noise levels will intermittently exceed the 45dB(A) target for teaching spaces.

    - NSW Children's Hospital and surrounding - Noise will be less than 45dB(A) in internal areas, and therefore compliance with EPA Interim Construction Noise Guidelines.

- During erection of the structure, it is the use of hand tools and concrete pumps which are the loudest typical activity (sound power levels of approximately 105dB(A)$L_{eq(15min)}$). Exceedances of EPA guidelines "Noise Affected" level may intermittently occur at the Botany Street residences and within the Samuels and Biological Sciences Buildings.

- 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, construction noise is unlikely to exceed EPA recommended levels.

6.2.2 Construction Noise - Comments and Recommendations

With respect to the predictions above, we note:

- Excavation is likely to be as quiet as practicable. Excavation in sand reduces potential need for the noisiest activities (use of pneumatic hammer/saw).

- Proposed piling method (auger) is the quietest and least vibration intensive or potential methods.

- Proposed crane (electric) is significantly quieter than using a diesel crane.

Based on the above, we recommend:

- On completion of the construction program, acoustic review of proposed construction activities and plant/methods should be undertaken to identify the extent and duration of potential exceedances of EPA construction "noise management" levels.

- Implement a notification process whereby nearby residents and University staff are made aware of the time and duration of noise intensive construction processes.

- Undertake noise measurement/monitoring as follows:
    - In rooms within the Biological Sciences Building (D26) closest to proposed tower crane engine to determine whether any screening of the engine is warranted (bearing in mind the crane engine is located above roof level);
    - In lecture theatres and teaching laboratories on the southern façade of the Biological Sciences building to determine whether any scheduling of noisy works/respite periods is required;
    - At Botany Street residences during excavation works.

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

6.2.3 Construction Vibration

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

Excavation is primarily in sand, and will not require vibration intensive equipment such as pneumatic hammers or rock saws. Piling will be done using continuous flight auger piling, which generates significantly less vibration than driven or vibrated piles.

We are aware that the existing Biological Sciences Building and Samuels Buildings within the UNSW grounds (adjacent to the site) contain a number of vibration sensitive spaces, including animal research laboratories and research/teaching labs (DNA sequencers/microscopes).

In order to address potential vibration issues, consultation with university users will be undertaken to identify critical areas. Vibration loggers with SMS notification/warning system will be installed in the critical lab areas closest to the work site to enable Acoustic Logic and the Contractor to be instantly notified in the event that predetermined trigger levels are exceeded.

Vibration/SMS triggers levels for these areas will be determined based on the EPA document "*Assessing Vibration: A Technical Guideline*", although the targets will potentially be amended depending on the sensitivity of the laboratory equipment in question.

7 TRAFFIC NOISE IMPACT ASSESSMENT

An assessment of traffic noise impact is presented in this section of the report. Based on a site survey, the main environmental noises incident on the site are those generated by traffic along Botany Street.

7.1 INTERNAL NOISE CRITERIA

The determination of an acceptable level of traffic noise within the Biological Sciences (D26) facility building requires consideration of the activities carried out within the space and the degree to which noise will interfere with those activities

Assessment shall be conducted in accordance with the NSW Department of Planning "*Development near Rail Corridors and Busy Roads*" and Australian Standard AS2107-2000 "Recommended Design Sound Levels and Reverberation Times for Building Interiors".

The guideline nominates internal levels for educational spaces, but does not nominate criteria for general work areas. AS2107-2000 recommends maximum design sound levels for different areas of occupancy in the educational development.

Based on AS2107-2000 the following assessment criteria would apply to the proposed development.

Table 11 - Internal Traffic Noise Criteria

SPACE/ACTIVITY TYPE	NOISE LEVEL dB(A)L_{eq} (Daytime period)
Teaching Rooms (including teaching labs), Office Spaces (Private), Consult Rooms, Meeting Rooms, Boardroom.	40
Office Spaces (Open Plan), Laboratories, Lab Support	45
Corridors	50
Lobby / Reception	50
Animal Holding Rooms	40
Toilets / Store Rooms	50

Noise within rooms shall be free of tones, excessive low frequency content or other undesirable characteristics.

7.2 EXTERNAL NOISE LEVELS

Unattended noise monitoring was conducted between 29 October and 3 November 2014 using an Acoustic Research Laboratories monitor set on A-weighted fast response mode. The monitor was calibrated before and after the measurements using a Rion Type NC-73 calibrator. No significant drift was recorded. This unattended monitoring was supplemented by additional attended measurements conducted on site.

Table 12 – Façade Noise Levels

Location	External Noise Level dB(A)$L_{eq\ (period)}$ Day (7am – 10pm)
Proposed Eastern Façade	63

In determining the required building shell construction for control of traffic noise impacts, analysis will take into account change in noise level associated with different facades/orientation.

7.3 EVALUATION OF NOISE INTRUSION AND RECOMMENDATIONS

Internal noise levels will primarily be as a result of noise transfer through the windows and doors and roof, as these are relatively light building elements that offer less resistance to the transmission of sound.

The predicted noise levels through the windows, doors and roof are discussed below. The predicted noise levels have been based on the measured level and spectral characteristics of the external noise, the area of building elements exposed to traffic noise, the absorption characteristics of the rooms and the noise reduction performance of the building elements.

7.3.1 Glazing

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

Table 13 – Recommended Glazing Requirements

Façade	Spatial Use	Glazing Requirements	Acoustic Seals
East (Botany Street) and North East Corner	Teaching Rooms, Meeting Rooms	10.38mm laminated glass or 10.38mm laminated/12mm airgap/6mm IGU	Yes
	Remaining Areas	6.38mm laminated glass or 6.38mm laminated/12mm airgap/6mm IGU	Yes
South	Teaching Lab, Lab Support	6.38mm laminated glass or 6.38mm laminated/12mm airgap/6mm IGU	Yes
Other	All	6mm glass or 6mm /12mm airgap/6mm IGU	Yes

The glazing thicknesses recommended are those needed to satisfy acoustic requirements and do not take into account other requirements such as thermal, structural, safety or other considerations. These additional considerations may require the glazing thickness to be increased beyond the acoustic requirement.

In addition to complying with the minimum scheduled glazing thickness, the STC rating of the glazing fitted into openable frames and fixed into the building opening should not be lower than the values listed in Table 14 for all rooms. Where nominated, this will require the use of acoustic seals around the full perimeter of openable frames and the frame will need to be sealed into the building opening using a flexible sealant. Note that mohair seals in windows and doors are not acceptable where acoustic seals are required.

Table 14 – Minimum STC of Glazing

Glazing Assembly	Acoustic Seals	Minimum STC of Installed Window
6mm Float or 6/12/6 IGU	Yes	29
6.38mm Laminated or 6.38/12/6 IGU	Yes	31
10.38mm Laminated or 10.38/12/6 IGU	Yes	34

7.3.2 External Walls

All external masonry walls are acoustically acceptable. Light weight walls (if proposed) may require additional acoustic treatment and must be reviewed.

In the event of there being any plant room or other ventilation louvres, these will be reviewed once final position/dimension determined to ensure noise ingress into the building via the louvres does not result in excessive internal noise levels.

7.3.3 Roof/Ceiling

The currently proposed concrete roof/ceiling constructions will be acoustically acceptable for environmental noise intrusion.

8 CONCLUSION

Potential noise impacts from the proposed UNSW Biological Sciences project within the UNSW have been assessed.

As required by Secretary's Environmental Assessment Requirement 6:

- Noise emission objectives for the site have been determined based on on-site noise logging and noise emission guidelines in the EPA Industrial Noise Policy, Interim Construction Guidelines and Assessing Vibration: A Technical Guideline documents. Compliance with operational noise requirements will be achievable using typical acoustic treatments to plant and equipment.

- Given the proximity of the site to existing University Buildings and (residences on Botany Street, exceedance of EPA noise and vibration guidelines are likely to intermittently occur during construction works. Noise and vibration monitoring of critical areas in the adjacent University Buildings is proposed. On finalisation of the construction program, detailed review of noise impacts on critical areas (teaching labs and meeting rooms/offices) will be conducted to ensure classes are not excessively impacted.

- Noise impacts from nearby noise sources (primarily traffic noise) on occupants of the future development have been assessed in accordance with the document *Development Near Rail Corridors and Busy Roads*. The acoustic treatments necessary to achieve these guidelines have been set out in section 7.

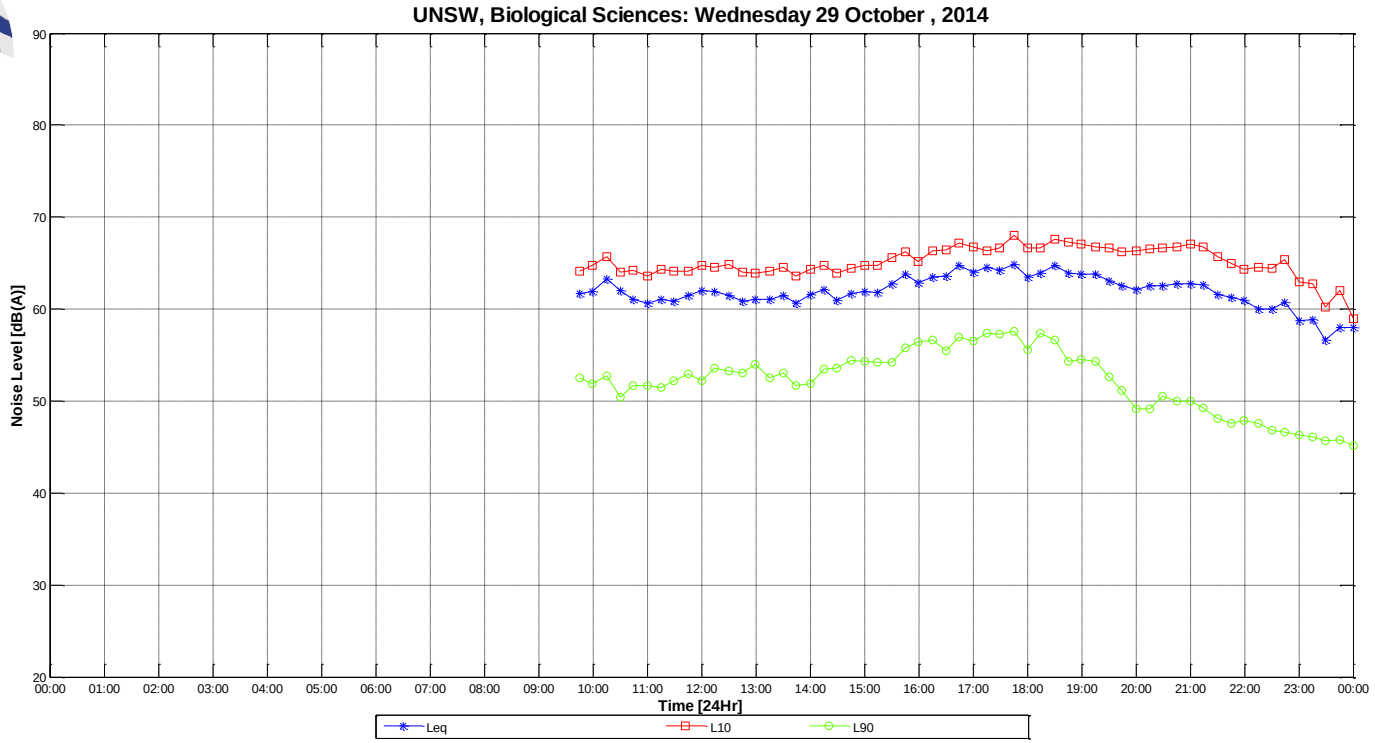
We trust this information is satisfactory. Please contact us should you have any further queries.

Yours faithfully,

Acoustic Logic Consultancy Pty Ltd
Thomas Taylor

Appendix 1

Noise Logging Data


UNSW, Biological Sciences: Wednesday 29 October , 2014
Noise Level [dB(A)]
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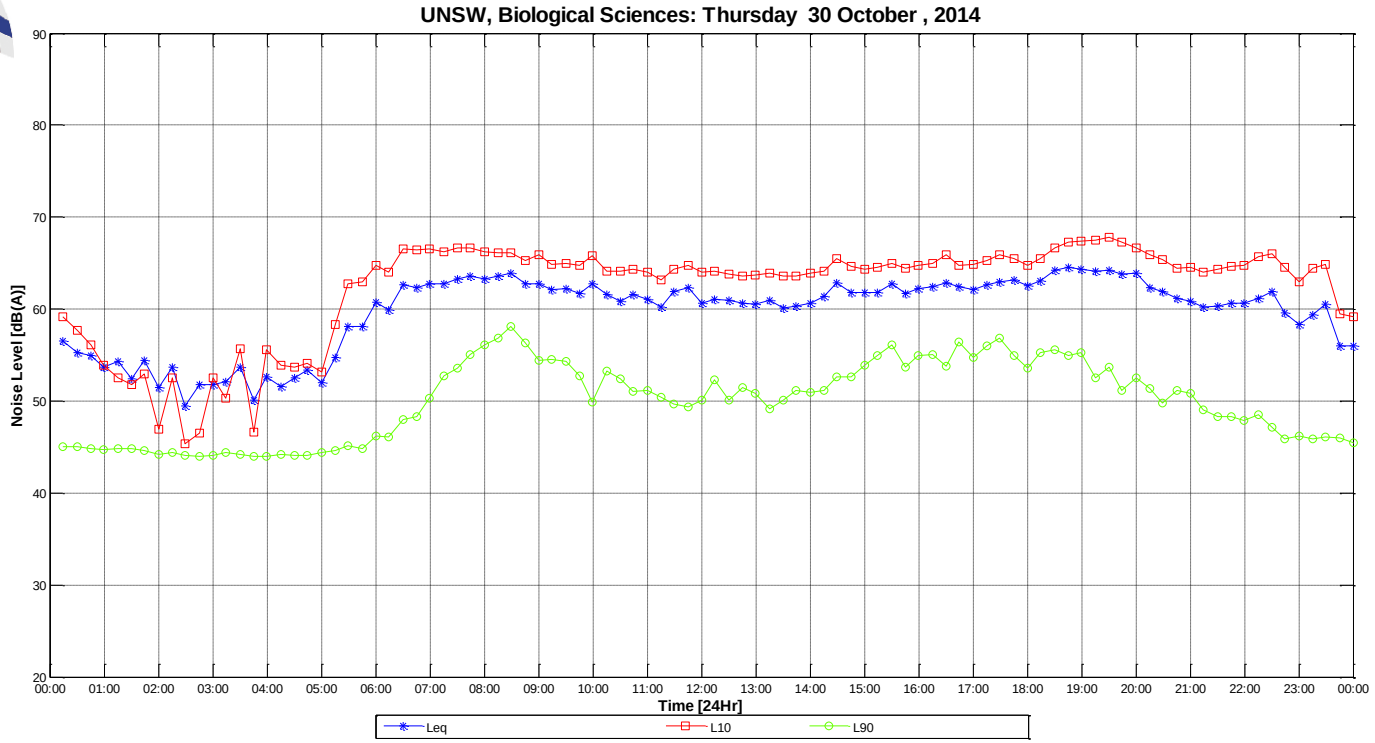
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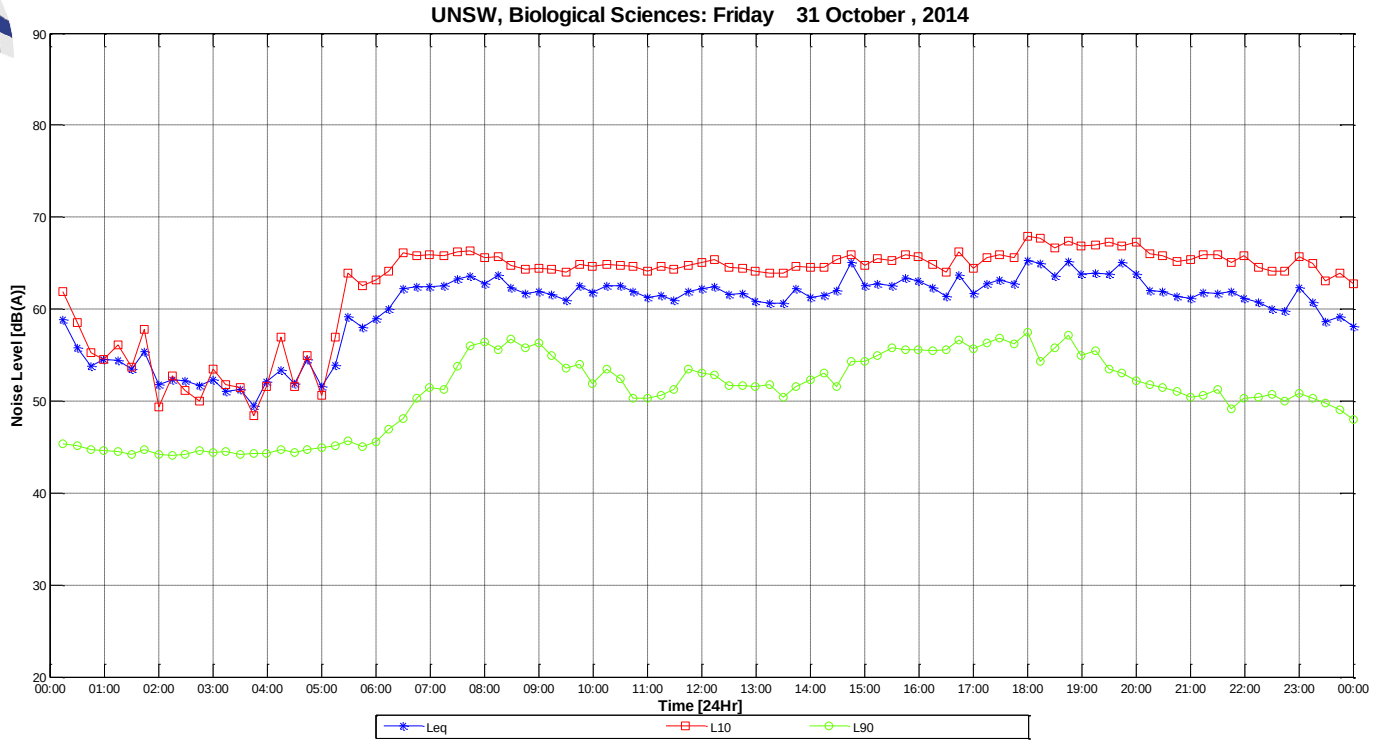
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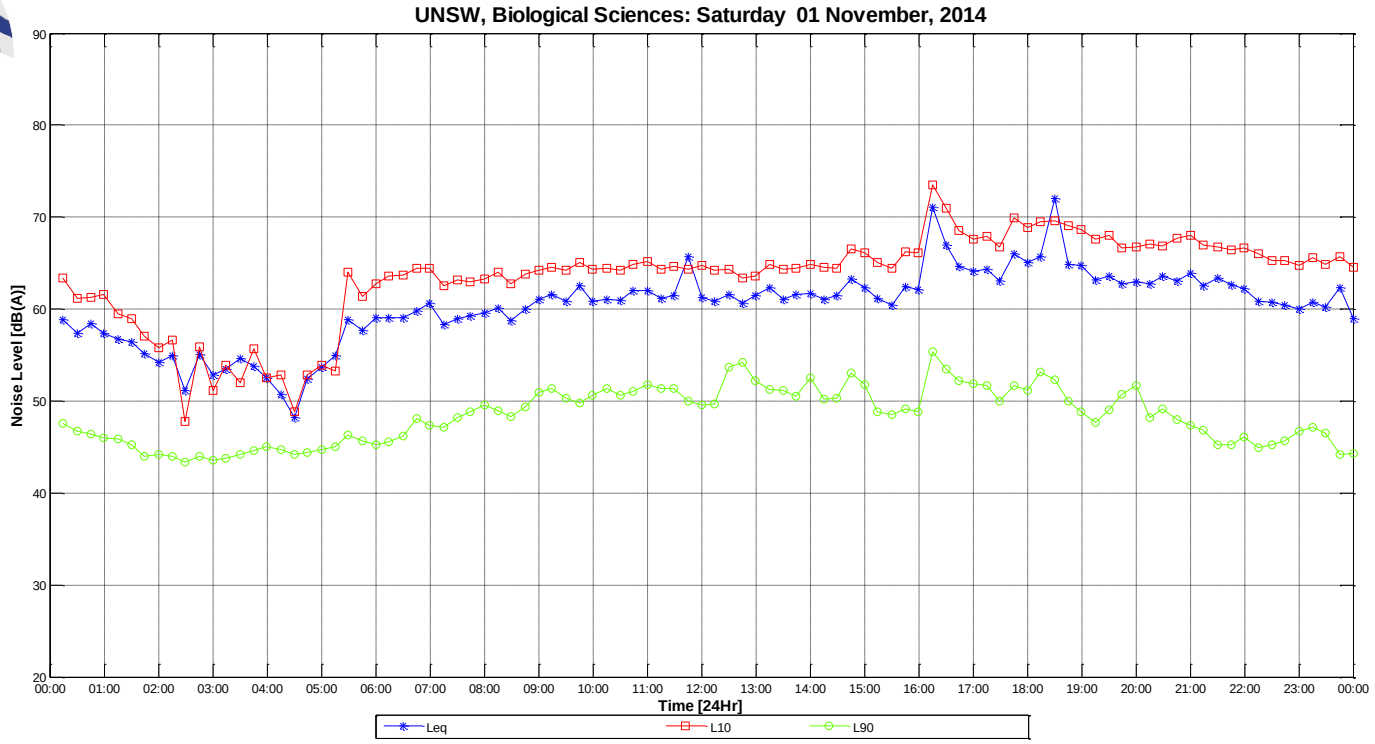
UNSW, Biological Sciences: Saturday 01 November, 2014
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Time [24Hr]
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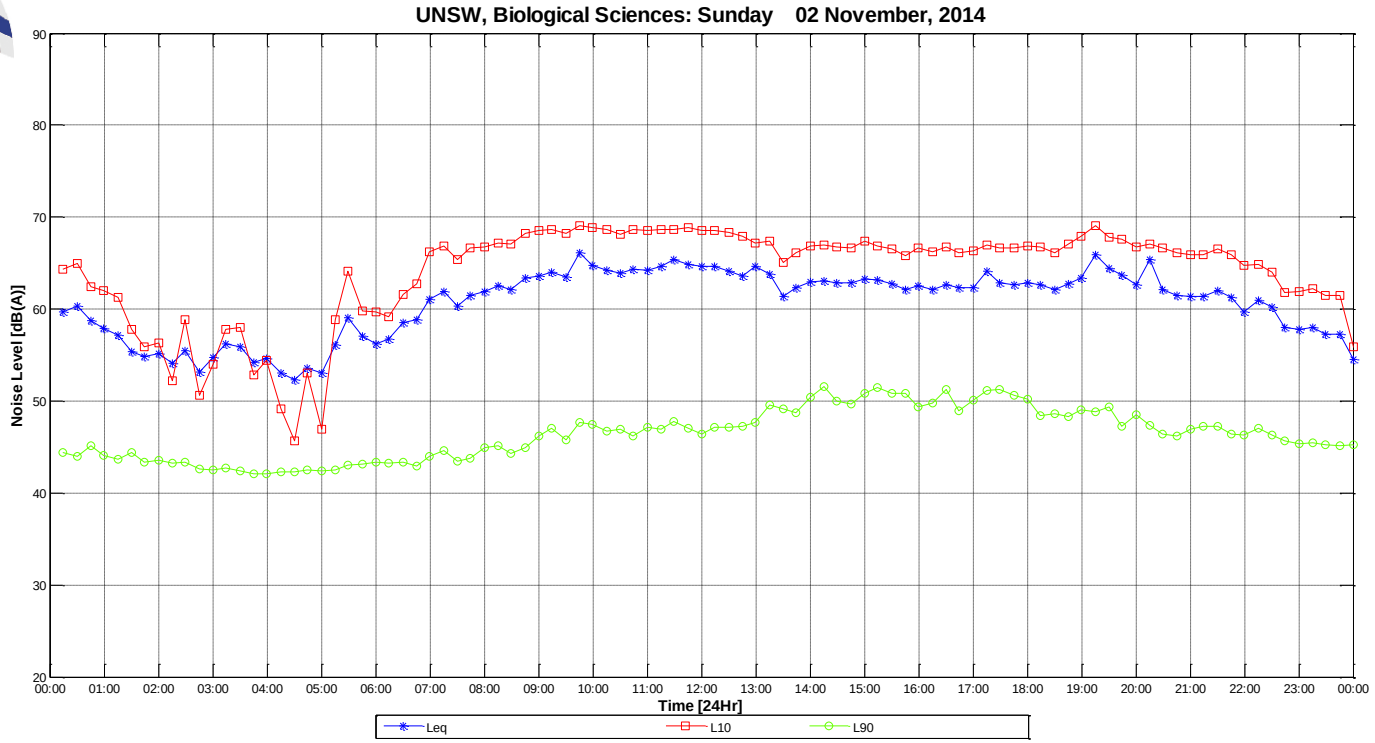
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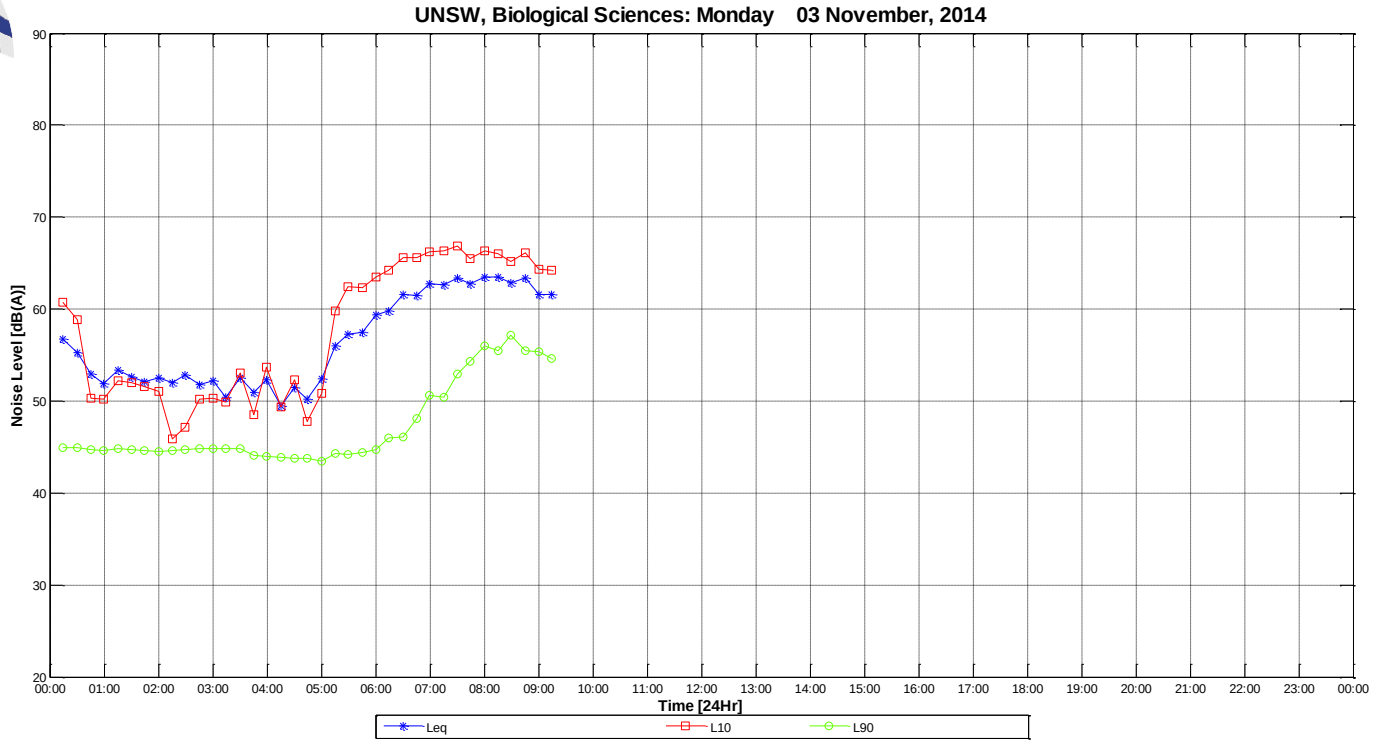
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