

University of Wollongong
**University of Wollongong Western
Building**
State Significant Development
Application - Acoustic Report

R03

Issue 1 | 27 October 2017

This report takes into account the particular instructions and requirements of our client.
It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 256024-00

Arup
Arup Pty Ltd ABN 18 000 966 165
Arup
Level 4, 108 Wickham Street
Fortitude Valley
QLD 4006
GPO Box 685 Brisbane QLD 4001
Australia
www.arup.com



ARUP

Job title		University of Wollongong Western Building		Job number 256024-00	
Document title		State Significant Development Application - Acoustic Report		File reference	
Document ref		R03			
Revision	Date	Filename	R03_AcousticDAReport_Issue1.docx		
Issue 1	27 Oct 2017	Description	Acoustic DA Report		
			Prepared by	Checked by	Approved by
		Name	Kim Jones	Grant Cuthbert	Chris Field
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
Issue Document Verification with Document ☒					

Contents

		Page
1	Introduction	1
1.1	Summary of SEARs Requirements	1
1.2	Operational noise criteria (INP)	1
1.3	Construction noise	2
1.4	Disturbance to buildings occupants	2
2	Noise Survey	4
2.1	Noise Sensitive Receivers	4
2.2	Existing Noise Environment	5
3	Assessment of Impacts	6
3.1	Operational Noise Emission	6
3.2	Construction Noise and Vibration	6
4	Noise Intrusion	8
5	Conclusions	10

References

Tables

- Table 1: INP Amenity Criteria - Recommended L_{Aeq} noise levels from industrial noise sources (NSW INP Table 2.1)
- Table 2: Construction noise management levels at residential receivers
- Table 3: Construction noise management levels at other noise sensitive land uses
- Table 4: Types of vibration – Definition
- Table 5: Preferred and maximum vibration acceleration levels for human comfort, m/s^2
- Table 6: Acceptable vibration dose values (VDV) for intermittent vibration ($m/s^{1.75}$)
- Table 7: Unattended Noise logging results
- Table 8: Attended short-term noise monitoring results
- Table 9: INP noise criteria modifying factor corrections for duration
- Table 10: Predicted typical construction equipment / activities
- Table 11: Predicted construction noise levels
- Table 12: Project acoustic design criteria

Figures

- Figure 1: Noise logger across the road from the Early Start Facility
- Figure 2: Noise logger near Kooloobong Village (attended measurement setup also shown)
- Figure 3: Site vicinity of the University of Wollongong Western Building, showing nearby noise-sensitive receivers and logger locations (image from SIX Maps)
- Figure 4: University of Wollongong Site Map (existing)

Appendices

Appendix A

Daily Unattended Noise Logging Results: Logger 1

Appendix B

Daily Unattended Noise Logging Results: Logger 2

1 Introduction

Arup is undertaking the acoustic design of the University of Wollongong (UoW) Western Building, which will co-locate the School of the Arts, English and Media (TAEM) within the Faculty of Law, Humanities and the Arts (LHA), and the School of Health and Society (HAS) and the School of Geography and Sustainable Communities (SGSC) within the Faculty of Social Sciences (SOC) within a new-build building.

This report details acoustic criteria for the Project in order that it meet the operational and construction noise and vibration requirements as set out by the SEARs for the development (SSD 8596). Further acoustic assessment will be undertaken as the design progresses.

Daily unattended noise logging measurement results used as the basis for setting noise criteria for the project can be found in Appendix A and Appendix B.

1.1 Summary of SEARs Requirements

Key Issue 7 of the SEARs for SSD 8596 (Noise and Vibration) states the following:

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

The following sections summarise the relevant sections of the *NSW Industrial Noise Policy (INP)*¹, the *Interim Construction Noise Guidelines (ICNG)*² and *Assessing Vibration: A Technical Guide (AVTG)*³.

1.2 Operational Noise Criteria (INP)

Operational noise emission criteria for the project have been assessed in accordance with the NSW INP, which is primarily concerned with controlling intrusive noise impacts in the short-term for residences, and maintaining long-term noise level amenity for residences and other land uses.

Both the INP ‘Intrusive’ and ‘Amenity’ criteria have been determined, with the most onerous being adopted as the operational noise criteria for the Project.

Intrusive noise criteria

The intrusiveness criteria is applicable to residential premises only. The intrusiveness criterion is summarised as follows:

- $L_{Aeq,15minute} \leq \text{Rating Background Level (RBL) plus 5 dB}$

As the intrusiveness criteria is established from the prevailing background noise levels at the residential receiver locations, the rating background noise level is required to be quantified in order to establish Project noise goals.

Amenity noise criteria

The INP amenity criteria are for the purpose of maintaining noise amenity, for which the INP recommends ‘acceptable’ and ‘recommended maximum’ cumulative noise levels for all industrial noise at different receiver types, including residential, commercial, industrial receivers and other sensitive receivers.

Table 1: INP Amenity Criteria - Recommended L_{Aeq} noise levels from industrial noise sources (NSW INP Table 2.1)

Type of receiver	Indicative Noise Amenity Area	Time of day ¹	Recommended L_{Aeq} (period) noise level	
			Acceptable	Recommended maximum
Residence	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
School classrooms - internal	All	Noisiest 1 hour period when in use	35	40

Note1 – Daytime, 7.00am to 6.00pm; Evening 6.00pm to 10.00pm; Night-time 10.00pm to 7.00am

On Sundays and Public Holidays, Daytime 8.00am - 6.00pm; Evening 6.00pm - 10.00pm; Night-time 10.00pm - 8.00 am.

¹ NSW Environmental Protection Authority, “NSW Industrial Noise Policy,” Environmental Protection Authority, Sydney, 2000.

² Department of Environment and Climate Change NSW, “Interim Construction Noise Guideline,” Department of Environment and Climate Change NSW, Sydney, 2009.

³ Department of Environment and Conservation (NSW), “Assessing Vibration: A technical guideline,” Department of Environment and Conservation (NSW), Sydney, 2006.

An equivalent external criteria for School Classrooms (see Table 1) is 45 dB(A) Acceptable / 50 dB(A) Recommended Maximum (assuming a 10 dB(A) correction for façade with open window).

Reference should be made to the INP for full assessment procedures and application, including modifying factor adjustments, background measurement procedures, adverse meteorological effects as well as assessment of sleep disturbance.

1.3 Construction noise

The NSW ICNG provides a management approach for airborne construction noise at sensitive land uses. The guideline provides construction management noise levels above which all feasible and reasonable work practices should be applied to minimise the construction noise impact. The ICNG works on the principle of a ‘screening’ criterion – if predicted or measured construction noise exceeds the ICNG levels then the construction activity must implement all ‘feasible and reasonable’ work practices to reduce noise levels.

The ICNG provides two methods for assessing construction noise, varying typically on the basis of the project duration, being either a quantitative or a qualitative assessment. A quantitative assessment is recommended for major construction projects of significant duration, and involves the measurement of background noise levels for determination of management levels and prediction of construction noise levels. A qualitative assessment is recommended for small projects with a duration of less than three weeks and focuses on minimising noise disturbance through the implementation of reasonable and feasible work practices, and community notification.

The ICNG sets out management levels for noise at noise sensitive receivers, and how they are to be applied. These management noise levels for residential receivers are reproduced below, in Table 2 and other sensitive receivers in Table 3 below.

Table 2: Construction noise management levels at residential receivers

Time of day	Management level ¹ L _{Aeq} (15 min)	How to apply
Recommended standard hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays	Noise affected RBL + 10dB	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 75dB(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: - times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences - if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5dB	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2 of the ICNG.

Note1 - Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Table 3: Construction noise management levels at other noise sensitive land uses

Land use	Where objective applies	Management level L _{Aeq} (15 min) ¹
Classrooms at schools and other educational institutions	Internal noise level	45 dB(A)

Note1 - Noise management levels apply when receiver areas are in use only.

For work within standard construction hours, if after implementing all ‘feasible and reasonable’ noise levels the site still exceeds the noise affected level, the ICNG does not require any further action – since there is no further scope for noise mitigation.

For out-of-hours work, the ICNG uses a noise level 5 dB above the noise-affected level as a threshold where the proponent should negotiate with the community. While there is no ‘highly-noise affected level’ outlined in the ICNG for out-of-hours work, this report adopts the terminology where the construction noise level is 5 dB above the noise affected level.

1.4 Vibration

Assessment of potential vibration disturbance to human occupants of buildings is made in accordance with the NSW DEC ‘Assessing Vibration; a technical guideline’ (DEC, 2006). The criteria outlined in the guideline are based on the British Standard BS 6472-1992 ‘Evaluation of human exposure to vibration in buildings (1-80Hz)’. Sources of vibration are defined as either 'Continuous', 'Impulsive' or 'Intermittent', as described in Table 4, with construction vibration typically being defined as intermittent.

Table 4: Types of vibration – Definition

Type of vibration	Definition	Examples
Continuous vibration	Continues uninterrupted for a defined period (usually throughout the day-time and/or night-time)	Machinery, steady road traffic, continuous construction activity (such as tunnel boring machinery).
Impulsive vibration	A rapid build-up to a peak followed by a damped decay that may or may not involve several cycles of vibration (depending on frequency and damping). It can also consist of a sudden application of several cycles at approximately the same amplitude, providing that the duration is short, typically less than 2 seconds	Infrequent: Activities that create up to 3 distinct vibration events in an assessment period, e.g. occasional dropping of heavy equipment, occasional loading and unloading.
Intermittent vibration	Can be defined as interrupted periods of continuous or repeated periods of impulsive vibration that varies significantly in magnitude	Trains, nearby intermittent construction activity, passing heavy vehicles, forging machines, impact pile driving, jack hammers. Where the number of vibration events in an assessment period is three or fewer, this would be assessed against impulsive vibration criteria.

Table 5 reproduces the ‘Preferred’ and ‘Maximum’ values for continuous and impulsive vibration from Table 2.2 of the Guideline.

Table 5: Preferred and maximum vibration acceleration levels for human comfort, m/s²

Location	Assessment period ¹	Preferred values		Maximum values	
		z-axis	x- and y-axes	z-axis	x- and y-axes
Continuous vibration (weighted RMS acceleration, m/s ² , 1-80Hz)					
Critical areas ²	Day- or night-time	0.005	0.0036	0.010	0.0072
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day- or night-time	0.020	0.014	0.040	0.028
Workshops	Day- or night-time	0.04	0.029	0.080	0.058
Impulsive vibration (weighted RMS acceleration, m/s ² , 1-80Hz)					
Critical areas ²	Day- or night-time	0.005	0.0036	0.010	0.0072
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and places of worship	Day- or night-time	0.64	0.46	1.28	0.92
Workshops	Day- or night-time	0.64	0.46	1.28	0.92

Note 1 - Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am

Note 2 - Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria specified above. Alternative criteria is outside the scope of the policy and other guidance documents should be referred to.

Table 6 reproduces the ‘Preferred’ and ‘Maximum’ values for intermittent vibration from Table 2.4 of the Guideline.

Table 6: Acceptable vibration dose values (VDV) for intermittent vibration (m/s^{1.75})

Location	Daytime ¹		Night-time ¹	
	Preferred value	Maximum value	Preferred value	Maximum value
Critical areas ²	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Note 1- Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am

Note 2 - Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be a need to assess intermittent values against the continuous of impulsive criteria for critical areas.

Source: BS 6472-1992

2 Noise Survey

An environmental noise survey was conducted by Arup from 03 October 2017 to 13 October 2017. Results from the noise survey were used as the basis for setting noise criteria at the nearest noise sensitive receivers.

The survey consisted of unattended noise monitoring using two ARL Ngara noise logger (serial numbers 878061 and 8780D1), supplemented with attended (short-term) measurements using a B&K 2250 sound level meter. Both the long-term noise loggers and the sound level meters used for obtaining the short-term measurements were checked for calibration before and after the measurements, with no significant drift noted.

The loggers were set up across the road from the Early Start Facility and near Kooloobong Village, as shown in Figure 1 and Figure 2. These locations were chosen as they represent the nearest receivers which will be sensitive to the operational noise emitted from the Western Building.

The loggers measured the L_{A1} , L_{A10} , L_{Aeq} and L_{A90} statistical indices. The logger data has been analysed in 15 minute intervals to obtain the operational noise criteria as set out in the NSW INP.

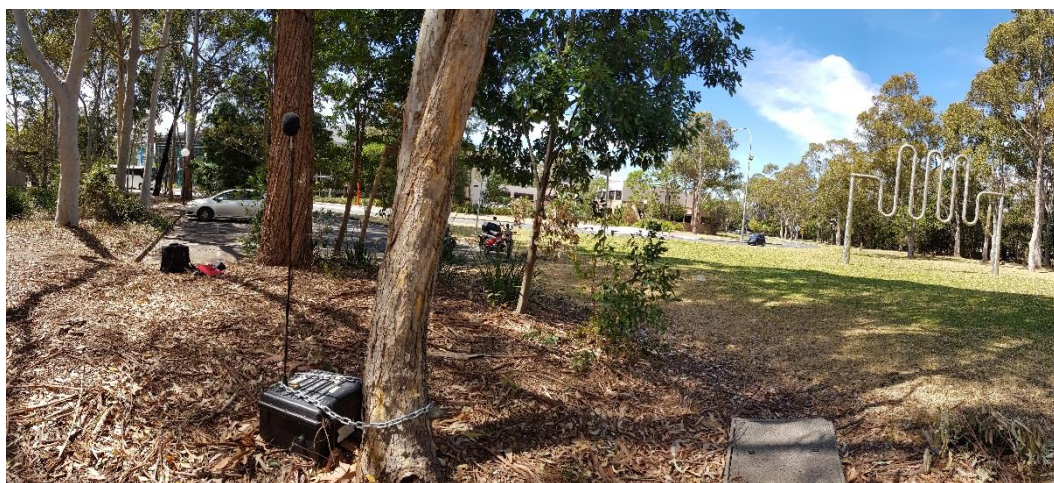


Figure 1: Noise logger across the road from the Early Start Facility



Figure 2: Noise logger near Kooloobong Village (attended measurement setup also shown)

2.1 Noise Sensitive Receivers

The nearest noise-sensitive receivers for the Western Building are the Kooloobong Village (student accommodation) and the University of Wollongong Early Start Facility, as shown in Figure 3.



Figure 3: Site vicinity of the University of Wollongong Western Building, showing nearby noise-sensitive receivers and logger locations (image from SIX Maps)

The Early Start Facility is the closest noise-sensitive receiver for noise emission from the Western Building. The building contains educational and childcare facilities. Kooloobong Village, a residential building, is slightly further away from the Western Building. Noise impacts on both the Early Start Facility and Kooloobong Village must be considered from the Western Building project.

2.2 Existing Noise Environment

Table 7 shows a summary the results of the unattended noise monitoring at the two nearest noise-sensitive receivers. No existing industrial noise exposure was audible at the noise logger location.

Table 7: Unattended Noise logging results

Location	Time Period	Average over measurement period; dB LAeq,15mins	RBL, dB LA90,15mins
Kooloobong Village	Day	55	43
	Evening	47	38
	Night	47	35
Early Start Facility	Day	53	46
	Evening	49	40
	Night	47	34

Table 8 shows the results of the short-term attended noise monitoring at the two nearest noise-sensitive receivers, which were used to cross-check the output from the long-term loggers.

Table 8: Attended short-term noise monitoring results

Location	Time	Measured Noise Level, dB LAeq,15mins	Measured Noise Level, dB LA90,15mins
Kooloobong Village	3 Oct 2017 13:56 – 14:11	51	49
Early Start Facility	3 Oct 2017 12:24 – 12:39	55	49

2.3 Project specific noise criteria: INP

Based on the noise monitoring results shown in Table 7, Table 9 summarises the derived project noise criteria based on the INP.

Table 9: INP noise criteria modifying factor corrections for duration

Receiver	Time period	Operational Noise Criteria		
		Intrusive	Base Amenity	Project Criteria ¹
Residential receivers				
Kooloobong Village	Day	48	60	48
	Evening	43	50	43
	Night	40	45	40
Other sensitive receivers				
Early Learning Facility	Use hours	-	35	35
	Other times	-	-	-

Note1 – Project criteria is the most onerous of the intrusive and amenity criteria

3 Assessment of Impacts

3.1 Operational Noise Emission

The environmental noise emission from the Western Building should be controlled to achieve compliance with the criteria outlined in Section 2.3 at nearby sensitive receivers.

The noise impacts from the following noise sources are being considered in the design:

- Noise breakout from performance spaces, including theatres and the rehearsal/performance space during performances and rehearsals
- Noise breakout from studios during music recording and practice sessions
- Rooftop plant, such as AHUs, fans, chillers, pumps, water heaters and associated equipment

3.1.1 Musical / Theatrical Operational Noise

The envelope of the theatres, recording studios and other music spaces includes constructions specifically designed to provide very high levels of sound insulation to control noise intrusion from various external sources to sensitive internal spaces. By design, this will also control the breakout of noise from internal sources to external locations.

The operational noise emission from music rehearsal rooms during use has been considered by calculating the resultant noise breakout of a typical band practice at 90 dB(A), based on previous Arup measurements of band practices in similar spaces.

Noise breakout through the façade has been considered (assumed façade glazing construction of 6mm float | 12mm gap | 6mm float double glazing). The resultant predicted noise level of operational noise breakout is as follows:

- Early Start Facility < 20 dB(A) (inaudible external and internal)
- Kooloobong Village < 20 dB(A) (inaudible external and internal)

Internal noise levels within the Early Start learning centre have been based on a typical façade construction of 6|12|6 glazing.

The requirements for controlling noise intrusion for the Western Building are more onerous than those for noise breakout. This means that noise emission from internal usage of the Western Building will be well below the atmospheric noise criteria given above.

3.1.2 Noise from Externally Located Building Plant

At this stage of the development, mechanical plant equipment has yet to be selected. The critical nature of the internal environment means that many of the plant items will be selected to be as quiet as possible. The noise emissions from the mechanical plant will be attenuated, where necessary, in order to meet the criteria at the nearest sensitive receivers.

3.2 Construction Noise and Vibration (for guidance)

At this stage of the development, the details of construction processes and equipment that will be required have not been determined. As a result, a preliminary quantitative construction noise assessment, based on predicted construction equipment and noise levels, is provided. Please note that this analysis is for guidance purposes only at this stage of the project, and will be supplemented by a more-detailed review to be conducted by the contractor as part of the construction planning process.

There are various factors that will affect the actual construction noise level, including:

- Type of construction processes and equipment, and their duration
- Location of works within the site
- Façade build-up of receiving building (for the purposes of this assessment, the internal noise predictions have been based on 6mm float | 12mm gap | 6mm float double glazed façade)
- Dimensions and finishes in receiving room.

The predicted typical construction equipment / activities that have been assumed for this development are listed in Table 10.

Table 10: Predicted typical construction equipment / activities

Description
Petrol Hand-held Circular Saw
Dozer 20 t
Dump Truck (Empty)
Crane (tower)
Concrete Pump + Cement Mixer Truck (Discharging)
Core Drill (Electric)

Figure 4 shows the existing site map of the south west of the University of Wollongong campus. Building 21 is the Early Start Facility and Building 68 is Kooloobong Village. In addition, the construction noise levels at Buildings 73, 74 and 75 has been investigated.

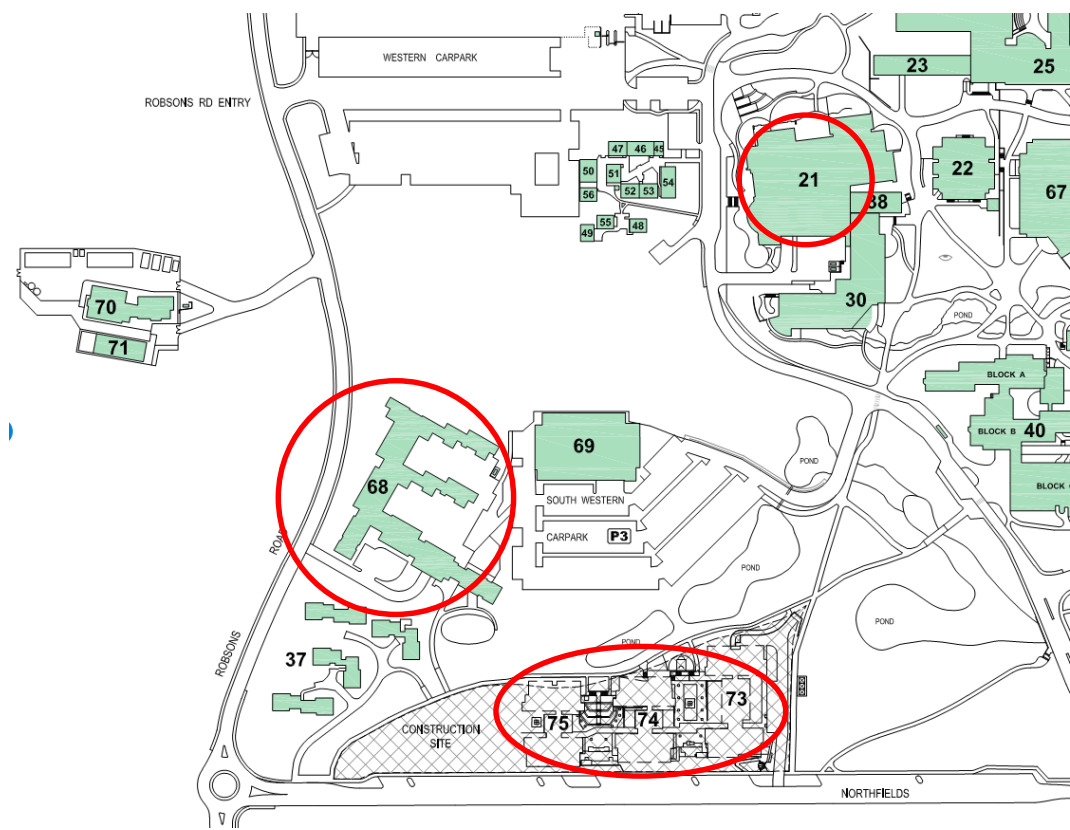


Figure 4: University of Wollongong Site Map (existing)

The approximate predicted internal and external construction noise levels for these locations are presented in Table 11.

Table 11: Predicted construction noise levels

Location	Approximate predicted construction noise level (external)	Approximate predicted construction noise level (internal)
Building 21	82 dB(A)	59 dB(A)
Building 68	82 dB(A)	59 dB(A)
Building 73	75 dB(A)	52 dB(A)
Building 74	74 dB(A)	51 dB(A)
Building 75	74 dB(A)	51 dB(A)

The selected Contractor will provide a detailed construction noise and vibration assessment and management plan, which will include processes for managing noise impacts to the nearby buildings to ensure that the internal noise levels meet the requirements of the ICNG. This might include respite periods if/when necessary and agreed between the relevant parties.

4 Noise Intrusion Criteria

Table 12 presents the following criteria for each of the rooms in the Western Building:

- Background noise criteria / Noise break-in criteria
- Rain noise criteria
- Impact noise criteria

These criteria will be used as the basis for adequately controlling noise intrusion to various spaces within the Western Building.

Table 12: Project acoustic design criteria

Space	Internal Background Noise Level, L _{Aeq,1min} (maximum)		Noise Intrusion from Exterior, L _{Aeq,1min}	Impact Noise, L’ _{nTw}	Rain Noise, L _{Aeq,15min}
	Project Criteria	AS/NZS 2107:2016 Guidance			
Large Theatre	NR 20	25-30 dB(A) (drama theatres)	NR 15	50	25 dB(A)
Small Theatre	NR 20	25-30 dB(A) (drama theatres)	NR 15	50	25 dB(A)
Control Rooms	NR 20	-	NR 15	50	25 dB(A)
Rehearsal Room	NR 30	35-40 dB(A) (drama studio – educational)	NR 25	55	35 dB(A)
Dressing Rooms	45 dB(A)	-	50 dB(A)	62	50 dB(A)
Workshop	55 dB(A)	-	-	-	-
Performance Store Rooms	55 dB(A)	-	-	-	-
Rack Rooms	65 dB(A)	-	-	-	-
Dimmer Rooms	65 dB(A)	-	-	-	-
Video Production	NR 25	25-30 dB(A) (film or television studios)	NR 20	55	30 dB(A)
Radio Studio	NR 20	20-25 dB(A) (voice over booth)	NR 15	50	25 dB(A)
Radio Director	NR 25	-	NR 20	55	30 dB(A)
Newsroom	40 dB(A)	-	45 dB(A)	62	50 dB(A)
Edit Suites	NR 25	-	NR 20	55	30 dB(A)
Digital Studio	40 dB(A)	-	45 dB(A)	62	45 dB(A)
Design Digital Studio	40 dB(A)	-	45 dB(A)	62	45 dB(A)
Music Teaching and Performance Space	NR 20	Specialist advice should be sought (concert and recital halls)	NR 15	50	25 dB(A)
Rehearsal Rooms - Group	NR 25	30-35 dB(A)	NR 25	55	30 dB(A)
Rehearsal Rooms – Individual	NR 25	30-35 dB(A)	NR 25	55	30 dB(A)
3D Audio Studio	NR 20**	-	NR 20	50	25 dB(A)
Recording Studio Large Control Room	NR 20**	20-25 dB(A) (music recording studios)	NR 20	50	25 dB(A)
Recording Studio Small Control Room	NR 20**	20-25 dB(A) (music recording studios)	NR 20	50	25 dB(A)
Recording Studio Live Room	NR 20	20-25 dB(A) (music recording studios)	NR 15	50	25 dB(A)
Recording Studio Sound Lock / Isolation Room	NR 25	25-30 dB(A) (music recording studios)	NR 20	55	30 dB(A)
Music Digital Studio	NR 30	-	40 dB(A)	55	45 dB(A)
Music Edit Suite	NR 25	-	30 dB(A)	55	30 dB(A)
Gallery	35 dB(A)	40-45 dB(A) (art galleries)	40 dB(A)	62	40 dB(A)
Maker Studio	45 dB(A)	40-45 dB(A) (art/craft studios)	50 dB(A)	-	50 dB(A)

Space	Internal Background Noise Level, L _{Aeq,1min} (maximum)		Noise Intrusion from Exterior, L _{Aeq,1min}	Impact Noise, L' nTw	Rain Noise, L _{Aeq,15min}
	Project Criteria	AS/NZS 2107:2016 Guidance			
Design Studio	40 dB(A)	40-45 dB(A) (art/craft studios)	45 dB(A)	62	45 dB(A)
Project Room	40 dB(A)	40-45 dB(A) (art/craft studios)	45 dB(A)	62	45 dB(A)
SOC Digital Lab	40 dB(A)	40-45 dB(A) (computer rooms – teaching)	45 dB(A)	-	45 dB(A)
Community / Project / Meeting Room	40 dB(A)	35-40 dB(A) (conference rooms)	45 dB(A)	-	45 dB(A)
Sim Labs – Reception	45 dB(A)	<50 dB(A) (corridors and lobbies)	50 dB(A)	-	50 dB(A)
Sim Labs – Interview Rooms	35 dB(A)	30-40 dB(A) (video/audio conference rooms)	40 dB(A)	62	40 dB(A)
Ergonomics Lab	45 dB(A)	35-45 dB(A) (teaching laboratories)	50 dB(A)	-	50 dB(A)
WHS Lab	45 dB(A)	35-45 dB(A) (teaching laboratories)	50 dB(A)	-	50 dB(A)
Foyer	50 dB(A)	<50 dB(A) (corridors and lobbies)	55 dB(A)	-	55 dB(A)
Circulation	50 dB(A)	<50 dB(A) (corridors and lobbies)	55 dB(A)	-	55 dB(A)
Common Teaching Areas – Large	NR 30	35-45 dB(A) (teaching spaces)	40 dB(A)	62	40 dB(A)
Common Teaching Areas – Small	40 dB(A)	35-45 dB(A) (teaching spaces)	45 dB(A)	62	45 dB(A)
Informal Learning Spaces	50 dB(A)	35-45 dB(A) (teaching spaces)	55 dB(A)	N/A	55 dB(A)
Workspaces	45 dB(A)	40-45 dB(A) (office areas)	50 dB(A)	N/A	50 dB(A)
Private Offices	40 dB(A)	35-40 dB(A) (professional and admin offices)	45 dB(A)	62	45 dB(A)
Meeting Rooms	40 dB(A)	35-40 dB(A) (conference rooms)	45 dB(A)	62	45 dB(A)
Print Rooms	55 dB(A)	-	-	-	-
Staff Rooms	45 dB(A)	40-45 dB(A) (staff common rooms)	50 dB(A)	-	50 dB(A)
Kitchen	55 dB(A)	55 dB(A) (kitchens)	-	-	-
Amenities and Change Rooms	55 dB(A)	<55 dB(A) (toilet/ change/ showers)	-	-	-
Store Rooms	65 dB(A)	-	-	-	-
Plant Rooms	85 dB(A)*	-	-	-	-
MCR Comms MSB	65 dB(A)	-	-	-	-

*If noise levels in plant rooms exceed 85 dB(A) during normal operation hearing protection will be required in plant rooms.

** NB: Dolby guidelines recommend maximum NR 15. NR 20 is recommended (and was adopted for the QUT precedent project) as a relaxed noise level for an educational facility.

Note:

- For services noise, all noise levels are expressed as the L_{Aeq,1min} noise level in dB re 20 µPa, spatially-averaged at 1.5 m above the finished floor level, from all building services (mechanical, electrical, hydraulic, theatrical equipment, etc.) operating, with the room finished and furnished but unoccupied.
For particularly-noise sensitive spaces the services noise level is expressed using the Noise Rating (NR) curves, which are nominally equivalent to the dB(A) value 5 units above – e.g. NR30 is nominally equivalent to 35 dB(A). The NR curves shall take precedence over the equivalent dB(A) values for the purposes of design.
- Rain noise limits are expressed as the L_{Aeq} noise level in dB re 20 µPa, spatially-averaged at 1.5 m above the finished floor level, from the one-year annual recurrence, one hour rainfall event as reported by the Bureau of Meteorology.
These criteria are provided for all spaces at this stage of design, but will only be relevant for spaces located on the top floor.
- External noise intrusion limits are expressed as the L_{Aeq,1min} noise level in dB re 20 µPa, spatially-averaged at 1.5 m above the finished floor level, from sources external to the building.
These criteria are provided for all spaces at this stage of design, but will only be relevant for façade-located spaces.
- Impact noise criteria are maximum values of impact noise and apply to the floor/ceiling construction above the space.

5 Conclusions

An assessment of acoustic impacts from the proposed operation and construction of the University of Wollongong Western Building have been assessed against the policies and guidelines outlined in the SEARs for the project (SSD 8596).

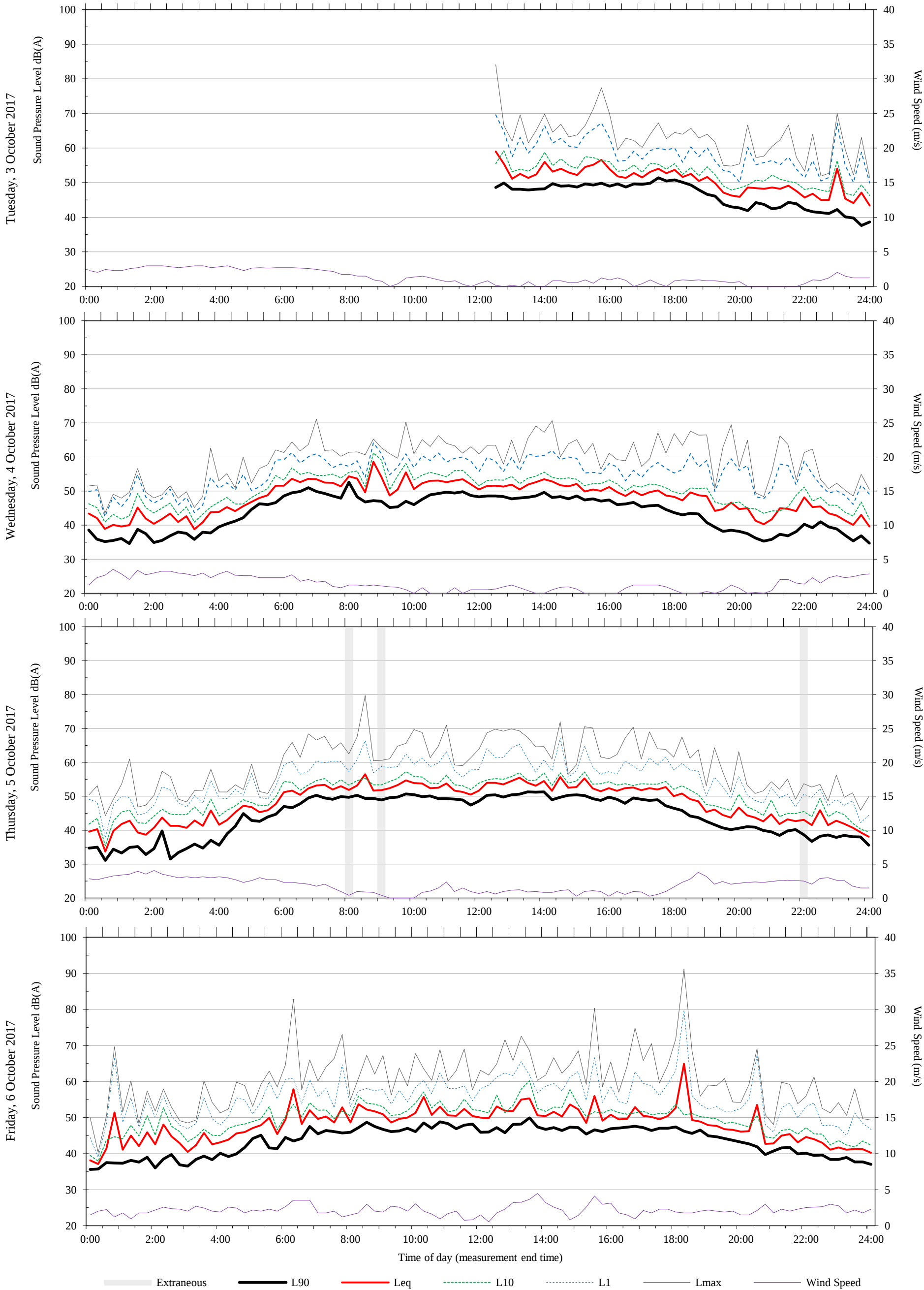
Noise levels from the operation of the building (e.g. rooftop mechanical plant) at the nearest sensitive receivers will be required to be designed and provided with noise mitigation if required to be below the levels indicated in Table 9.

It has been demonstrated that the noise break-out from operations of the Western Building, including amplified performances, will be well below the specified criteria.

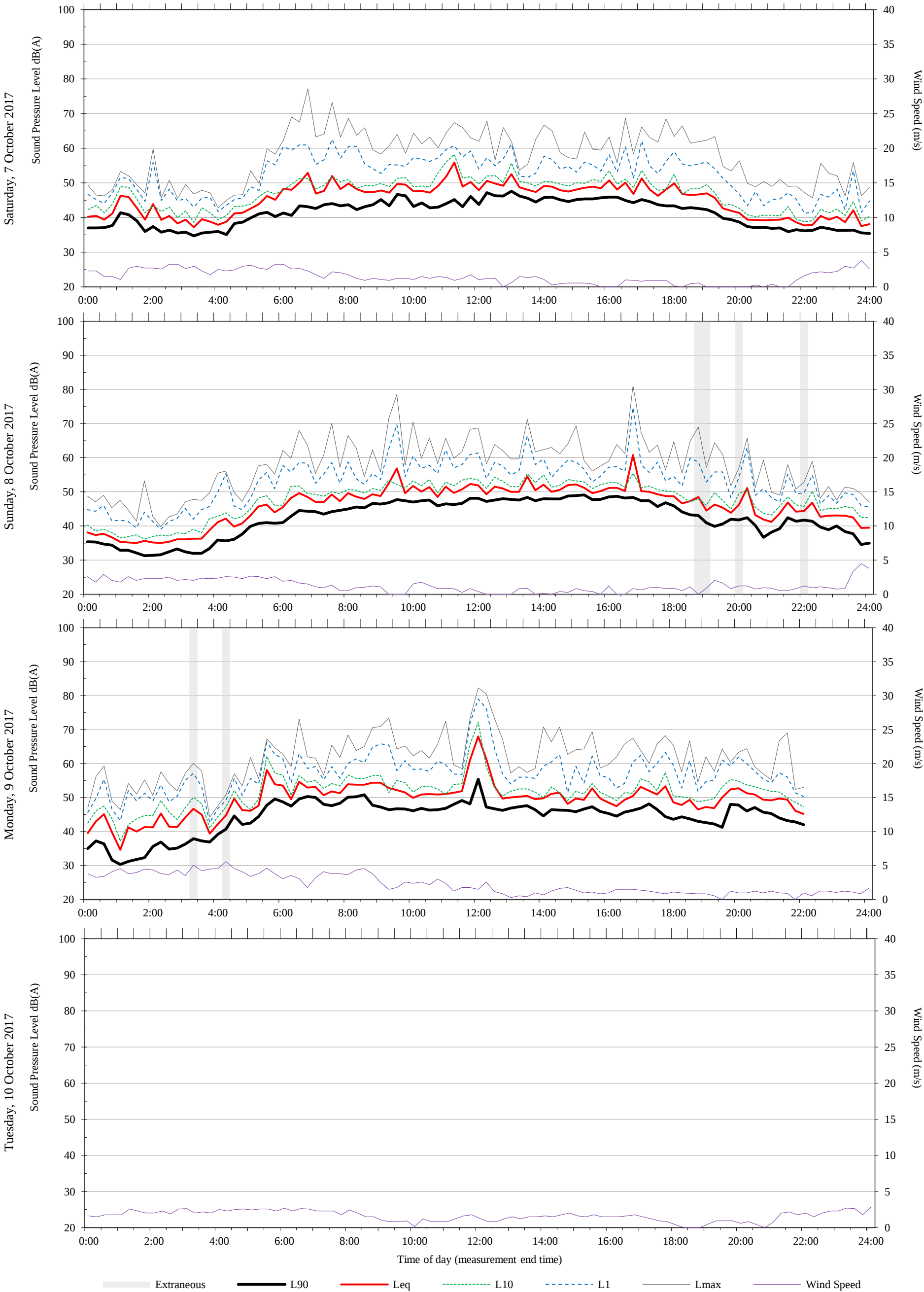
Appendix A

Daily Unattended Noise Logging
Results: Logger 1

Unattended monitoring: (Free Field)

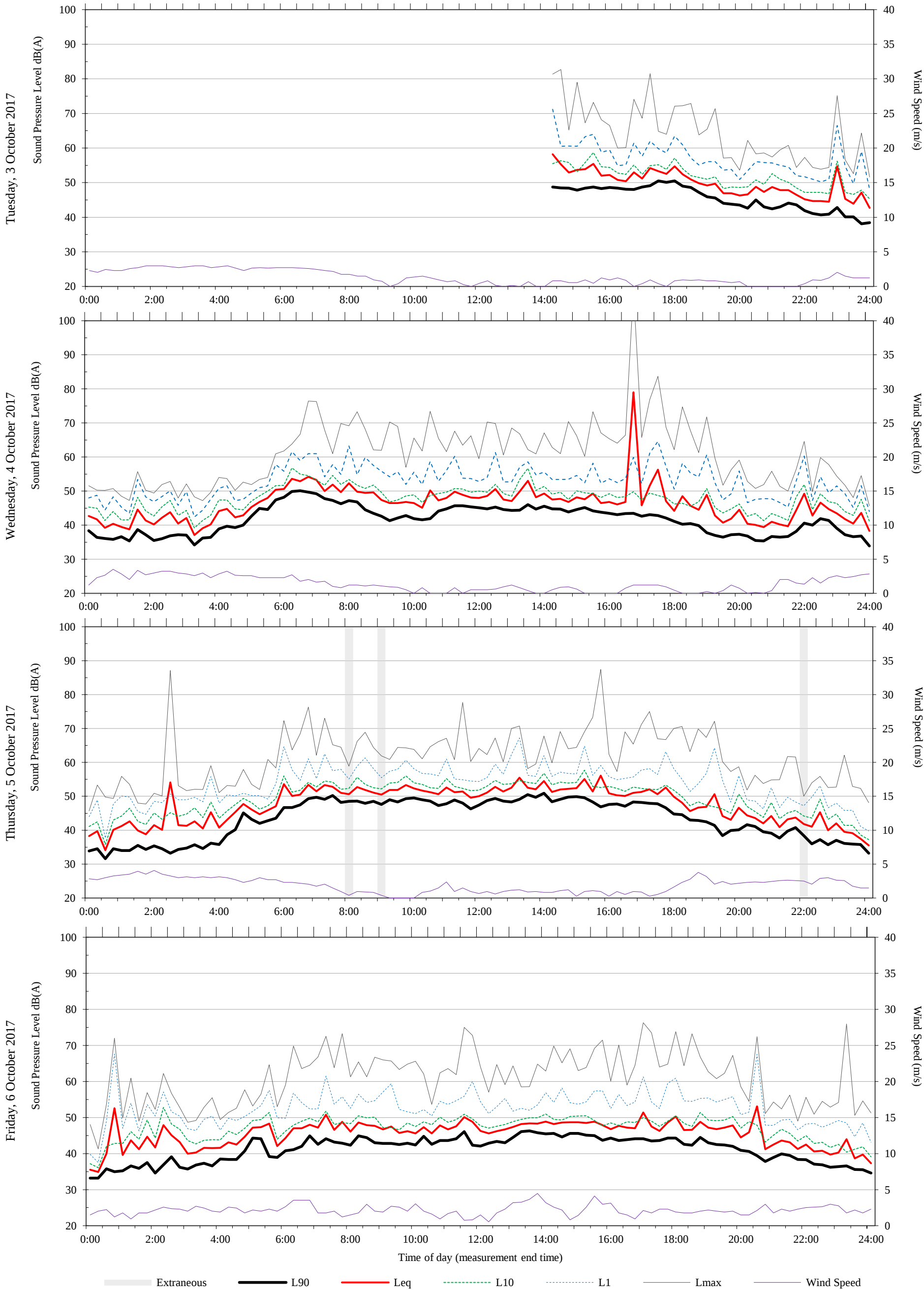


Unattended monitoring: (Free Field)

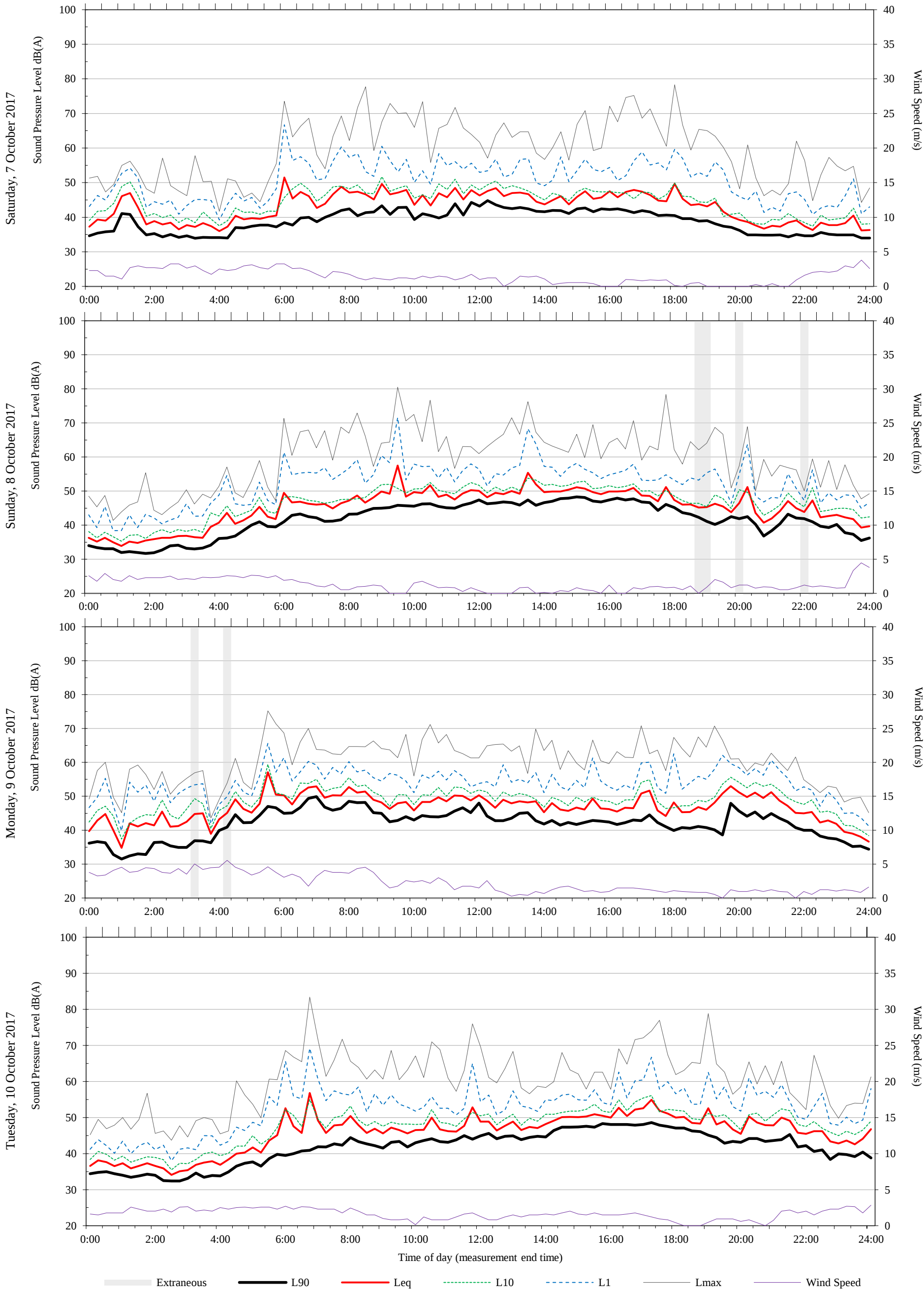


Appendix B

Daily Unattended Noise Logging
Results: Logger 2



Unattended monitoring: (Free Field)



Unattended monitoring: (Free Field)

