

15 January 2019

SY180872-AU

Mr Blake Welsh  
Lead Electrical Engineer - Power Systems  
Downer Group  
6-16 Galleghan Road  
Hexham NSW 2322

Dear Blake

**Re: Acoustic Report for Strathfield South Sub-Station**

We confirm that the acoustic assessments in the report has been carried out in accordance with the NSW Environment Protection Authority (EPA) Noise Policy for Industry (2017).

References were made in the report to the NSW Industrial Noise Policy under the headings "Strathfield Council Development Control Plan (2005)" and "Key messages by Ausgrid" for source document reference consistency.

Yours sincerely,



Riduan Osman  
Senior Acoustic Engineer  
Northrop Consulting Engineers Pty. Ltd.



# Construction Noise and Vibration Management Plan Strathfield South Sub-Station

7-9 Dunlop Street, Strathfield South NSW 2136

REPORT

## PREPARED FOR

Downer  
2/16 Galleghan Street  
Hexham NSW 2322

Tel: 02 9468 9700

Ref: SY180872-AUR02

Rev: B

Date: 04.11.2018

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# CONSTRUCTION NOISE MANAGEMENT PLAN

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## Activity Schedule

Date	Revision	Issue	Prepared By	Approved By
18.07.2018	A	Issued	I. Adlington, R. Osman	C. Pop
04.11.2018	B	Revised Issue	I. Adlington	R. Osman

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# TABLE OF CONTENTS

---

1. Introduction .....	3
2. Noise and Vibration .....	4
2.1 Existing Environment Noise and Vibration .....	4
2.2 Potential Noise Impacts During Construction .....	4
3. Construction Noise & Vibration Guidelines And Regulations .....	5
3.1 NSW Interim Construction Noise Guidelines .....	5
3.2 Vibration guidelines .....	6
3.3 Ausgrid Guidelines .....	6
4. Construction Noise and Vibration Control .....	8
4.1 Standard Hours for Construction Work .....	8
4.2 Airborne Construction Noise Affecting Nearby Properties .....	8
4.3 Noise Sensitive Receivers to the Site .....	10
4.4 Operator attended measurements .....	10
4.5 Long term noise monitoring .....	11
4.6 Noise Criteria at the nearest affected neighbouring properties .....	11
4.7 Equipment Noise Levels for the Proposed Construction Works .....	12
4.8 Temporary Sound and Dust Barrier Walls .....	12
4.9 Vibration Criteria .....	14
5. Community Engagement during Construction .....	17
5.1 Neighbouring Community Engagement .....	17
5.2 Keeping the Noise Affected Community Informed .....	17
5.3 Dealing with Community and public complaints .....	17
6. Training .....	18
7. Appendix A – Typical Sound Levels From Construction, Maintenance and Demolition Plant Noise & Vibration .....	19
8. Appendix B – Noise & Vibration Related Acronyms and Glossary .....	20

# 1. INTRODUCTION

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Northrop Consulting Engineers Pty Ltd (Northrop) Acoustics have been engaged by Downer to provide an demolition, excavation and construction noise and vibration management plan for Strathfield South substation to be located at 7-9 Dunlop Street, Strathfield South NSW 2136.

A demolition, excavation and construction noise and vibration management plan is a site specific plan developed to ensure that appropriate work practices are implemented during the demolition, excavation and construction to minimise noise and vibration impact. This document provides a construction noise management plan so as to comply with the DECCW Interim Construction Noise Guideline (July 2009).

Procedures for neighbouring community engagement and keeping noise and vibration affected neighbouring community informed are addressed in this construction noise management plan. Procedures on dealing with community complaints are also outlined in this construction noise management plan.

Measurement and reporting methodology and the relevant reporting procedures are provided in this construction noise management plan.

## 2. NOISE AND VIBRATION

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Northrop Consulting Engineers Pty Ltd (Northrop) Acoustics have been engaged by Downer to provide a demolition, excavation and construction noise and vibration management plan for Strathfield South substation to be located at 7-9 Dunlop Street, Strathfield South NSW 2136.

### 2.1 Existing Environment Noise and Vibration

The normal day time noise and vibration environment near the proposed substation site and feeder routes is primarily influenced by traffic flows, local fauna and industry.

The existing environment is characterised by a mix of commercial, light industrial, recreational areas and residential receivers.

Apart from residences potential sensitive receivers proximate to the project area include recreations users at Dean Reserve.

Northrop Consulting Engineers (Northrop) were engaged to undertake a Construction Noise and Vibration Impact Assessment (CNVIA) for the proposal (Appendix E).

An assessment of existing ambient noise levels was undertaken by Northrop. Noise levels were taken in proximity to the study area to characterise the background noise environment at nearest potential noise affected receivers and establish representative construction noise management levels for the proposal (refer to Figure 1 below).

### 2.2 Potential Noise Impacts During Construction

The normal day time noise and vibration environment near the proposed substation site and feeder routes is primarily influenced by traffic flows, local fauna and industry.

The Interim Construction Noise Guideline (ICNG) [i] outlines that a quantitative assessment must be undertaken where works are likely to affect an individual or sensitive land use for more than three weeks in total.

A specialist CNVIA was undertaken for the proposed construction works. The following activities were undertaken as part of the CNVIA:

- attended and unattended noise monitoring at locations indicative of noise sensitive receivers
- establishment of project specific airborne noise construction goals based on monitored existing noise levels
- prediction of construction noise levels from proposed construction works
- recommendation of environmental noise control options/management practices.

Noise impacts predicted are representative of peak noise generating construction works without implementation of any mitigation measures. As works progress, nearest receivers are anticipated to be less impacted by construction noise as the plant and equipment used during feeder pull, jointing and backfill phases of the joint works have lower noise levels and various mitigation measures would be implemented.

Construction noise is managed in accordance with the EPA Interim Construction Noise Guideline (ICNG, 2009) which provides management objectives for construction noise at non-residential land uses. The ICNG airborne noise goals are to be applied to assess noise impacts and determine the requirement for the reasonable and feasible management of construction noise to minimise potential for disturbance.

Site specific construction noise management levels have been established adopting the measured background noise levels and the ICNG corrections for the time of construction work.



## 3. CONSTRUCTION NOISE & VIBRATION GUIDELINES AND REGULATIONS

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Construction noise is one of the major environmental noise issues in NSW – not only from building works but also from demolition, remediation, renewal and maintenance.

Construction can generate high noise levels that can adversely affect:

- sleep
- concentration, and thus learning performance
- mental and physical health.

Construction can occur close to residences or other sensitive land uses and be variable in times of occurrence. These aspects of construction can exacerbate noise levels and their effects. Construction noise by its nature is temporary, may not be amenable to purpose-built noise control measures applied to industrial processes, and may move as construction progresses.

### 3.1 NSW Interim Construction Noise Guidelines

The Protection of the Environment Operations Act 1997 (NSW) Act is the key piece of environment protection legislation, and the Protection of the Environment Operations (Noise Control) Regulation 2008 (NSW) provides for inspection and testing of noise emissions.

The “Interim Construction Noise Guidelines” (published by the NSW Office of Environment and Heritage, 2009) deals with the assessment of noise from construction activities and advises on best practice approaches to minimise noise impacts. It is aimed at managing noise from construction works regulated by Office of Environment and Heritage, and is used to set statutory conditions in licences or other regulatory instruments.

Construction site operators must comply with the following construction noise and vibration control requirements from the Interim Construction Noise Guidelines (2009):

#### **17 Noise and vibration measures**

*17.1 Construction contractors are to implement the requirements of the DECCW interim Construction Noise Guideline (July 2009) “as far as practicable.*

*17.2 All reasonable, practicable steps are to be undertaken to reduce noise and vibration from the site.*

*17.3 Demolition noise is to be attenuated with the use of screening, acoustic enclosures, engine silencing and substitution by alternative processes to reduce noise emission levels from typical demolition equipment.*

*17.4 Plant and equipment is to be maintained, checked and calibrated in accordance with the appropriate design requirements and to ensure that maximum sound power levels are not exceeded.*

*17.6 Unnecessary noise is to be avoided when carrying out manual operations and operating plant.*

*17.7 Any equipment not used for extended periods is to be switched off.*

*17.8 The use of any rock excavation machinery or any mechanical pile drivers or the like would be restricted to the hours of 8:00am to 5:00pm (maximum) on Monday to Friday only, to minimise the noise levels during construction and loss of amenity to the surrounding area.*

*17.9 Rock breaking, rock hammering, sheet piling, pile-driving and any similar activity is to be scheduled only between the following hours unless otherwise approved:*

- 9am to 12pm, Monday to Friday;
- 2pm to 5pm, Monday to Friday; and
- 9am to 12pm, Saturday.

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

### 3.2 Vibration guidelines

The “Assessing vibration: A Technical Guideline” (published by the NSW Office of Environment and Heritage, 2006) is based on guidelines contained in BS 6472-1992, and presents preferred and maximum vibration values for use in assessing human responses to vibration and provides recommendations for measurement and evaluation techniques. It does not address motion sickness, occupational vibration, blasting vibration effects or vibration-induced damage to buildings or structures.

### 3.3 Ausgrid Guidelines

The following are the Ausgrid Guidelines for managing noise and vibration issues during construction.

What to do during planning:

- Be aware of any noise sensitive neighbours located near the proposed infrastructure (schools, child care centres, aged care facilities, churches etc).
- Consult noise sensitive stakeholders such as schools and aged care facilities before starting work in the area to identify special needs.
- Wherever possible, schedule noisy work near schools to occur during school holidays.
- Door knock affected residents and businesses where noise impacts are expected to be higher and/or extend for a longer period (e.g. joint bay construction). Provide information about the project and potential impacts during construction so they know what to expect.
- Conduct property condition (dilapidation) surveys before work begins that is likely to cause vibration. This will help to resolve any future property damage claims.
- Assess the need for temporary noise absorbing walls/barriers to be installed during construction.

What to do during construction:

- Notify affected residents and businesses about the work at least four business days before it is scheduled to start (including site establishment and work compounds). Four clear business days is required for noisy works outside normal operating hours.
- Provide regular updates and maintain communication with highly affected neighbours.
- Provide signage outside the worksite with the 24-hour contact number clearly displayed.
- Respond promptly to complaints. Monitor the number of complaints received.
- Consider using noise or vibration monitoring if there is a risk of vibration damage or that noise limits will be exceeded.
- Ensure work only occurs within standard work hours unless approval has been given to undertake out of hours work and local residents have been notified. This includes all deliveries to site.
- Ensure the construction team complies with respite period requirements where high impact works (e.g. rock breaking) affect someone for more than one week.
- Consider respite accommodation on a case-by-case basis in response to a request from an affected resident.
- Brief the local council and provide them with the 24-hour contact number in case people contact council to make a complaint.



Key messages by Ausgrid:

- Ausgrid is committed to minimising the impact of its activities on local communities. Anyone with questions or comments about the project should contact the 24-hour community information line.
- Ausgrid carries out an environmental assessment of all new projects which includes an assessment of potential noise impacts during construction and operation.
- Ausgrid applies the NSW Industrial Noise Policy to the operation of its assets.

## 4. CONSTRUCTION NOISE AND VIBRATION CONTROL

The following section addresses the site-specific construction noise and vibration criteria, measurement procedures and the various noise levels of construction equipment likely to be used at the site.

### 4.1 Standard Hours for Construction Work

The recommended standard hours for construction (including demolition and excavation) work are as follows

- Monday to Friday 7 am to 6 pm
- Saturday 8 am to 1 pm
- No work on Sundays or public holidays

Section 2.2 of the “DECC Interim Construction Noise Guideline” (2009) specifies five categories of work that might be taken outside the standard hours. The categories relevant to this project are:

- The delivery of oversized plant or structures that police or other authorities determine require special arrangements to transport along public roads.
- Emergency work to avoid loss of life or damage to property, or to prevent environmental harm.
- Maintenance and repair of public infrastructure where disruption to essential services and/or consideration of worker safety do not allow work within the standard hours.

Blasting during the construction work is not permitted for this project due to the proximity of residences and heritage buildings.

### 4.2 Airborne Construction Noise Affecting Nearby Properties

Table 1 below shows an extract from Table 2 of Section 4.1.1 of the “DECC Interim Construction Noise Guideline” (2009) which sets out the management levels for construction noise at residences and nearby properties. The determination of the Rated Background Noise Level (RBL) is shown in Section 4.4 below.

**Table 1:** Extract from Table 2 of Section 4.1.1 of the “DECC Interim Construction Noise Guideline” (2009)

Time of day	Management level $L_{Aeq(15\text{ min})}$ *	How to apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. - Where the predicted or measured $L_{Aeq(15\text{ min})}$ 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.

The Interim Construction Noise Guideline (DECC 2009) notes there may be some community reaction to noise from major construction projects where this is more than 10 decibels above the background noise level for work during the daytime. This recognises that construction noise is generally temporary with the community having a slightly higher tolerance for it.

The best management practices involve adopting particular operational procedures that minimise noise while retaining production efficiency. Some common noise reduction strategies include:

- Changing the activity to reduce the noise impact or disturbance (e.g. reorganising the way the activity is carried out).
- Choosing a suitable time — schedule noisy activity to less sensitive times of the day. There are sensitive times of the day for different people, for example, schools during the day, times of religious services, and residences during evenings and night. Where several noisy pieces of equipment are used, their operation should be scheduled to minimise impacts.
- Keeping neighbours informed of a planned noisy activity, its duration and the reasons for the activity. Neighbours may be more accepting of temporary noise if they know when and why the noise is happening, and how long it will last.
- Educating staff and contractors about noise and quiet work practices. This could include signage, for example, some construction sites have signs reminding contractors to consider neighbours and be quiet, and to not start noisy work too early (e.g. before 7.30 am).

Noise can be controlled in the transmission path by using separation distances, barriers and sound absorptive materials.

- Increasing the separation distance (distance attenuation) between the noise source and receiver reduces the noise level. As a rule of thumb, each doubling of the distance from a noise source equates to a reduction of sound pressure level of 6 dB (the inverse square law). This does not apply close to a loud noise source. It may also be affected by wind and temperature inversions for distances over 300 metres between the source and receiver.
- Careful site selection for a new noisy activity can help minimise noise impacts where it is possible to provide adequate separation distances. Taking advantage of topographic features by siting the noisy activity behind a hill can reduce the distance needed to adequately reduce noise levels.
- Barriers are most effective when they are located close to the noise source and block the line of sight between the source and receiver. The amount of noise reduction achieved depends on the height and mass of the barrier and the frequency of the noise (barriers are less effective for low-frequency noise). Noise barriers should have no gaps. Use of absorptive material on the side of the barrier facing the noise source can also help to reduce noise levels by reducing noise reflections.
- Materials commonly used for noise barriers include solid brick walls, concrete blocks or panels, earth mounds, trenches and cuttings. Natural topography and existing buildings can also provide an effective noise barrier and should be considered when developing a new noisy activity. Trees or other vegetation do not provide an effective noise barrier. Some limited attenuation may be gained where trees are densely planted but little attenuation is achieved for low frequencies.
- Sound-absorptive materials reduce the level of reflected sound. They are porous materials such as glass fibre, wool and mineral wool. Thin layers are capable of absorbing only high frequencies, whereas thicker layers can absorb a wider frequency range.

### 4.3 Noise Sensitive Receivers to the Site

The most impacted community during the construction phase of the development at 7-9 Dunlop Street are the residents at 130 and 148 Dean Street. Figure 1 below show the relative locations of the nearest affected properties and residences and measurement locations.



**Figure 1:** The proposed development is outlined in red, and the nearest affected residences are outlined in yellow. Long term logger measurement location is marked as L in green and operator attended measurements M1-3 in blue.

### 4.4 Operator attended measurements

Fifteen-minute attended measurements were conducted to verify unattended background noise levels, to establish the octave band noise levels and to characterise the acoustic environment around the site. Operator attended noise measurement survey was conducted with an integrating Type 1 sound level meter and windshield. Measurements were taken continuously and the microphone was set to receive direct frontal sound and facing the direction of sound emission.

The operator attended noise measurements were performed on Saturday 16<sup>th</sup> June 2018 and Wednesday 20<sup>th</sup> June 2018 at locations shown in Figure 1. Results are presented in Table 1 below.

**Table 1: Operator attended acoustic measurements results**

Measurement	Measurement date and time	L <sub>Aeq, 15 minute</sub> – dB(A)	L <sub>A10, 15 minute</sub> – dB(A)	L <sub>A90, 15 minute</sub> – dB(A)	Notes
M1	16/6/2018 7:21am – 7:36am	66	68	50	Truck noises
M2	20/6/2018 9:47am – 10:02am	51	52	49	Traffic noise
M3	20/6/2018 10:15am – 10:30am	58	62	49	Truck noises

#### 4.5 Long term noise monitoring

Automatic logging noise measurements were performed at the site to document the existing acoustic environment.

Long term noise monitoring was conducted between Friday 8<sup>th</sup> June 2018 and Wednesday 20<sup>th</sup> June 2018 at Logger location shown in Figure 1 above.

The results of the automatic logging measurements are shown in Table 1 below.

**Table 1: Long term noise monitoring results**

Location	Equivalent Continuous Noise Level			Rating Background Noise Level RBL		
	L <sub>Aeq,15min</sub> – dB(A)			L <sub>A90,15min</sub> – dB(A)		
	Day	Evening	Night	Day	Evening	Night
L	54	47	43	46	43	40

#### 4.6 Noise Criteria at the nearest affected neighbouring properties

The noise criteria derived from the measurements using NSW Noise Policy for Industry methodology at the nearest affected receiver is summarised in the Acoustic Report for Development Application prepared by Northrop Acoustics.

Based on the measurements and assessment undertaken in accordance with the NSW INP, the criteria for the project intrusiveness and amenity noise criteria (in bold) at the nearest affected residential property boundaries at the rear of 130 and 148 Dean Street are shown in Table 3 below.

**Table 3: Project specific noise levels (PSNL)**

Period	Descriptor	PSNL dB(A)
<b>Residential receivers</b>		
Day (7:00am to 6:00pm)	L <sub>Aeq,15min</sub>	<b>49</b>
Evening (6:00pm to 10:00pm)	L <sub>Aeq,15min</sub>	<b>37</b>
Night (10:00pm to 7:00am)	L <sub>Aeq,15min</sub>	<b>33</b>

The project specific noise level at the residential receivers during the day period (7am to 6pm, Monday to Saturday) is 49dB(A). The management trigger level as shown in Table 1 is PSNL + 10 dB L<sub>Aeq</sub> (15 min) which is 59dB<sub>L<sub>Aeq</sub> (15 min)</sub>.



## 4.7 Equipment Noise Levels for the Proposed Construction Works

The construction activities associated with the proposed development will consist of various plant and equipment as detailed above. The sound power levels of the noisy plant and equipment likely to be used during the construction works and the periods planned during which the equipment are planned to be used are provided below. The predicted noise levels at Nos.130 (house) and 148 (town-house) Dean Street, South Strathfield are based on the existing barriers at the site being in place for the duration of the construction period and shown in Table 4 below. Noise modelling prediction were made in accordance with the AS 1055.3.

**Table 4: Construction equipment & sound pressure levels at 10 metres in dB(A) and at the boundary with Nos.130 (house) and 148 (town-house) Dean Street, South Strathfield.**

Plant description	Typical A-weighted sound power levels $L_{WA}$ dB ref: $10^{-12}$ W	A-weighted sound pressure levels $L_{pA}$ (mid-point) dB at 10 m	A-weighted sound pressure levels $L_{pA}$ (mid-point) dB at 55 m (148 Dean St)	A-weighted sound pressure levels $L_{pA}$ (mid-point) dB at 70 m (130 Dean St)
Asphalt paver	108	80	60	58
Asphalt rotomill	111	83	63	61
Backhoe	104	76	57	55
Backhoe with auger	106	78	58	56
Bulldozer	108	80	60	58
Cherry picker	105	77	57	55
Compactor	113	85	65	63
Compressor (silenced)	101	73	53	51
Concrete agitator truck	109	76	61	59
Concrete pencil vibrator	103	75	55	53
Concrete pump truck	108	80	60	58
Crane (mobile)	104	76	56	54
Crane (tower)	105	77	57	55
Excavator	107	79	59	57
Filtration unit (40 000 cfm)	109	81	61	59
Forklift	106	78	58	56
Front end loader	113	85	65	63
Generator (diesel)	99	71	61	59
Grader	110	82	62	60
Hand tools (electric)	102	74	54	52
Hand tools (pneumatic)	116	88	68	66
Loader (wheeled)	105	77	57	55
Machine mounted hydraulic drill	113	85	65	63
Machine mounted percussive drill	116	88	68	66
Machine mounted pneumatic drill	116	88	68	66
Piling (bored)	111	83	63	61
Roller (vibratory)	108	80	60	58
Scraper	116	88	68	66
Truck (>20 tonne)	107	79	59	57
Truck (dump)	117	89	69	67
Vehicle (light commercial e.g. 4WD)	106	78	58	56
Welder	105	77	57	55

## 4.8 Temporary Sound and Dust Barrier Walls

It is recommended that a temporary sound barrier wall be erected for each stage of the project along part of the boundaries to block the direct line of sight between the noise generating activities on site and the residential buildings.



The height of the barrier shall be a minimum of 1.8 metre high. Retaining the barriers shown below will provide the desired noise barrier attenuation. With these noise barriers in position, the noise level from the construction works is not likely to exceed  $59\text{dB}_{\text{LAeq}} (15 \text{ min})$ .



Figure 2: Recommended minimum noise barriers during construction.

## 4.9 Vibration Criteria

### 4.9.1 Objectives

The management objective for the site is to limit vibration from construction activities so as to avoid building damage and human discomfort associated with the construction works. It is noted that buildings in the vicinity of development are residential and health buildings. Vibration impacts on the buildings and their occupants should be considered for the assessment of structural damage and human annoyance, respectively.

### 4.9.2 Vibration Sources

Typical vibration levels from construction plant equipment most likely to cause significant vibration are summarised below.

**Table 5: Typical ground vibration generated by construction plant**

Activity	Typical ground vibration
Bulldozers/ Excavators	Typical ground vibration from bulldozers range from 1mm/s to 2mm/s at distances of approximately 5m and at distances greater than 20m, vibration levels are usually below 0.2mm/s.
Jack Hammers	Typical ground vibrations from jack hammers are generally greater than 5mm/s at distances of 1m and no more than 2mm/s for distances of 5m or more.
Truck traffic	Typical vibration from heavy trucks passing over normal (smooth) road surfaces generate relatively low vibration in the range 0.01-0.2mm/s at the footings of buildings located 10-20m from a roadway. In general ground vibration from trucks is usually imperceptible in nearby buildings.

Therefore, vibration management strategies implemented on site shall consider these items of plant and construction activities involving these items of plant.

### 4.9.3 Vibration Criteria

The following criteria are considered applicable when assessing vibration emission levels from the construction works.

The effects of ground vibration on buildings near construction sites may be broadly defined by the following three categories:

1. Disturbance to building occupants - Vibration in which the occupants or users of the building are inconvenienced or possibly disturbed,
2. Effects on building contents - Vibration where the building contents may be affected, and,
3. Effects on building structures - Vibration in which the integrity of the building or structure itself may be prejudiced.

In general, vibration criteria for human disturbance (1) are more stringent than vibration criteria for effects on building contents (2) and building structural damage (3). Hence, compliance with the more stringent limits dictated by Category 1, would allow for compliance to be achieved for the other two categories.

#### Category 1 – Disturbance to Buildings Occupants

For disturbance to human occupants of buildings, we refer to the DECC's 'Assessing Vibration; a technical guideline', published in February 2006. This document provides criteria which are based on the British Standard BS 6472-1992, 'Evaluation of human exposure to vibration in buildings (1-80Hz)'.

Vibration sources are defined as *Continuous, Impulsive or Intermittent*. Section 2 of the technical guideline defines each type of vibration as follows:

**'Continuous** vibration continues uninterrupted for a defined period (usually throughout the day-time and/or night-time).

**Impulsive** vibration is 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.

**Intermittent** vibration can be defined as interrupted periods of continuous or repeated periods of impulsive vibration that varies significantly in magnitude’.

The criteria are to be applied to a single weighted root mean square (rms) acceleration source level in each orthogonal axis. Section 2.3 of the guideline states:

*‘Evidence from research suggests that there are summation effects for vibrations at different frequencies. Therefore, for evaluation of vibration in relation to annoyance and comfort, overall weighted rms acceleration values of the vibration in each orthogonal axis are preferred (BS 6472).’*

Preferred and maximum values for continuous and impulsive vibration are defined in below in Table 6 extracted from “Table 2.2 of the guideline” and the values for residential type buildings are reproduced below.

**Table 6: Preferred and maximum weighted rms values for continuous and impulsive vibration acceleration (m/s<sup>2</sup>) 1-80Hz**

Location	Assessment period <sup>1</sup>	Preferred values		Maximum values	
		z axis	x & y axis	z axis	x & y axis
<b>Continuous vibration</b>					
Residences	Daytime (7am-10pm)	0.010	0.0071	0.020	0.014
Offices	Daytime (7am-10pm)	0.020	0.014	0.040	0.028
<b>Impulsive vibration</b>					
Residences	Daytime (7am-10pm)	0.30	0.21	0.60	0.42
Offices	Daytime (7am-10pm)	0.64	0.46	1.28	0.92

Notes: 1. Daytime is 7.00 am to 10.00 pm and night-time is 10.00pm to 7.00 am

Intermittent vibration is to be assessed using vibration dose values (VDVs). The VDV method is a fourth power approach which is more sensitive to peaks in the acceleration waveform and makes corrections to the criteria based on the duration of the source’s operation. The VDV can be calculated using the overall weighted rms acceleration of the vibrating source in each orthogonal axis and the total period during which the vibration may occur. Weighting curves are provided in each orthogonal axis in the guideline. Preferred and maximum VDV values are defined in Table 7 below extracted from “Table 2.4 of the guideline” and VDV values for residential type buildings are reproduced below.

**Table 7: Acceptable vibration dose values for intermittent vibration (m/s<sup>1.75</sup>)**

Location	Daytime (7am-10pm) <sup>1</sup>		Night-time (10pm-7am) <sup>1</sup>	
	Preferred values	Maximum values	Preferred values	Maximum values
Residences	0.20	0.40	0.13	0.26
Offices	0.40	0.80	0.40	0.80

Notes: 1. Daytime is 7.00 am to 10.00 pm and night-time is 10.00pm to 7.00 am

#### 4.9.4 Buffer Distances for Vibration Control

The relationship between vibration and the probability of causing human annoyance or damage to structures is complex. This complexity is mostly due to the magnitude of the vibration source, the particular ground conditions between the source and receiver, the foundation-to-footing interaction and the large range of structures that exist



in terms of design (eg dimensions, materials, type and quality of construction and footing conditions). The intensity, duration, frequency content and number of occurrences of a vibration, all play an important role in both the annoyance caused and the strains induced in structures.

As the pattern of vibration radiation is very different to the pattern of airborne noise radiation, and is very site specific, below are some indicative minimum 'buffer' distances determined for some common construction plant with data available from recent projects, which assist to avoid human discomfort in terms of perceptible (or tactile) vibration during daytime construction hours:

**Table 8: Recommended Minimum Buffer Distances for Construction Plant**

Plant Item	Recommended Minimum Buffer Distance (m)
CFA (Continuous Flight Auger) Piling rig	10
Excavators	10
Jack hammers	5

From the above table the nearest receivers are less than 10m from the site, and as such, vibration may cause discomfort to occupants during piling activities. Therefore, site specific buffer distances should be determined for piling activities once vibration emission levels are measured from the piling rig prior to the commencement of its regular use on site.

#### 4.9.5 Vibration Management Measures

Further to buffer distances, to ensure vibration impacts are minimised during the construction period, the following vibration management control measures are provided:

1. The proper implementation of a vibration management plan is required to avoid adverse vibration disturbance to affected occupancies. Consultation with occupants and property owners is recommended and should be aimed at providing a communication path directly to the contractor.
2. A management procedure will be implemented to deal with vibration complaints. Each complaint will be investigated and where vibration levels are established as exceeding the set limits, appropriate amelioration measures shall be put in place to mitigate future occurrences
3. Where vibration is found to be excessive, management measures shall be implemented to ensure vibration compliance is achieved. Management measures may include modification of construction methods such as using smaller units, establishment of safe buffer zones and if necessary, time restrictions for the most excessive vibration activities. Time restrictions are to be negotiated with affected receivers.

## 5. COMMUNITY ENGAGEMENT DURING CONSTRUCTION

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### 5.1 Neighbouring Community Engagement

As a project moves towards the site preparation and construction phase more details normally becomes available on the planned work methods, location of plant and equipment, and scheduling. For the development construction works, contact with the nearest affected community is desirable once approval has been given to commence works and should be undertaken prior to any work beginning. The type of community engagement should relate to the likelihood and extent of noise and vibration impacts from the construction works.

The aim of community engagement is to:

- establish good working relationships between the developer, builder, the community and other stakeholders in relation to the construction project
- receive feedback on the project's environmental performance, discuss community concerns and identify opportunities for the resolution of community complaints and concerns
- gain advice on how best to communicate relevant information on the project and its environmental performance to the broader community
- work cooperatively towards outcomes of benefit to the project, immediate neighbours and the local and regional community.

The Building Contractor shall nominate one of its staff as a community liaison officer for the project as a point of contact for the community regarding issues related to the construction of the development, including issues relating to noise and vibration. The secondary contact for the nearest affected community and other members of the public would be the site manager of the site. Any formal complaints received regarding noise and vibration matters at the construction site shall be passed on to the Building Contractor for the complaints to be addressed and resolved.

### 5.2 Keeping the Noise Affected Community Informed

Being up-front with the noise affected community from the outset can assist in transferring information to the affected community. An example of being up-front is to present noise and vibration related information on the construction works to noise affected community before commencing works. The most noise sensitive properties likely to be most affected by site works and the operation of plant machinery particularly during the demolition and excavation phases are the residents at 130 and 148 Dean Street.

### 5.3 Dealing with Community and public complaints

Complaints from the community and public can arise when accidental or unintentional noise and/or vibration are generated due to unforeseen circumstances or error of judgement made by the construction team. The community and public are generally understanding when this happens once or not too often. The complaints must be handled in a serious and respectful way. The complaints should be recorded and logged in a noise and vibration complaints log book and followed up by the site manager.

Following resolution of the noise or vibration problem, the complainant should be informed of the remedial actions taken before the complaint can be recorded as being resolved.

## 6. TRAINING

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The site manager shall implement appropriate training and induction in the requirements of this construction noise management plan. All employees, contractors and utility staff working on site will undergo site induction training which includes Environmental Due Diligence Training. The induction will address:

- This Construction Noise Management Plan
- The Ausgrid Guidelines
- The existence of noise legislation and what this means for the project, i.e. OEH and Noise Management Levels
- Delivery hours and locations.
- Reporting and recording environmental incidents related to noise and vibration.
- Noise and vibration minimisation measures.
- The importance of regular maintenance noise and vibration generating plant.

Records will be kept of all personnel undertaking the site induction and training, including the contents of the training, date and name of trainer/s.

Key staff will undertake more comprehensive training relevant to their position and/or responsibility. This training may be provided as “toolbox” talk training.



## 7. APPENDIX A – TYPICAL SOUND LEVELS FROM CONSTRUCTION, MAINTENANCE AND DEMOLITION PLANT NOISE & VIBRATION

The noise generated by machinery such as construction, maintenance and demolition plant may be expressed in terms of the A-weighted sound pressure level measured at some distance from the machine, or in terms of the A-weighted sound power level. The table below extracted from the Australian Standard “AS 2436-2010 Guide to noise and vibration control on construction, demolition and maintenance sites” lists typical construction plant and equipment and the range of sound power levels and mid-point sound pressure levels at 10 metres.

(from Appendix A - AS 2436-2010)

Plant description	A-weighted sound power levels $L_{WA}$ dB ref: $10^{-12}$ W		A-weighted sound pressure levels $L_{PA}$ (mid-point) dB at 10 m
	Typical or Range	Typical (mid-point)	
Asphalt paver	103-112	108	80
Asphalt rotomill	111	111	83
Backhoe	100-108	104	76
Backhoe with auger	100-111	106	78
Bulldozer	102-114	108	80
Cherry picker	105	105	77
Compactor	110-115	113	85
Compressor (silenced)	93-110	101	73
Concrete agitator truck	107-111	109	76
Concrete pencil vibrator	101-105	103	75
Concrete pump truck	103-113	108	80
Concrete saw	112-122	117	89
Concrete vibratory screed	115	115	87
Crane (mobile)	95-113	104	76
Crane (tower)	105	105	77
Excavator	97-117	107	79
Filtration unit (40 000 cfm)	109	109	81
Forklift	106	106	78
Front end loader	110-115	113	85
Generator (diesel)	84-113	99	71
Grader	105-115	110	82
Gritblaster (grit & nozzle air noise)	129	129	101
Hand tools (electric)	95-110	102	74
Hand tools (pneumatic)	114-117	116	88
Jack hammers	121	121	93
Loader (wheeled)	99-111	105	77
Machine mounted hydraulic drill	110-115	113	85
Machine mounted percussive drill	116	116	88
Machine mounted pneumatic drill	110-121	116	88
Piling (bored)	111	111	83
Piling (impact sheet) ( $L_{max}$ )	126-147	137	109
Piling (vibratory)	116-133	125	97
Rock breaker	118	118	90
Roller (vibratory)	103-112	108	80
Scraper	116	116	88
Spreader	95	95	67
Truck (>20 tonne)	107	107	79
Truck (dump)	117	117	89
Truck (water cart)	106-108	107	79
Vehicle (light commercial e.g. 4WD)	100-111	106	78
Welder	100-110	105	77

## 8. APPENDIX B – NOISE & VIBRATION RELATED ACRONYMS AND GLOSSARY

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ABL - The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10th percentile (lowest 10th percent) background level ( $L_{A90}$ ) for each period.

DECCW NSW - Department of Environment, Climate Change and Water (see OEH below).

DP&I NSW - Department of Planning and Infrastructure (formerly DOP).

EPL - Environmental Protection Licence, issued by OEH.

$L_{A1}$  - The  $L_{A1}$  level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the  $L_{A1}$  level for 99% of the time.

$L_{A10}$  - The  $L_{A10}$  level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the  $L_{A10}$  level for 90% of the time. The  $L_{A10}$  is a common noise descriptor for environmental noise and road traffic noise.

$L_{Aeq}$  - The equivalent continuous sound level ( $L_{Aeq}$ ) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

$L_{A50}$  - The  $L_{A50}$  level is the noise level which is exceeded for 50% of the sample period. During the sample period, the noise level is below the  $L_{A50}$  level for 50% of the time.

$L_{A90}$  - The  $L_{A90}$  level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the  $L_{A90}$  level for 10% of the time. This measure is commonly referred to as the background noise level.

$L_{Amax}$  - The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

$L_{pA}$  dB - The A-weighted sound pressure measured at a particular location referenced to 20  $\mu$ Pa.

$L_{wA}$  dB - The A-weighted sound power generated by a machine or plant referenced to  $10^{-12}$  W.

OEH - Office of Environment and Heritage (formerly DECCW)

RBL - The Rating Background Level for each period is the median value of the ABL values for the period over all the days measured. There is therefore an RBL value for each period – daytime, evening and night time.



# Acoustic Report for Strathfield South Sub-Station

7-9 Dunlop Street, Strathfield South NSW 2136

REPORT

## PREPARED FOR

Downer  
2/16 Galleghan Street  
Hexham NSW 2322

Tel: 02 9468 9700

Ref: SY180872-AUR01

Rev: D

Date: 14.12.2018

## PREPARED BY

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# ACOUSTIC REPORT FOR AUSGRID SOUTH STRATHFIELD

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## Activity Schedule

Date	Revision	Issue	Prepared By	Approved By
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17.07.2018	B	Issued	I. Adlington, R. Osman	C. Pop
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# TABLE OF CONTENTS

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1. Executive summary .....	3
2. Site description .....	4
2.1 Existing Site and Neighbouring Properties .....	4
2.2 Existing Environment Noise and Vibration .....	5
3. Site measurements .....	6
3.1 Instrumentation .....	6
3.1 Operator attended measurements .....	6
3.2 Long term noise logging .....	6
4. Environmental noise criteria for the Development .....	8
4.1 Strathfield Council Development Control Plan (2005) .....	8
4.2 NSW EPA Noise Policy for Industry 2017 .....	8
4.3 Compliance with noise criteria acoustic assessment .....	10
5. Construction Noise & Vibration Guidelines And Regulations .....	11
5.1 NSW Interim Construction Noise Guidelines .....	11
5.2 Vibration guidelines .....	12
5.3 Ausgrid Guidelines .....	12
6. Construction Noise and Vibration Control .....	14
6.1 Standard Hours for Construction Work .....	14
6.2 Airborne Construction Noise Affecting Nearby Properties .....	14
6.3 Noise Sensitive Receivers to the Site .....	16
6.4 Noise Criteria at the nearest affected neighbouring properties .....	16
6.5 Equipment Noise Levels for the Proposed Construction Works .....	17
6.6 Temporary Sound and Dust Barrier Walls .....	19
6.7 Vibration Criteria .....	21
7. Community Engagement during Construction .....	24
7.1 Neighbouring Community Engagement .....	24
7.2 Keeping the Noise Affected Community Informed .....	24
7.3 Dealing with Community and public complaints .....	24
8. Training .....	25
9. Conclusion .....	26
Appendix A – long term noise monitoring .....	27
Appendix B – Typical Sound Levels From Construction, Maintenance and Demolition Plant Noise & Vibration .....	41
Appendix C – Noise & Vibration Related Acronyms and Glossary .....	42



# 1. EXECUTIVE SUMMARY

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Northrop Consulting Engineers Pty Ltd (Northrop) Acoustics have been engaged by Downer to provide an acoustic report for the Strathfield South substation to be located at 7-9 Dunlop Street, Strathfield South NSW 2136, to be used in the Review of Environmental Factors for the project under Part 5 of the Environmental Planning and Assessment Act, 1979

This assessment discusses the potential noise impact from the development on the nearest most-affected receivers.

This assessment has been prepared considering the following documentation:

- Strathfield Council Development Control Plan (DCP) 2005
- Strathfield Local Environmental Plan 2012
- NSW Environment Protection Authority (EPA) Noise Policy for Industry 2017
- NSW Environment Protection Authority (EPA) Interim Construction Noise Guideline (ICNG) 2009
- Architectural Drawings provided by Downer Group

This report provides:

- A statement of compliance with the relevant statutory criteria for the proposed development within the vicinity of the nearest potentially affected receivers.
- Recommendations for noise mitigation measures for the proposed development in order to meet the relevant criteria when compliance is not achieved.

This report is based on our understanding of the proposed project, application of the relevant state guidelines and professional experience within the acoustic field.

The following documentation has been used for the preparation of this report:

- Site drawings presenting the location of the proposed development in relation to the nearest receivers
- Noise data collected on site through the use of long term noise loggers and a hand held sound level meter for spectrum analysis
- Architectural drawings provided by Downer Group



## 2. SITE DESCRIPTION

### 2.1 Existing Site and Neighbouring Properties

The proposed site (shown in red) is located at 7-9 Dunlop Street, Strathfield South. The nearest affected residential receivers are 130 and 148 Dean Street, shown in yellow in Figure 1. Figure 1 also shows the locations of the long-term noise monitor and operator attended measurements.

The Site is zoned SP2 – Infrastructure and is surrounded by IN1 General Industrial, RE1 – Public Recreation, R2 Low Density Residential and R3 Medium Density Residential zoned land. (Strathfield Local Environmental Plan 2012 Land Zoning Map - Sheet LZN\_006).



**Figure 1** : Aerial view of site. The proposed development is outlined in red sharing boundaries with industrial premises to the north and south. The nearest affected residences are outlined in yellow and the Active Recreation Area circled in brown. Long term logger measurement location is marked as L in green and operator attended measurements M1-3 in blue.

## 2.2 Existing Environment Noise and Vibration

The normal day time noise and vibration environment near the proposed substation site and feeder routes is primarily influenced by traffic flows, local fauna and industry.

The existing environment is characterised by a mix of commercial, light industrial, recreational areas and residential receivers.

Apart from residences potential sensitive receivers proximate to the project area include recreations users at Dean Reserve.

## 3. SITE MEASUREMENTS

### 3.1 Instrumentation

The survey was conducted with the following instruments:

- Rion NL-52 Type 1 noise logging sound level meter
- NTI Precision Integrating Octave Band Sound Level Meter, Type XL2 with 1/3 Oct band filter unit, which conforms to applicable standards of IEC 61672-1:2002-05 CLASS1 & IEC 60651 TYPE1.

All equipment was calibrated before and after the measurements using a Brüel & Kjær Acoustic Calibrator. No calibration deviations were recorded.

### 3.1 Operator attended measurements

Fifteen-minute attended measurements were conducted to verify unattended background noise levels, to establish the octave band noise levels and to characterise the acoustic environment around the site. Operator attended noise measurement survey was conducted with an integrating Type 1 sound level meter and windshield. Measurements were taken continuously and the microphone was set to receive direct frontal sound and facing the direction of sound emission.

The operator attended noise measurements were performed on Saturday 16<sup>th</sup> June 2018 and Wednesday 20<sup>th</sup> June 2018 at locations shown in Figure 1 above. Results are presented in Table 1 below.

**Table 1: Operator attended measurements 26/7/18**

Measurement	Measurement date and time	L <sub>Aeq, 15 minute</sub> – dB(A)	L <sub>A10, 15 minute</sub> – dB(A)	L <sub>A90, 15 minute</sub> – dB(A)	Notes
M1	16/6/2018 7:21am – 7:36am	66	68	50	Truck noises
M2	20/6/2018 9:47am – 10:02am	51	52	49	Traffic noise
M3	20/6/2018 10:15am – 10:30am	58	62	49	Truck noises

### 3.2 Long term noise logging

Automatic logging noise measurements were performed at the site to document the existing acoustic environment.

Long term noise monitoring was conducted between Friday 8<sup>th</sup> June 2018 and Wednesday 20<sup>th</sup> June 2018 at Logger location shown in Figure 1 above. Detailed results of the logger measurements are shown in Appendix 1.

The results of the automatic logging measurements are shown in Table 2 below.

**Table 2: Long term noise monitoring results**

Location	Equivalent Continuous Noise Level			Rating Background Noise Level RBL		
	L <sub>Aeq,15min</sub> – dB(A)			L <sub>A90,15min</sub> – dB(A)		
	Day	Evening	Night	Day	Evening	Night
L	54	47	43	46	43	40

The L<sub>A90</sub> rating background noise levels were determined using the methodology as described in Section 3.1 of the NSW EPA Noise Policy for Industry.

## 4. ENVIRONMENTAL NOISE CRITERIA FOR THE DEVELOPMENT

---

### 4.1 Strathfield Council Development Control Plan (2005)

The following is an excerpt from the Strathfield Council Development Control Plan (2005) Part D – Industrial Development:

#### **2.14 Air, Noise and Water Pollution**

##### **Objective:**

*To ensure industrial developments do not create a pollution problem by the discharge of an unacceptable level of air, noise and/or water emissions.*

##### **Guidelines:**

#### **2.14.1 General**

*1. The emission of any air impurities including offensive odours, the discharge of any waste into any waters or the emission of noise associated with any development shall not contravene the Protection of the Environment Operations Act 1997.*

#### **2.14.2 Noise**

*2. The proximity of the proposal to residential areas will influence the type of land use or machinery that will be permissible.*

*3. The proposed building(s) must be designed (orientated, insulated etc) to inhibit the transmission of noise. Hours of operation and access to the site through residential streets may be restricted where the proposed development involves the generation of noise likely to affect residential areas. Council may require an acoustic report from a suitably qualified acoustic consultant where a proposed development may create excessive noise.*

*4. The use of the premises including plant and equipment will be subject to strict compliance with the NSW Environmental Protection Authority's Environmental Noise Control Manual and the Industrial Noise Policy 2000.*

### 4.2 NSW EPA Noise Policy for Industry 2017

The NSW Environment Protection Authority (EPA) Noise Policy for Industry (2017) sets out noise criteria to control the noise emission from industrial noise sources. Mechanical and operational noise from the development shall be addressed following the guideline in the NSW EPA Noise Policy for Industry.

The calculation is based on the results of the ambient and background noise unattended monitoring, addressing two components:

- Controlling intrusive noise into nearby residences (Intrusiveness Criteria)
- Maintaining noise level amenity for particular land uses (Amenity Criteria)

Once both criteria are established the most stringent for each considered assessment period (day, evening, night) is adopted as the project-specific noise level (PSNL).

#### 4.2.1 Intrusiveness Criteria

The NSW EPA Noise Policy states the following:

*“The intrusiveness of an industrial noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented*

by the  $L_{Aeq}$  descriptor), measured over a 15-minute period, does not exceed the background noise level measured in the absence of the source by more than 5 dB(A).”

The intrusiveness criterion can be summarised as  $L_{Aeq, 15 \text{ minute}} \leq \text{RBL background noise level plus } 5 \text{ dB(A)}$ .

**Table 3: EPA Noise Policy intrusiveness criteria**

Period	Noise Descriptor – dB(A)	Noise Criteria – dB(A)
Day (Mon-Sat 7:00am to 6:00pm) Day (Sunday 8:00am to 6:00pm)	$L_{Aeq, 15min} \leq \text{RBL} + 5$	51
Evening (6:00pm to 10:00pm)	$L_{Aeq, 15min} \leq \text{RBL} + 5$	48
Night (Sun-Fri 10:00pm to 7:00am) Night (Sat 10:00pm to Sun 8:00am)	$L_{Aeq, 15min} \leq \text{RBL} + 5$	45

#### 4.2.2 Amenity Criteria

The NSW EPA Noise Policy states the following:

*“To limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in Table 2.1 of the INP. Meeting the acceptable noise levels in table 2.1 will protect against noise impacts such as speech interference, community annoyance and to some extent sleep disturbance. These levels represent best practice for assessing industrial noise sources, based on research and a review of assessment practices used overseas and within Australia.”*

The applicable parts of Table 2.1: Recommended  $L_{Aeq}$  Noise Levels from Industrial Noise Sources – dB(A) from the Noise Policy for Industry which are relevant to the project are reproduced in Table 4 below:

**Table 4: Amenity criteria for external noise levels**

Type of Receiver	Time of Day	Recommended Amenity Noise Level, $L_{Aeq}$ dB(A)
Suburban residential	Day	55
	Evening	45
	Night	40
Active Recreation Area (e.g, school playground & golf course)	When in use	55
Commercial premises	When in use	65
Industrial premises	When in use	70

#### 4.2.3 Project Specific Noise Levels (PSNL)

The following criteria is applicable for the external noise emissions from the development, as detailed below in Table 5. These project specific noise levels are in accordance with the requirements of the NSW INP, and shall be assessed to the most affected point on or within the nearest noise sensitive receiver.



**Table 5: Project specific noise levels**

Period	Descriptor	PSNL dB(A)
<b>Residential receivers</b>		
Day (7:00am to 6:00pm)	$L_{Aeq,15min}$	<b>51</b>
Evening (6:00pm to 10:00pm)	$L_{Aeq,15min}$	<b>48</b>
Night (10:00pm to 7:00am)	$L_{Aeq,15min}$	<b>45</b>
<b>Active Recreation Area</b>		
When in use	$L_{Aeq,15min}$	<b>55</b>
<b>Commercial receivers</b>		
When in use	$L_{Aeq,15min}$	<b>65</b>
<b>Industrial receivers</b>		
When in use	$L_{Aeq,15min}$	<b>70</b>

### 4.3 Compliance with noise criteria acoustic assessment

In accordance with the NSW EPA Noise Policy for Industry, the criteria for the project's intrusiveness and amenity noise criteria at the boundaries of the nearest affected have been determined. Acoustic compliance with the noise criteria determined by long-term sound logger measurements as per the Noise Policy for Industry can be achieved.

Two transformers are proposed at the site. The **Sound Power Level** of each of the transformers at 105% of the rated tapping voltage is 73 dB(A), so in combination, 76 dB(A).

Noise modelling prediction were made in accordance with the AS 1055.3.

A summary of the Predicted Noise Impact ( $L_{Aeq, 15min}$ ) and the compliance status at the nearest affected receivers are as follows.

Receiver Location	Predicted Noise Impact $L_{Aeq,15min}$ – dB(A)	Adopted Operational Noise Criterion	Criteria Compliance
R1 – 130 Dean Street (residence)	32	40 dB(A) $L_{Aeq}$	<b>Yes</b>
R2 – 148 Dean Street (residence)	33	40 dB(A) $L_{Aeq}$	<b>Yes</b>
R3 – 11 Dunlop Street (commercial)	54	65 dB(A) $L_{Aeq}$	<b>Yes</b>

Compliance with the Adopted Operational Noise Criterion for the nearest affected residences at 130 and 148 Dean Street and the commercial property at 11 Dunlop Street is achieved.

## 5. CONSTRUCTION NOISE & VIBRATION GUIDELINES AND REGULATIONS

---

Construction noise is one of the major environmental noise issues in NSW – not only from building works but also from demolition, remediation, renewal and maintenance.

Construction can generate high noise levels that can adversely affect:

- sleep
- concentration, and thus learning performance
- mental and physical health.

Construction can occur close to residences or other sensitive land uses and be variable in times of occurrence. These aspects of construction can exacerbate noise levels and their effects. Construction noise by its nature is temporary, may not be amenable to purpose-built noise control measures applied to industrial processes, and may move as construction progresses.

### 5.1 NSW Interim Construction Noise Guidelines

The Protection of the Environment Operations Act 1997 (NSW) Act is the key piece of environment protection legislation, and the Protection of the Environment Operations (Noise Control) Regulation 2008 (NSW) provides for inspection and testing of noise emissions.

The “Interim Construction Noise Guidelines” (published by the NSW Office of Environment and Heritage, 2009) deals with the assessment of noise from construction activities and advises on best practice approaches to minimise noise impacts. It is aimed at managing noise from construction works regulated by Office of Environment and Heritage, and is used to set statutory conditions in licences or other regulatory instruments.

Construction site operators must comply with the following construction noise and vibration control requirements from the Interim Construction Noise Guidelines (2009):

#### **“ 17 Noise and vibration measures**

*17.1 Construction contractors are to implement the requirements of the DECCW interim Construction Noise Guideline (July 2009) as far as practicable.*

*17.2 All reasonable, practicable steps are to be undertaken to reduce noise and vibration from the site.*

*17.3 Demolition noise is to be attenuated with the use of screening, acoustic enclosures, engine silencing and substitution by alternative processes to reduce noise emission levels from typical demolition equipment.*

*17.4 Plant and equipment is to be maintained, checked and calibrated in accordance with the appropriate design requirements and to ensure that maximum sound power levels are not exceeded.*

*17.6 Unnecessary noise is to be avoided when carrying out manual operations and operating plant.*

*17.7 Any equipment not used for extended periods is to be switched off.*

*17.8 The use of any rock excavation machinery or any mechanical pile drivers or the like would be restricted to the hours of 8:00am to 5:00pm (maximum) on Monday to Friday only, to minimise the noise levels during construction and loss of amenity to the surrounding area.*

*17.9 Rock breaking, rock hammering, sheet piling, pile-driving and any similar activity is to be scheduled only between the following hours unless otherwise approved:*

- 9am to 12pm, Monday to Friday;
- 2pm to 5pm, Monday to Friday; and
- 9am to 12pm, Saturday.

17.10 For activities where acoustic controls and management techniques still cannot guarantee compliant noise levels, a notification process would be implemented whereby nearby development would be made aware of the time and duration of noise intensive construction processes.”

## 5.2 Vibration guidelines

The “Assessing vibration: A Technical Guideline” (published by the NSW Office of Environment and Heritage, 2006) is based on guidelines contained in BS 6472-1992, and presents preferred and maximum vibration values for use in assessing human responses to vibration and provides recommendations for measurement and evaluation techniques. It does not address motion sickness, occupational vibration, blasting vibration effects or vibration-induced damage to buildings or structures.

## 5.3 Ausgrid Guidelines

The following are the Ausgrid Guidelines for managing noise and vibration issues during construction.

What to do during planning:

- Be aware of any noise sensitive neighbours located near the proposed infrastructure (schools, child care centres, aged care facilities, churches etc).
- Consult noise sensitive stakeholders such as schools and aged care facilities before starting work in the area to identify special needs.
- Wherever possible, schedule noisy work near schools to occur during school holidays.
- Door knock affected residents and businesses where noise impacts are expected to be higher and/or extend for a longer period (e.g. joint bay construction). Provide information about the project and potential impacts during construction so they know what to expect.
- Conduct property condition (dilapidation) surveys before work begins that is likely to cause vibration. This will help to resolve any future property damage claims.
- Assess the need for temporary noise absorbing walls/barriers to be installed during construction.

What to do during construction:

- Notify affected residents and businesses about the work at least four business days before it is scheduled to start (including site establishment and work compounds). Four clear business days is required for noisy works outside normal operating hours.
- Provide regular updates and maintain communication with highly affected neighbours.
- Provide signage outside the worksite with the 24-hour contact number clearly displayed.
- Respond promptly to complaints. Monitor the number of complaints received.
- Consider using noise or vibration monitoring if there is a risk of vibration damage or that noise limits will be exceeded.
- Ensure work only occurs within standard work hours unless approval has been given to undertake out of hours work and local residents have been notified. This includes all deliveries to site.
- Ensure the construction team complies with respite period requirements where high impact works (e.g. rock breaking) affect someone for more than one week.
- Consider respite accommodation on a case-by-case basis in response to a request from an affected resident.
- Brief the local council and provide them with the 24-hour contact number in case people contact council to make a complaint.

Key messages by Ausgrid:

- Ausgrid is committed to minimising the impact of its activities on local communities. Anyone with questions or comments about the project should contact the 24-hour community information line.
- Ausgrid carries out an environmental assessment of all new projects which includes an assessment of potential noise impacts during construction and operation.
- Ausgrid applies the NSW Industrial Noise Policy to the operation of its assets.

## 6. CONSTRUCTION NOISE AND VIBRATION CONTROL

The following section addresses the site-specific construction noise and vibration criteria, measurement procedures and the various noise levels of construction equipment likely to be used at the site.

### 6.1 Standard Hours for Construction Work

The recommended standard hours for construction (including demolition and excavation) work are as follows

- Monday to Friday 7 am to 6 pm
- Saturday 8 am to 1 pm
- No work on Sundays or public holidays

Section 2.2 of the “DECC Interim Construction Noise Guideline” (2009) specifies five categories of work that might be taken outside the standard hours. The categories relevant to this project are:

- The delivery of oversized plant or structures that police or other authorities determine require special arrangements to transport along public roads.
- Emergency work to avoid loss of life or damage to property, or to prevent environmental harm.
- Maintenance and repair of public infrastructure where disruption to essential services and/or consideration of worker safety do not allow work within the standard hours.

Blasting during the construction work is not permitted for this project due to the proximity of residences and heritage buildings.

### 6.2 Airborne Construction Noise Affecting Nearby Properties

Table 6 below shows an extract from Table 2 of Section 4.1.1 of the “DECC Interim Construction Noise Guideline” (2009) which sets out the management levels for construction noise at residences and nearby properties. The determination of the Rated Background Noise Level (RBL) is shown in Section 4.4 below.

**Table 6:** Extract from Table 2 of Section 4.1.1 of the “DECC Interim Construction Noise Guideline” (2009)

Time of day	Management level $L_{Aeq(15\ min)}$ *	How to apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	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.



The Interim Construction Noise Guideline (DECC 2009) notes there may be some community reaction to noise from major construction projects where this is more than 10 decibels above the background noise level for work during the daytime. This recognises that construction noise is generally temporary with the community having a slightly higher tolerance for it.

The best management practices involve adopting particular operational procedures that minimise noise while retaining production efficiency. Some common noise reduction strategies include:

- Changing the activity to reduce the noise impact or disturbance (e.g. reorganising the way the activity is carried out).
- Choosing a suitable time — schedule noisy activity to less sensitive times of the day. There are sensitive times of the day for different people, for example, schools during the day, times of religious services, and residences during evenings and night. Where several noisy pieces of equipment are used, their operation should be scheduled to minimise impacts.
- Keeping neighbours informed of a planned noisy activity, its duration and the reasons for the activity. Neighbours may be more accepting of temporary noise if they know when and why the noise is happening, and how long it will last.
- Educating staff and contractors about noise and quiet work practices. This could include signage, for example, some construction sites have signs reminding contractors to consider neighbours and be quiet, and to not start noisy work too early (e.g. before 7.30 am).

Noise can be controlled in the transmission path by using separation distances, barriers and sound absorptive materials.

- Increasing the separation distance (distance attenuation) between the noise source and receiver reduces the noise level. As a rule of thumb, each doubling of the distance from a noise source equates to a reduction of sound pressure level of 6 dB (the inverse square law). This does not apply close to a loud noise source. It may also be affected by wind and temperature inversions for distances over 300 metres between the source and receiver.
- Careful site selection for a new noisy activity can help minimise noise impacts where it is possible to provide adequate separation distances. Taking advantage of topographic features by siting the noisy activity behind a hill can reduce the distance needed to adequately reduce noise levels.
- Barriers are most effective when they are located close to the noise source and block the line of sight between the source and receiver. The amount of noise reduction achieved depends on the height and mass of the barrier and the frequency of the noise (barriers are less effective for low-frequency noise). Noise barriers should have no gaps. Use of absorptive material on the side of the barrier facing the noise source can also help to reduce noise levels by reducing noise reflections.
- Materials commonly used for noise barriers include solid brick walls, concrete blocks or panels, earth mounds, trenches and cuttings. Natural topography and existing buildings can also provide an effective noise barrier and should be considered when developing a new noisy activity. Trees or other vegetation do not provide an effective noise barrier. Some limited attenuation may be gained where trees are densely planted but little attenuation is achieved for low frequencies.
- Sound-absorptive materials reduce the level of reflected sound. They are porous materials such as glass fibre, wool and mineral wool. Thin layers are capable of absorbing only high frequencies, whereas thicker layers can absorb a wider frequency range.

### 6.3 Noise Sensitive Receivers to the Site

The most impacted community during the construction phase of the development at 7-9 Dunlop Street are the residents at 130 and 148 Dean Street. Figure 1 above show the relative locations of the nearest affected properties and residences and measurement locations.

### 6.4 Noise Criteria at the nearest affected neighbouring properties

The noise criteria derived from the measurements using NSW Noise Policy for Industry methodology at the nearest affected receiver is summarised in Section 4 above.

The operator attended noise measurements were performed on Saturday 16<sup>th</sup> June 2018 and Wednesday 20<sup>th</sup> June 2018 are presented in Table 1 above.

Long term noise monitoring was conducted between Friday 8<sup>th</sup> June 2018 and Wednesday 20<sup>th</sup> June 2018 and the results of the automatic logging measurements are shown in Table 2 above.

Based on the measurements and assessment undertaken in accordance with the NSW INP, the criteria for the project intrusiveness and amenity noise criteria (in bold) at the nearest affected residential property boundaries at the rear of 130 and 148 Dean Street are shown in Table 3 below.

Table 7: Project specific noise levels (PSNL)

Period	Descriptor	PSNL dB(A)
<b>Residential receivers</b>		
Day (7:00am to 6:00pm)	$L_{Aeq,15min}$	<b>51</b>
Evening (6:00pm to 10:00pm)	$L_{Aeq,15min}$	<b>48</b>
Night (10:00pm to 7:00am)	$L_{Aeq,15min}$	<b>45</b>

The project specific noise level at the residential receivers during the day period (7am to 6pm, Monday to Saturday) is 49dB(A). The management trigger level as shown in Table 1 is PSNL + 10 dB  $L_{Aeq}$  (15 min) which is 61dB $L_{Aeq}$  (15 min).

## 6.5 Equipment Noise Levels for the Proposed Construction Works

The construction activities associated with the proposed development will consist of various plant and equipment as detailed above. The sound power levels of the noisy plant and equipment likely to be used during the construction works and the periods planned during which the equipment are planned to be used are provided below. The predicted noise levels at Nos.130 (house) and 148 (town-house) Dean Street, South Strathfield are based on the existing barriers at the site being in place for the duration of the construction period and shown in Table 8 below. Noise modelling prediction were made in accordance with the AS 1055.3.

**Table 8: Construction equipment & sound pressure levels at 10 metres in dB(A) and at the boundary with Nos.130 (house) and 148 (town-house) Dean Street, South Strathfield.**

Plant description	Typical A-weighted sound power levels $L_{WA}$ dB ref: $10^{-12}$ W	A-weighted sound pressure levels $L_{pA}$ (mid-point) dB at 10 m	A-weighted sound pressure levels $L_{pA}$ (mid-point) dB at 55 m (148 Dean St)	A-weighted sound pressure levels $L_{pA}$ (mid-point) dB at 70 m (130 Dean St)
Asphalt paver	108	80	60	58
Asphalt rotomill	111	83	63	61
Backhoe	104	76	57	55
Backhoe with auger	106	78	58	56
Bulldozer	108	80	60	58
Cherry picker	105	77	57	55
Compactor	113	85	65	63
Compressor (silenced)	101	73	53	51
Concrete agitator truck	109	76	61	59
Concrete pencil vibrator	103	75	55	53
Concrete pump truck	108	80	60	58
Crane (mobile)	104	76	56	54
Crane (tower)	105	77	57	55
Excavator	107	79	59	57
Excavator 23tonne	113	85	65	63
Filtration unit (40 000 cfm)	109	81	61	59
Forklift	106	78	58	56
Front end loader	113	85	65	63
Generator (diesel)	99	71	61	59
Grader	110	82	62	60
Hand tools (electric)	102	74	54	52
Hand tools (pneumatic)	116	88	68	66
Loader (wheeled)	105	77	57	55
Machine mounted hydraulic drill	113	85	65	63
Machine mounted percussive drill	116	88	68	66
Machine mounted pneumatic drill	116	88	68	66
Piling (bored)	111	83	63	61
Roller (vibratory)	108	80	60	58
Scraper	116	88	68	66
Truck (>20 tonne)	107	79	59	57
Truck (dump)	117	89	69	67
Vehicle (light commercial e.g. 4WD)	106	78	58	56
Welder	105	77	57	55

Representative plant and plant sound power levels have been derived from the UK Department for Environment Food and Rural Affairs (DEFRA 2005) 'Update of Noise Data Base for the Prediction of Noise on Construction Sites.' Typical plant items for various works phases are presented below in Table 9.

Table 9: Source sound power levels for various plant,  $L_{Aeq,15minute} - dB(A)$ .

Plant	Octave band centre frequency								dB(A)
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	
<b>1. Site Establishment and Excavation Works</b>									
Excavator,23t	114	114	111	106	108	106	104	99	<b>113</b>
Screw piler	114	110	105	102	98	94	90	83	<b>104</b>
Truck delivery/spoil	104	101	90	94	90	86	82	77	<b>95</b>
Hammer	94	94	96	96	91	85	83	79	<b>97</b>
Angle grinder	85	79	80	88	98	105	101	101	<b>109</b>
<b>2. Structural Works</b>									
Excavator,5t	99	99	94	87	87	86	82	76	<b>93</b>
Truck delivery/spoil	104	101	90	94	90	86	82	77	<b>95</b>
Concrete pump, 25kW	99	99	94	87	87	86	82	76	<b>93</b>
Concrete saws, 3kW	110	110	100	99	97	96	90	92	<b>104</b>
Mobile crane	113	101	95	99	100	97	91	84	<b>104</b>
Angle grinder	85	79	80	88	98	105	101	101	<b>109</b>
Hammer	94	94	96	96	91	85	83	79	<b>97</b>
<b>3. Fit out Works</b>									
Angle grinder	85	79	80	88	98	105	101	101	<b>109</b>
Hammer	94	94	96	96	91	85	83	79	<b>97</b>
Truck delivery	104	101	90	94	90	86	82	77	<b>95</b>

DEFRA (2005)

Predicted construction noise levels at 130 Dean Street are presented below in Table 10. Predicted noise emissions are conservative and are based upon the closest operating distances to the residential receiver, at approximately 27m distance.

*Table 10: Predicted construction noise levels,  $L_{Aeq\ 15\text{minute}}$  dB(A) during standard hours, at the nearest affected residential receiver.*

Receivers	Works phase	Typical worst-case operating distances, m	Predicted construction noise levels – dB(A)	IGCN criteria – dB(A)	Complies Y/N	Predicted exceedances of ‘Noise Affected’ criteria, dB(A)
Residential - 148 Dean Street	1. Site est. & excavation	85	52 – 61	$(51 + 10) = 61$	Yes	-
	2. Structural		50 – 58		Yes	-
	3. Fit out		49 – 57		Yes	-
Residential - 130 Dean Street	1. Site est. & excavation	55	50 – 59	$(51 + 10) = 61$	Yes	-
	2. Structural		48 – 56		Yes	-
	3. Fit out		47 – 55		Yes	-

Note: The Calculations are based on the Temporary Sound and Dust Barrier Walls described in 6.6 below being in place.

## 6.6 Temporary Sound and Dust Barrier Walls

It is recommended that a temporary sound barrier wall be erected for each stage of the project along part of the boundaries to block the direct line of sight between the noise generating activities on site and the residential buildings. The height of the barrier shall be a minimum of 1.8 metre high. Retaining the barriers shown in Figures 2, 3 & 4 below will provide the desired noise barrier attenuation. With these noise barriers in position, the noise level from the construction works is not likely to exceed  $59\text{dB}_{L_{Aeq}} (15\ \text{min})$ , at 130 Dean Street,



Figure 2: Recommended minimum noise barriers during construction. (south-west)





Figure 3: Recommended minimum noise barriers during construction. (north-west)



Figure 4: Recommended minimum noise barriers during construction. (north-east)

## 6.7 Vibration Criteria

### 6.7.1 Objectives

The management objective for the site is to limit vibration from construction activities so as to avoid building damage and human discomfort associated with the construction works. It is noted that buildings in the vicinity of development are residential and health buildings. Vibration impacts on the buildings and their occupants should be considered for the assessment of structural damage and human annoyance, respectively.

### 6.7.2 Vibration Sources

Typical vibration levels from construction plant equipment most likely to cause significant vibration are summarised below.

**Table 10:** Typical ground vibration generated by construction plant

Activity	Typical ground vibration
Bulldozers/ Excavators	Typical ground vibration from bulldozers range from 1mm/s to 2mm/s at distances of approximately 5m and at distances greater than 20m, vibration levels are usually below 0.2mm/s.
Jack Hammers	Typical ground vibrations from jack hammers are generally greater than 5mm/s at distances of 1m and no more than 2mm/s for distances of 5m or more.
Truck traffic	Typical vibration from heavy trucks passing over normal (smooth) road surfaces generate relatively low vibration in the range 0.01-0.2mm/s at the footings of buildings located 10-20m from a roadway. In general ground vibration from trucks is usually imperceptible in nearby buildings.

Therefore, vibration management strategies implemented on site shall consider these items of plant and construction activities involving these items of plant.

### 6.7.3 Vibration Criteria

The following criteria are considered applicable when assessing vibration emission levels from the construction works.

The effects of ground vibration on buildings near construction sites may be broadly defined by the following three categories:

1. Disturbance to building occupants - Vibration in which the occupants or users of the building are inconvenienced or possibly disturbed,
2. Effects on building contents - Vibration where the building contents may be affected, and,
3. Effects on building structures - Vibration in which the integrity of the building or structure itself may be prejudiced.

In general, vibration criteria for human disturbance (1) are more stringent than vibration criteria for effects on building contents (2) and building structural damage (3). Hence, compliance with the more stringent limits dictated by Category 1, would allow for compliance to be achieved for the other two categories.

#### Category 1 – Disturbance to Buildings Occupants

For disturbance to human occupants of buildings, we refer to the DECC's 'Assessing Vibration; a technical guideline', published in February 2006. This document provides criteria which are based on the British Standard BS 6472-1992, 'Evaluation of human exposure to vibration in buildings (1-80Hz)'.

Vibration sources are defined as *Continuous, Impulsive or Intermittent*. Section 2 of the technical guideline defines each type of vibration as follows:

**‘Continuous** vibration continues uninterrupted for a defined period (usually throughout the day-time and/or night-time).

**Impulsive** vibration is 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.

**Intermittent** vibration can be defined as interrupted periods of continuous or repeated periods of impulsive vibration that varies significantly in magnitude’.

The criteria are to be applied to a single weighted root mean square (rms) acceleration source level in each orthogonal axis. Section 2.3 of the guideline states:

*‘Evidence from research suggests that there are summation effects for vibrations at different frequencies. Therefore, for evaluation of vibration in relation to annoyance and comfort, overall weighted rms acceleration values of the vibration in each orthogonal axis are preferred (BS 6472).’*

Preferred and maximum values for continuous and impulsive vibration are defined in below in Table 11 extracted from “Table 2.2 of the guideline” and the values for residential type buildings are reproduced below.

**Table 11:** Preferred and maximum weighted rms values for continuous and impulsive vibration acceleration ( $m/s^2$ ) 1-80Hz

Location	Assessment period <sup>1</sup>	Preferred values		Maximum values	
		z axis	x & y axis	z axis	x & y axis
<b>Continuous vibration</b>					
Residences	Daytime (7am-10pm)	0.010	0.0071	0.020	0.014
Offices	Daytime (7am-10pm)	0.020	0.014	0.040	0.028
<b>Impulsive vibration</b>					
Residences	Daytime (7am-10pm)	0.30	0.21	0.60	0.42
Offices	Daytime (7am-10pm)	0.64	0.46	1.28	0.92

Notes: 1. Daytime is 7.00 am to 10.00 pm and night-time is 10.00pm to 7.00 am

Intermittent vibration is to be assessed using vibration dose values (VDVs). The VDV method is a fourth power approach which is more sensitive to peaks in the acceleration waveform and makes corrections to the criteria based on the duration of the source’s operation. The VDV can be calculated using the overall weighted rms acceleration of the vibrating source in each orthogonal axis and the total period during which the vibration may occur. Weighting curves are provided in each orthogonal axis in the guideline. Preferred and maximum VDV values are defined in Table 12 below extracted from “Table 2.4 of the guideline” and VDV values for residential type buildings are reproduced below.

**Table 12:** Acceptable vibration dose values for intermittent vibration ( $m/s^{1.75}$ )

Location	Daytime (7am-10pm) <sup>1</sup>		Night-time (10pm-7am) <sup>1</sup>	
	Preferred values	Maximum values	Preferred values	Maximum values
Residences	0.20	0.40	0.13	0.26
Offices	0.40	0.80	0.40	0.80

Notes: 1. Daytime is 7.00 am to 10.00 pm and night-time is 10.00pm to 7.00 am

#### 6.7.4 Buffer Distances for Vibration Control

The relationship between vibration and the probability of causing human annoyance or damage to structures is complex. This complexity is mostly due to the magnitude of the vibration source, the particular ground conditions between the source and receiver, the foundation-to-footing interaction and the large range of structures that exist in terms of design (eg dimensions, materials, type and quality of construction and footing conditions). The intensity, duration, frequency content and number of occurrences of a vibration, all play an important role in both the annoyance caused and the strains induced in structures.

As the pattern of vibration radiation is very different to the pattern of airborne noise radiation, and is very site specific, below are some indicative minimum 'buffer' distances determined for some common construction plant with data available from recent projects, which assist to avoid human discomfort in terms of perceptible (or tactile) vibration during daytime construction hours:

**Table 13: Recommended Minimum Buffer Distances for Construction Plant**

Plant Item	Recommended Minimum Buffer Distance (m)
CFA (Continuous Flight Auger) Piling rig	10
Excavators	10
Jack hammers	5

From the above table the nearest receivers are less than 10m from the site, and as such, vibration may cause discomfort to occupants during piling activities. Therefore, site specific buffer distances should be determined for piling activities once vibration emission levels are measured from the piling rig prior to the commencement of its regular use on site.

#### 6.7.5 Vibration Management Measures

Further to buffer distances, to ensure vibration impacts are minimised during the construction period, the following vibration management control measures are provided:

1. The proper implementation of a vibration management plan is required to avoid adverse vibration disturbance to affected occupancies. Consultation with occupants and property owners is recommended and should be aimed at providing a communication path directly to the contractor.
2. A management procedure will be implemented to deal with vibration complaints. Each complaint will be investigated and where vibration levels are established as exceeding the set limits, appropriate amelioration measures shall be put in place to mitigate future occurrences
3. Where vibration is found to be excessive, management measures shall be implemented to ensure vibration compliance is achieved. Management measures may include modification of construction methods such as using smaller units, establishment of safe buffer zones and if necessary, time restrictions for the most excessive vibration activities. Time restrictions are to be negotiated with affected receivers.



## 7. COMMUNITY ENGAGEMENT DURING CONSTRUCTION

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### 7.1 Neighbouring Community Engagement

As a project moves towards the site preparation and construction phase more details normally become available on the planned work methods, location of plant and equipment, and scheduling. For the development construction works, contact with the nearest affected community is desirable once approval has been given to commence works and should be undertaken prior to any work beginning. The type of community engagement should relate to the likelihood and extent of noise and vibration impacts from the construction works.

The aim of community engagement is to:

- establish good working relationships between the developer, builder, the community and other stakeholders in relation to the construction project
- receive feedback on the project's environmental performance, discuss community concerns and identify opportunities for the resolution of community complaints and concerns
- gain advice on how best to communicate relevant information on the project and its environmental performance to the broader community
- work cooperatively towards outcomes of benefit to the project, immediate neighbours and the local and regional community.

The Building Contractor shall nominate one of its staff as a community liaison officer for the project as a point of contact for the community regarding issues related to the construction of the development, including issues relating to noise and vibration. The secondary contact for the nearest affected community and other members of the public would be the site manager of the site. Any formal complaints received regarding noise and vibration matters at the construction site shall be passed on to the Building Contractor for the complaints to be addressed and resolved.

### 7.2 Keeping the Noise Affected Community Informed

Being up-front with the noise affected community from the outset can assist in transferring information to the affected community. An example of being up-front is to present noise and vibration related information on the construction works to noise affected community before commencing works. The most noise sensitive properties likely to be most affected by site works and the operation of plant machinery particularly during the demolition and excavation phases are the residents at 130 and 148 Dean Street.

### 7.3 Dealing with Community and public complaints

Complaints from the community and public can arise when accidental or unintentional noise and/or vibration are generated due to unforeseen circumstances or error of judgement made by the construction team. The community and public are generally understanding when this happens once or not too often. The complaints must be handled in a serious and respectful way. The complaints should be recorded and logged in a noise and vibration complaints log book and followed up by the site manager.

Following resolution of the noise or vibration problem, the complainant should be informed of the remedial actions taken before the complaint can be recorded as being resolved.



## 8. TRAINING

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The site manager shall implement appropriate training and induction in the requirements of this construction noise management plan. All employees, contractors and utility staff working on site will undergo site induction training which includes Environmental Due Diligence Training. The induction will address:

- This Construction Noise Management Plan
- The Ausgrid Guidelines
- The existence of noise legislation and what this means for the project, i.e. OEH and Noise Management Levels
- Delivery hours and locations.
- Reporting and recording environmental incidents related to noise and vibration.
- Noise and vibration minimisation measures.
- The importance of regular maintenance noise and vibration generating plant.

Records will be kept of all personnel undertaking the site induction and training, including the contents of the training, date and name of trainer/s.

Key staff will undertake more comprehensive training relevant to their position and/or responsibility. This training may be provided as “toolbox” talk training.

## 9. CONCLUSION

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This report provides the operational and construction noise criteria for the proposed Ausgrid substation South Strathfield located at 7-9 Dunlop Street Strathfield South. Long term measurements were conducted at the site. The results of the measurements are presented in this report. The noise criteria derived from the measurements using NSW Noise Policy for Industry methodology at the nearest affected receiver is quantified.

With the total sound power level of 76 dB(A) (both transformers operating at 105% of the rated tapping voltage), the expected noise level at the nearest residential property boundary is less than 5 dB above the RBL night criteria. Hence, the noise produced by the transformers will be compliant with noise criteria at the nearest residential property boundary for all periods without additional acoustic treatment.

Acoustic compliance with the Strathfield Council and the NSW Noise Policy for Industry can be achieved.

## APPENDIX A – LONG TERM NOISE MONITORING

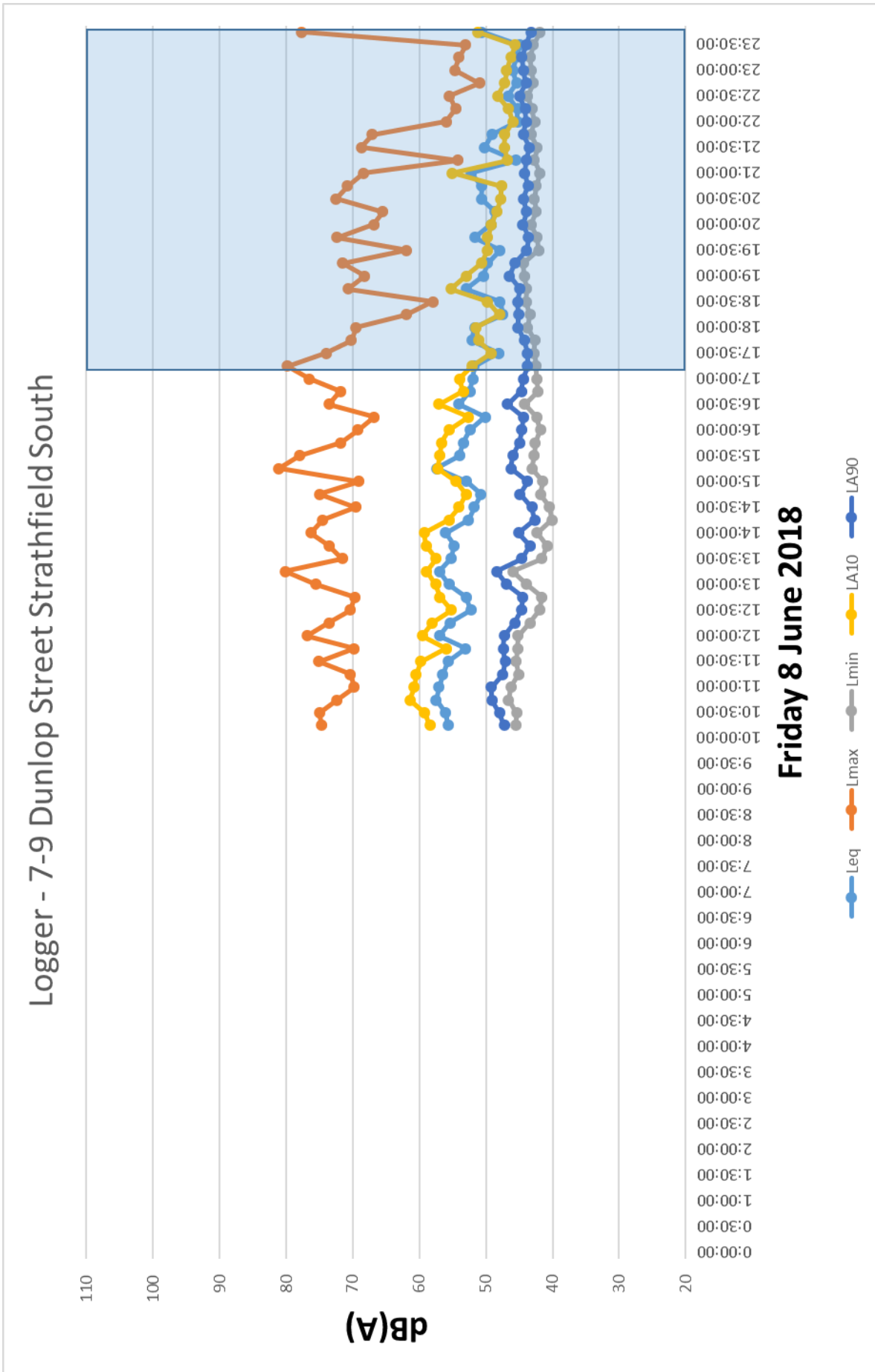
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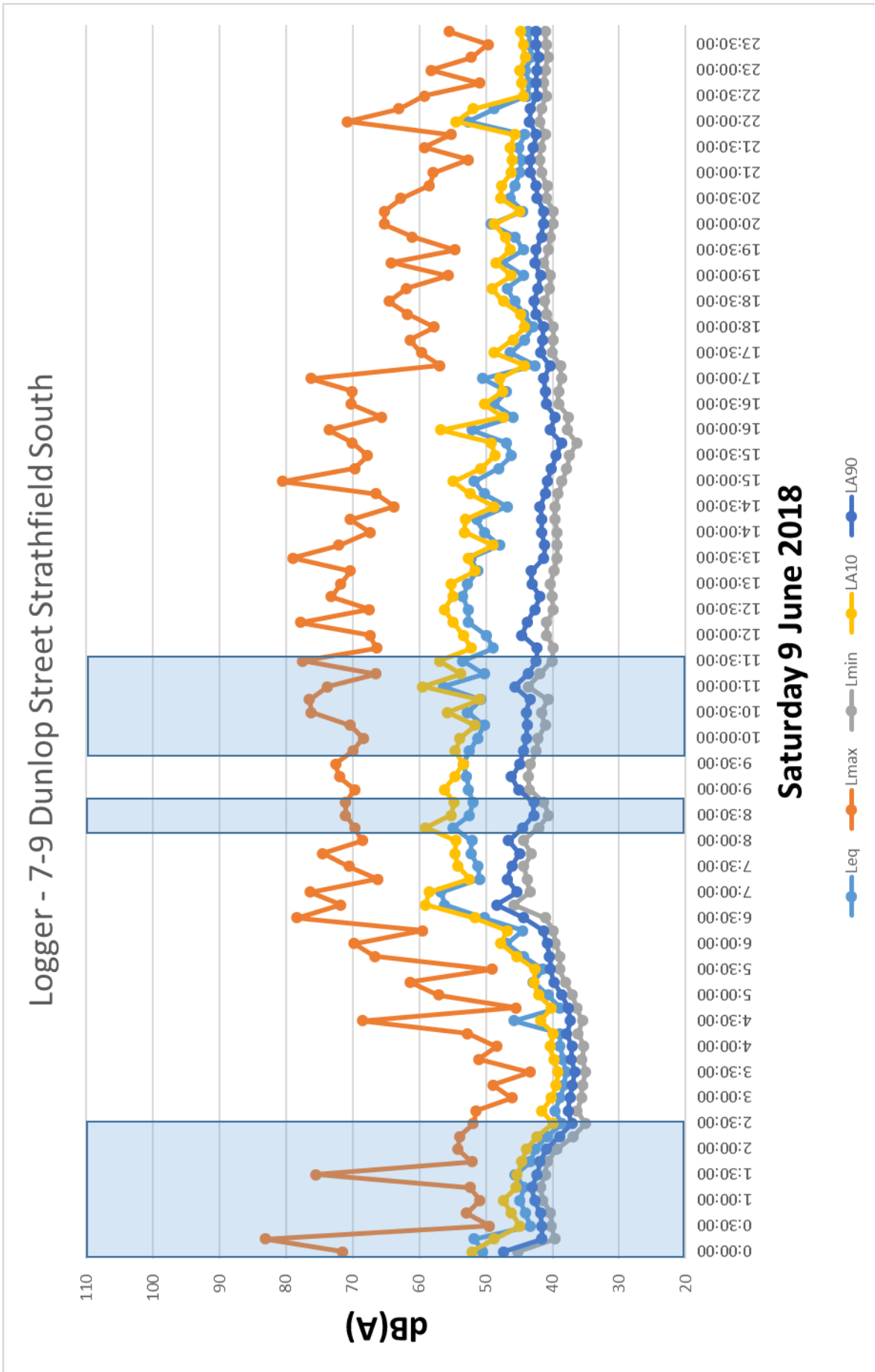
The details of the noise logging measurements are shown below. The measurements are in accordance with the NSW EPA Noise Policy for Industry (2017).

To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are plotted in the graphs below, are here defined.

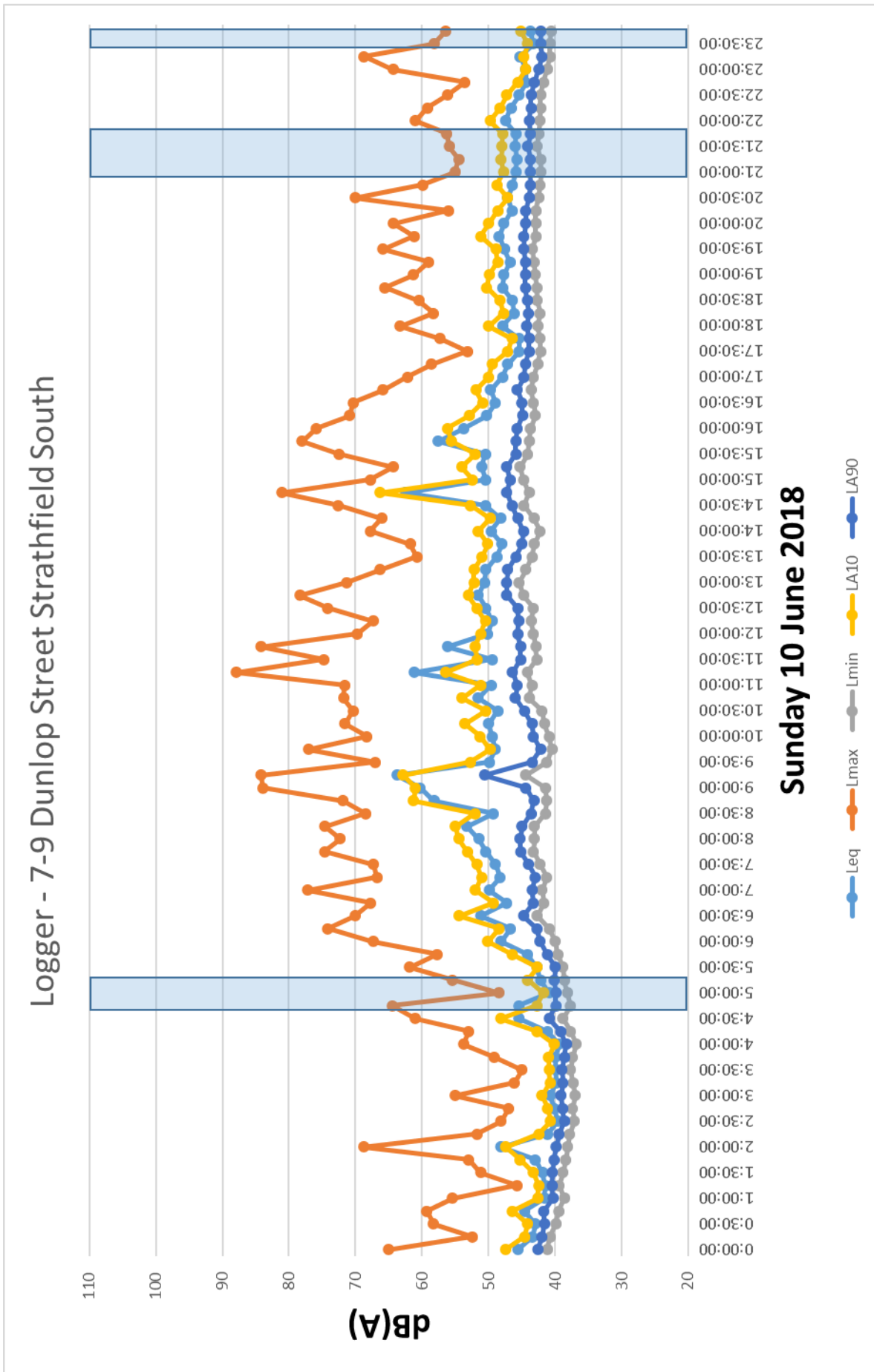
The sections marked in blue have been omitted due to rain that may have affected the measurements.

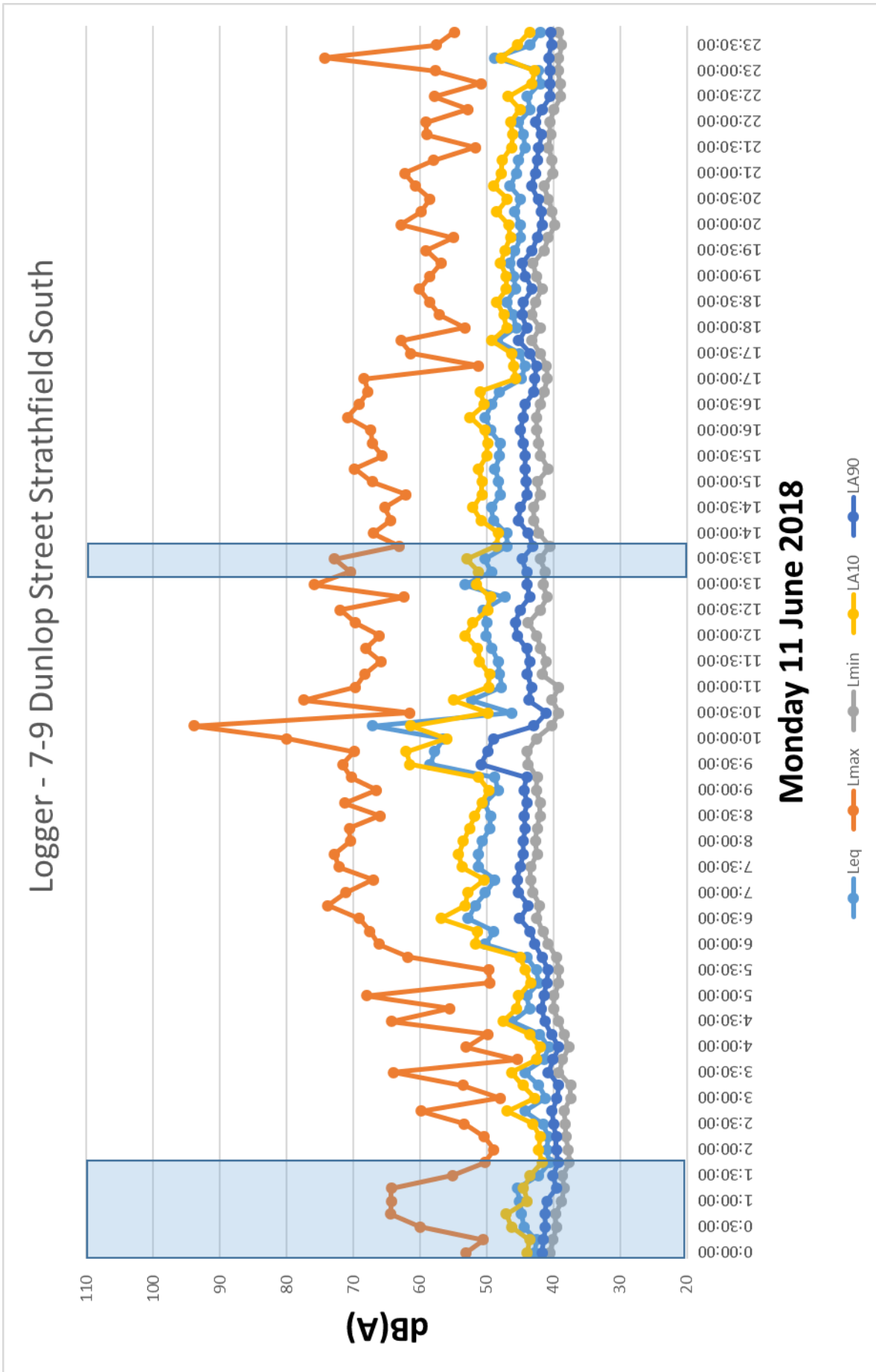
- **Maximum Noise Level ( $L_{Amax}$ )** – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.
- **$L_{A10}$**  – The  $L_{A10}$  level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the  $L_{A10}$  level for 90% of the time. The  $L_{A10}$  is a common noise descriptor for environmental noise and road traffic noise.
- **$L_{A90}$**  – The  $L_{A90}$  level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the  $L_{A90}$  level for 10% of the time. This measure is commonly referred to as the background noise level.
- **$L_{Aeq}$**  – The equivalent continuous sound level ( $L_{Aeq}$ ) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.
- **Minimum Noise Level ( $L_{Amin}$ )** – The minimum noise level over a sample period is the minimum level, measured on fast response, during the sample period.

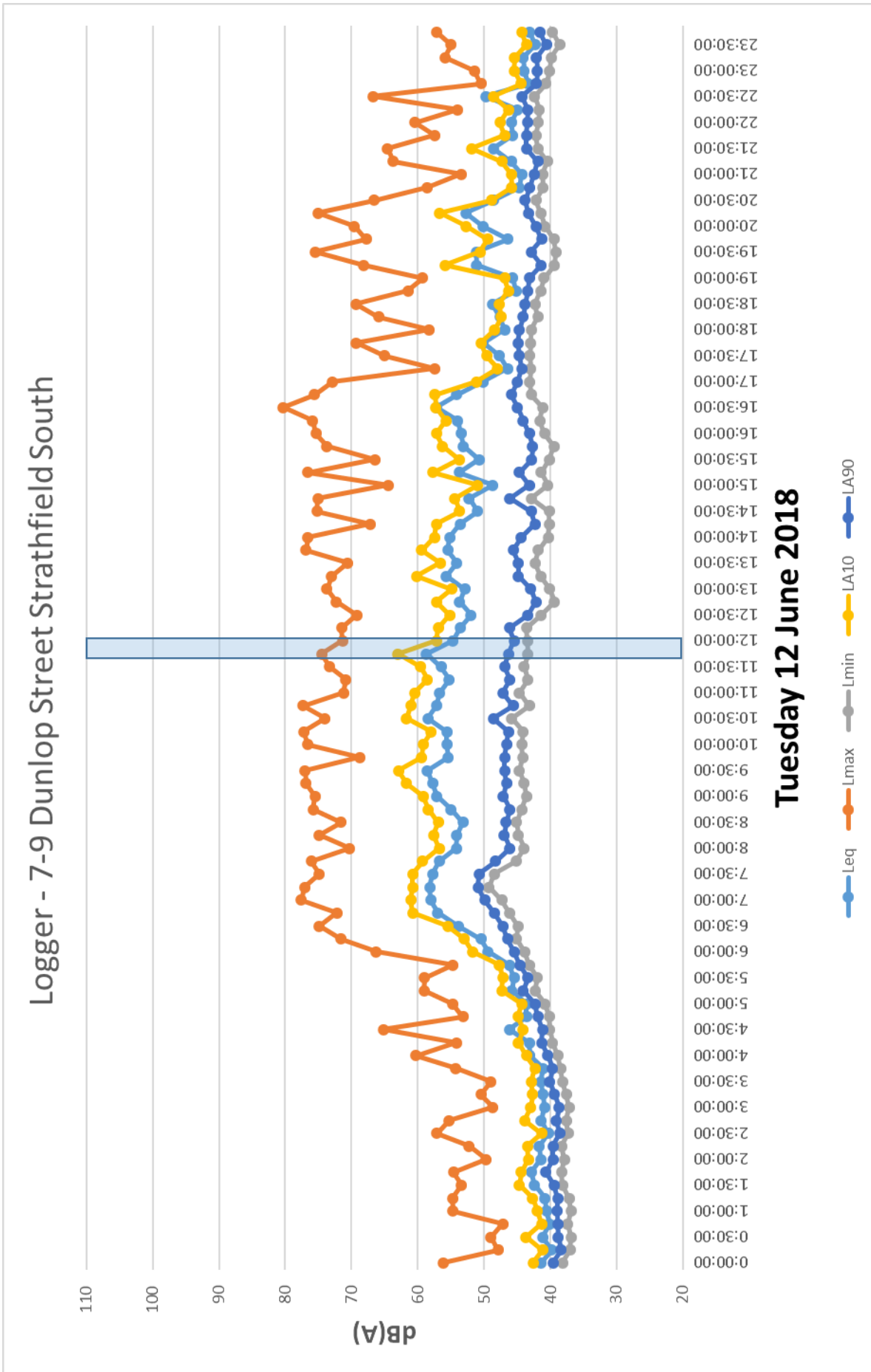


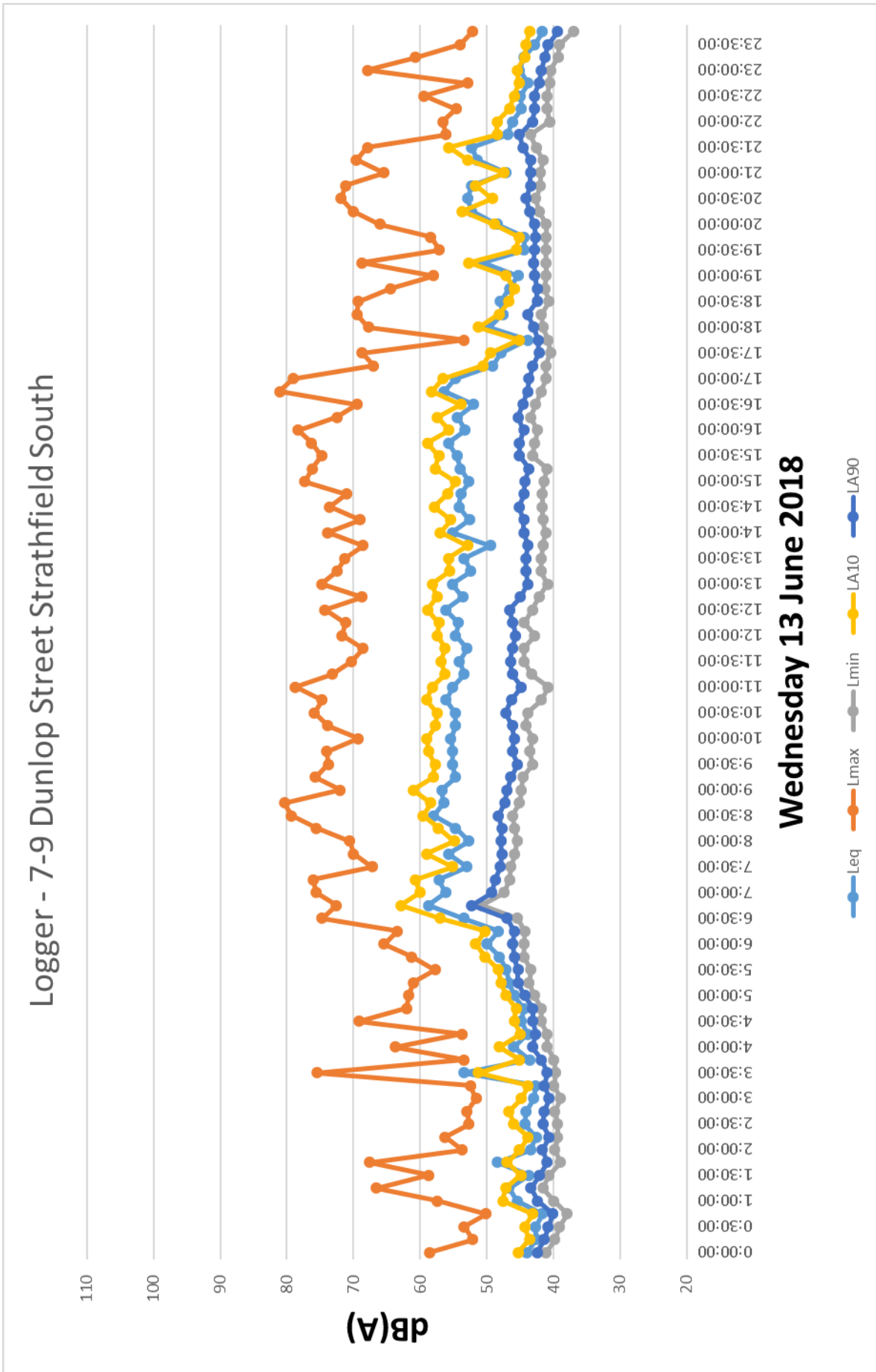


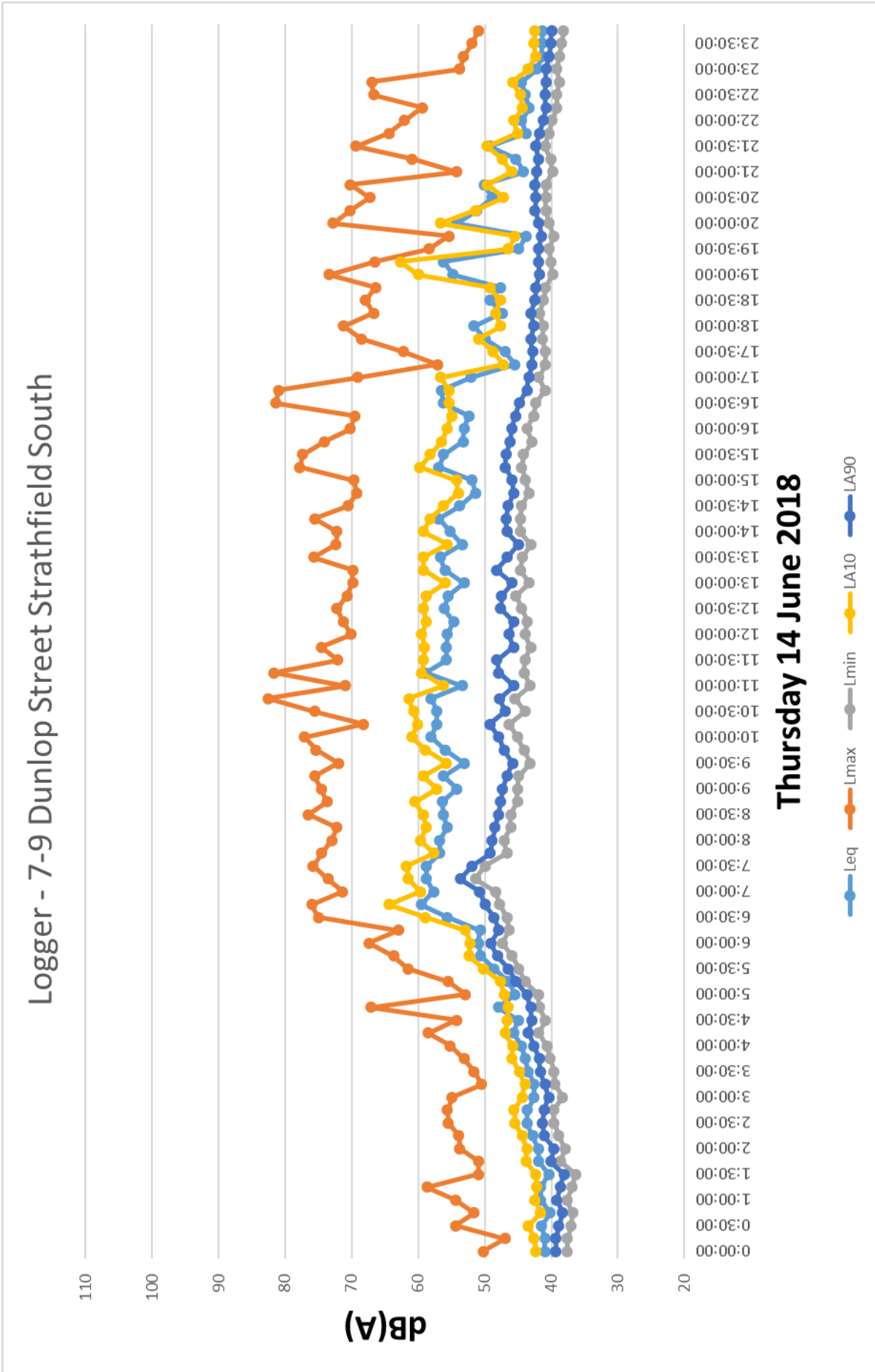




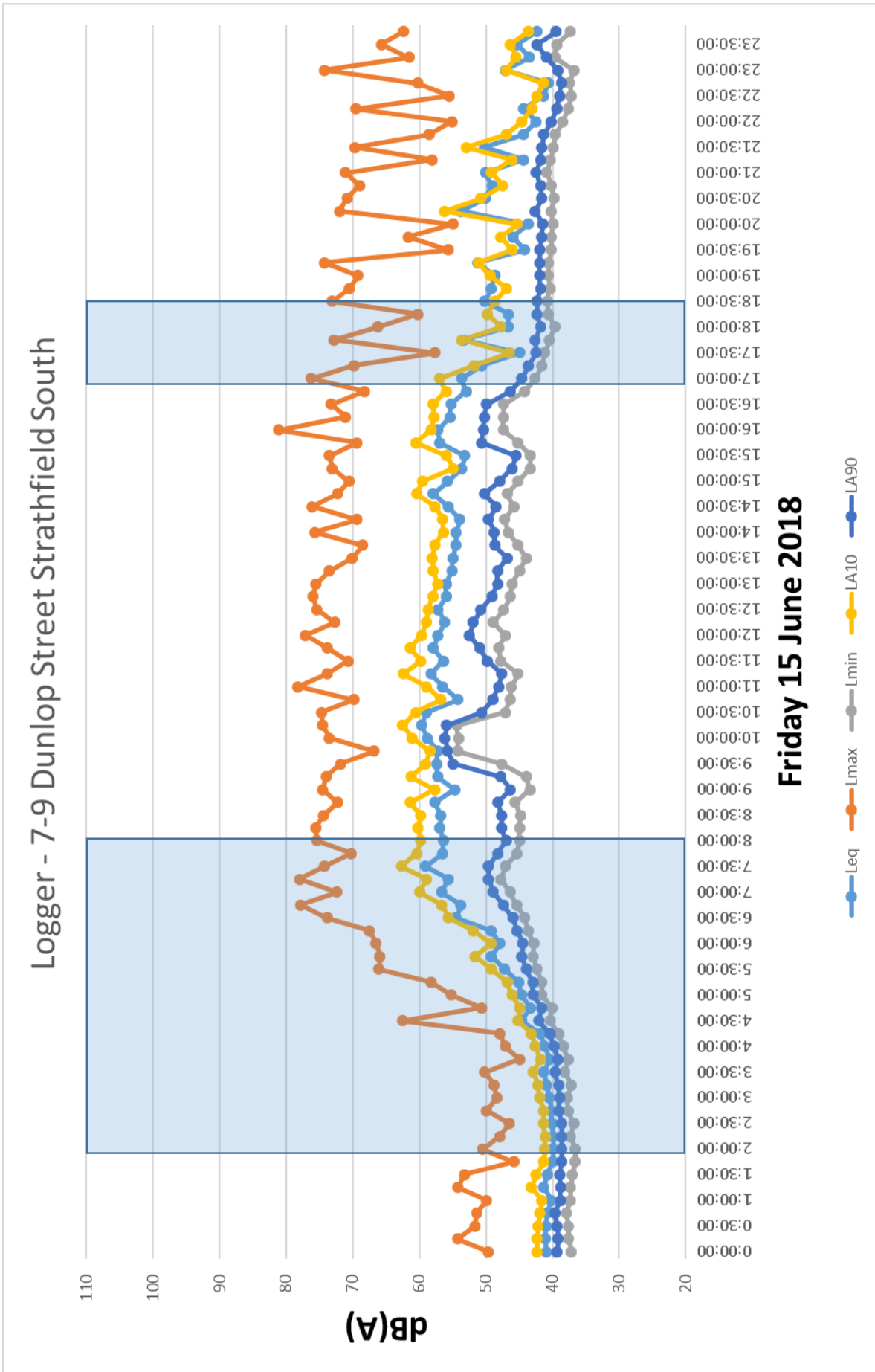


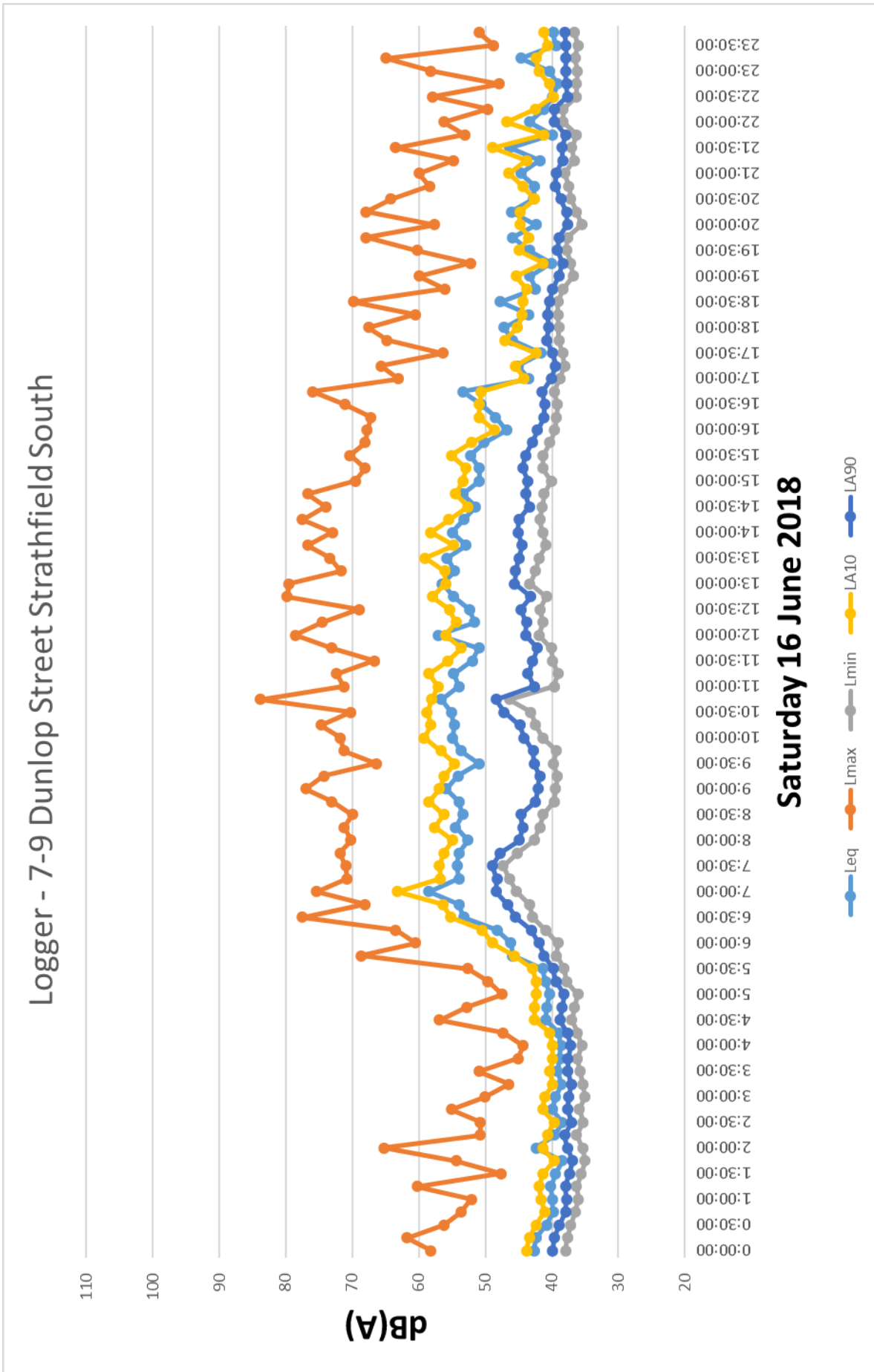


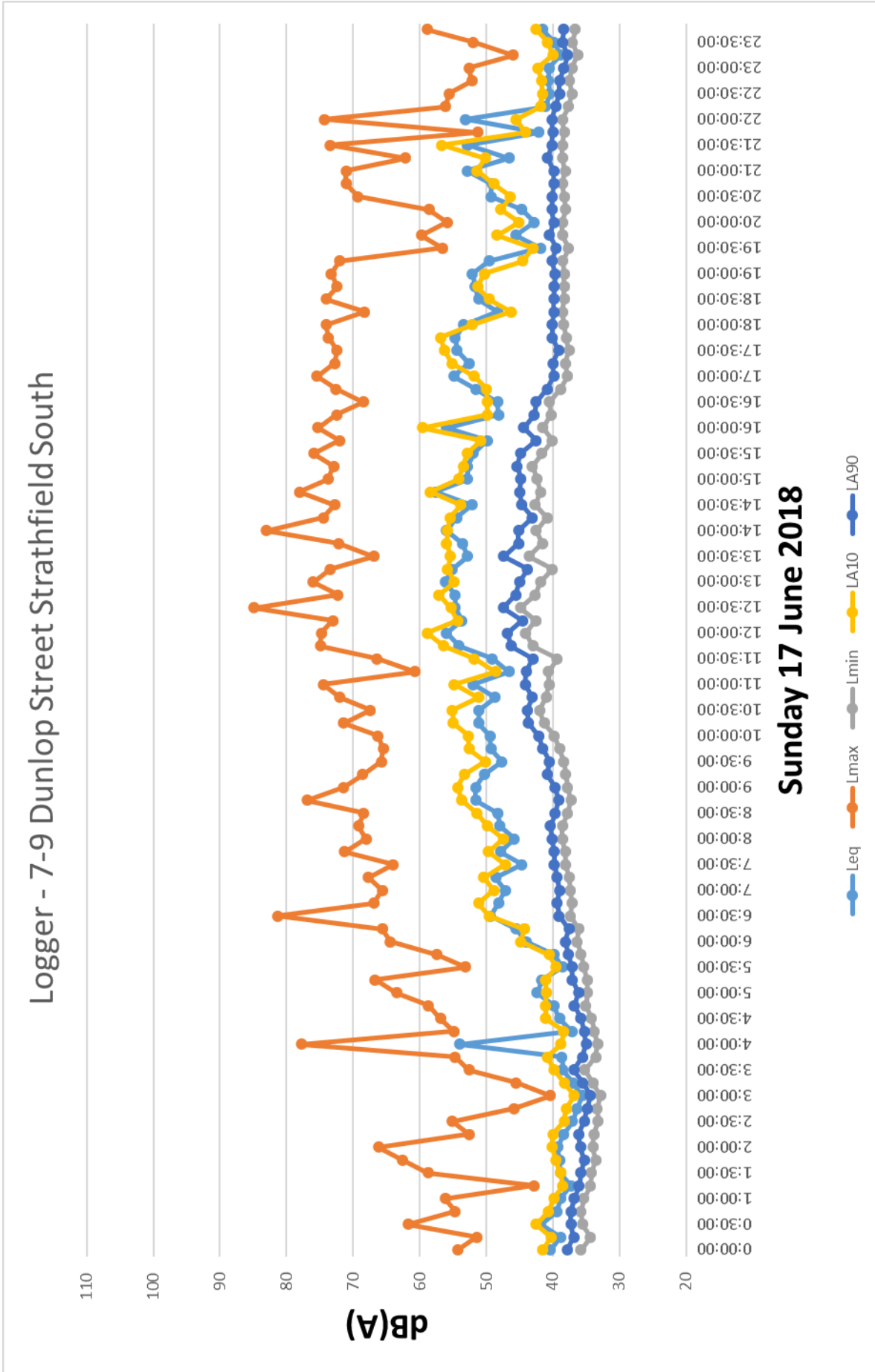


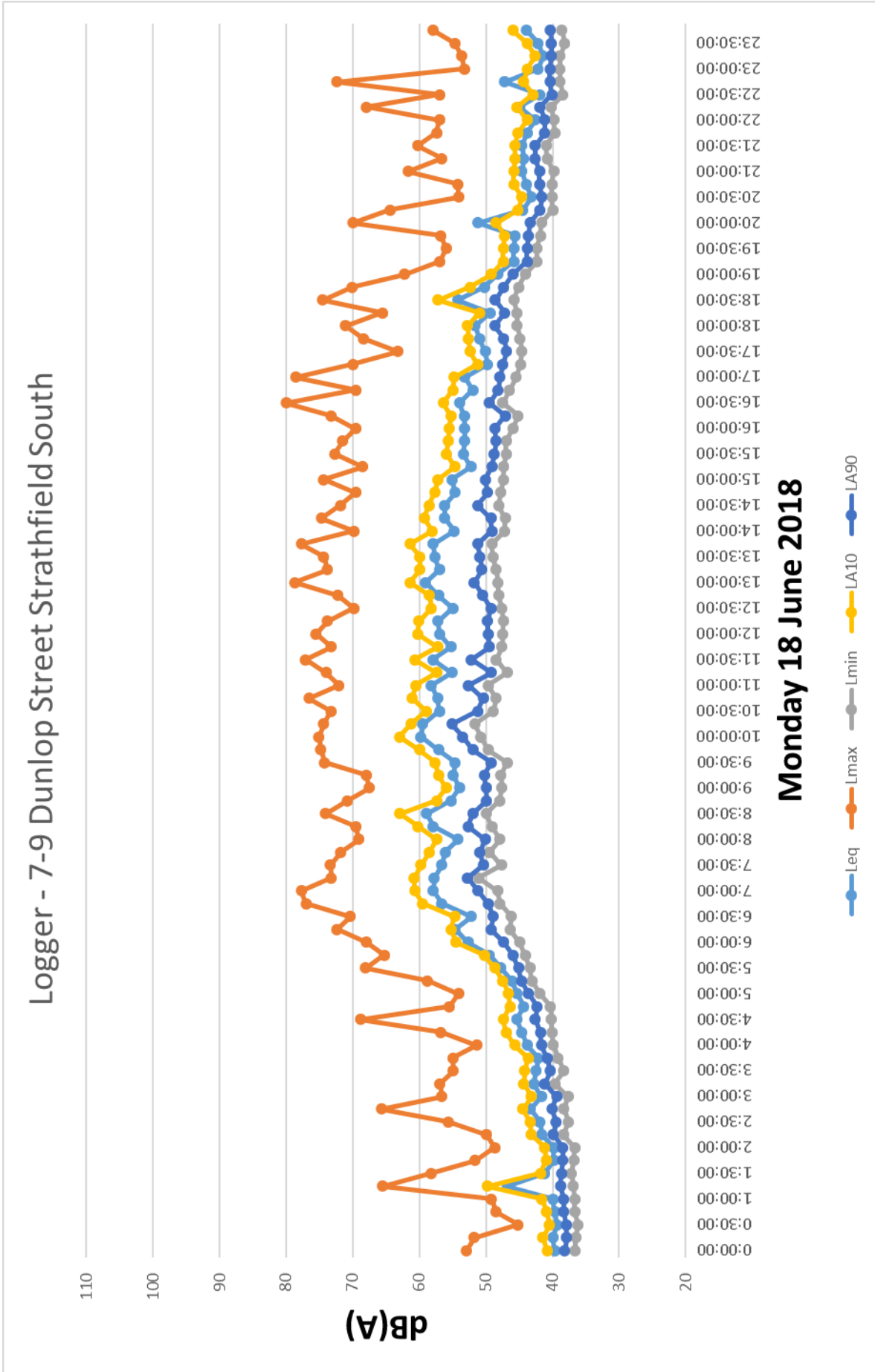


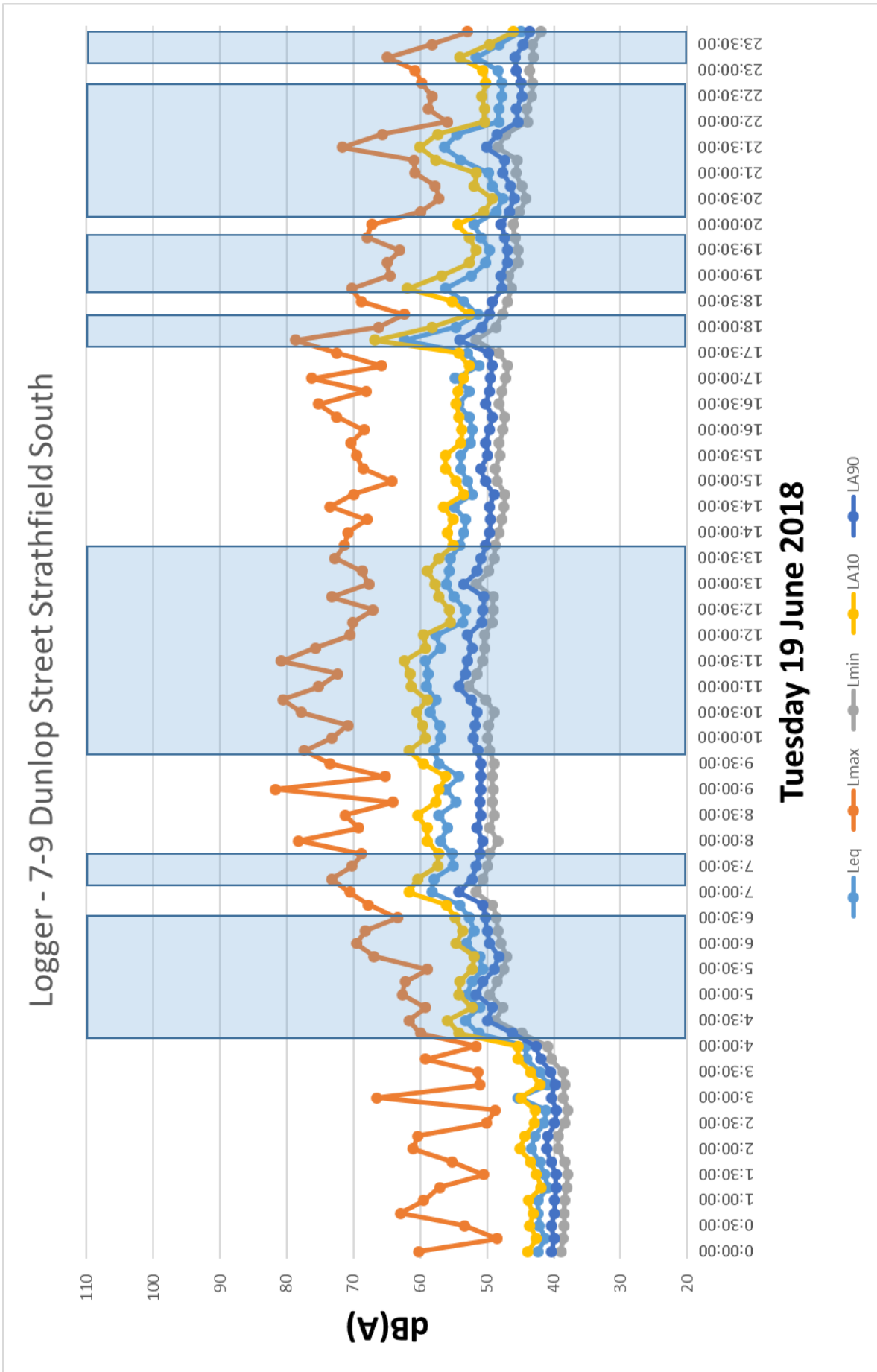


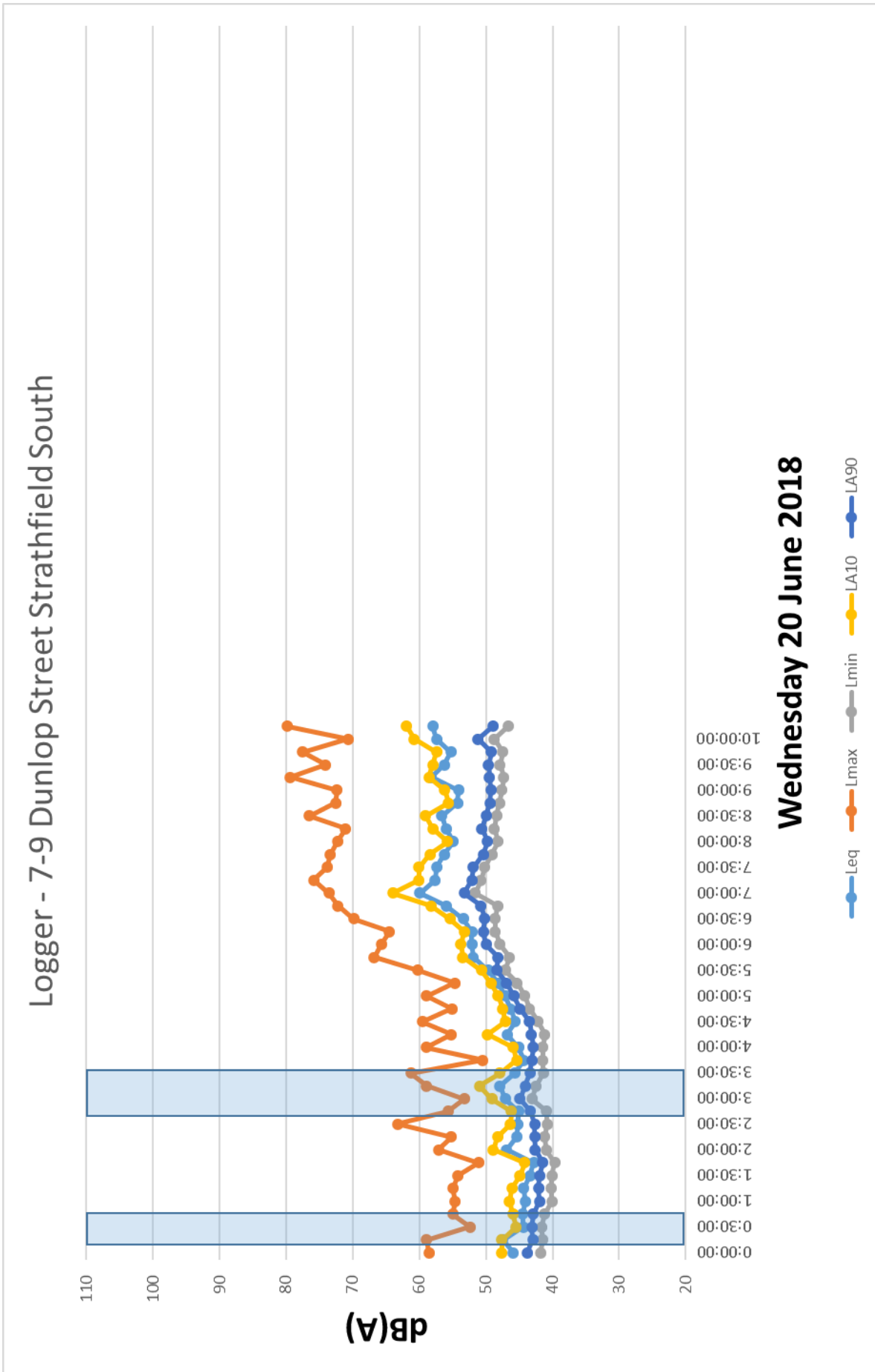














## APPENDIX B – TYPICAL SOUND LEVELS FROM CONSTRUCTION, MAINTENANCE AND DEMOLITION PLANT NOISE & VIBRATION

The noise generated by machinery such as construction, maintenance and demolition plant may be expressed in terms of the A-weighted sound pressure level measured at some distance from the machine, or in terms of the A-weighted sound power level. The table below extracted from the Australian Standard “AS 2436-2010 Guide to noise and vibration control on construction, demolition and maintenance sites” lists typical construction plant and equipment and the range of sound power levels and mid-point sound pressure levels at 10 metres.

(from Appendix A - AS 2436-2010)

Plant description	A-weighted sound power levels $L_{WA}$ dB ref: $10^{-12}$ W		A-weighted sound pressure levels $L_{PA}$ (mid-point) dB at 10 m
	Typical or Range	Typical (mid-point)	
Asphalt paver	103-112	108	80
Asphalt rotomill	111	111	83
Backhoe	100-108	104	76
Backhoe with auger	100-111	106	78
Bulldozer	102-114	108	80
Cherry picker	105	105	77
Compactor	110-115	113	85
Compressor (silenced)	93-110	101	73
Concrete agitator truck	107-111	109	76
Concrete pencil vibrator	101-105	103	75
Concrete pump truck	103-113	108	80
Concrete saw	112-122	117	89
Concrete vibratory screed	115	115	87
Crane (mobile)	95-113	104	76
Crane (tower)	105	105	77
Excavator	97-117	107	79
Filtration unit (40 000 cfm)	109	109	81
Forklift	106	106	78
Front end loader	110-115	113	85
Generator (diesel)	84-113	99	71
Grader	105-115	110	82
Gritblaster (grit & nozzle air noise)	129	129	101
Hand tools (electric)	95-110	102	74
Hand tools (pneumatic)	114-117	116	88
Jack hammers	121	121	93
Loader (wheeled)	99-111	105	77
Machine mounted hydraulic drill	110-115	113	85
Machine mounted percussive drill	116	116	88
Machine mounted pneumatic drill	110-121	116	88
Piling (bored)	111	111	83
Piling (impact sheet) ( $L_{max}$ )	126-147	137	109
Piling (vibratory)	116-133	125	97
Rock breaker	118	118	90
Roller (vibratory)	103-112	108	80
Scraper	116	116	88
Spreader	95	95	67
Truck (>20 tonne)	107	107	79
Truck (dump)	117	117	89
Truck (water cart)	106-108	107	79
Vehicle (light commercial e.g. 4WD)	100-111	106	78
Welder	100-110	105	77

## APPENDIX C – NOISE & VIBRATION RELATED ACRONYMS AND GLOSSARY

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ABL - The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10th percentile (lowest 10th percent) background level ( $L_{A90}$ ) for each period.

DECCW NSW - Department of Environment, Climate Change and Water (see OEH below).

DP&I NSW - Department of Planning and Infrastructure (formerly DOP).

EPL - Environmental Protection Licence, issued by OEH.

$L_{A1}$  - The  $L_{A1}$  level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the  $L_{A1}$  level for 99% of the time.

$L_{A10}$  - The  $L_{A10}$  level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the  $L_{A10}$  level for 90% of the time. The  $L_{A10}$  is a common noise descriptor for environmental noise and road traffic noise.

$L_{Aeq}$  - The equivalent continuous sound level ( $L_{Aeq}$ ) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

$L_{A50}$  - The  $L_{A50}$  level is the noise level which is exceeded for 50% of the sample period. During the sample period, the noise level is below the  $L_{A50}$  level for 50% of the time.

$L_{A90}$  - The  $L_{A90}$  level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the  $L_{A90}$  level for 10% of the time. This measure is commonly referred to as the background noise level.

$L_{Amax}$  - The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

$L_{pA}$  dB - The A-weighted sound pressure measured at a particular location referenced to 20  $\mu$ Pa.

$L_{WA}$  dB - The A-weighted sound power generated by a machine or plant referenced to  $10^{-12}$  W.

OEH - Office of Environment and Heritage (formerly DECCW)

RBL - The Rating Background Level for each period is the median value of the ABL values for the period over all the days measured. There is therefore an RBL value for each period – daytime, evening and night time.