

Health Infrastructure NSW
Westmead PSB and MSCP
Construction Noise Monitoring

Noise monitoring report
2022-07-01 to 2022-07-31

AC08

v1 | 4 August 2022

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 271985

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Document Verification

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Job title		Westmead PSB and MSCP Construction Noise Monitoring		Job number		271985	
Document title		Noise monitoring report 2022-07-01 to 2022-07-31		File reference		v1	
Document ref		AC08					
Revision	Date	Filename	271985-AC08v1 PSB and MSCP Noise monitoring - July 2022.pdf				
v1	04/08/22	Description	Issue				
			Prepared by	Checked by	Approved by		
		Name	Cynthia Nguyen	Clemence Terraz	Clemence Terraz		
		Signature					
		Filename					
		Description					
			Prepared by	Checked by	Approved by		
		Name					
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		Description					
			Prepared by	Checked by	Approved by		
		Name					
		Signature					
		Filename					
		Description					
			Prepared by	Checked by	Approved by		
		Name					
		Signature					
Issue Document Verification with Document ☒							

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Appendix A

Noise Monitoring Daily Results

1 Introduction

Arup has been commissioned by PricewaterhouseCoopers (PwC) on behalf of Health Infrastructure NSW to install noise monitors within the Central Acute Services Building (CASB), Children's Hospital Westmead (CHW) and Kids Research (KR) and Ronald McDonald House (RMH) buildings to monitor construction noise from the Paediatric Service Building (PSB) and Multi Storey Car Park (MSCP) development sites in the Westmead Precinct.

The noise loggers have been setup to send email and SMS notifications to stakeholders when construction Noise Management Levels (NMLs) are exceeded.

This report details noise measurement results from **1 July 2022 to 31 July 2022** inclusive.

2 Noise logger locations

Acoustic Research Labs Ngara noise loggers have been installed in the locations shown in Figure 1 and Figure 2 below.

The noise loggers were calibrated by Acoustic Research Labs (NATA-accredited calibration) in November 2021.

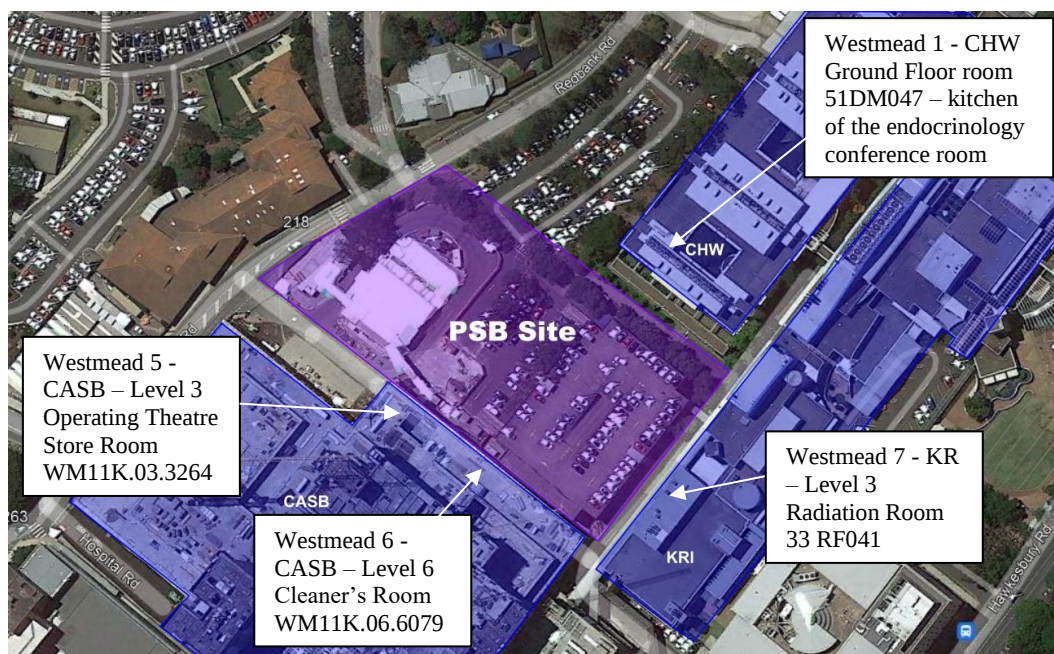


Figure 1: PSB noise monitoring locations.



Figure 2: MSCP noise monitoring locations.

2.1 Noise Logger relocation

The following table provides a record of the noise loggers which have been relocated during the project.

Table 1: Noise logger relocation records

Logger ID	Original location	Current location	
	Location	Date moved	Location
Westmead 2	CHW Level 2 Consult Room 92BW025	14/04/22	CHW Level 2 Parent Kitchen 92BW028

3 Noise Management Levels

The current construction Noise Management Levels for each internal monitoring location are set out in Table 2.

Measurement data taken from ‘standard’ construction work hours for the project only are assessed against the Noise Management Level criteria, being:

- 7am-6pm Mon-Fri
- 8am-1pm Sat
- No work on Sundays and Public Holidays.

As part of the previous installation works a baseline noise study was conducted to determine appropriate noise management level. Refer to Arup’s *Baseline noise measurements* report¹ for details regarding how these Management Levels were nominated.

Table 2: Baseline noise measurement results.

Logger ID	Location	Noise Management Level (upper limit), dB L _{Aeq,15min}
Westmead 1	CHW Ground Floor room 51DM047 – kitchen of the endocrinology conference room (facing PSB site)	60
Westmead 5	CASB Level 3 Operating Theatre Store Room WM11K.03.3264 (facing PSB site)	50
Westmead 6	CASB Level 6 Cleaner’s Room WM11K.06.6079 (facing PSB site)	52
Westmead 7	KR Level 3 Radiation Room 33 RF041(facing PSB site)	58
Westmead 2	CHW Level 2 Parent Kitchen 92BW025 (facing MSCP site)	64
Westmead 3	RMH Level 1 Store Room 101 (facing MSCP site)	47

3.1 Management Level updates

The following provides a progressive record of management level updates:

- None to-date.

¹ Arup report reference 271985-AC02.

4 Noise monitoring results

4.1 Outages

Noise monitoring outages are shown below. This excludes outages related to logger data collection and calibration.

Table 3: Noise logger outages during monitoring period.

Logger Id	Noise logger location	Outages
Westmead 1	CHW Ground Floor room 51DM047 – kitchen of the endocrinology conference room (facing PSB site)	-
Westmead 5	CASB Level 3 Operating Theatre Store Room WM11K.03.3264 (facing PSB site)	-
Westmead 6	CASB Level 6 Cleaner's Room WM11K.06.6079 (facing PSB site)	20/07/22-31/07/22
Westmead 7	KR Level 3 Radiation Room 33 RF041(facing PSB site)	
Westmead 2	CHW Level 2 Parent Kitchen 92BW025 (facing MSCP site)	-
Westmead 3	RMH Level 1 Store Room 101 (facing MSCP site)	-

4.2 Exceedances

The number of Management Level exceedances recorded at each noise monitoring location during the assessment period are shown below.

Table 4: Recorded Management Level exceedances.

Logger Id	Noise logger location	Noise Management Level exceedance instances
Westmead 1	CHW Ground Floor room 51DM047 – kitchen of the endocrinology conference room (facing PSB site)	19
Westmead 5	CASB Level 3 Operating Theatre Store Room WM11K.03.3264 (facing PSB site)	10
Westmead 6	CASB Level 6 Cleaner's Room WM11K.06.6079 (facing PSB site)	3
Westmead 7	KR Level 3 Radiation Room 33 RF041(facing PSB site)	2
Westmead 2	CHW Level 2 Parent Kitchen 92BW025 (facing MSCP site)	9
Westmead 3	RMH Level 1 Store Room 101 (facing MSCP site)	16

It is the responsibility of Ford Civils (the Head Contractor) to respond to each Noise Management Level exceedance when it occurs and record the outcome of the exceedance investigation (cause of NML exceedance, any noise mitigation measures implemented to address the exceedance, etc.).

4.3 Daily noise monitoring results

Daily noise monitoring results are showing for each location in Appendix A.

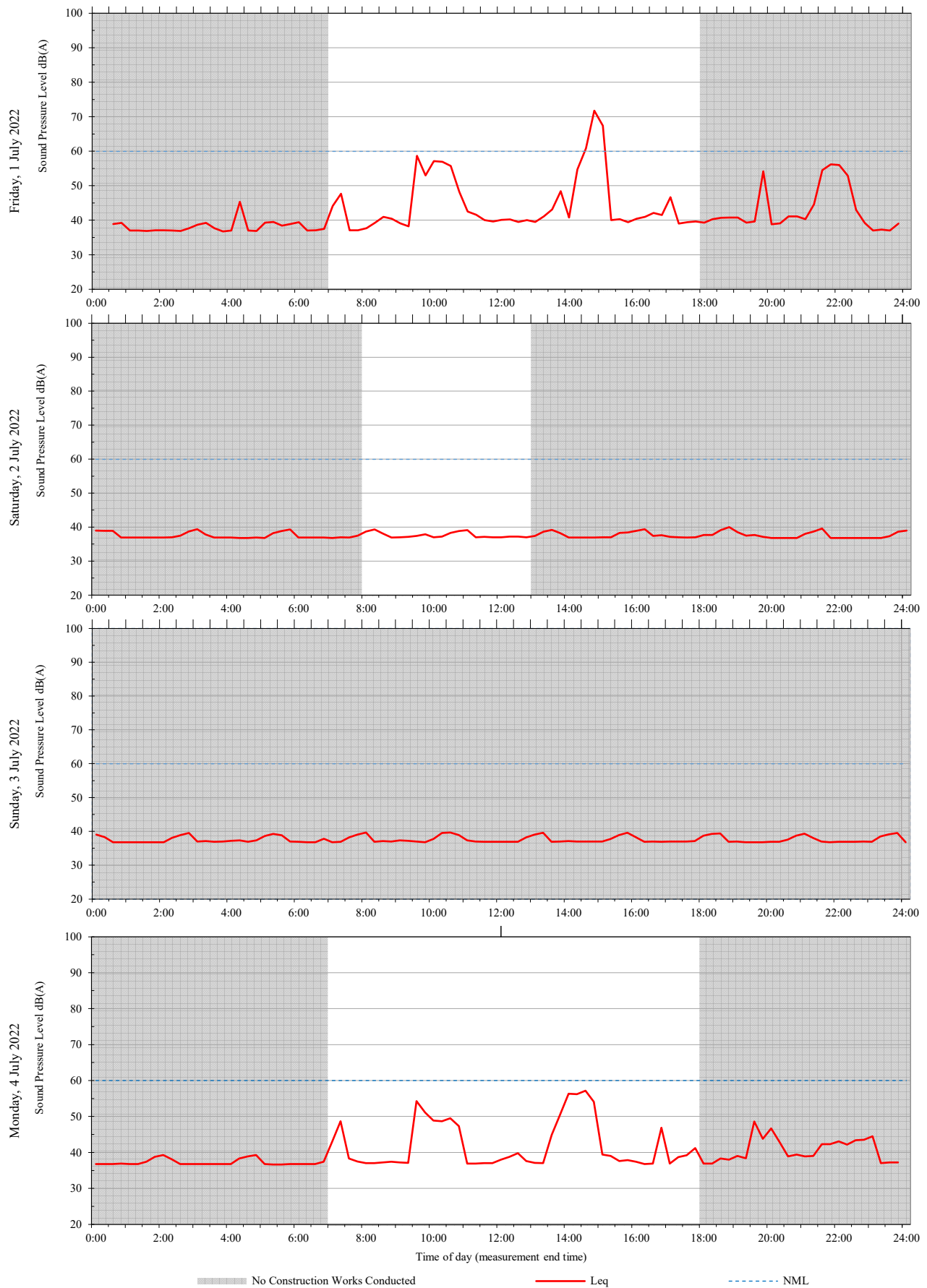
Appendix A

Noise Monitoring Daily Results

A1 CHW Ground Floor room 51DM047 (Westmead 1)

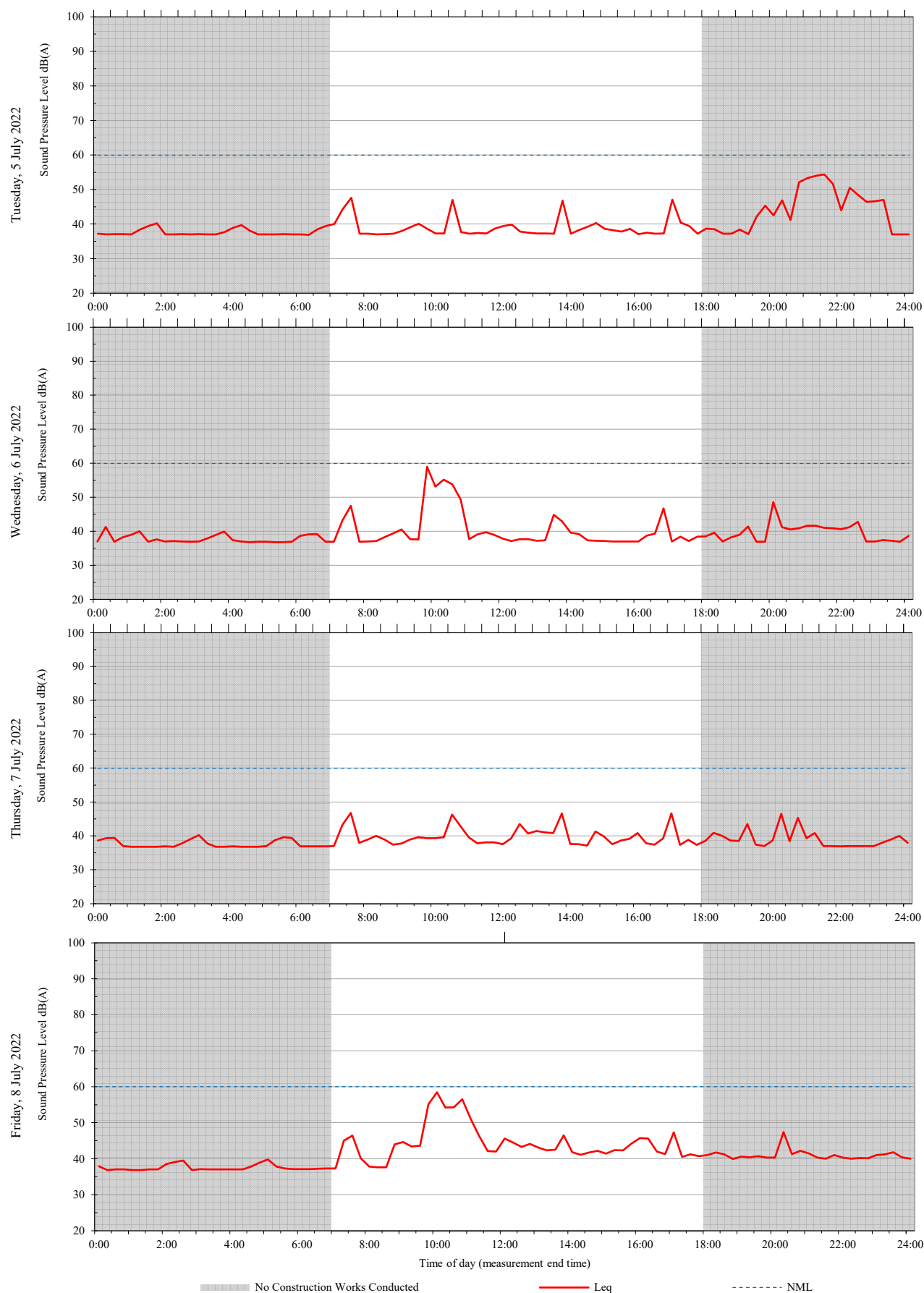
Unattended monitoring: Westmead 1 (CHW Endocrinology Kitchen) (51DM047) (Internal)

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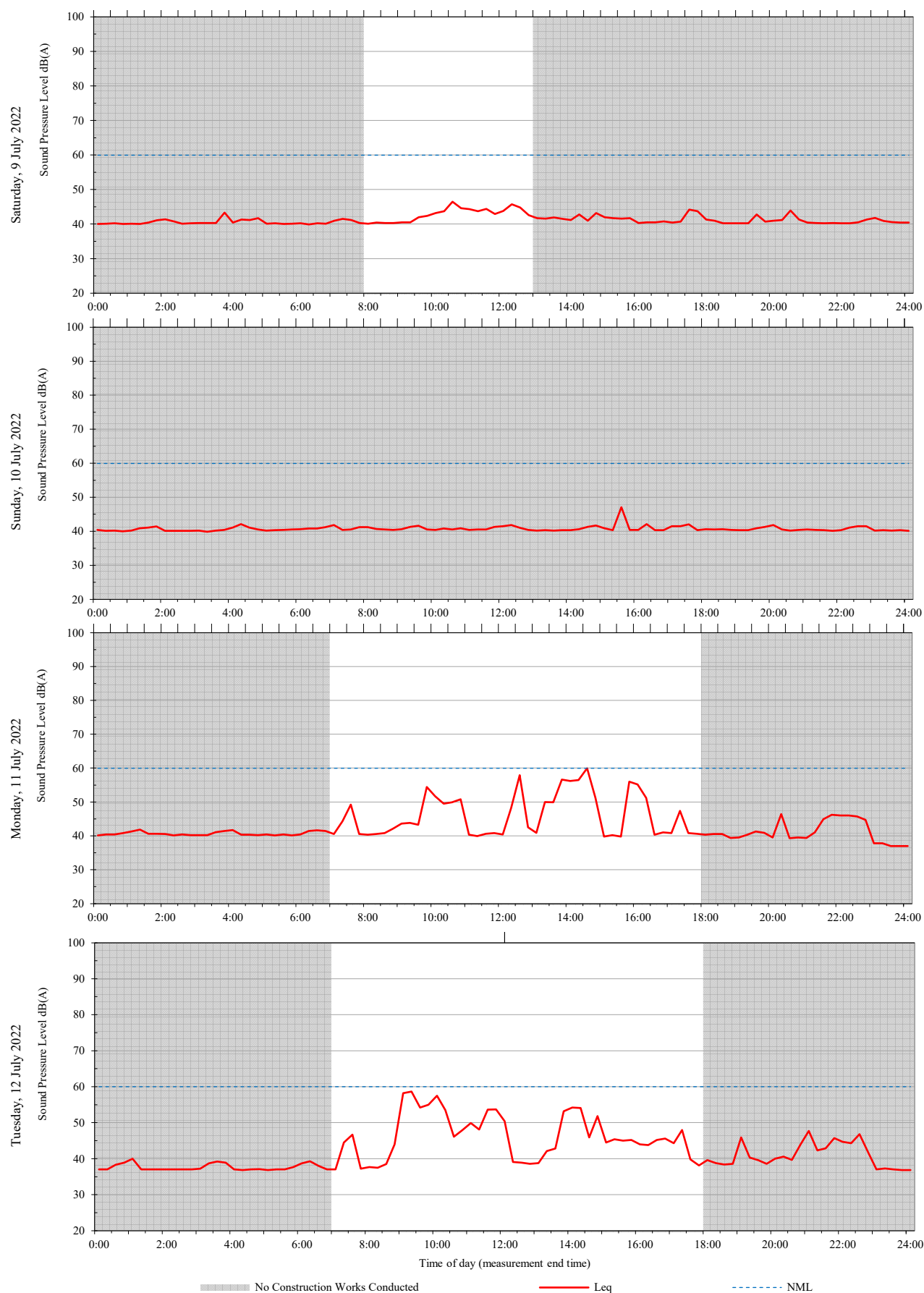
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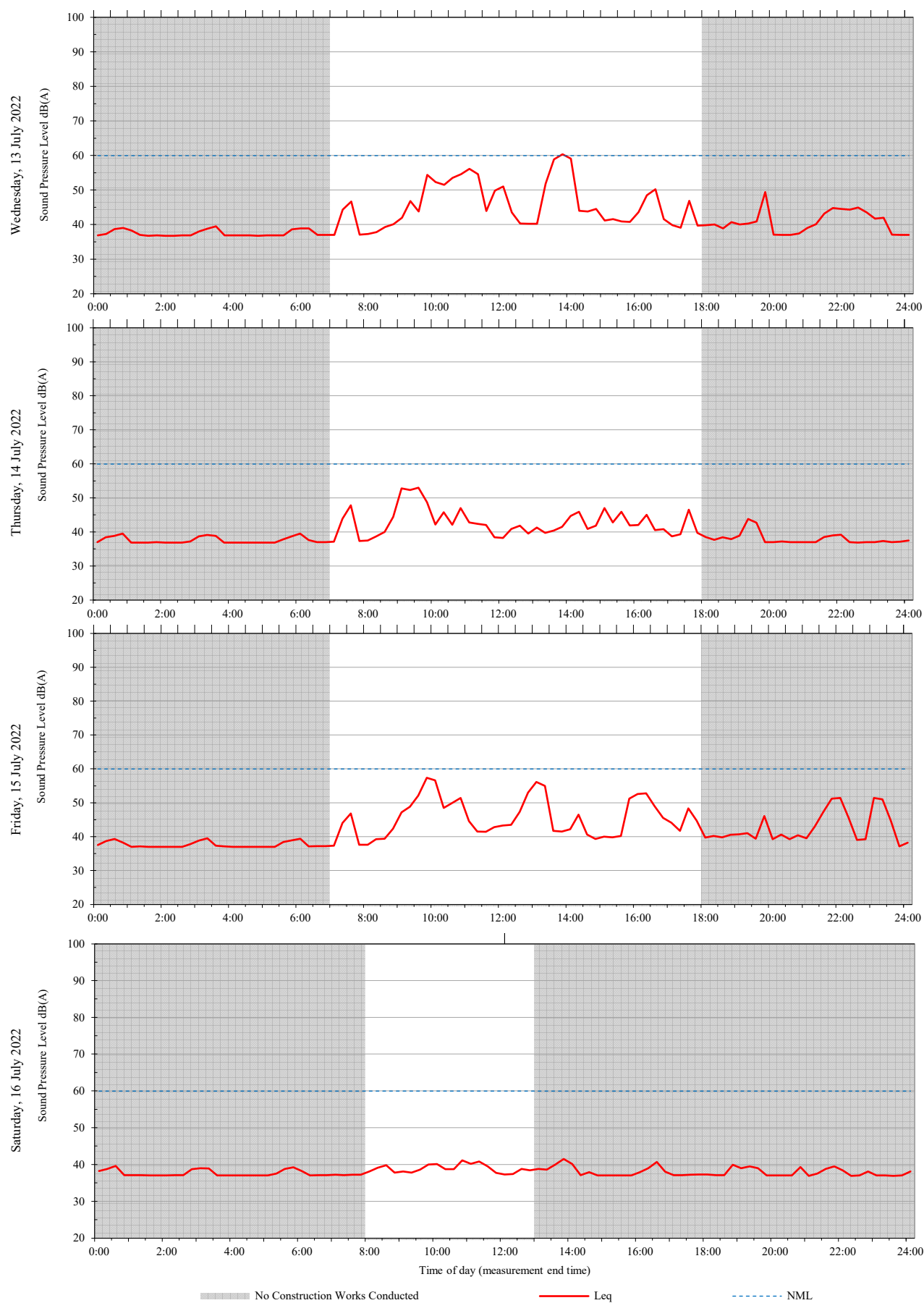
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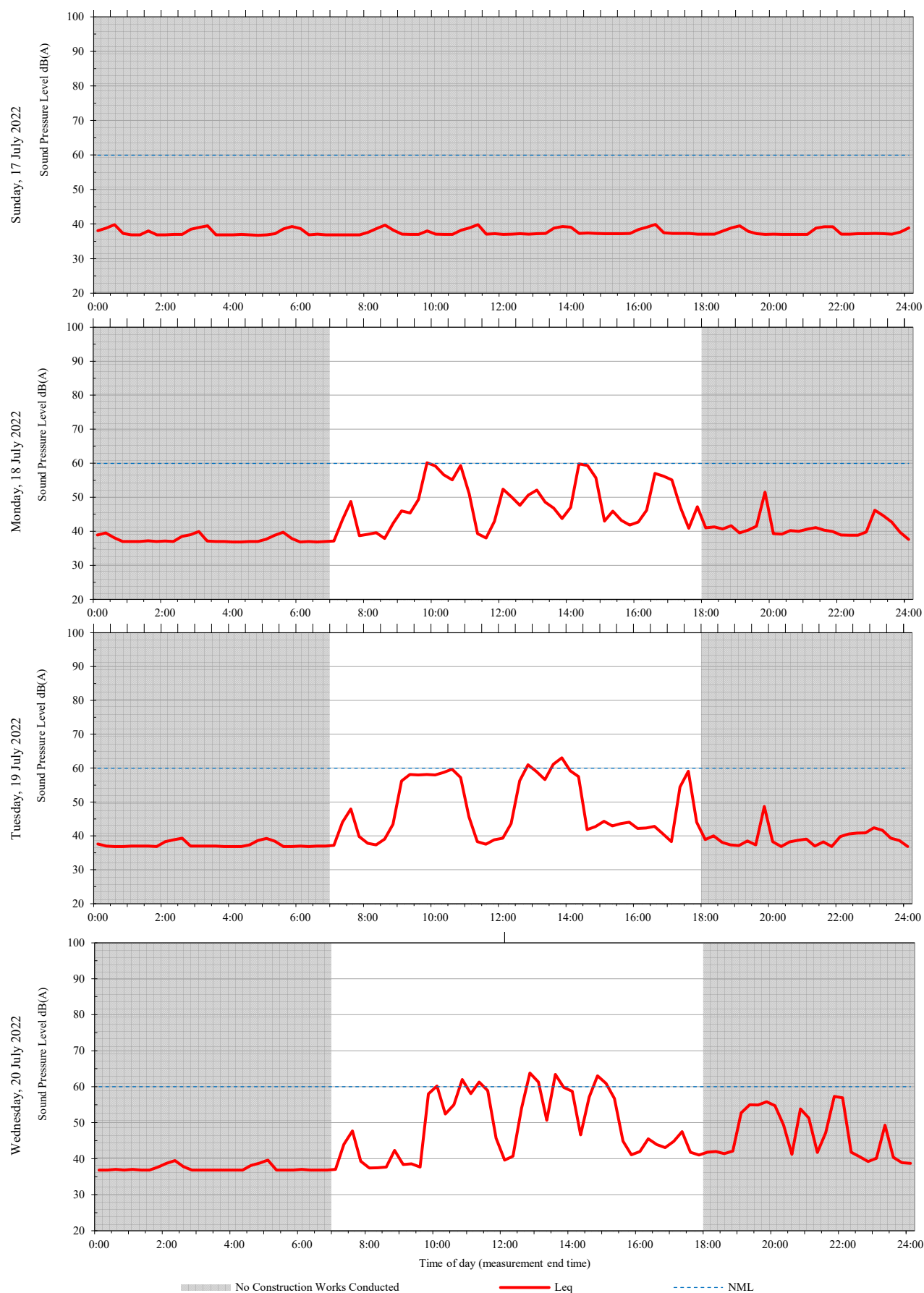


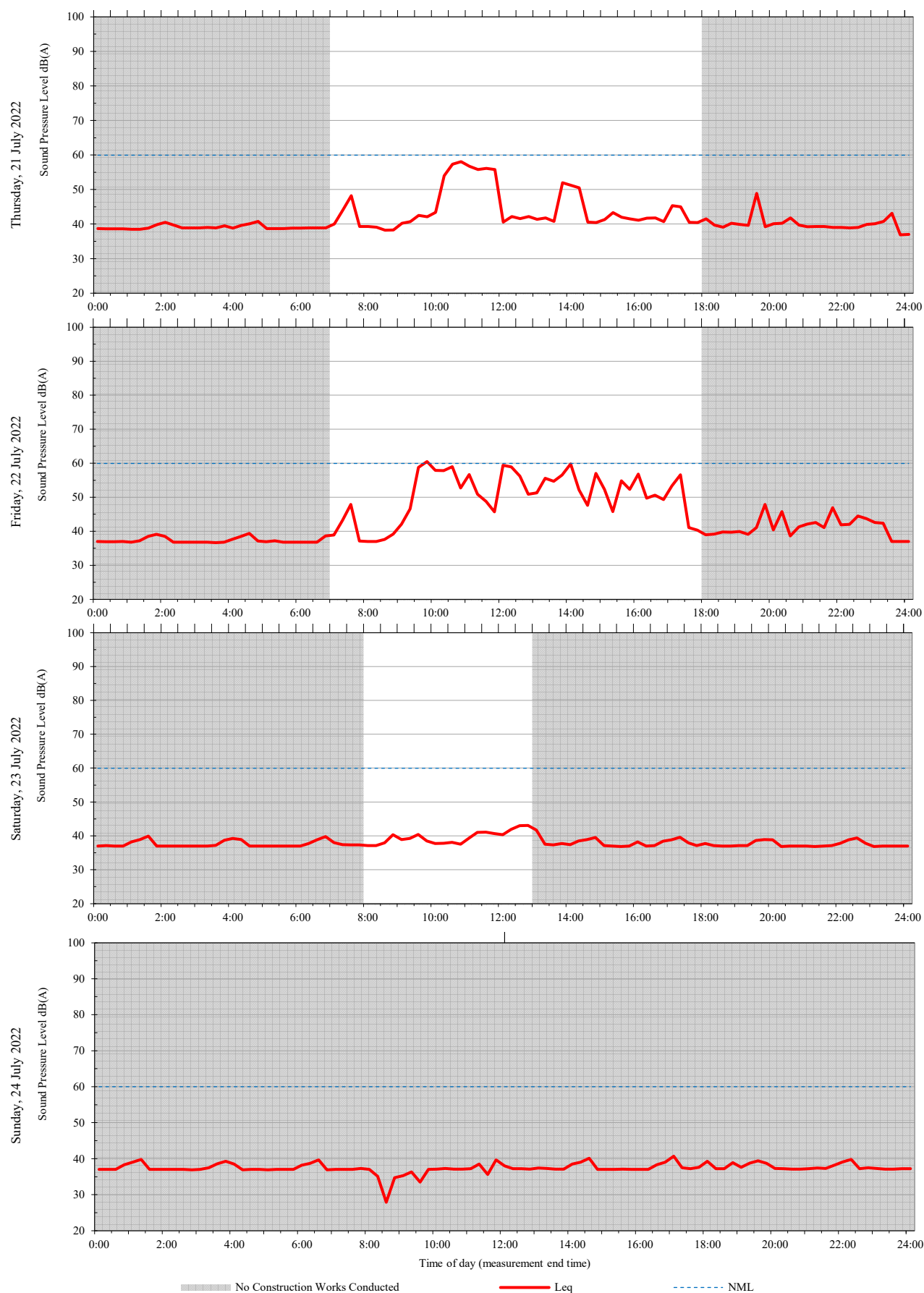
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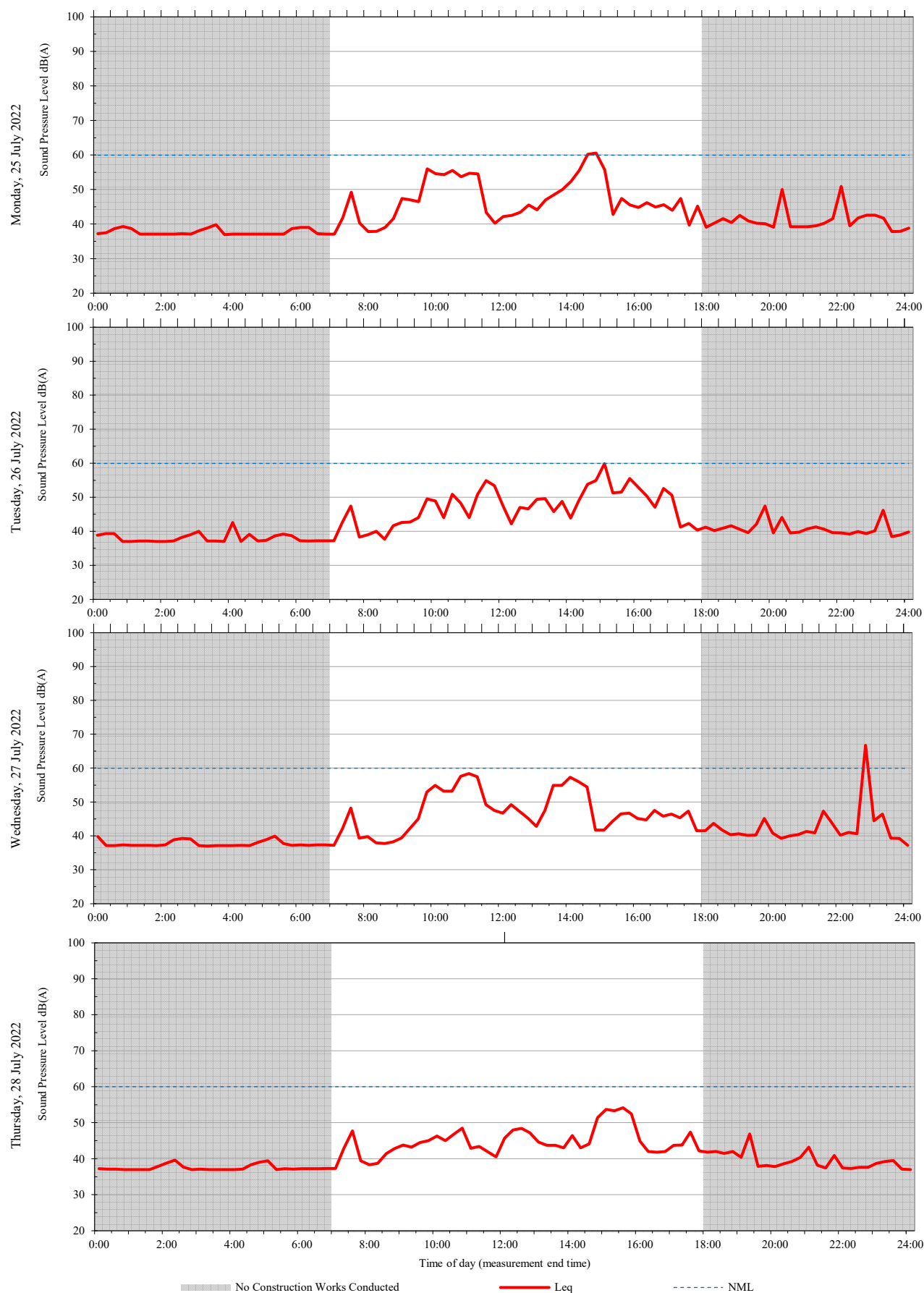
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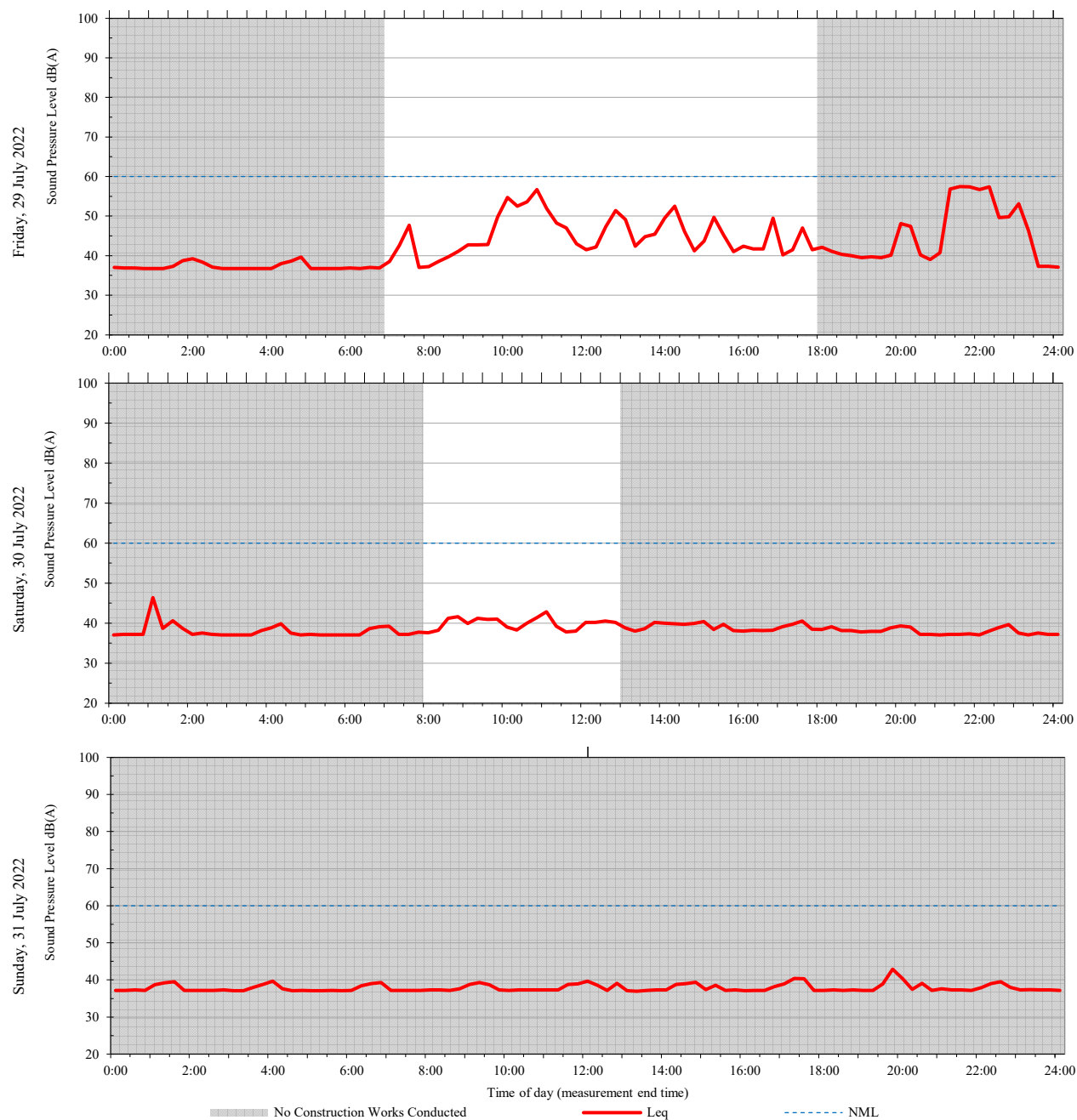






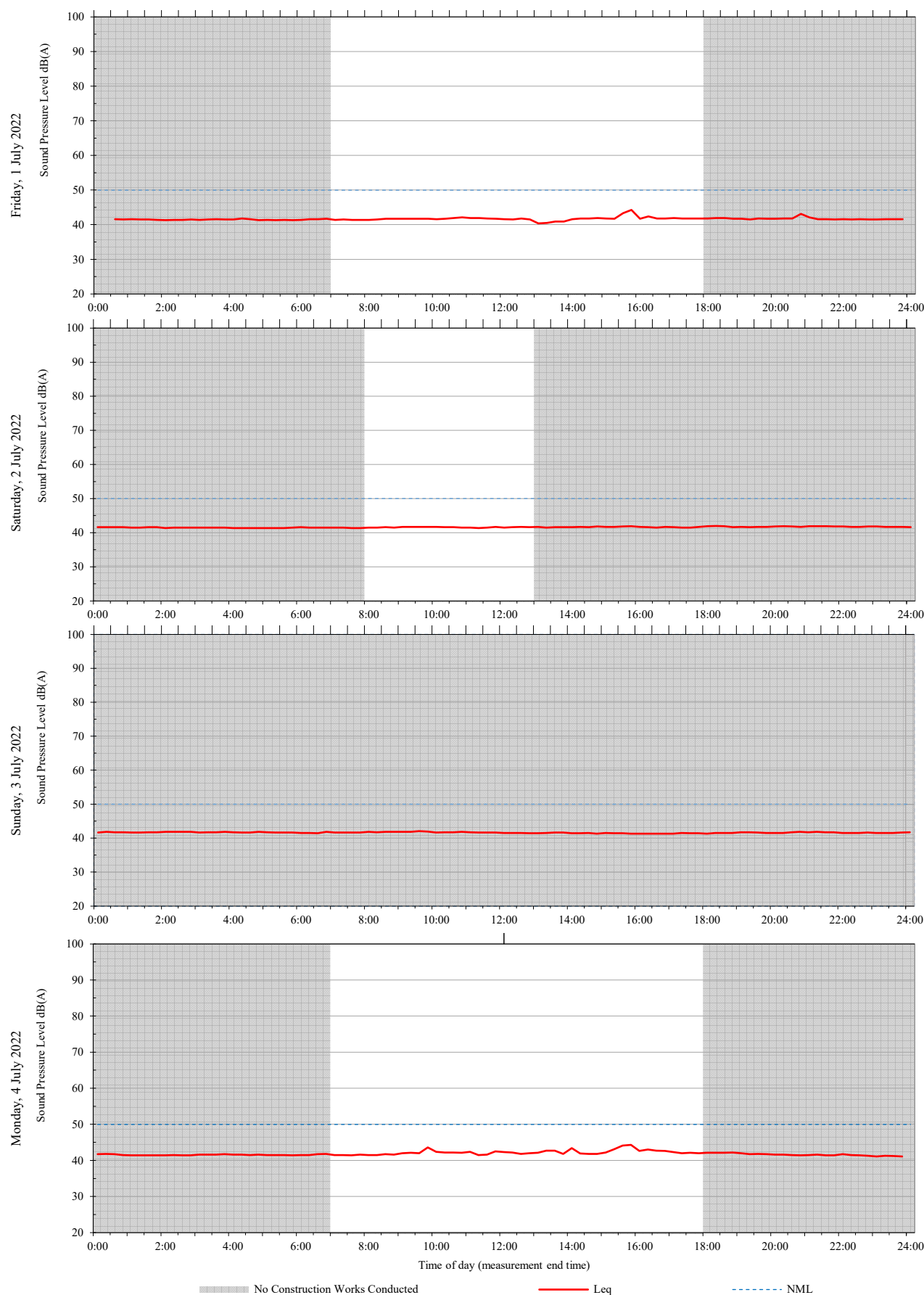
Unattended monitoring: Westmead 1 (CHW Endocrinology Kitchen) (51DM047) (Internal)

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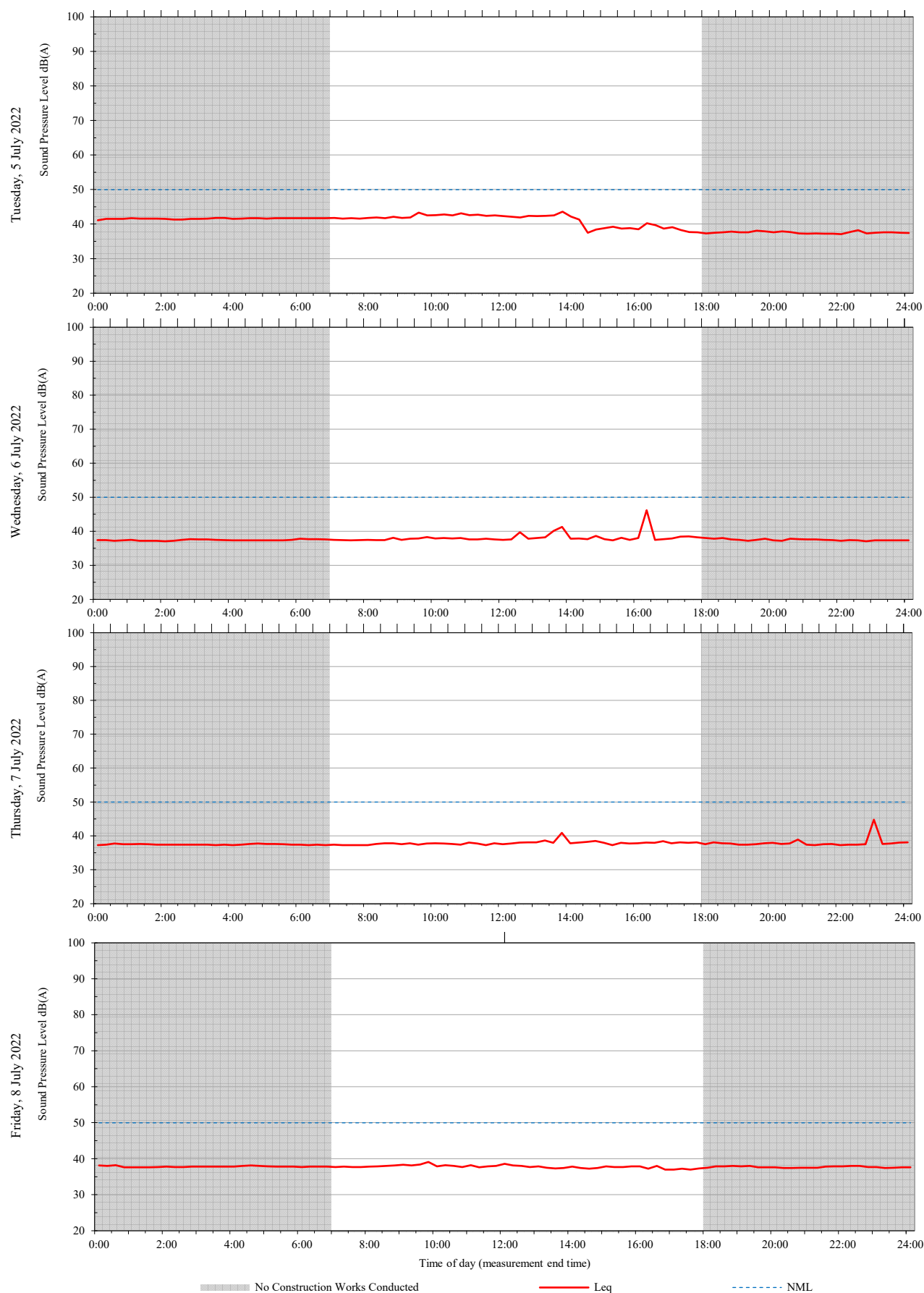


A2 CASB Level 3 Operating Theatre Store Room WM11K.03.3264 (Westmead 5)

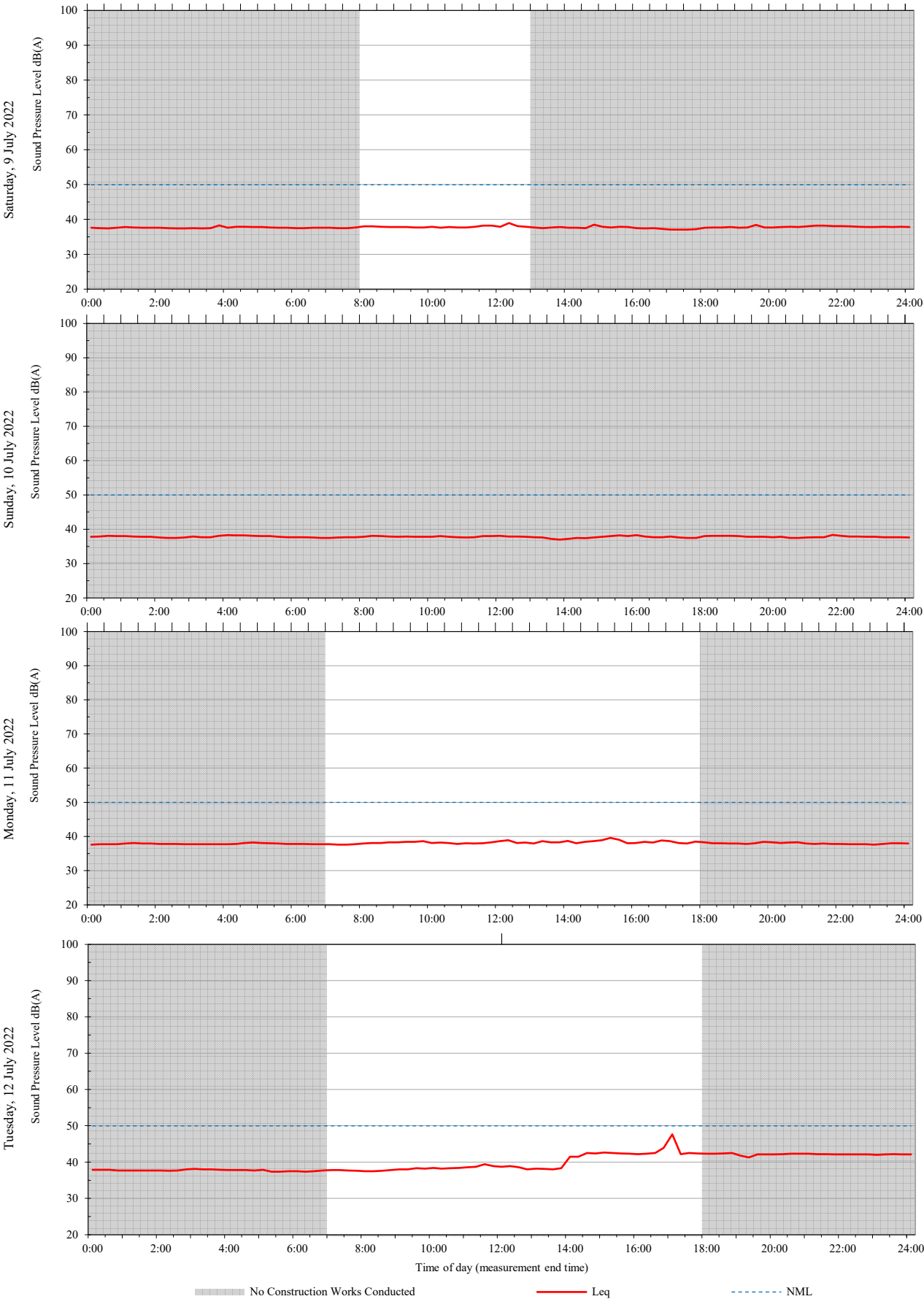
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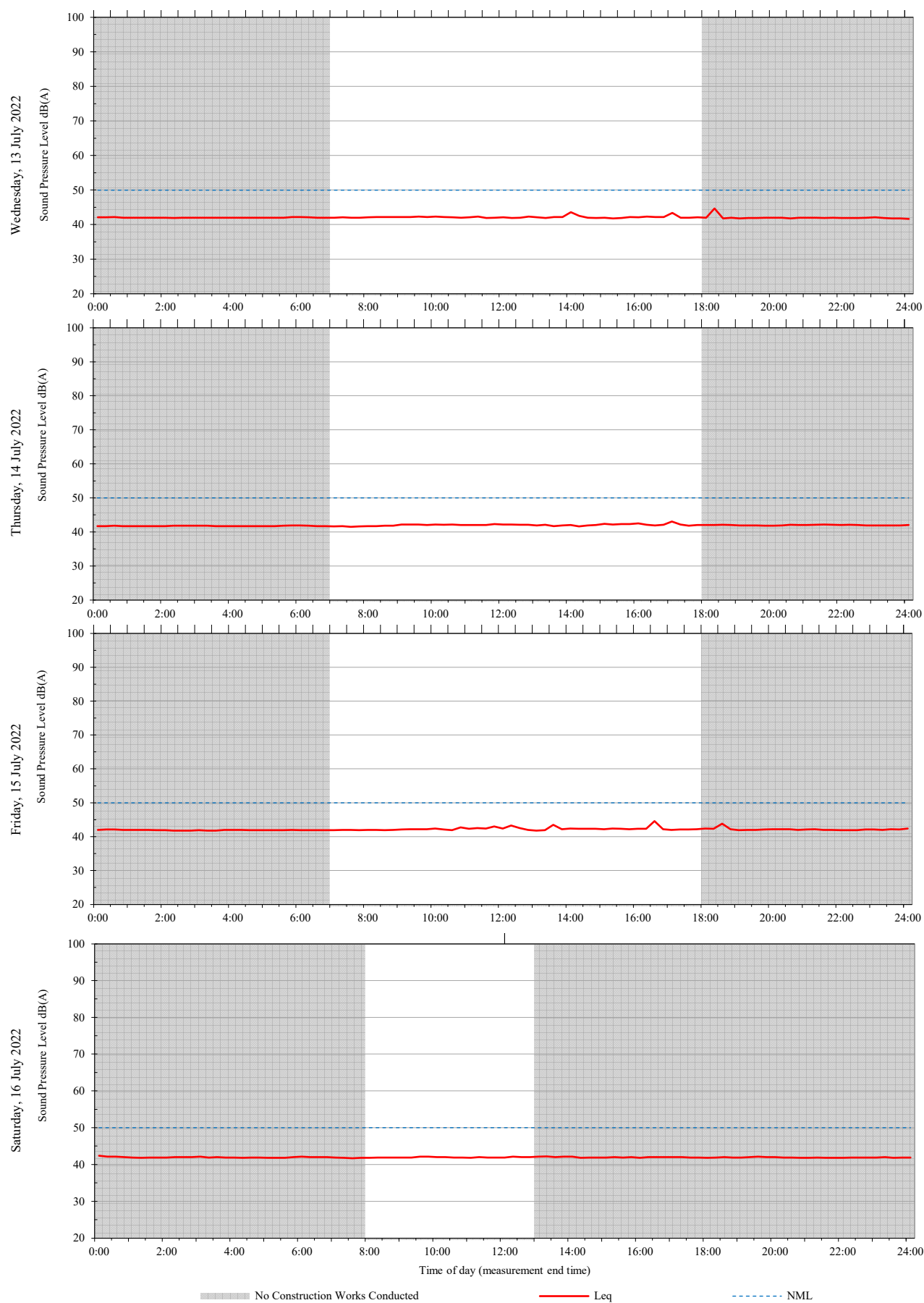
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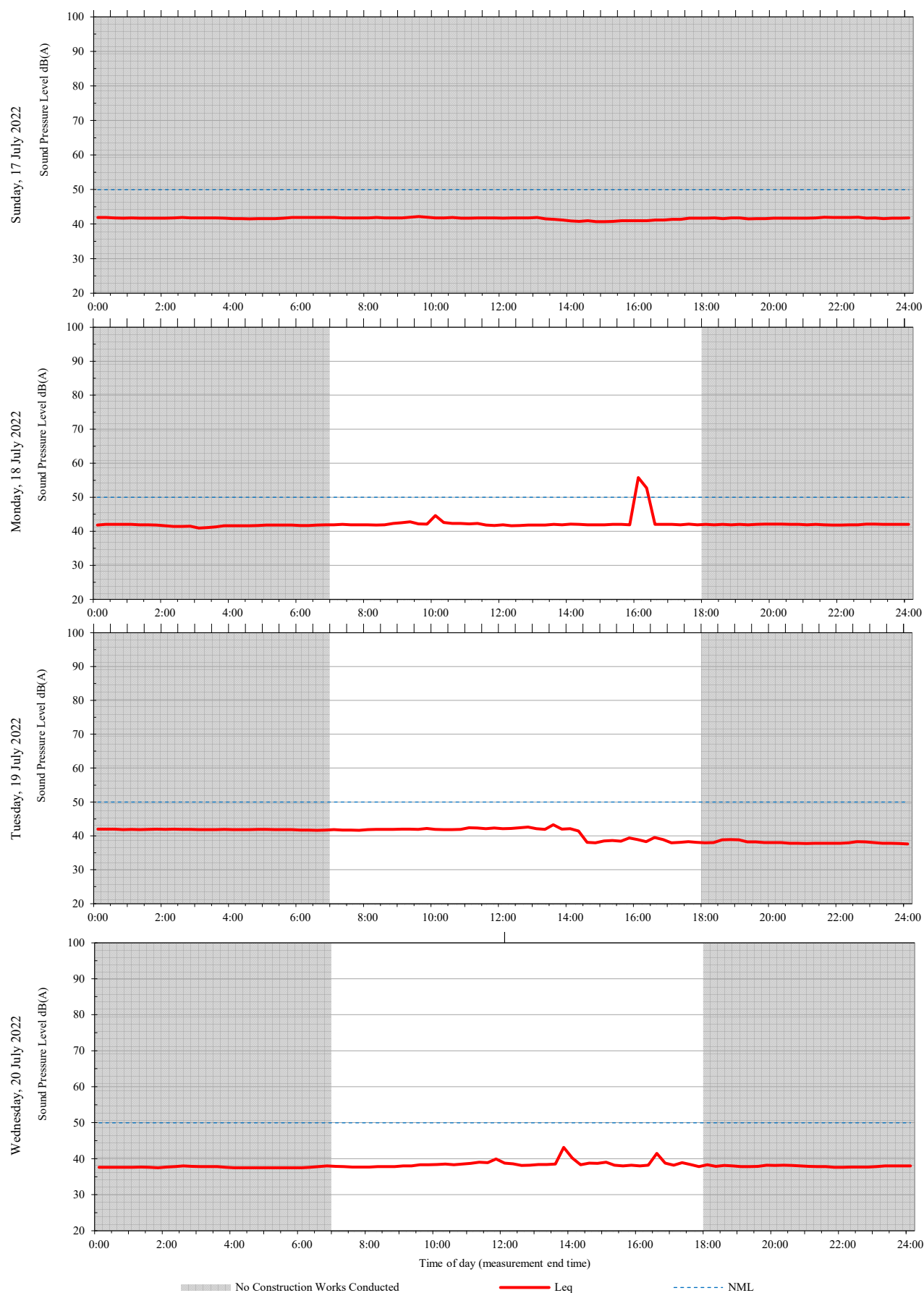
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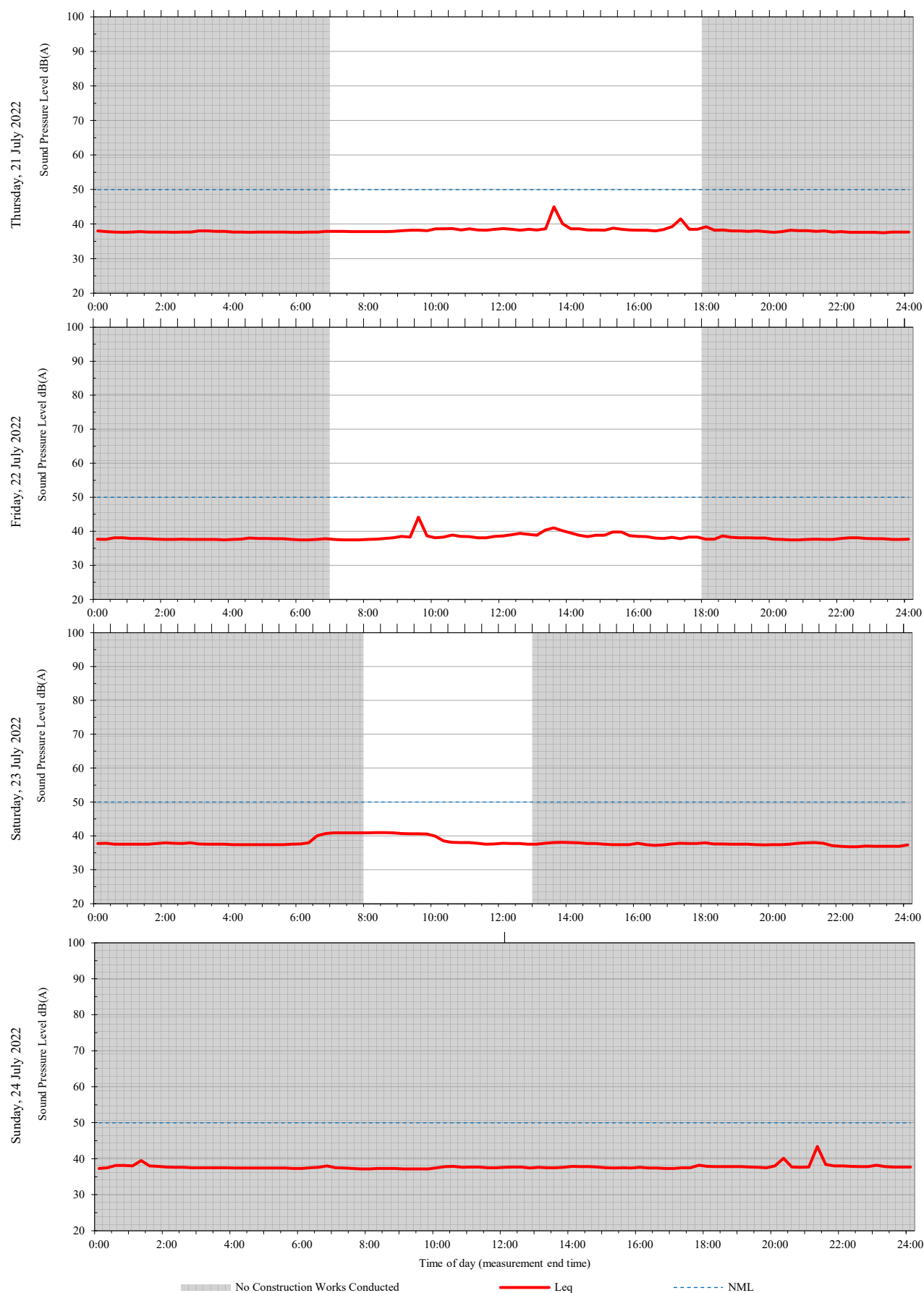
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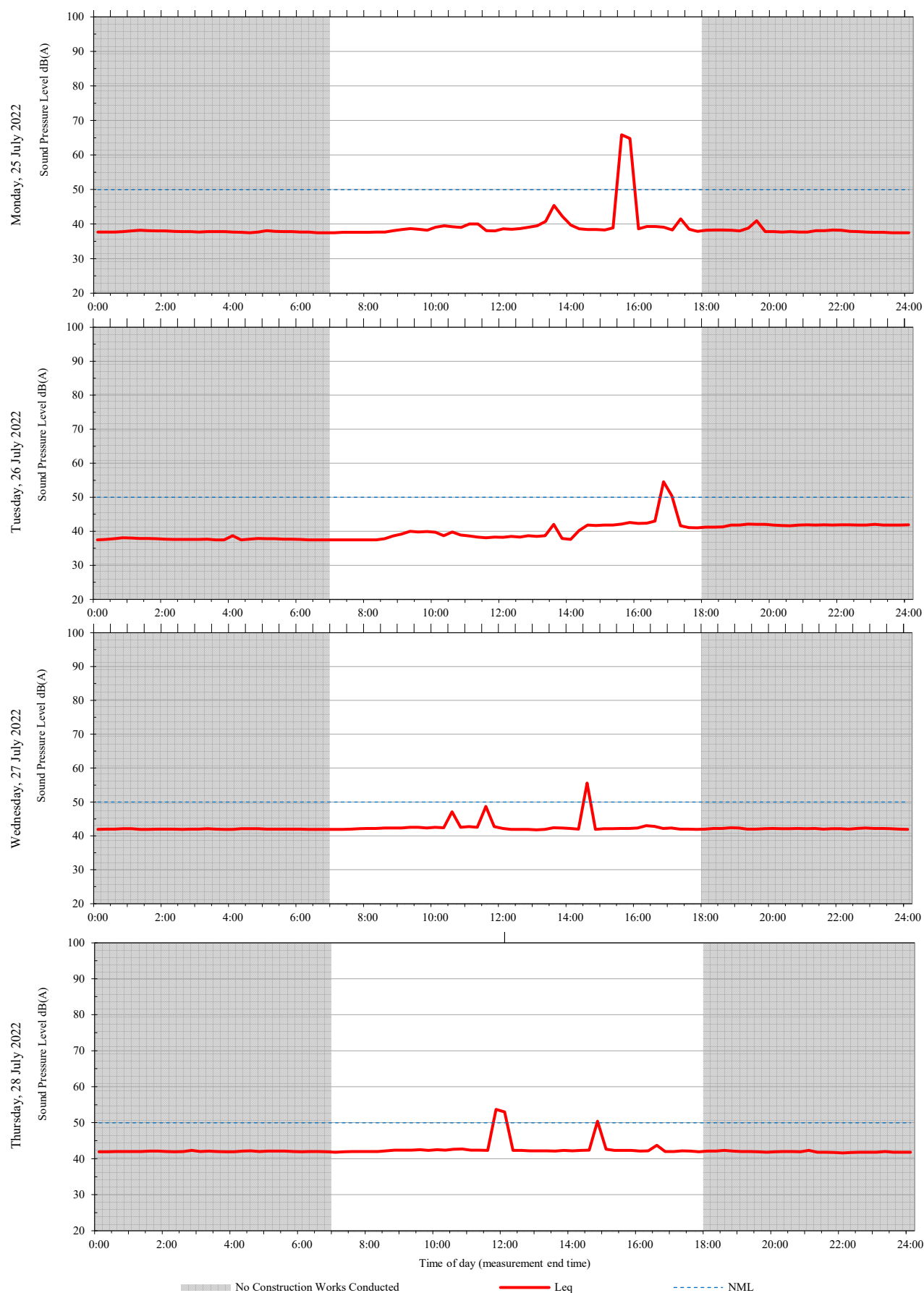
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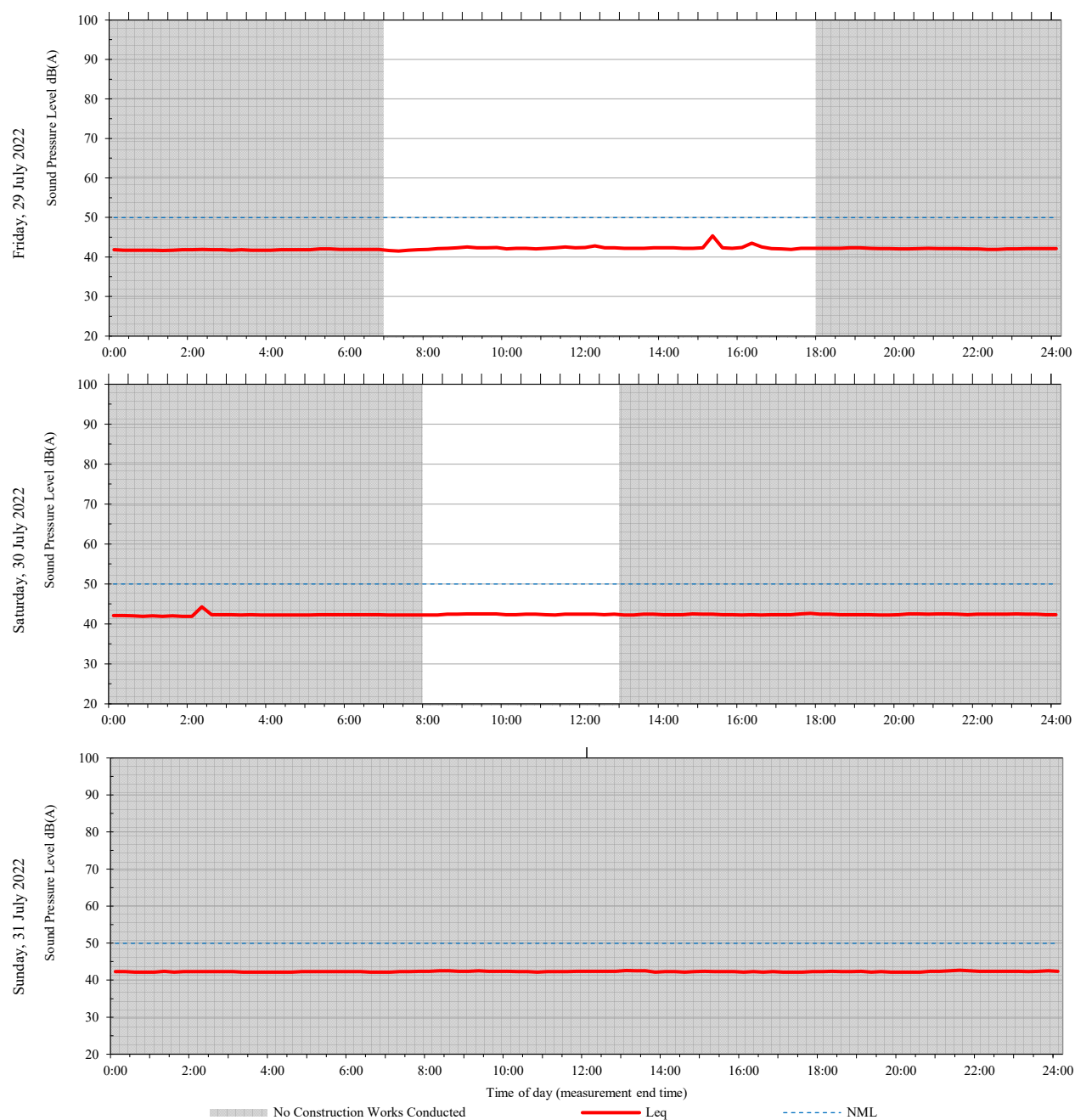
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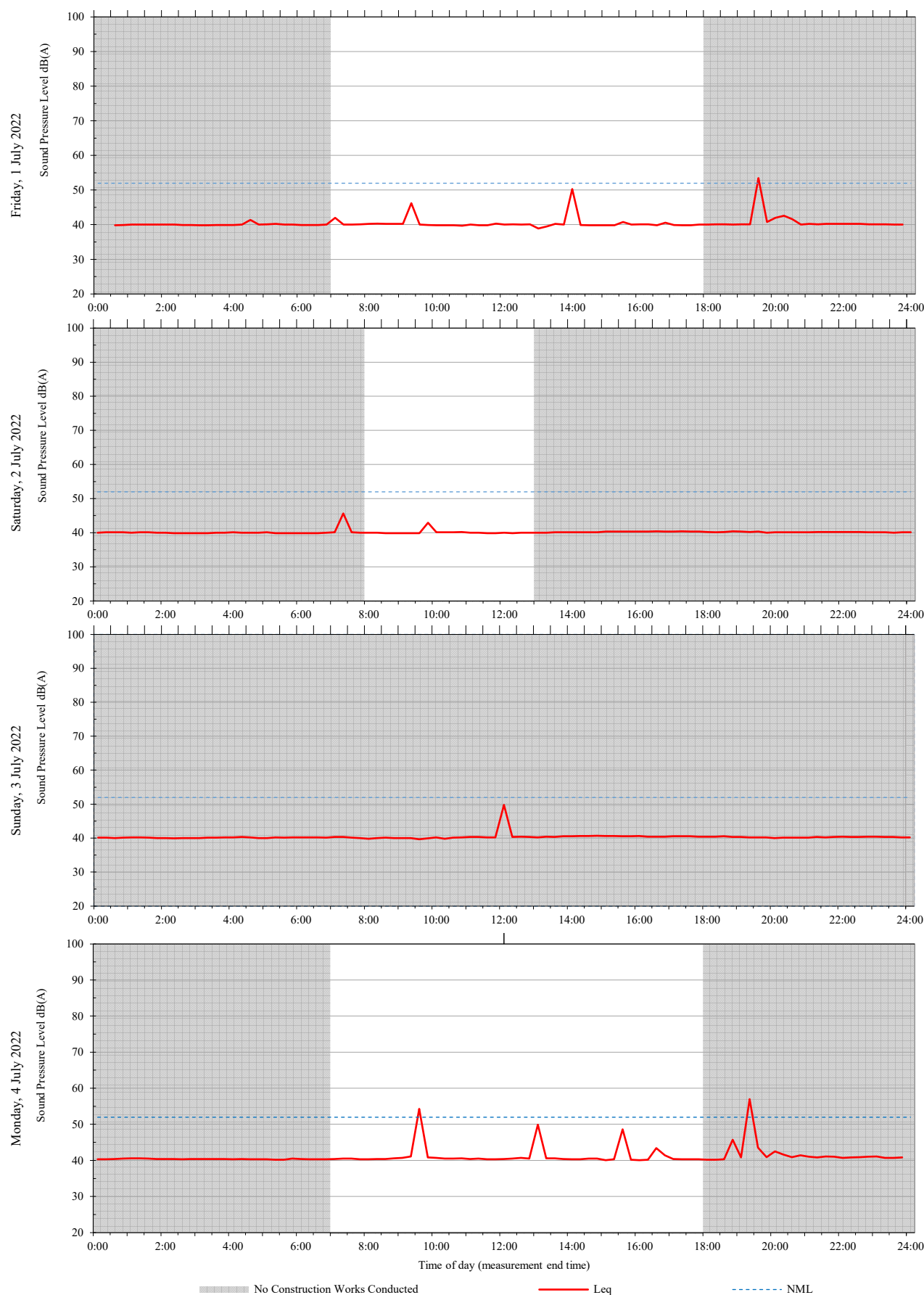
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Unattended monitoring: Westmead 5 - (CASB - L3 Operating Theatre Store Rm (WM11K.03.3264)) (InterARUP

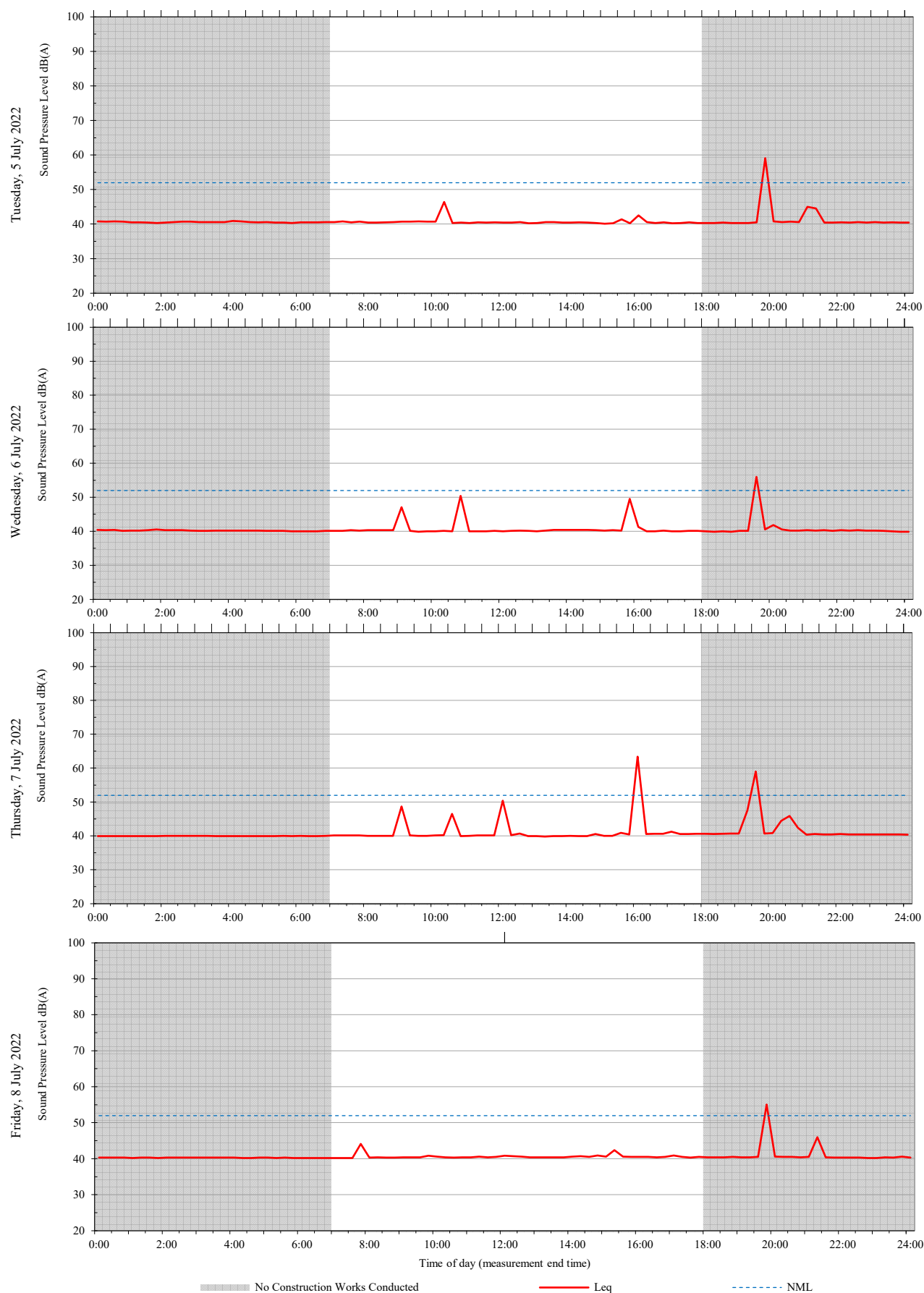


A3 CASB Level 6 Cleaner's Room WM11K.06.6079 (Westmead 6)



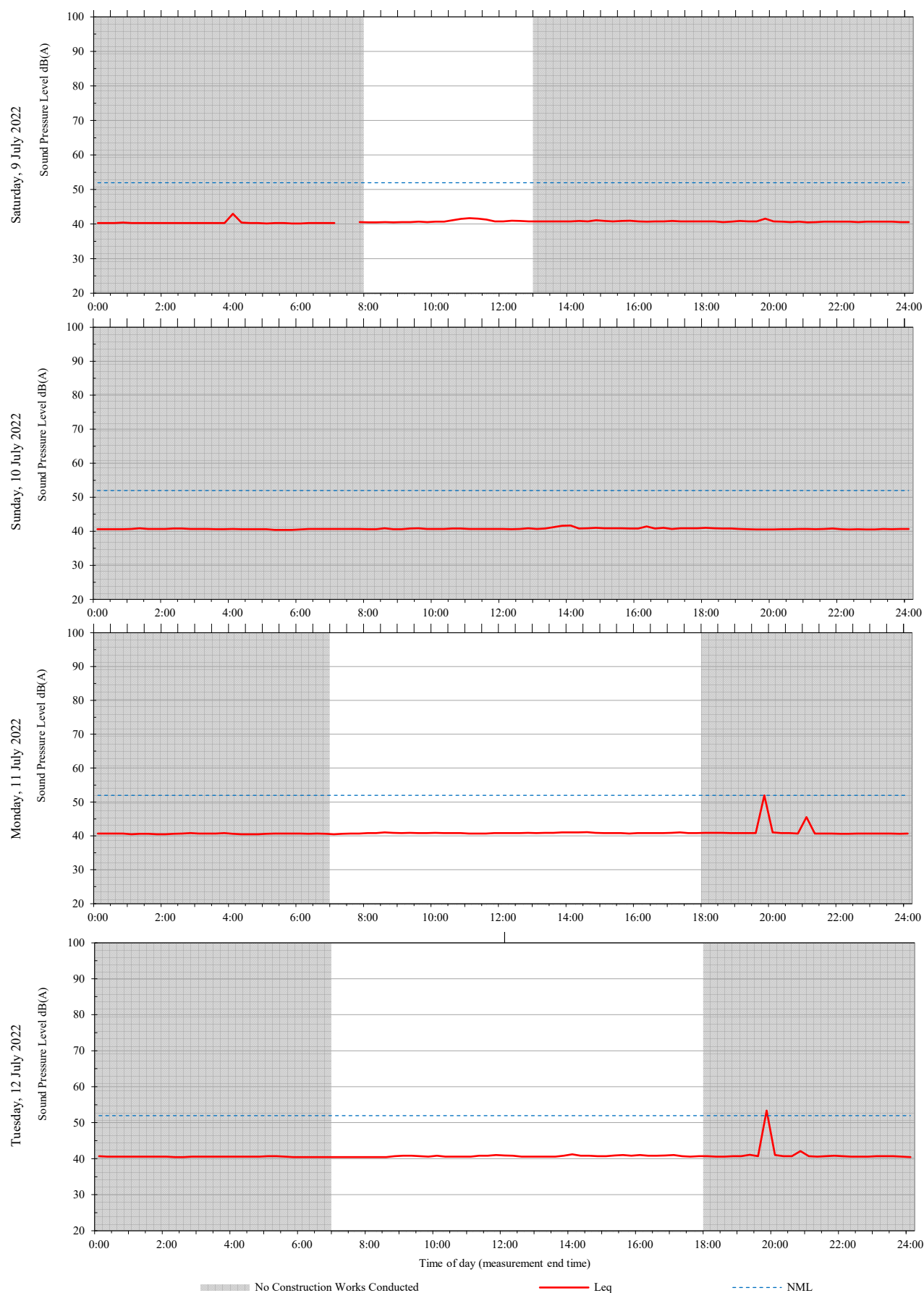
Unattended monitoring: Westmead 6- (CASB - L6 Cleaners Rm (WM11K.06.6079) (Internal)

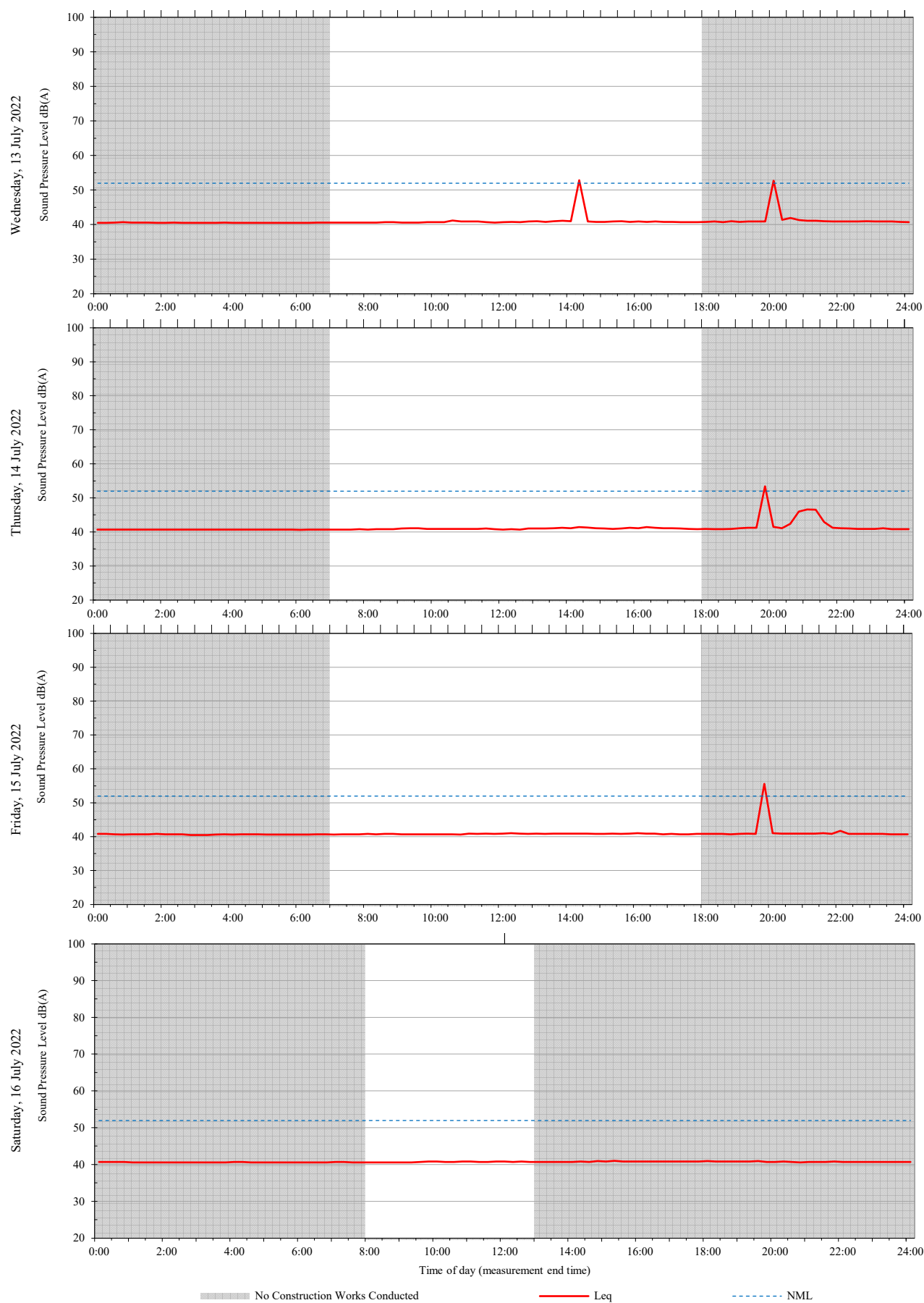
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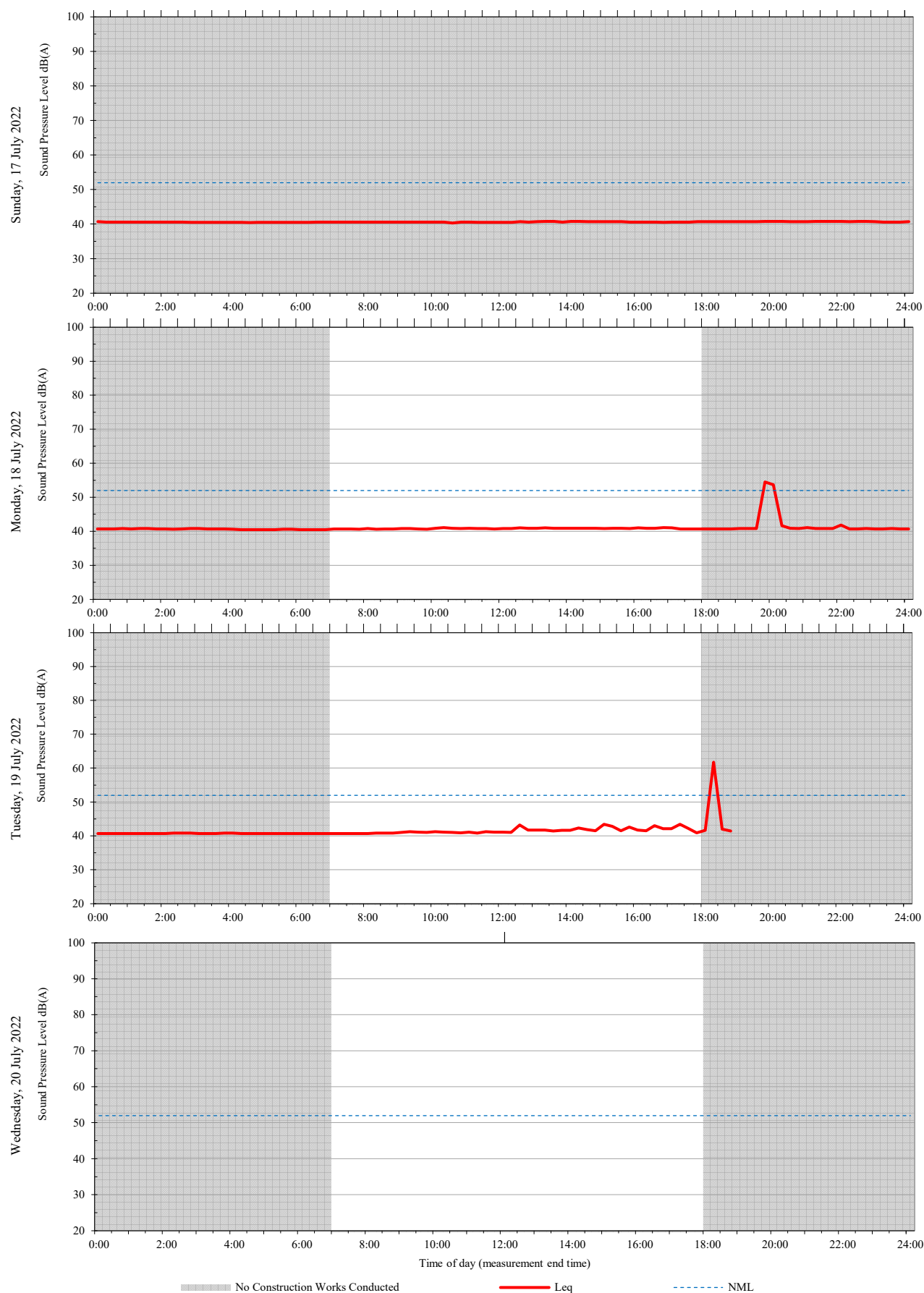


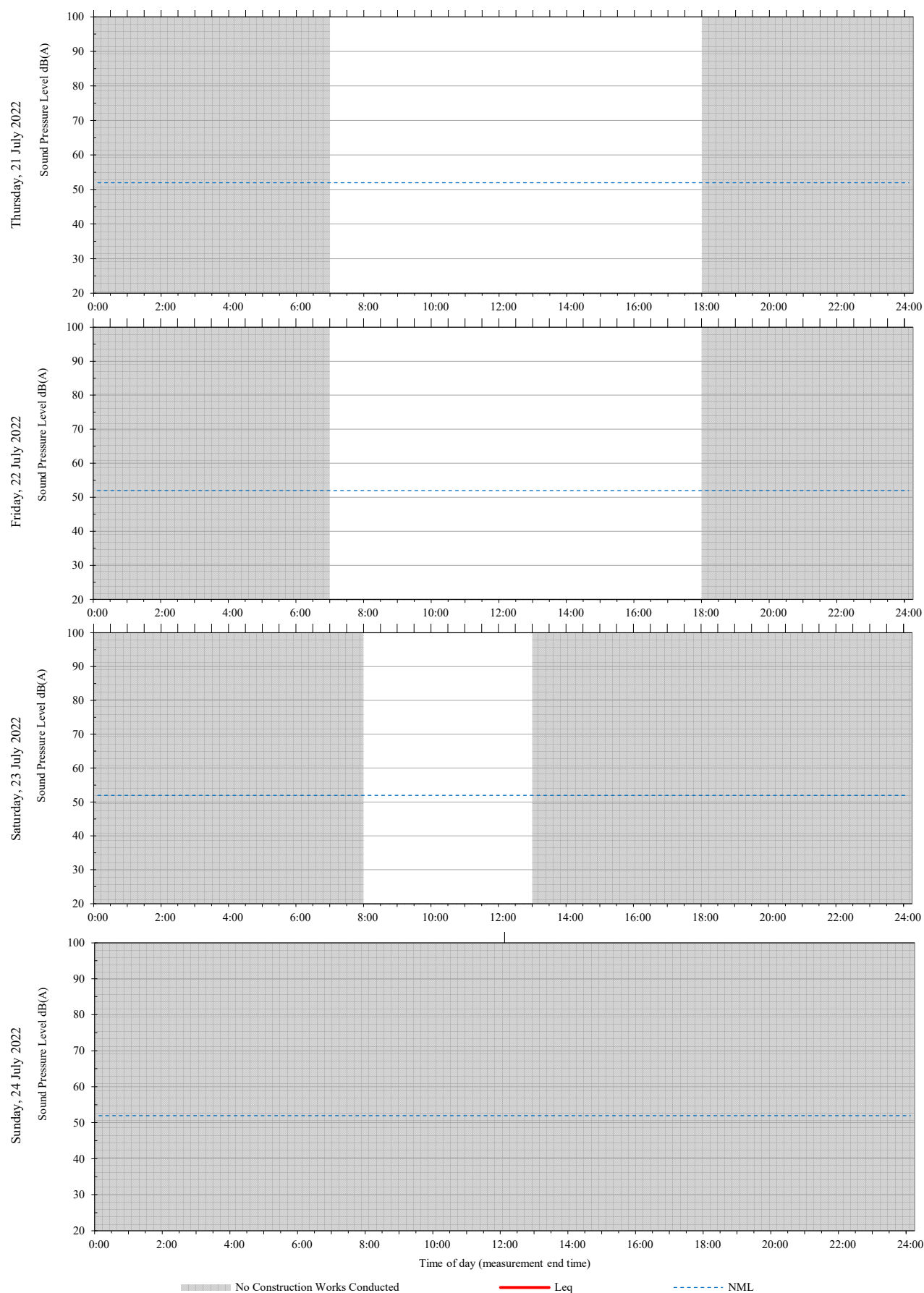
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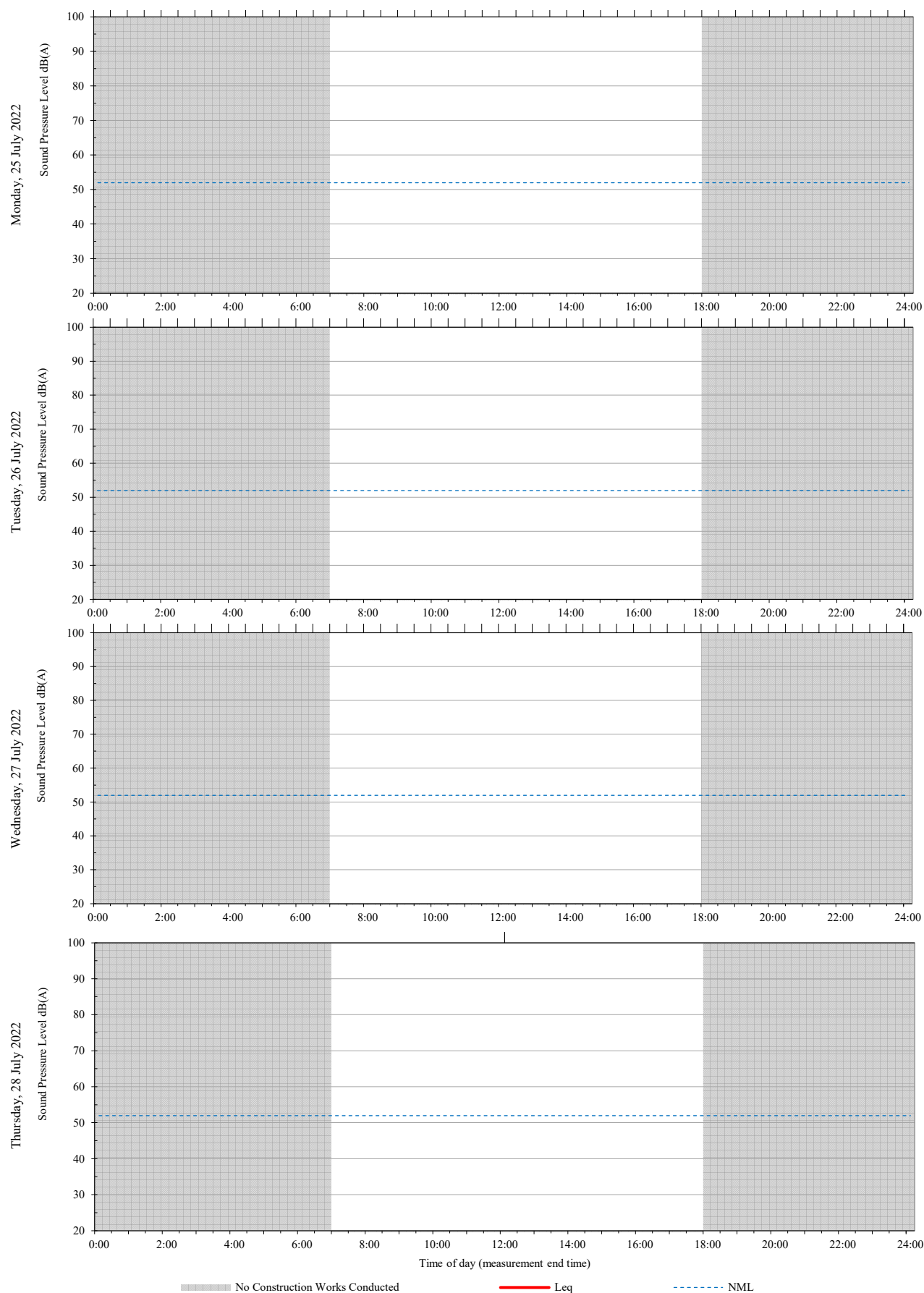






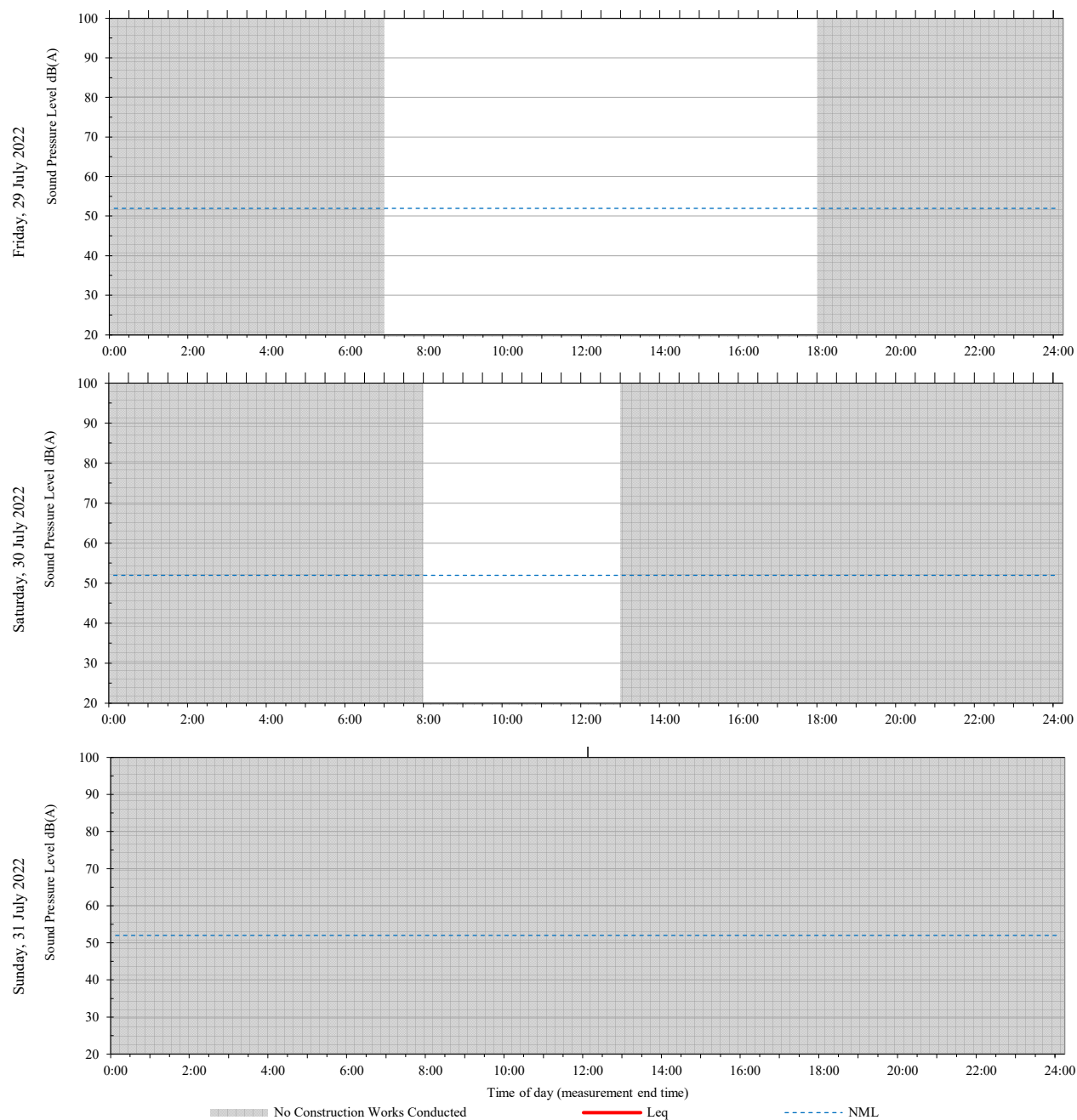
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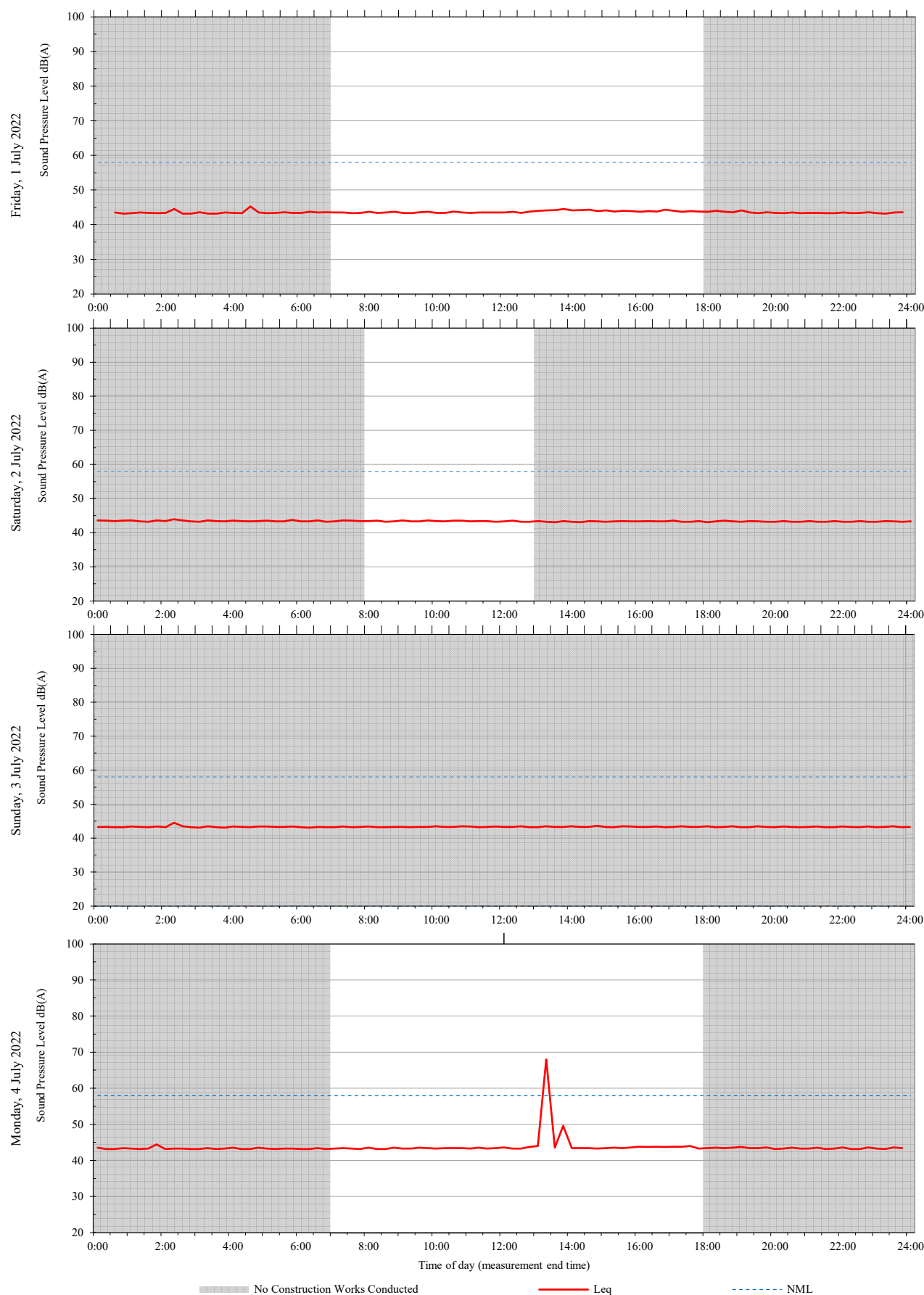
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A4 KR Level 3 Radiation Room 33 RF041 (Westmead 7)

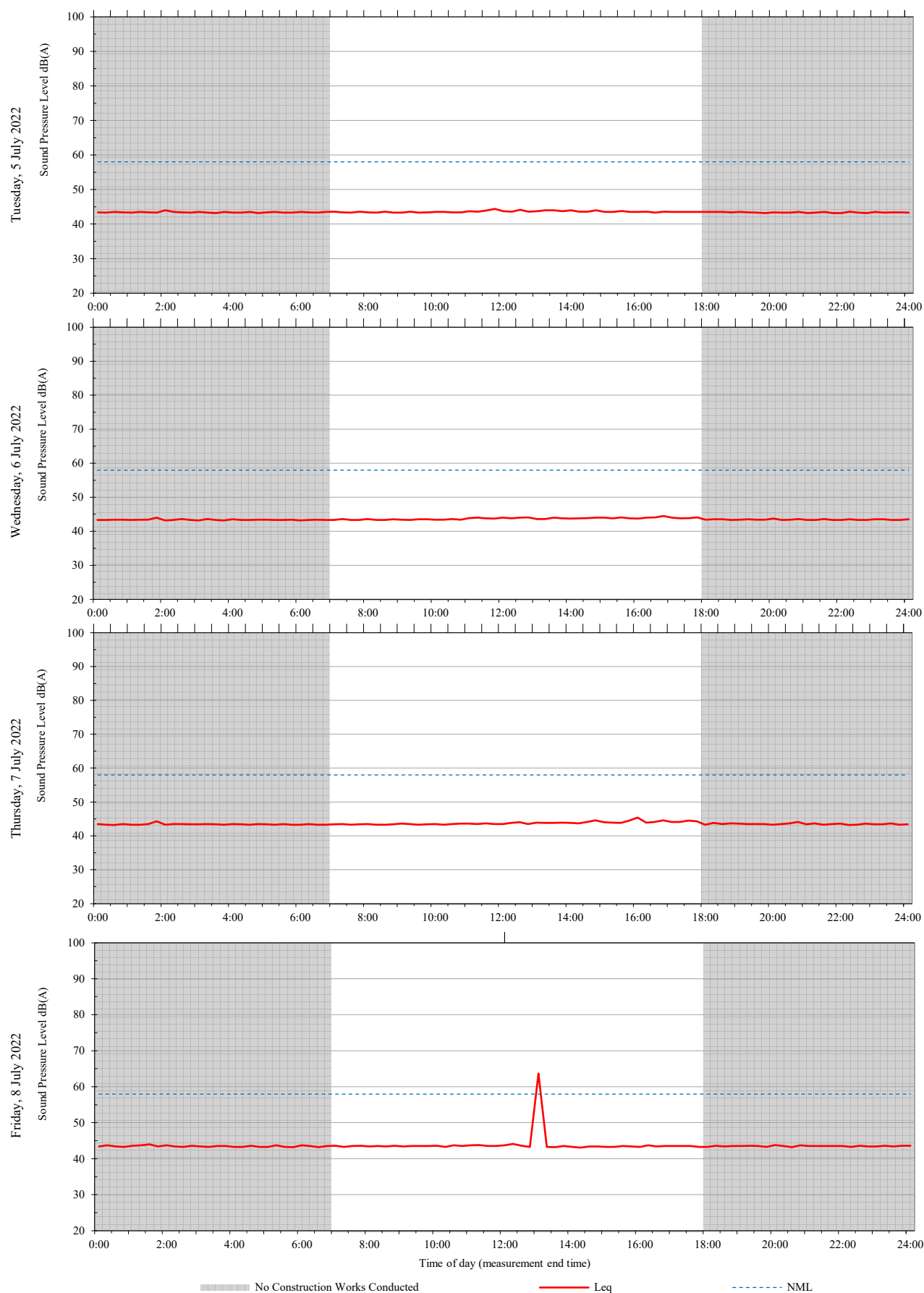
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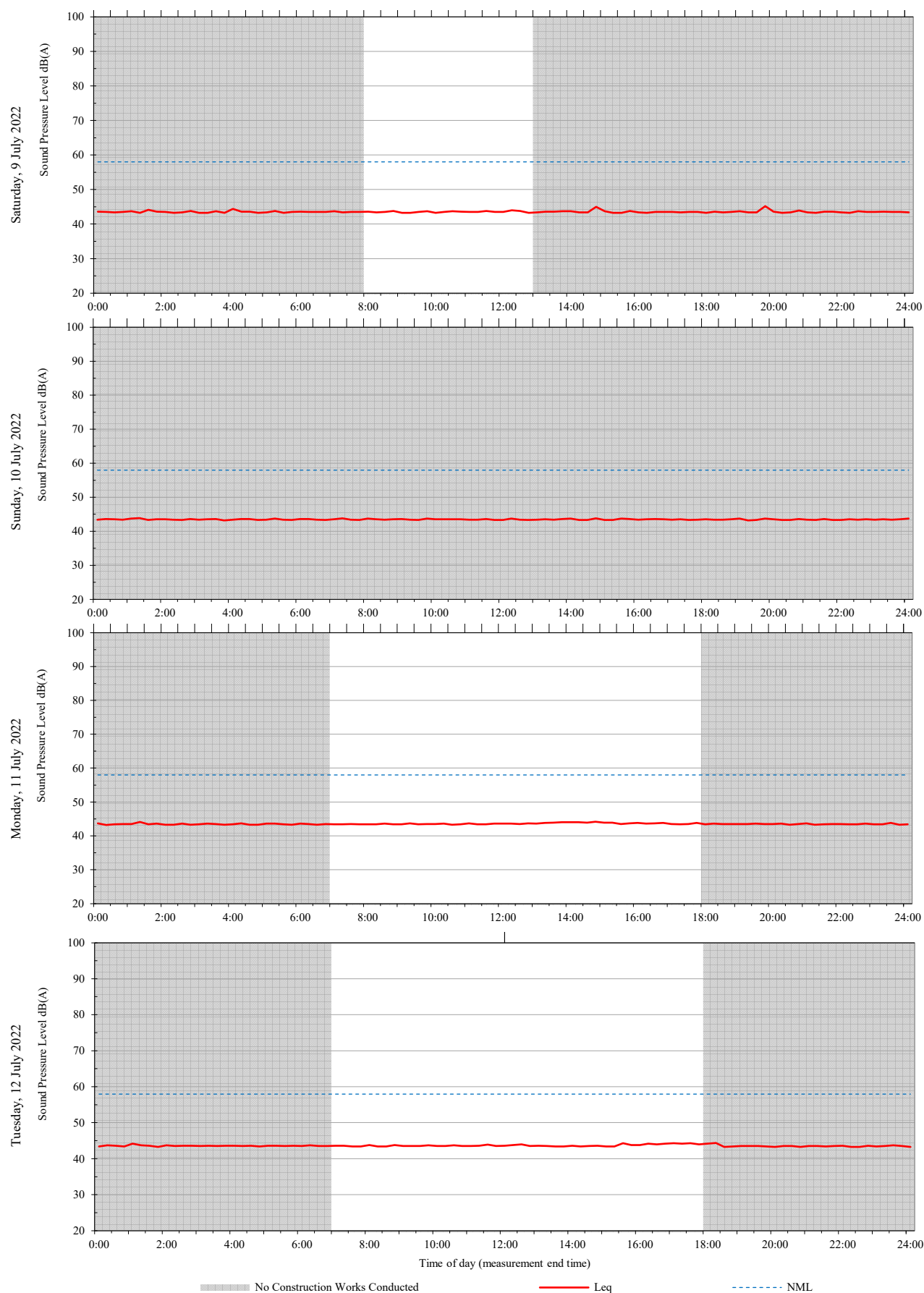
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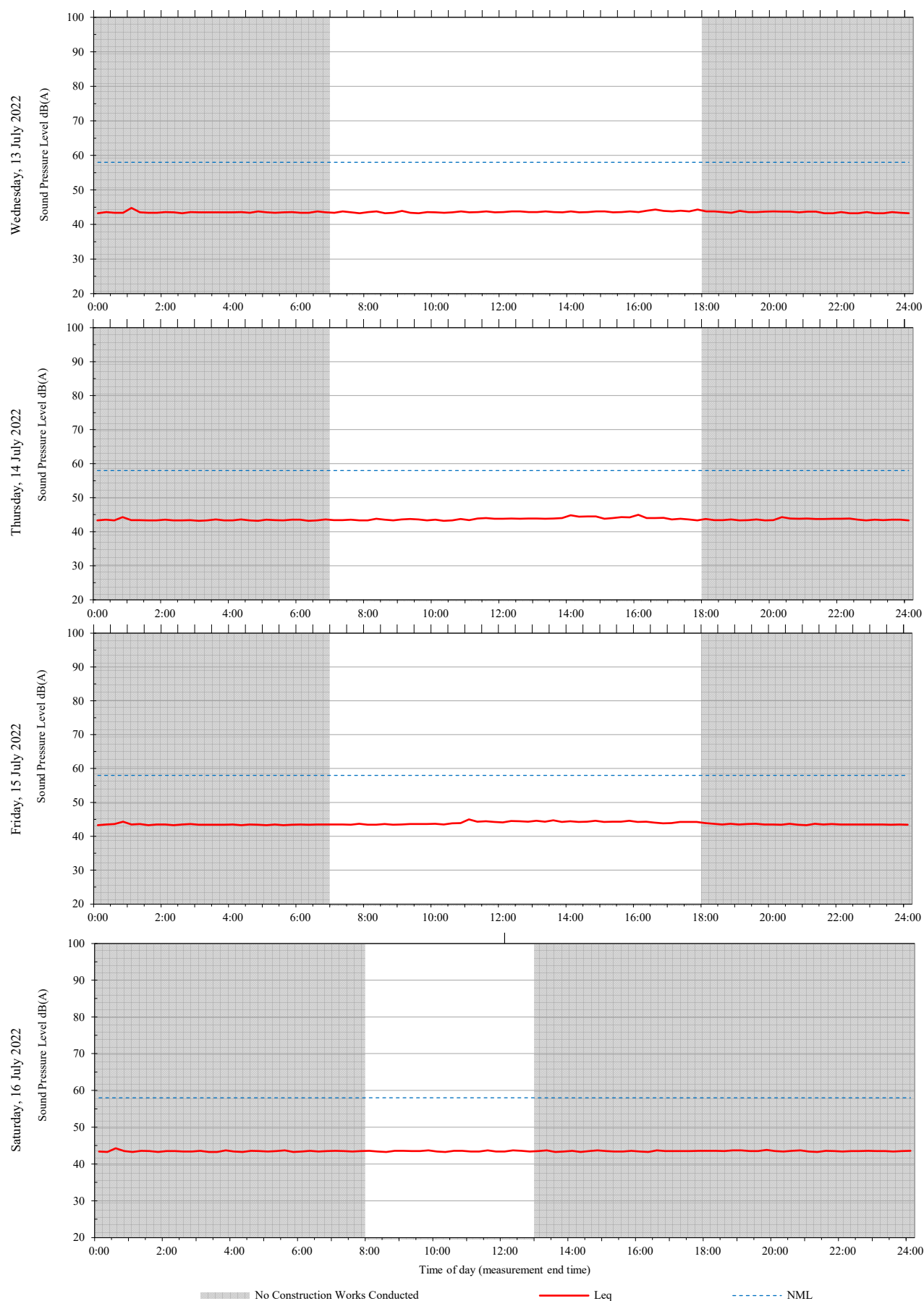
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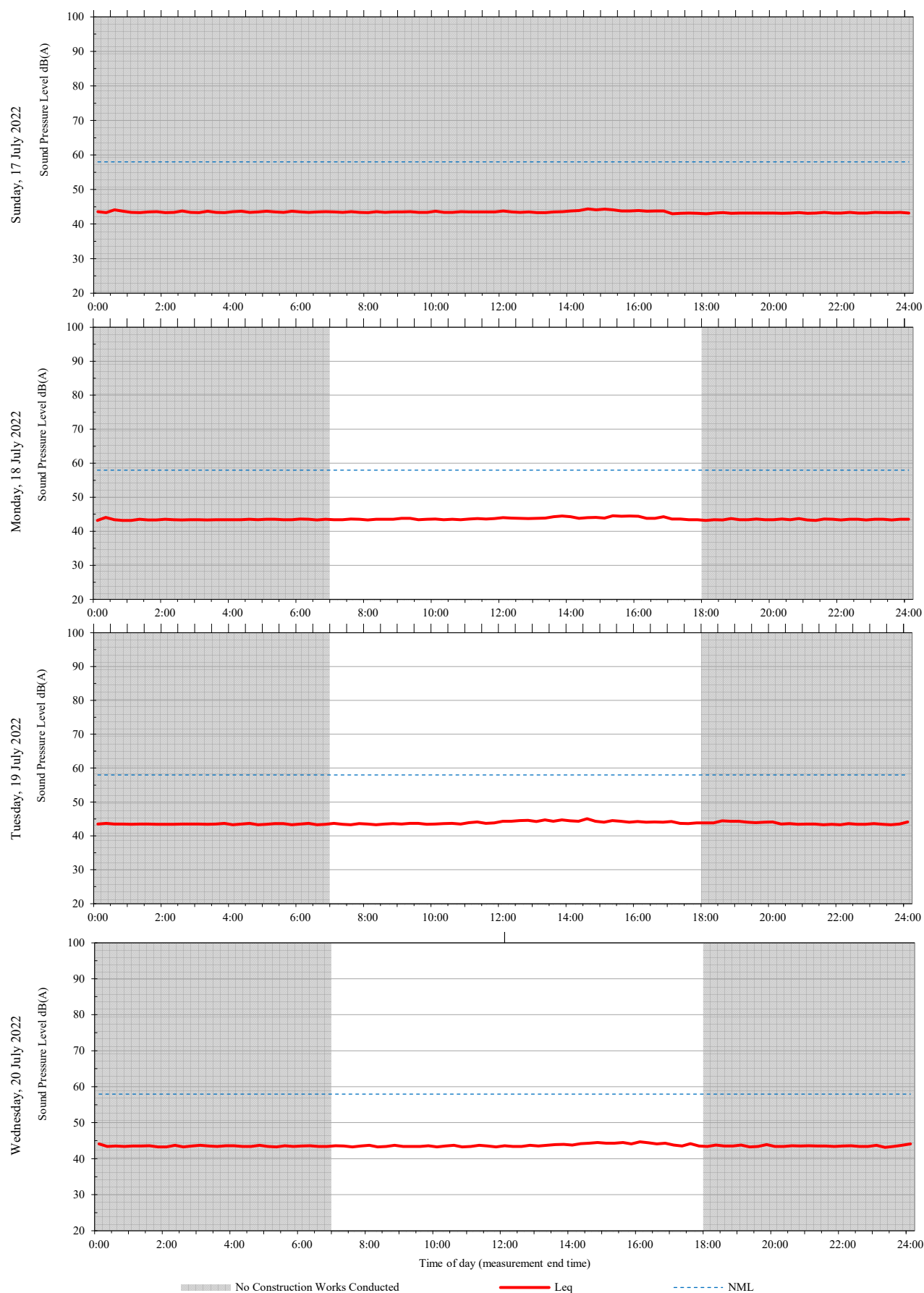
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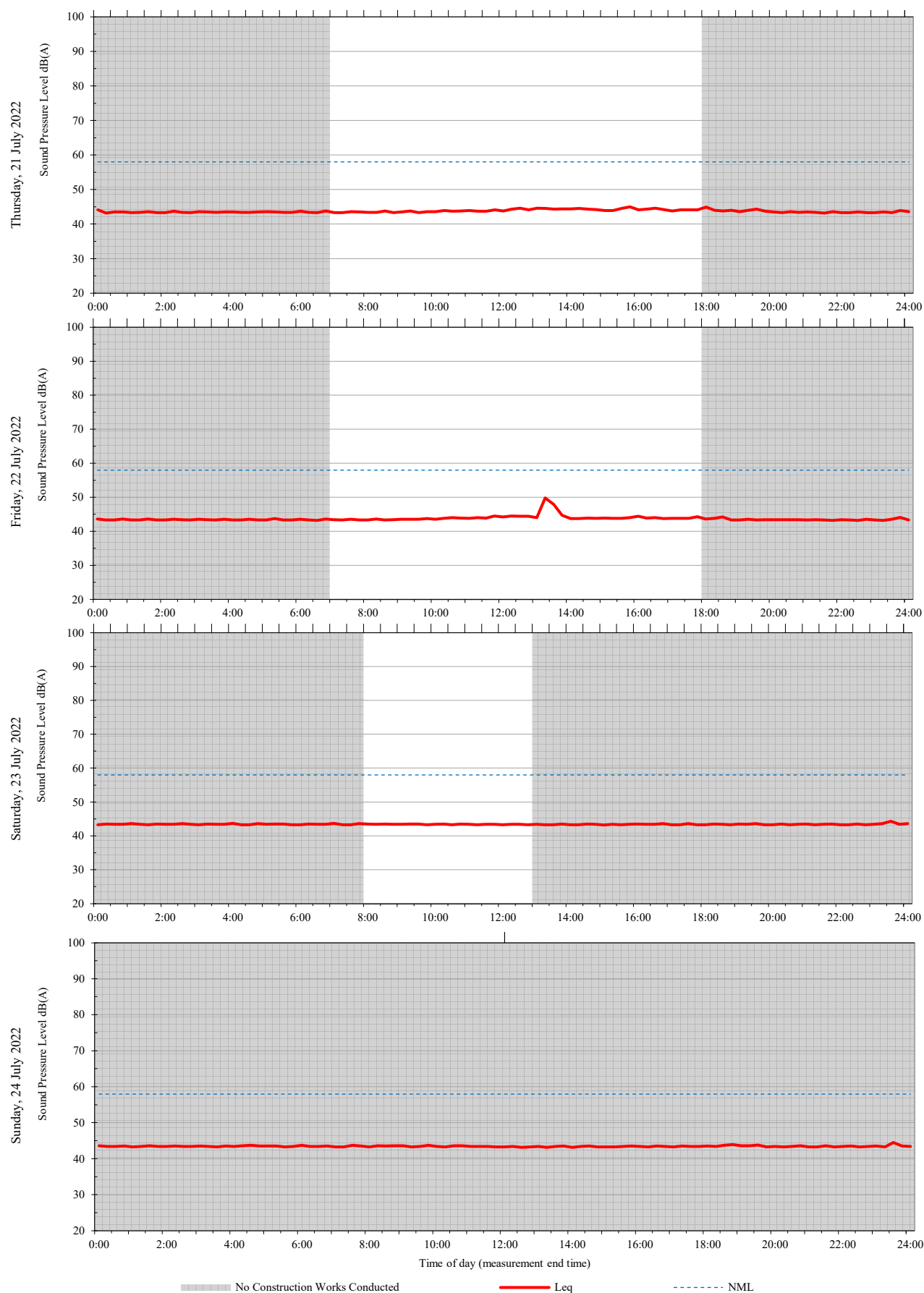
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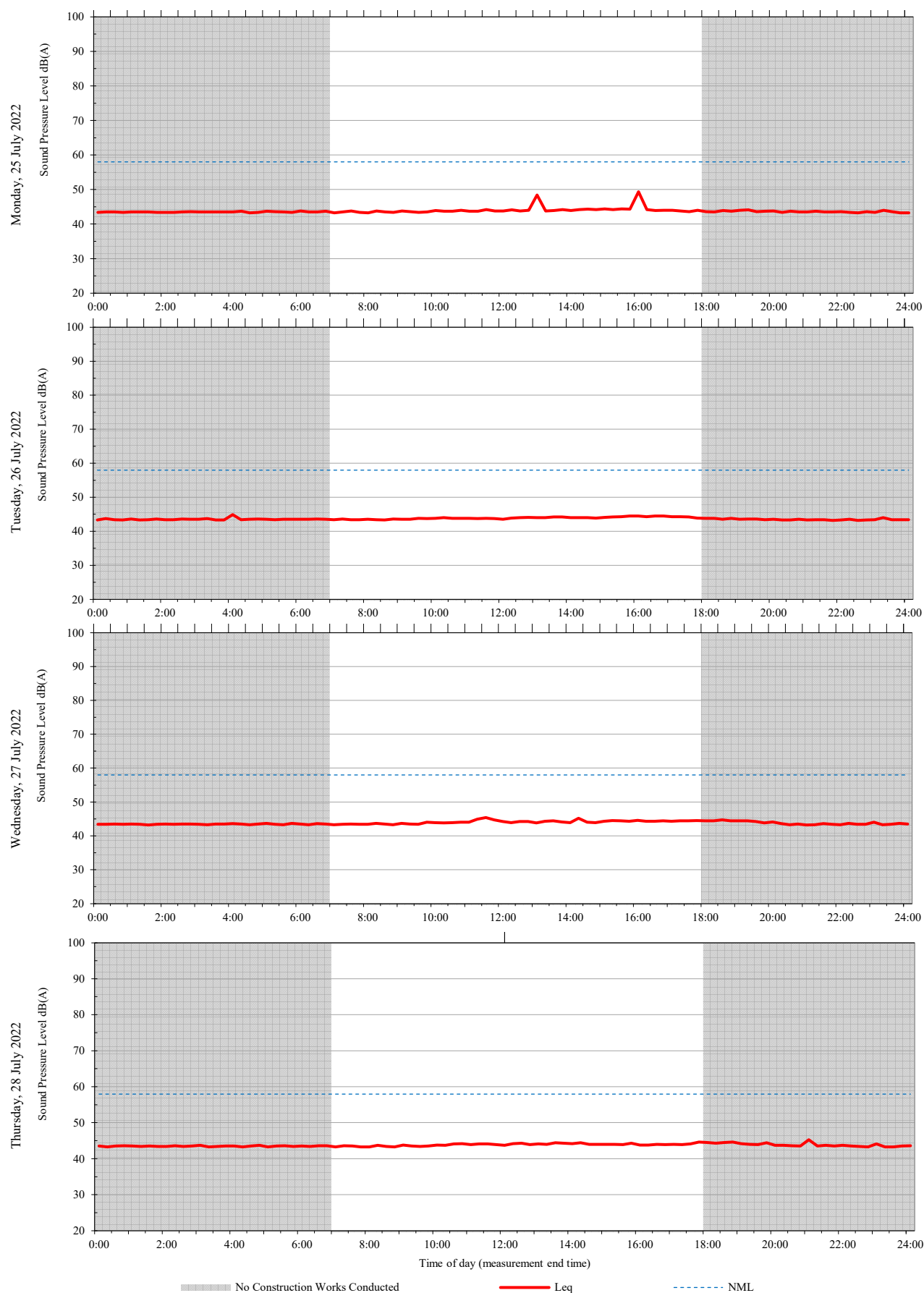
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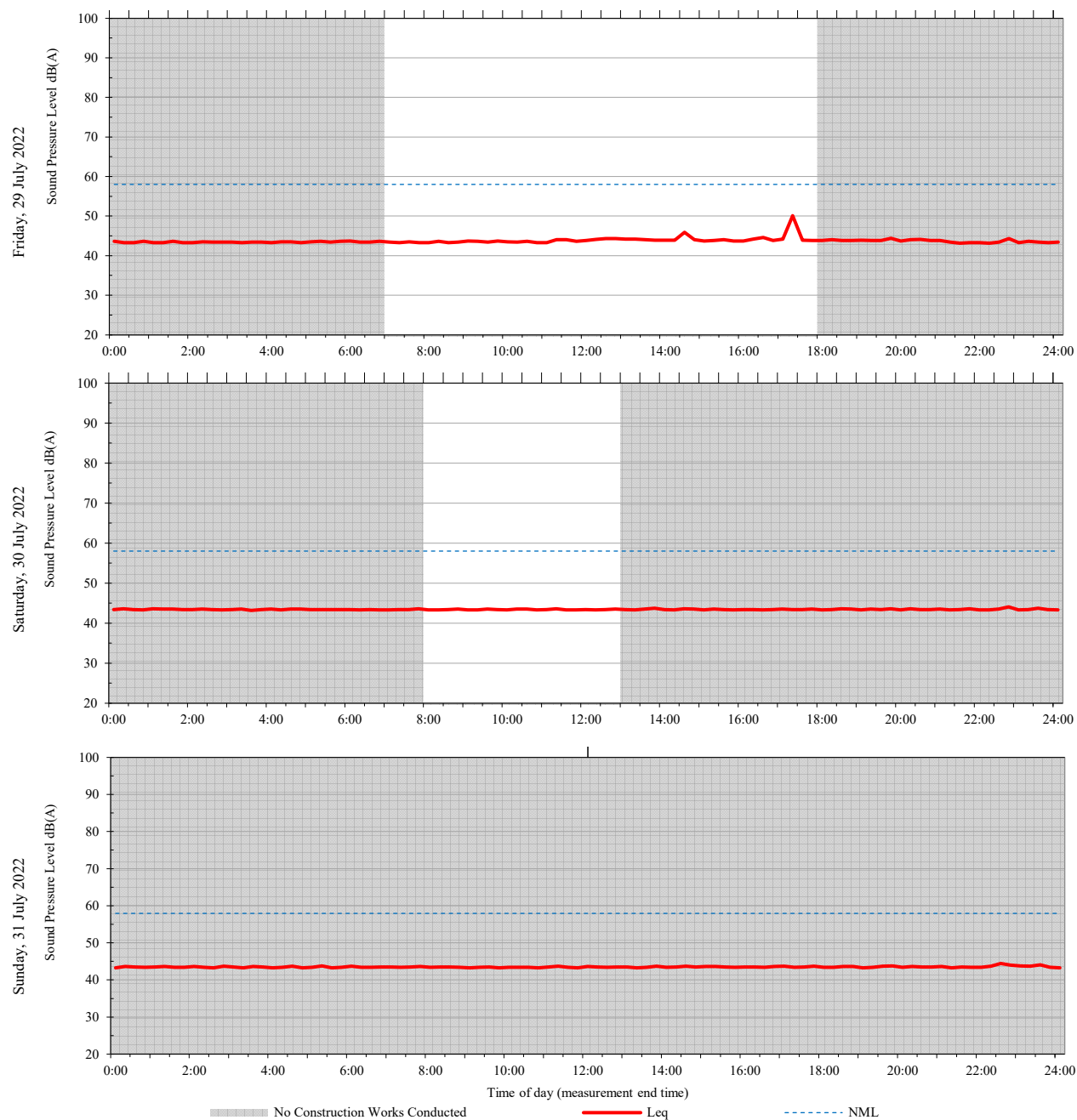
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Unattended monitoring: Westmead 7 - (KR – L3 Radiation Room 33 RF041) (Internal)

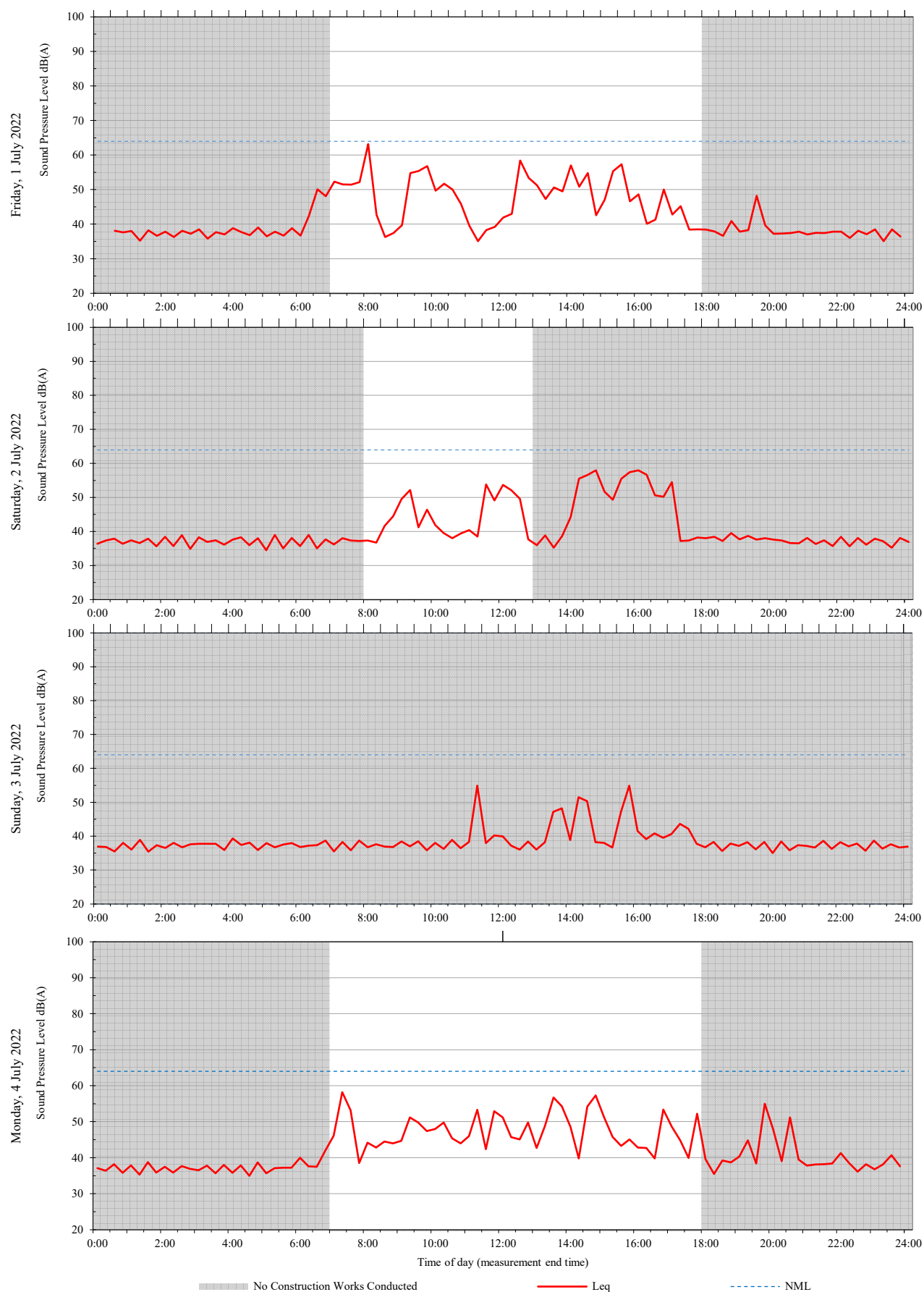
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A5 CHW Level 2 Parent Kitchen 92BW025 (facing MSCP site) (Westmead 2)

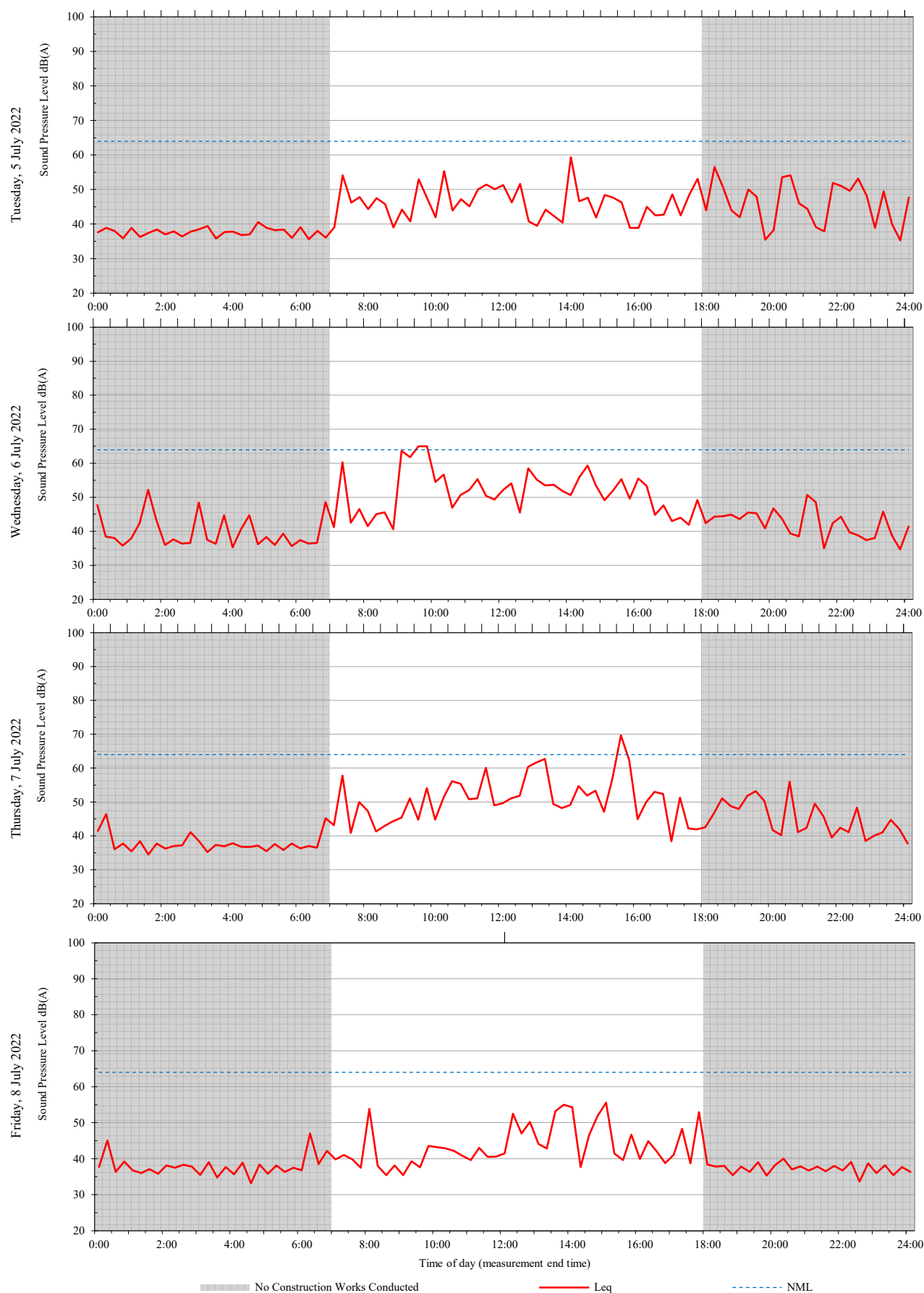
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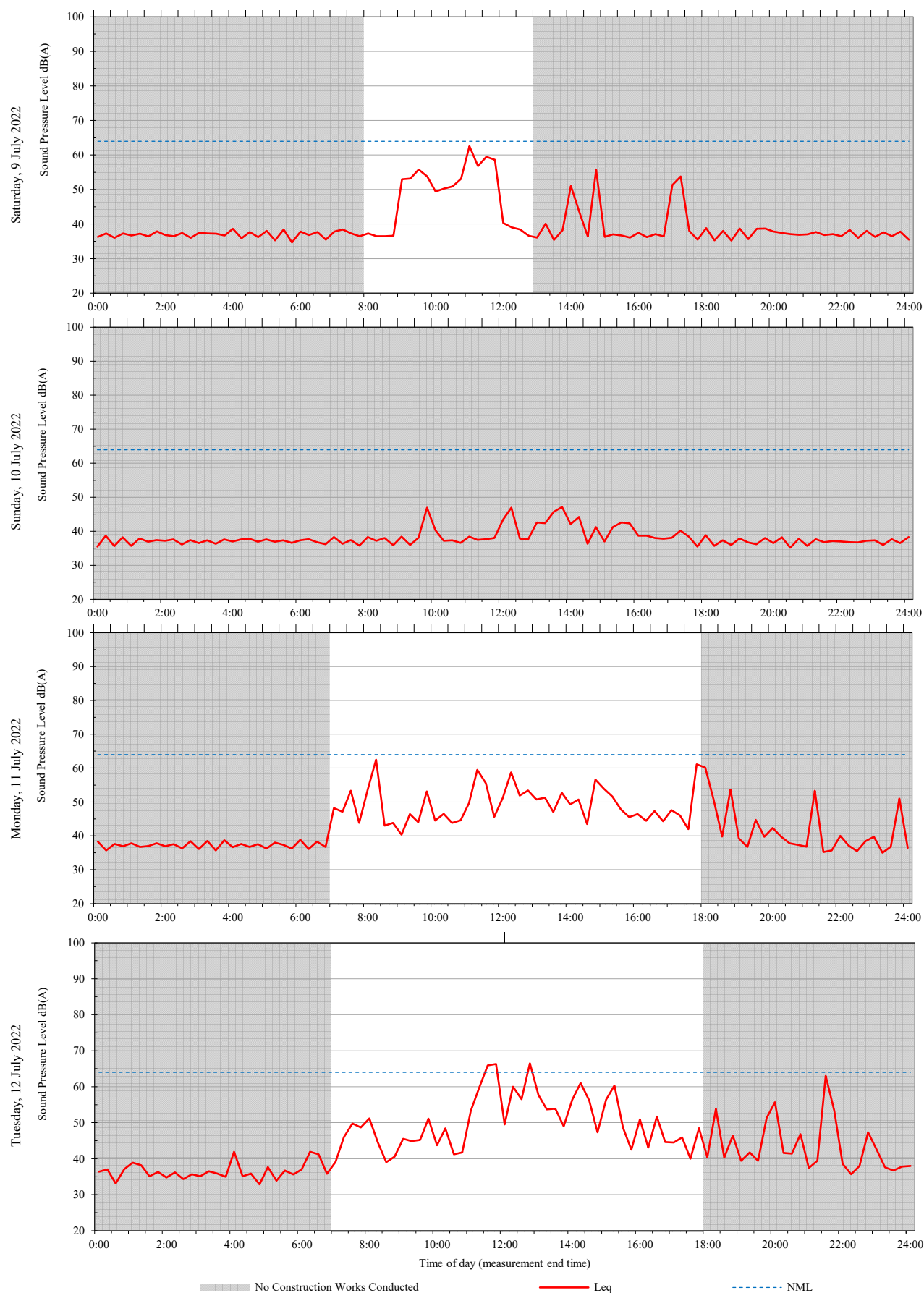
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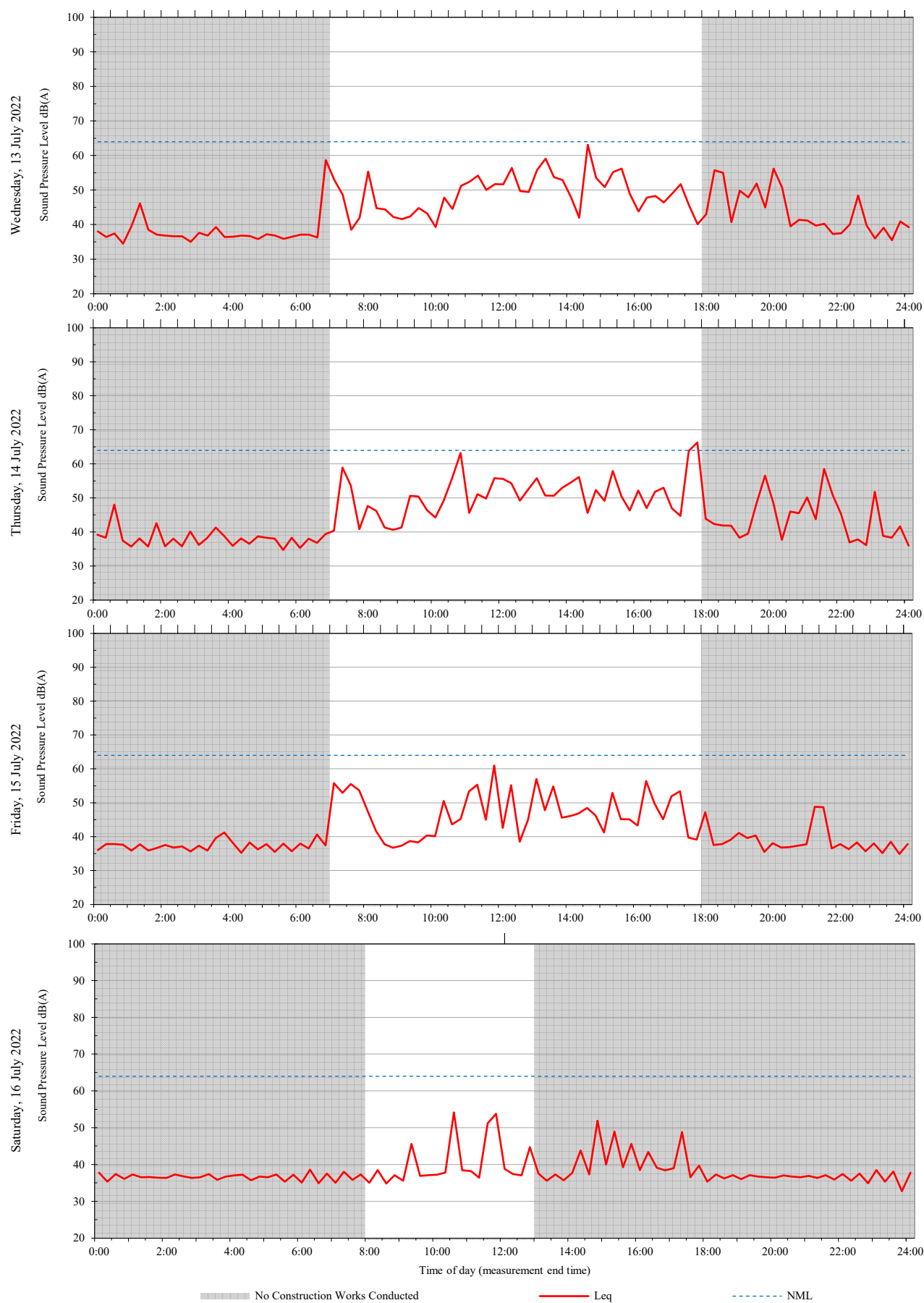


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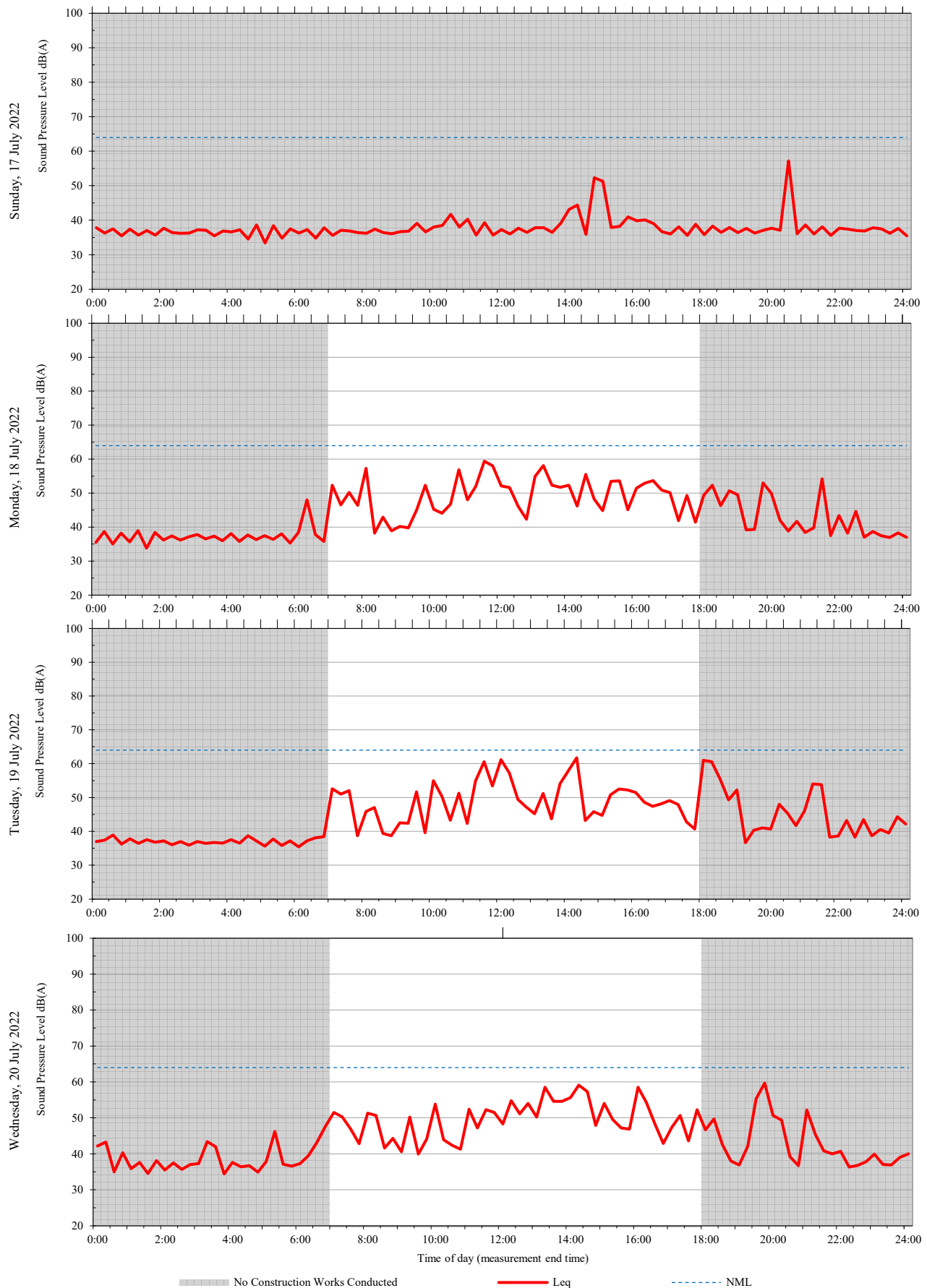


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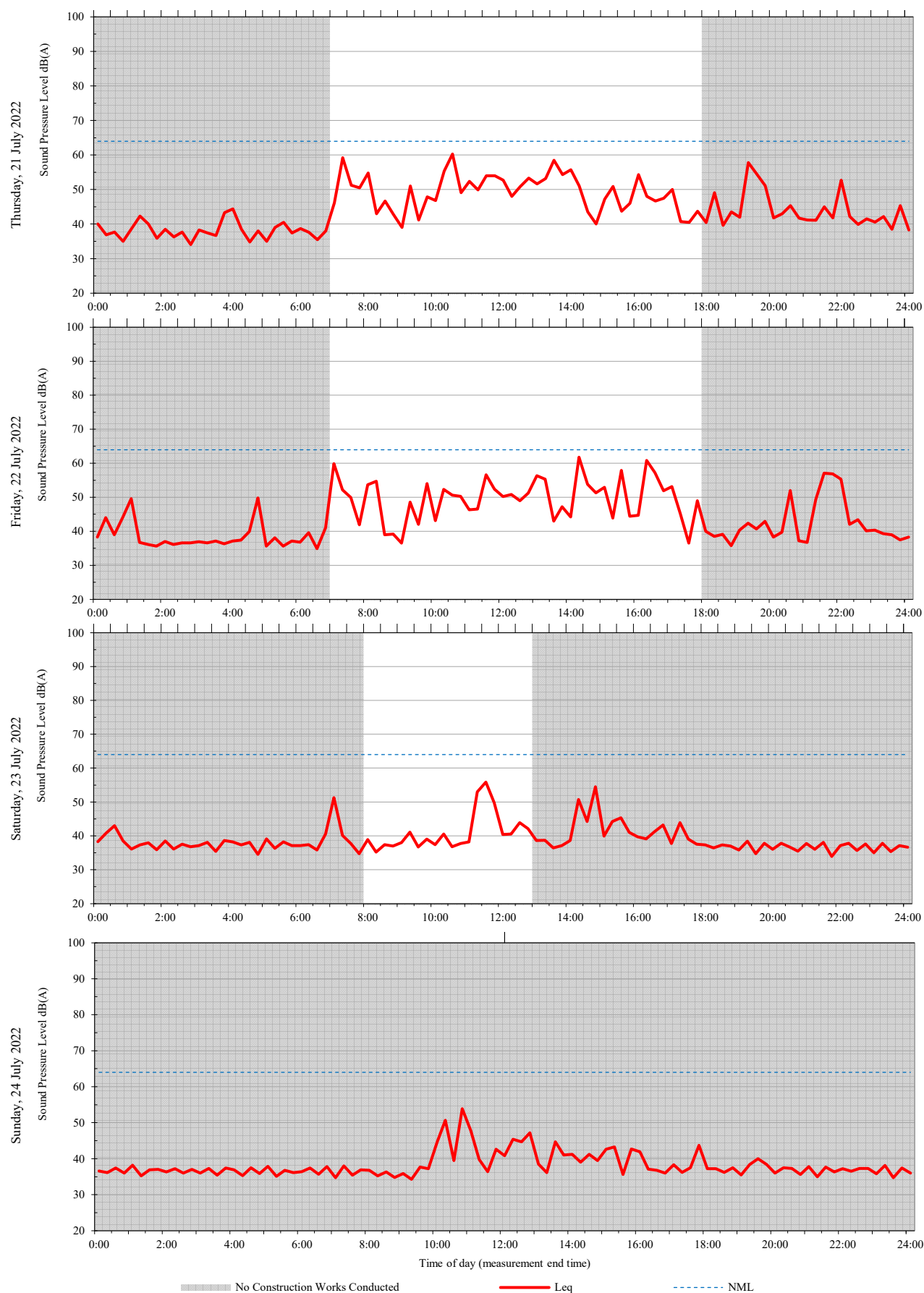
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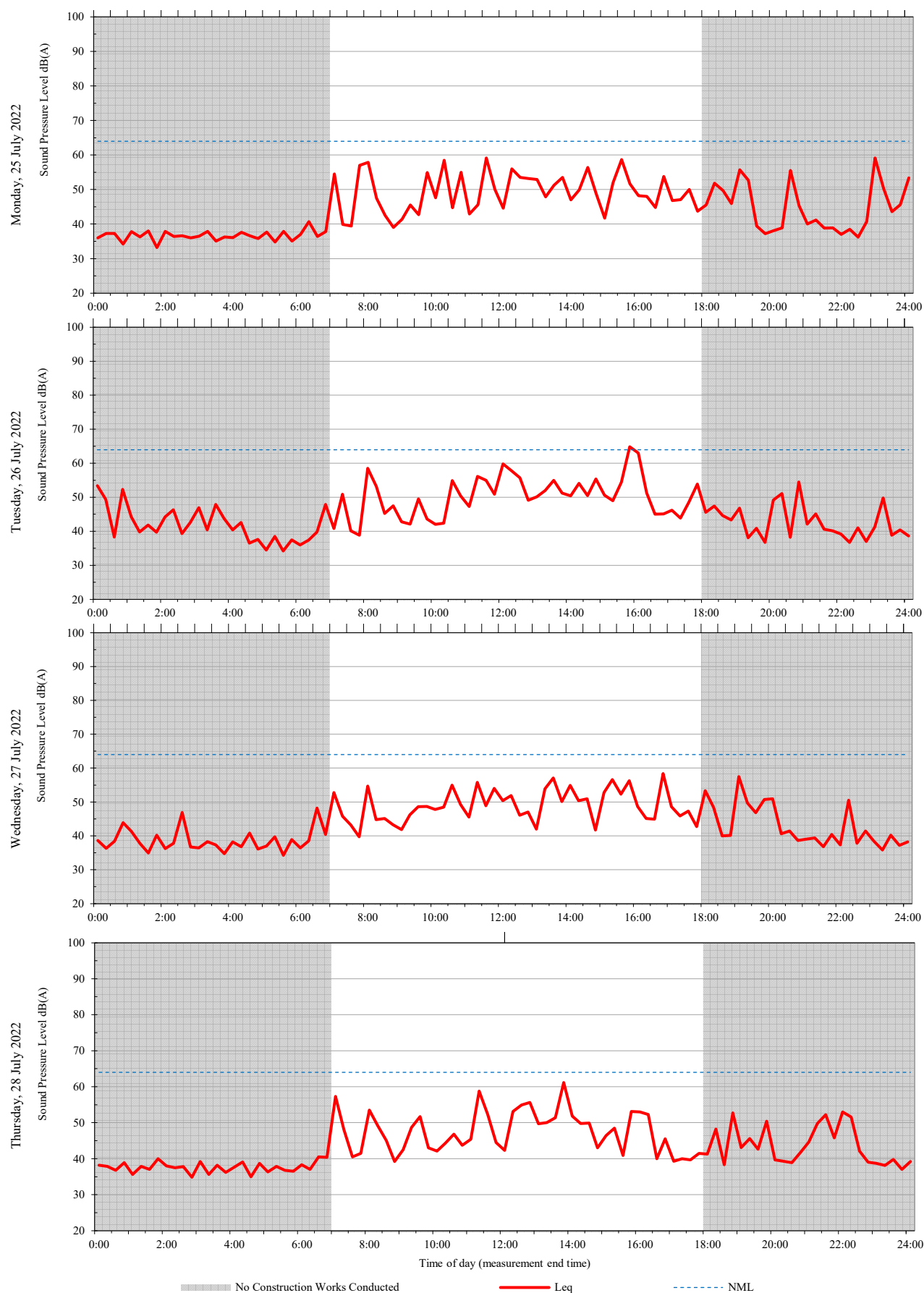
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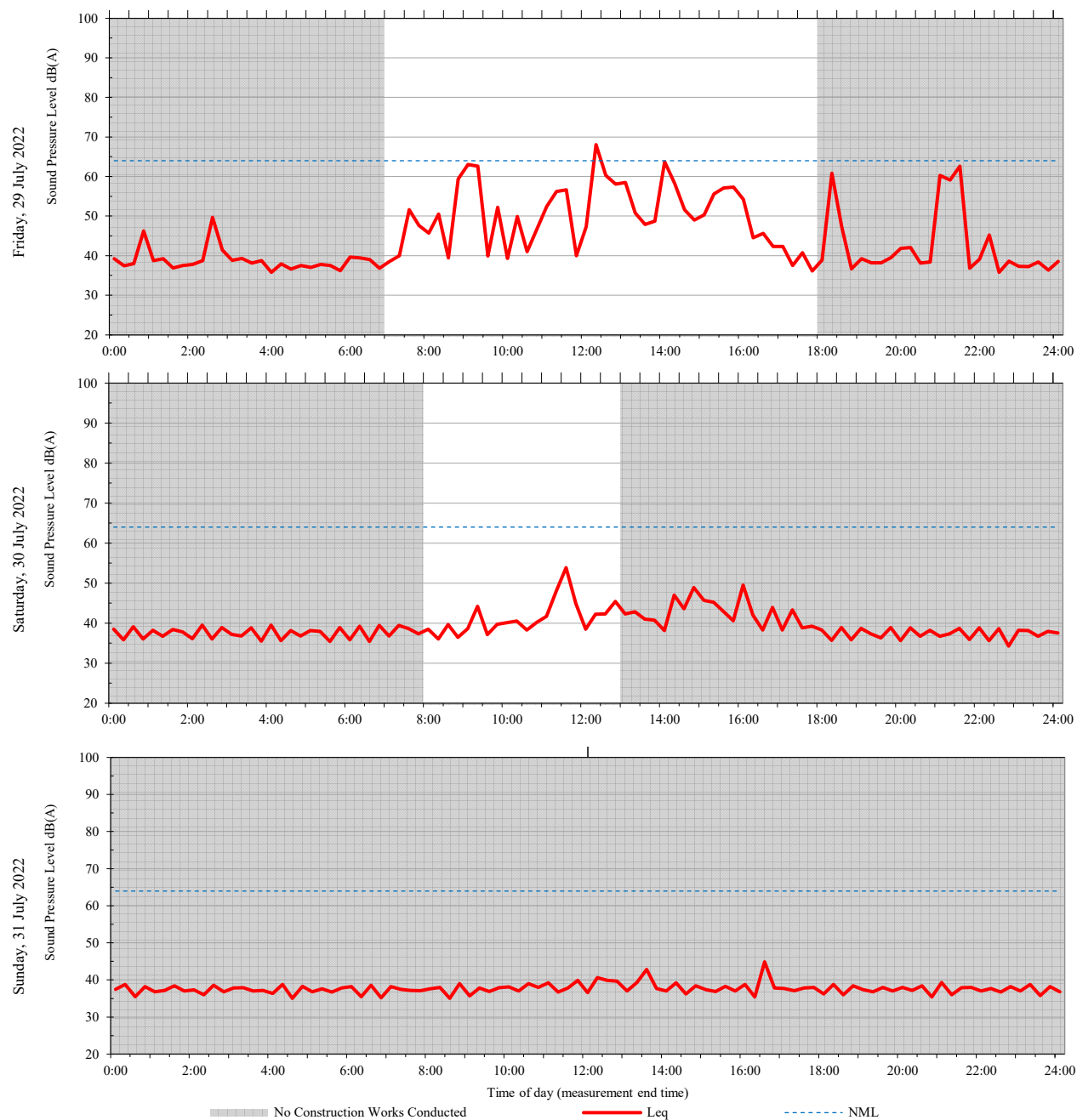
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Unattended monitoring: Westmead 2 (CHW L2 Parent Kitchen) (92BW028) (Internal)

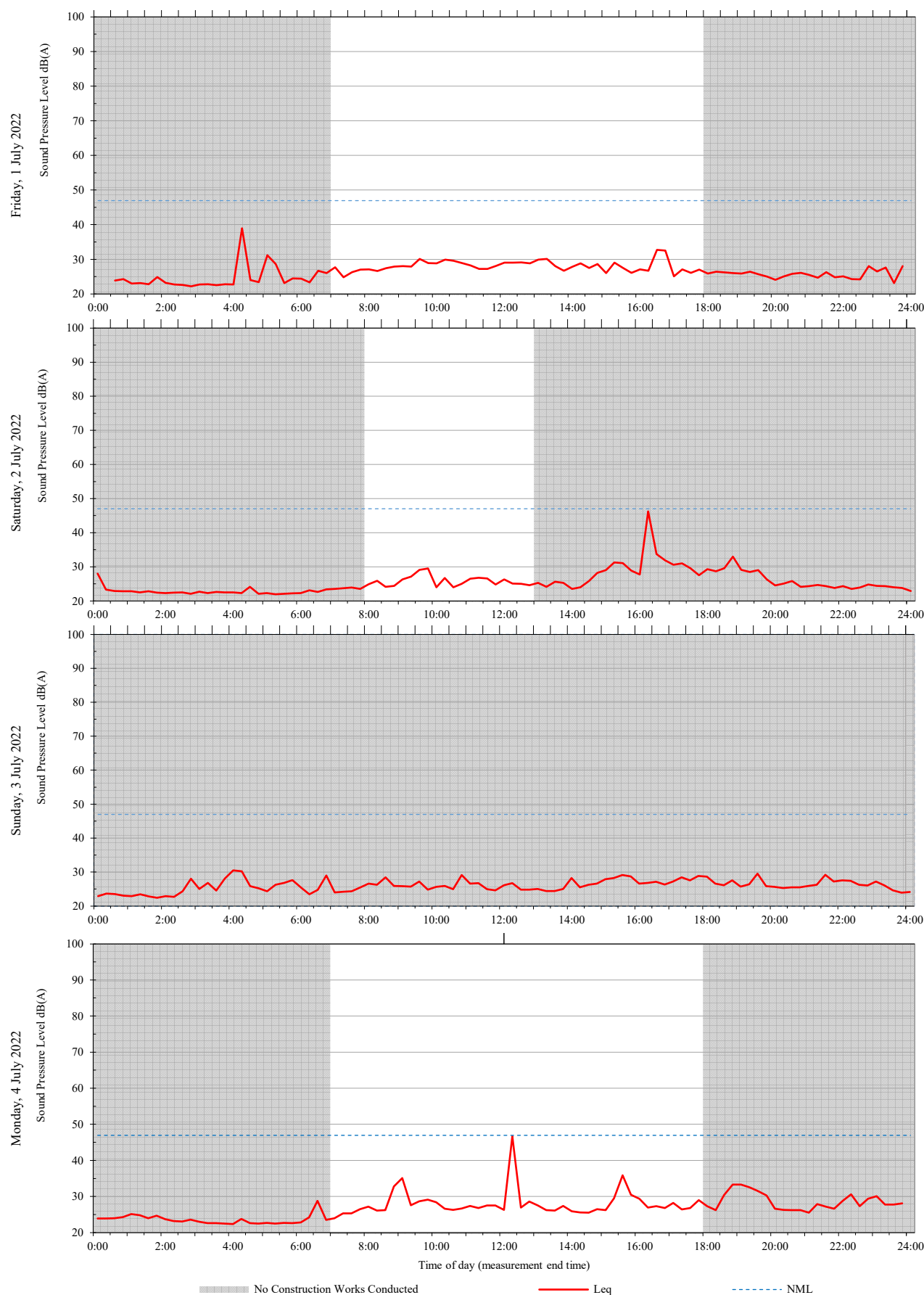
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A6 RMH Level 1 Store Room 101 (Westmead 3)

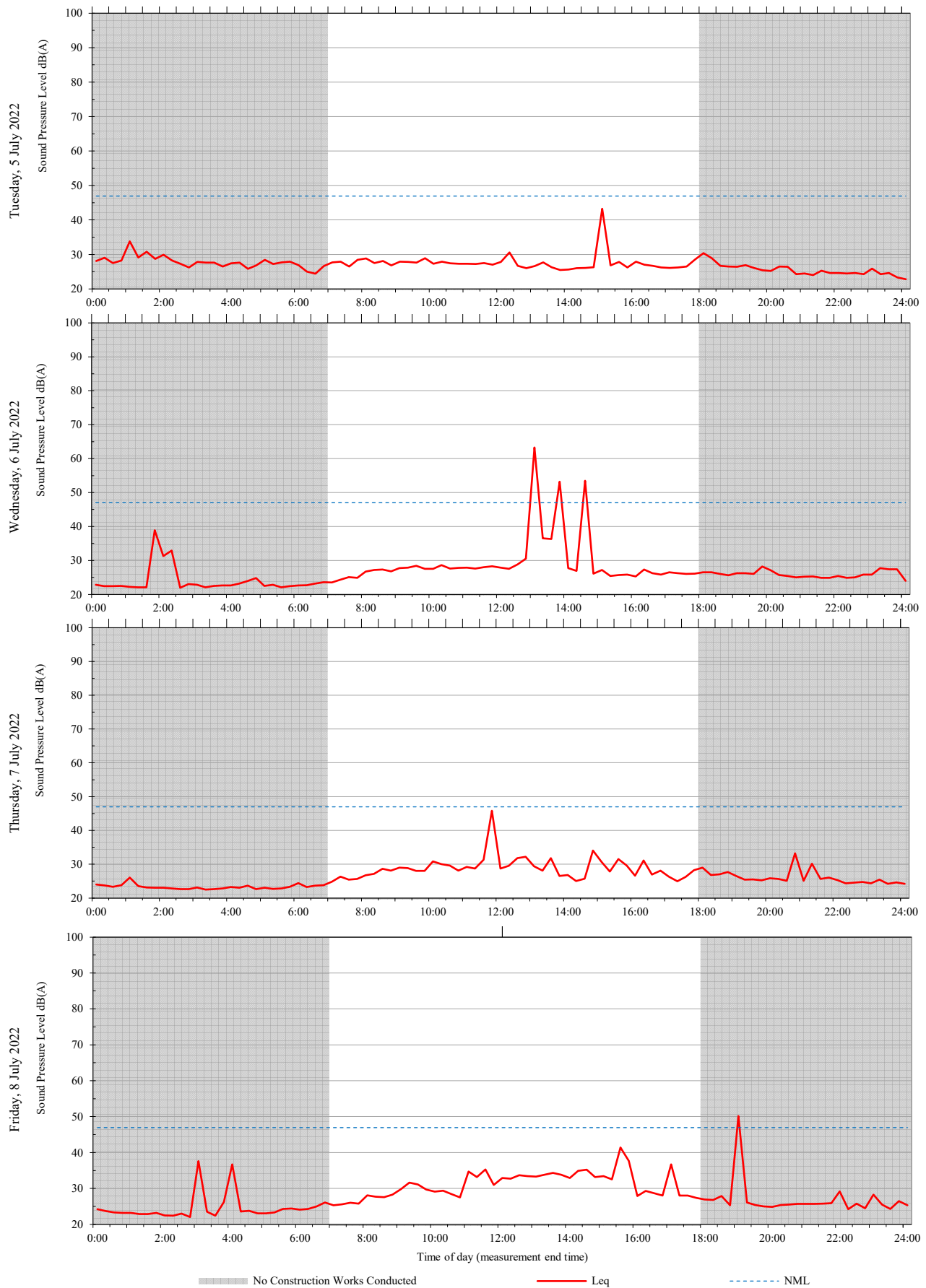
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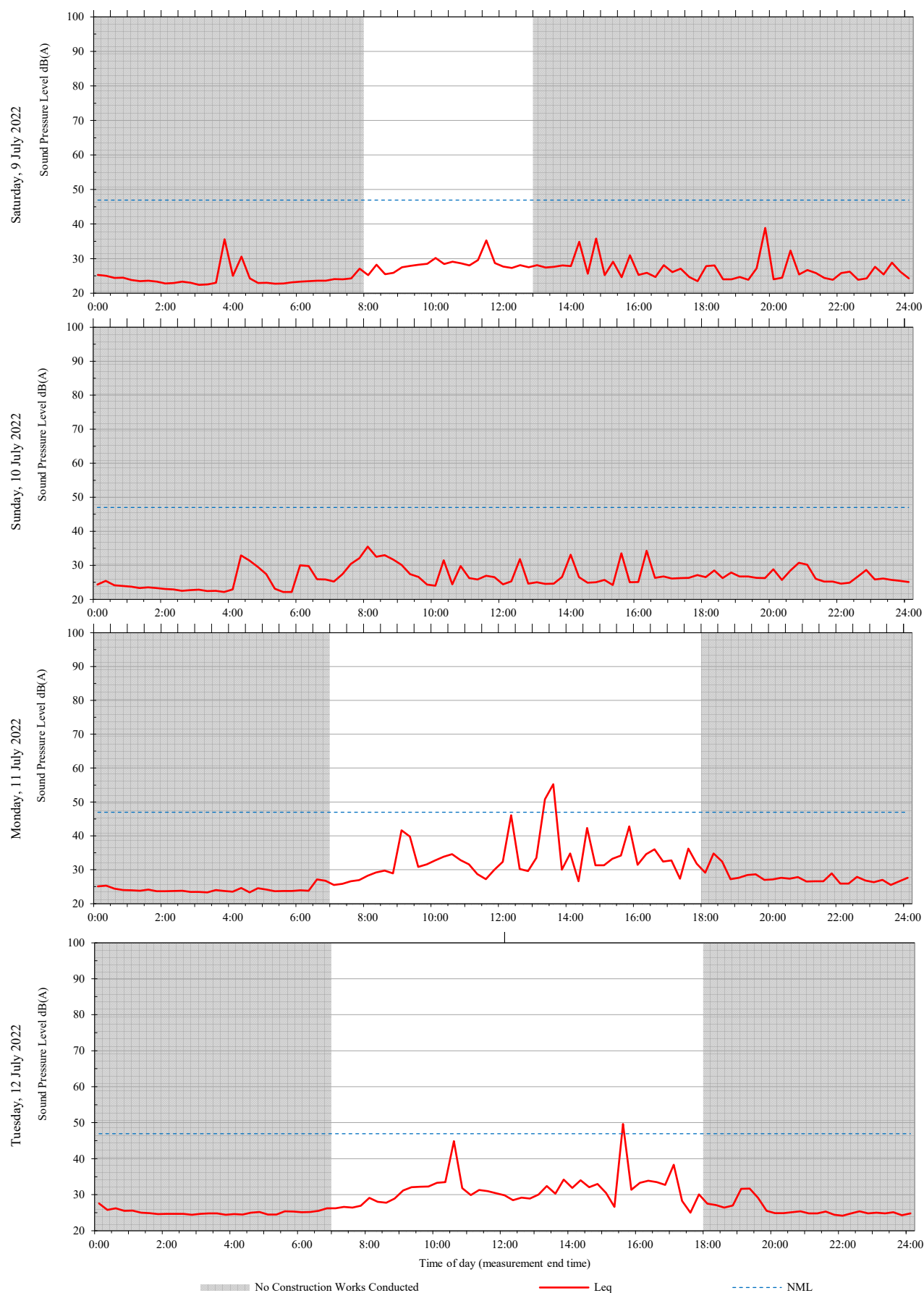
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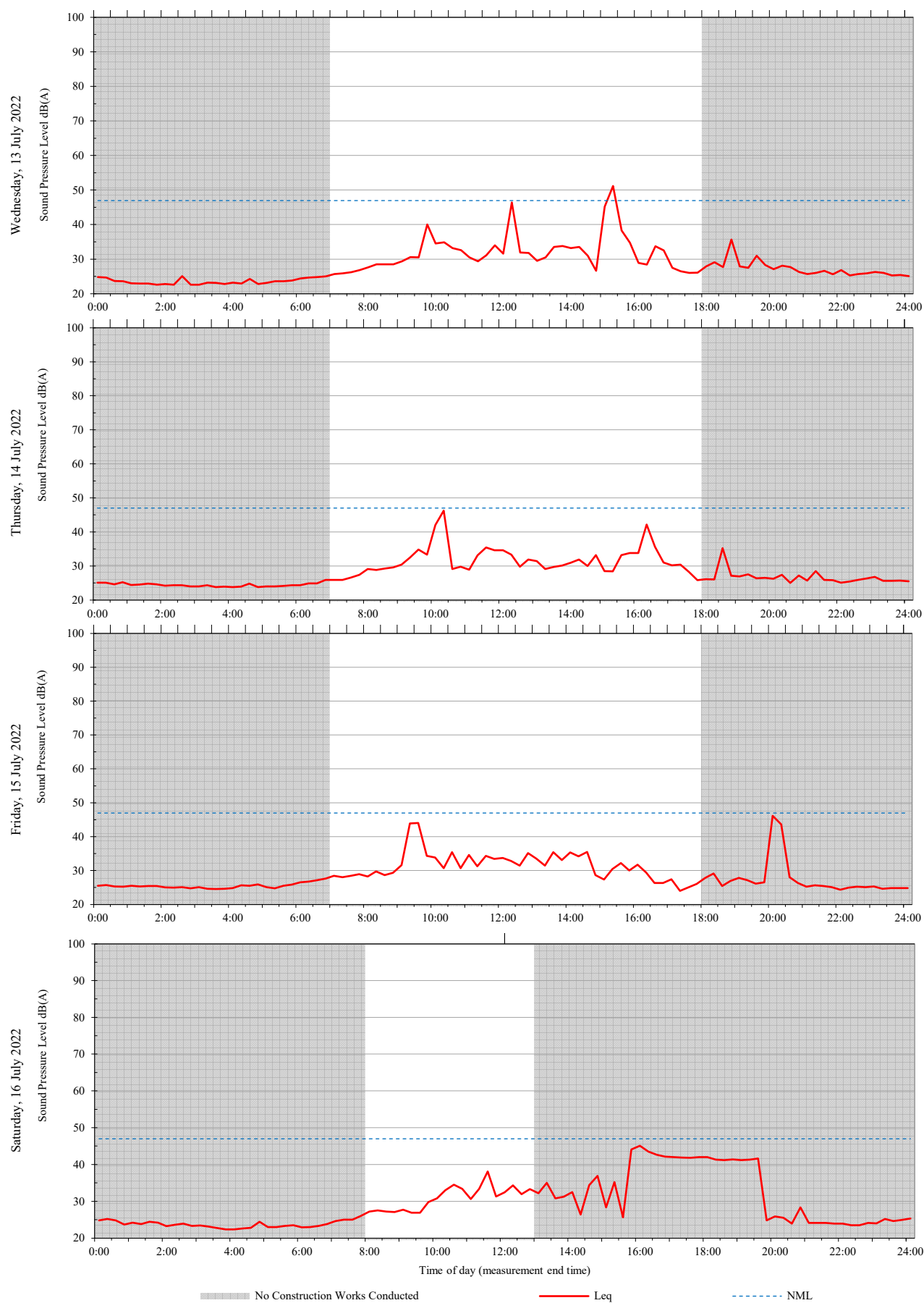
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Unattended monitoring: Westmead 3 - (RMH - L1 Store Room 101) (Internal)

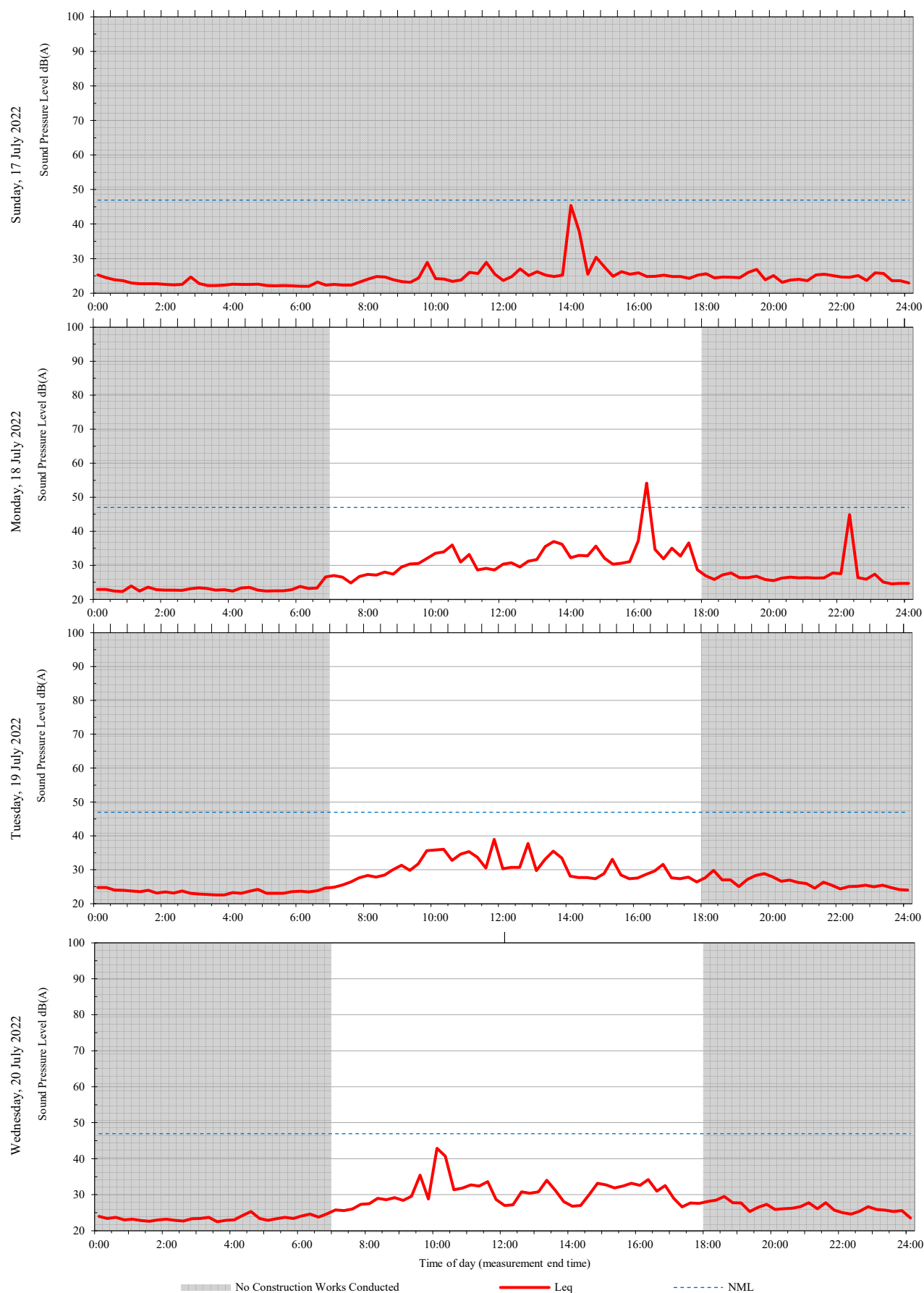
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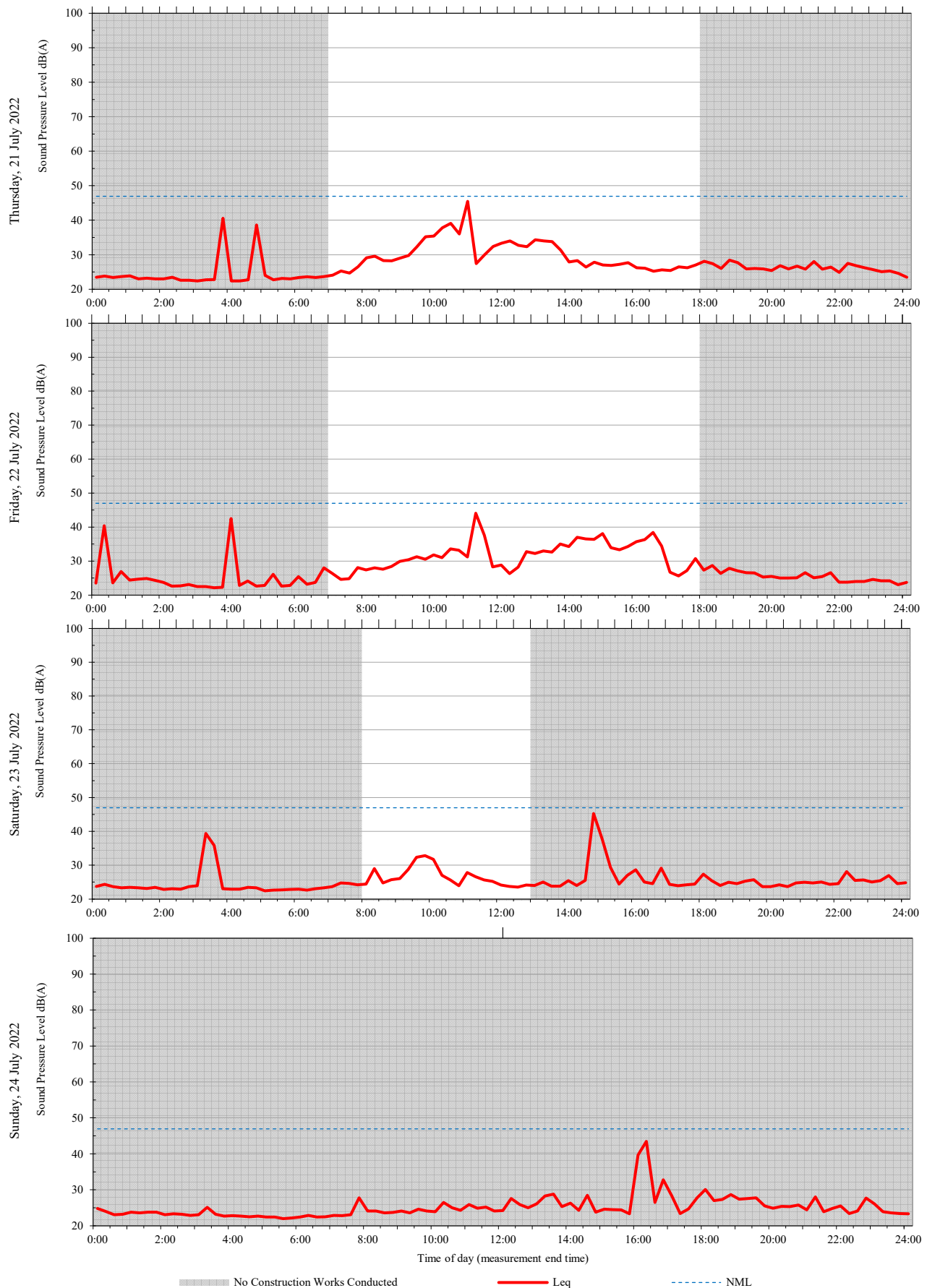
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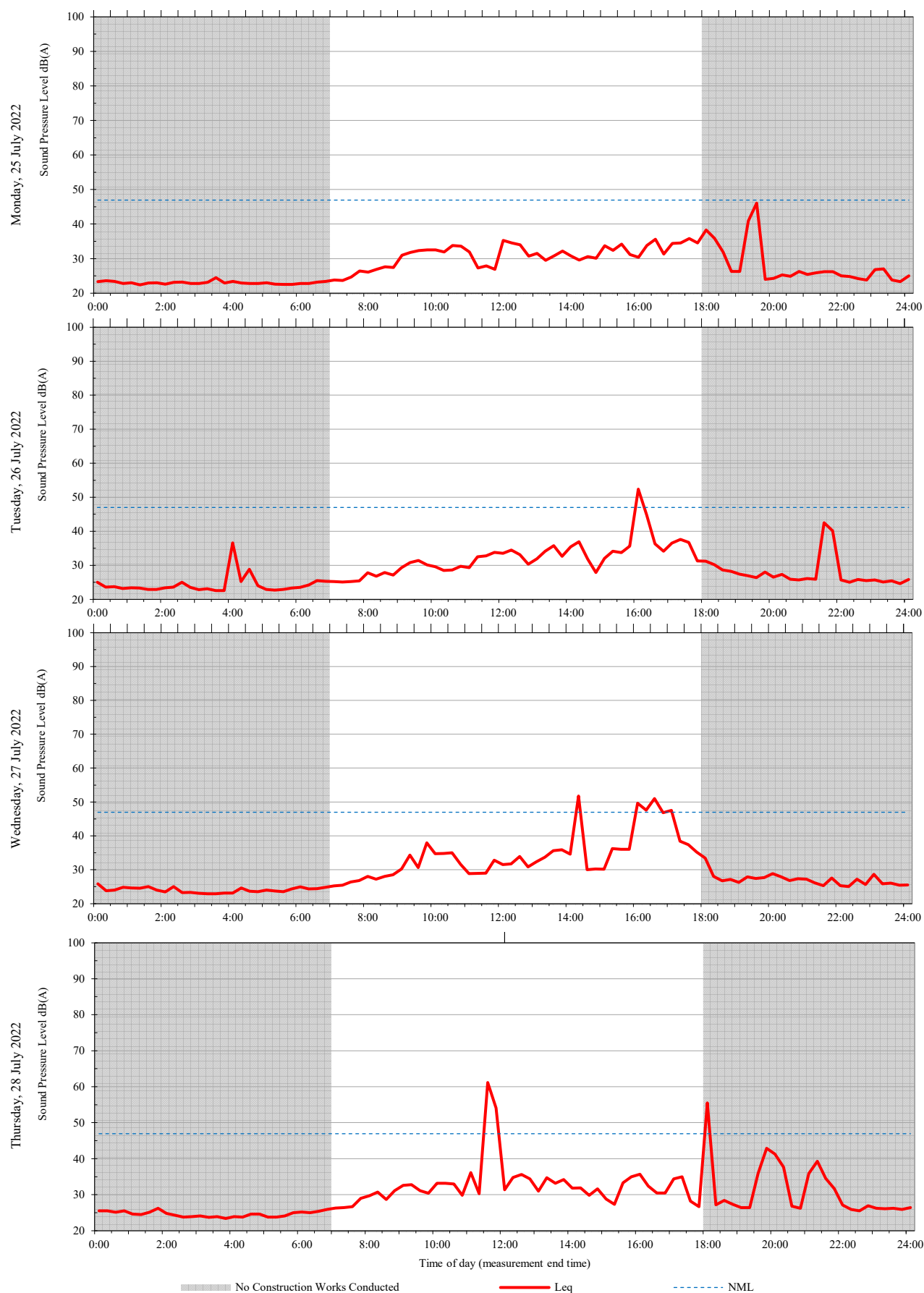
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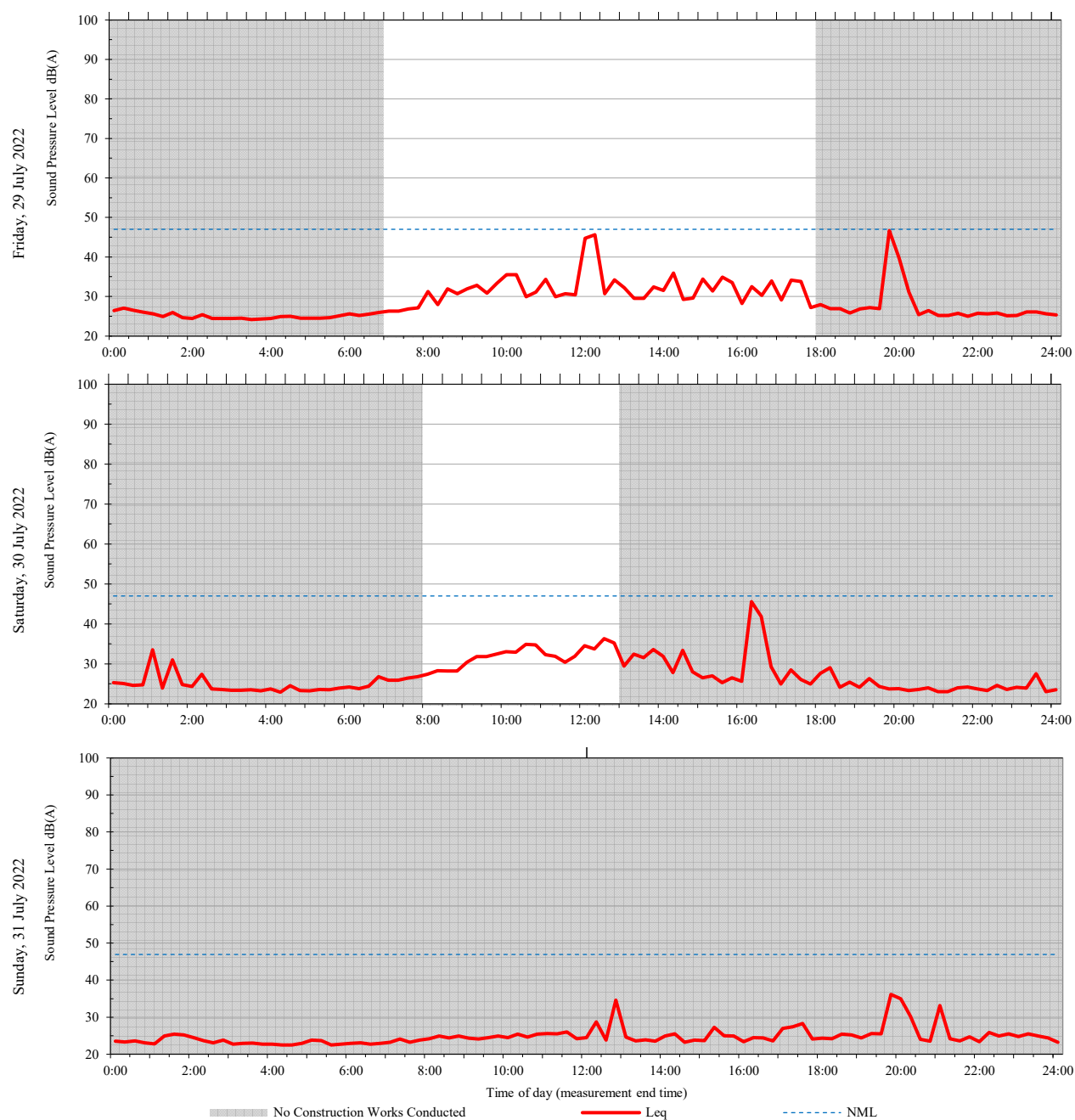
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Unattended monitoring: Westmead 3 - (RMH - L1 Store Room 101) (Internal)

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Health Infrastructure

Children's Hospital Westmead

**Vibration Monitoring - KR - Animal
House - July 2022**

CVM/ KR/202207

Issue 1 | 02/08/2022

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 271985

Arup Pty Ltd ABN 18 000 966 165

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Revision	Date	Filename	Westmead Hospital – 103156 KR - Animal House - Summary of Recent Vibration Measurments (01-07 to 31-07).docx
Issue 1	02/08/2022	Description	Issue

Filename			
Description			
	Prepared by	Checked by	Approved by
Name			
Signature			

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Executive Summary

This report summarises the vibration monitoring data recorded at KR - Animal House, over one month – from 01/07/2022 to 31/07/2022. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMSV Vibration Levels

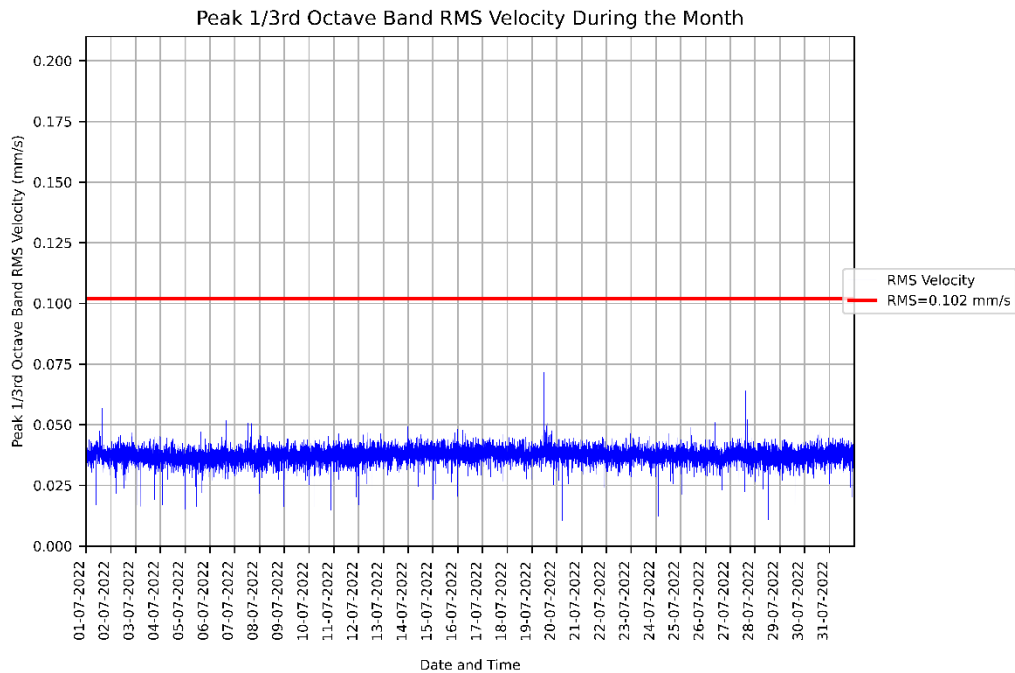


Figure 1: Measured RMSV vibration levels for 01/07/2022 to 31/07/2022 at the KR - Animal House.

The table below summarises the number of Root-Mean-Square Velocity (RMSV) limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
0	0

PPV Vibration Levels

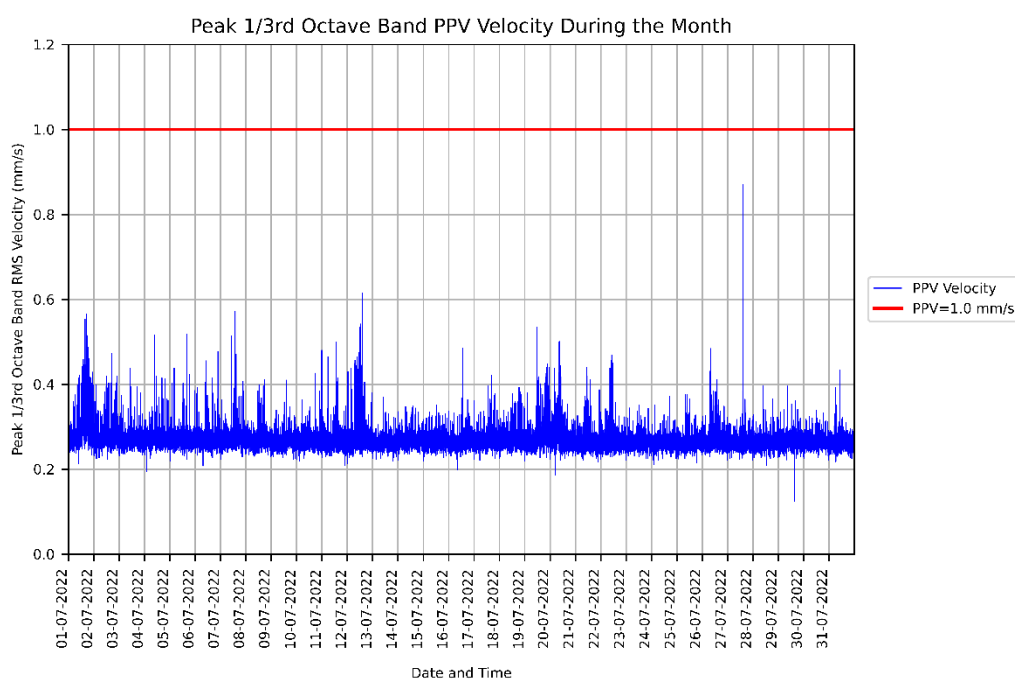


Figure 2: Measured vibration levels for 01/07/2022 to 31/07/2022 at the KR - Animal House.

The table below summarises the number of Peak Particle Velocity (PPV) limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
0	0

1. Introduction

Arup has been commissioned by PricewaterhouseCoopers (PwC) on behalf of NSW Health Infrastructure to monitor vibration levels in facilities adjacent to the Paediatric Services Building and Multi-storey Car Park development sites to ensure facility operations are not excessively impacted by the construction works. This report summarises the vibration monitoring data recorded at KR - Animal House during the period of the 01/07/2022 to 31/07/2022.

For the purposes of reporting, construction works are considered to be occurring at the following times:

Day	Construction Hours
Monday to Friday	7:00am to 6:00pm
Saturday	8:00am to 1:00pm
Sunday	No works
Public Holidays	No works

2. Monitor Location

The location of this monitor is shown below in Figure 3Figure .

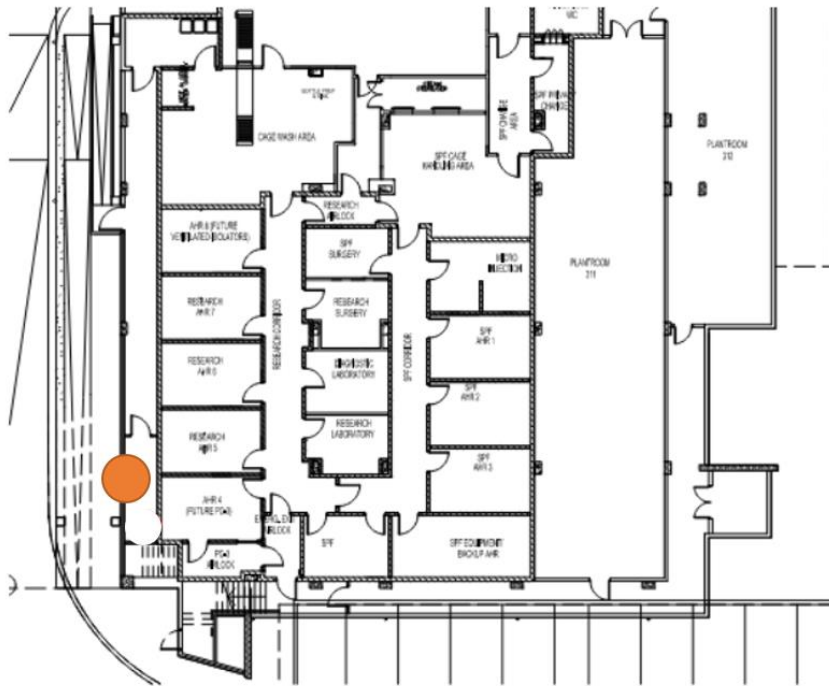


Figure 3: KR - Animal House vibration monitor location shown in orange

Monitoring at this location utilises a GeoSIG GMSplus with a GeoSIG VE-11 geophone. The calibration certificate for the geophone is included in Appendix A.

3. Recorded Data

Figure 4 below shows the vibration levels (RMS velocity) recorded between 01/07/2022 and 31/07/2022. The recorded data is shown in blue, while the limit of 0.102mm/s (V_{RMS}) is shown in red.

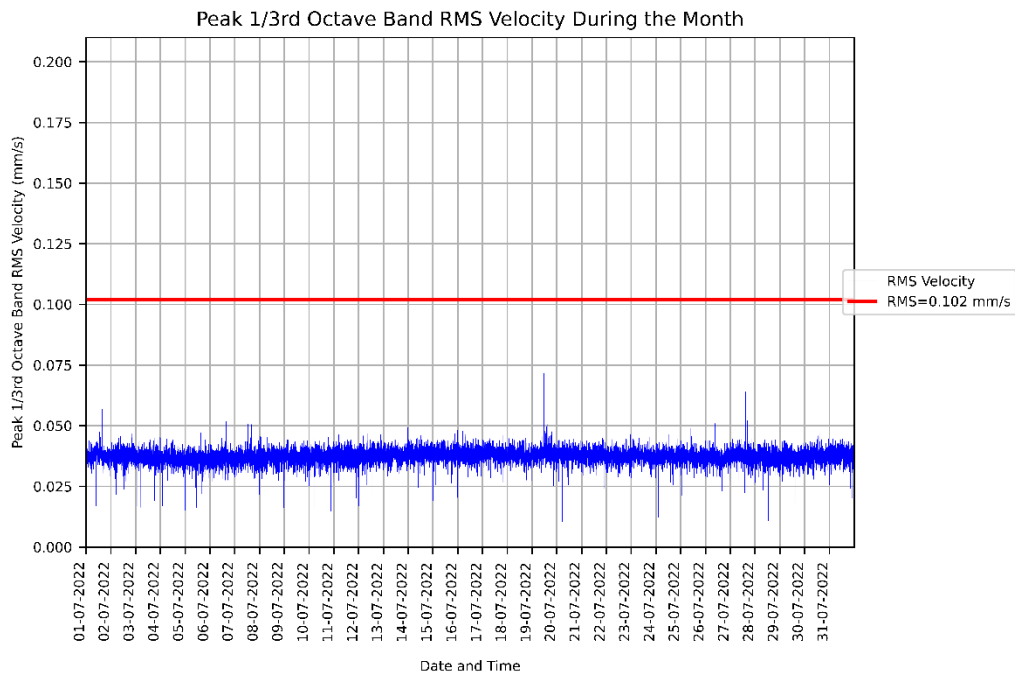


Figure 4: Measured RMSV vibration levels for 01/07/2022 to 31/07/2022 at the KR - Animal House.

The table below summarises the number of RMS Velocity limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
0	0

Figure 5 below shows the peak particle vibration levels (PPV velocity) recorded between 01/07/2022 and 31/07/2022. The recorded data is shown in blue, while the limit of 1.0mm/s (V_{PPV}) is shown in red.

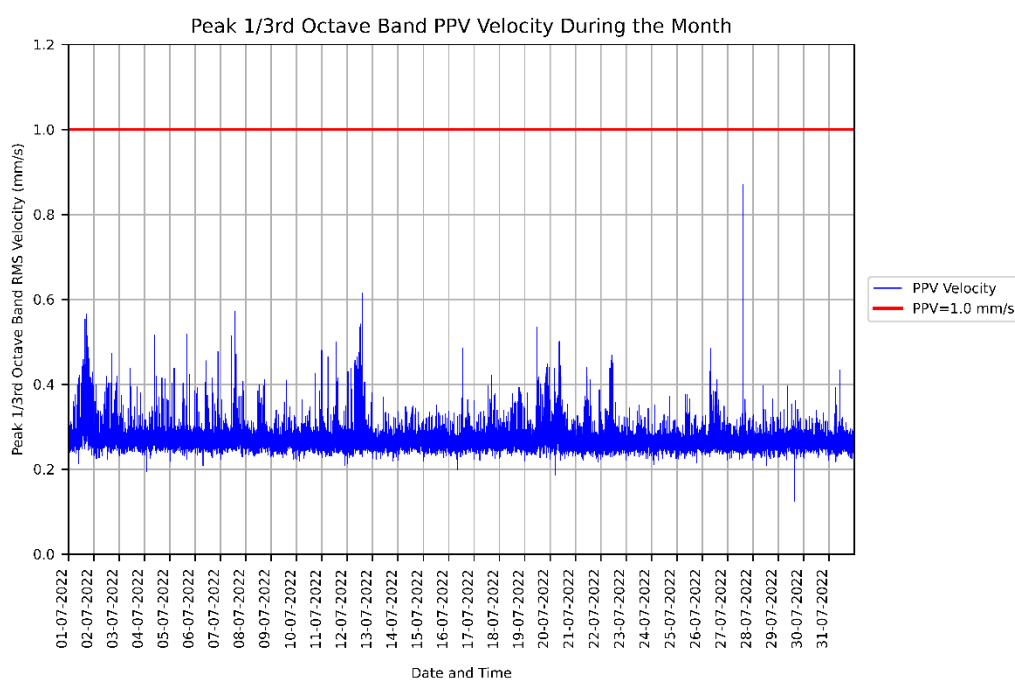
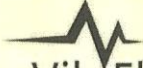


Figure 5: Measured PPV vibration levels for 01/07/2022 to 31/07/2022 at the KR - Animal House.

The table below summarises the number of PPV limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
0	0

Appendix A: Calibration Certificates

CERTIFICATE OF CALIBRATION	
CERTIFICATE No: G30982	
EQUIPMENT TESTED : Geophone	
Manufacturer: GeoSIG	Serial No: 55908
Geophone Type: VE-11	
Owner: Arup Services Pty Ltd Barrack Place, Level 5, 151 Clarence Street Sydney NSW 2000	
Tests Performed:	Frequency Response, Linearity & Sensitivity at Selected Frequencies
Comments:	Detailed overleaf.
CONDITION OF TEST:	
Temperature	23 °C ±1° C
Relative Humidity	44 % ±5%
Date of Receipt : 25/10/2021	
Date of Calibration : 01/11/2021	
Date of Issue : 01/11/2021	
Acu-Vib Test Procedure:	AVP15 (Low Frequency Transducer, Geophone) based on AS2187.2 & DIN45669-1
CHECKED BY:	AUTHORISED SIGNATURE: <i>Hein Soc</i>
Accredited for compliance with ISO/IEC 17025 - Calibration	
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.	
This report applies only to the item identified in the report and may not be reproduced in part.	
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.	
 WORLD RECOGNISED ACCREDITATION Accredited Lab No. 9262 Acoustic and Vibration Measurements	 Acu-Vib Electronics CALIBRATIONS SALES RENTALS REPAIRS Head Office & Calibration Laboratory Unit 14, 22 Hudson Ave. Castle Hill NSW 2154 (02) 9680 8133 www.acu-vib.com.au
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Frequency response and linearity characteristics for
GeoSIG Velocity Geophone **VE-11** Serial No. **55908**
Constant velocity of 10 mm/sec Peak applied for response
(Except at 200.0 Hz where applied level limited to 1.0 mm/s peak)
For amplitude linearity applied level varied at 15.92 Hz

12VDC Power Supply

Geophone Orientation.: Vertical

Frequency		Velocity mm/sec Peak	Indicated Sensitivity mV/mm s^{-1}	Expanded uncertainty
Hz	Radians/sec		Vertical Sensitivity	$U_{95} \%$
3.00	18.85	10.0	110.73	1.00%
4.00	25.13	10.0	110.65	0.90%
6.00	37.70	10.0	107.04	0.90%
10.00	62.83	10.0	101.63	0.90%
15.00	94.25	10.0	99.12	0.90%
15.92	94.25	1.0	N/A	0.90%
15.92	94.25	5.0	93.34	0.90%
15.92	94.25	10.0	93.15	0.90%
15.92	94.25	50.0	93.10	0.90%
15.92	94.25	100	N/A	0.50%
30.00	188.50	10.0	97.57	0.50%
60.00	376.99	10.0	98.58	0.50%
120.00	753.98	10.0	110.55	0.50%
150.00	942.48	10.0	125.20	0.50%
Hz	Radians/sec	Velocity mm/sec Peak	Vertical Sensitivity	$U_{95} \%$

Note1:

The laboratory has accreditation under ISO/IEC 17025 from NATA for calibration to ISO 16063-21 at frequencies from 0.5 Hz. Measurements at all frequencies and levels shown in the table above are made using reference equipment traceably calibrated to Australian National Standards.

Note2:

The uncertainties quoted are estimated at a confidence level of 95% and a coverage factor of $k=2$ applies unless otherwise stated.



Health Infrastructure

Children's Hospital Westmead

**Vibration Monitoring - CHW - L1 Lab -
July 2022**

CVM/ CHW/202207

Issue 1 | 02/08/2022

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 271985

Arup Pty Ltd ABN 18 000 966 165

Arup Pty Ltd

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Revision	Date	Filename	Westmead Hospital – 103157 CHW - L1 Lab - Summary of Recent Vibration Measurments (01-07 to 31-07).docx
Issue 1	02/08/2022	Description	Issue

Filename			
Description			
	Prepared by	Checked by	Approved by
Name			
Signature			

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Executive Summary

This report summarises the vibration monitoring data recorded at CHW - L1 Lab, over one month – from 01/07/2022 to 31/07/2022. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMSV Vibration Levels

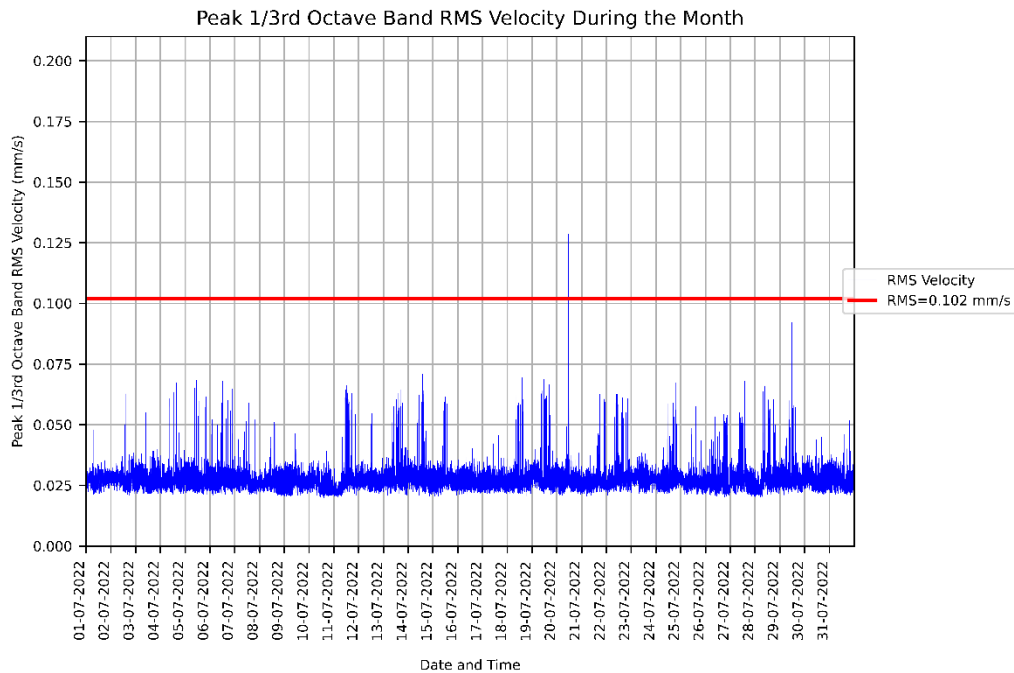


Figure 1: Measured RMSV vibration levels for 01/07/2022 to 31/07/2022 at the CHW - L1 Lab.

The table below summarises the number of Root-Mean-Square Velocity (RMSV) limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
1	0

1. Introduction

Arup has been commissioned by PricewaterhouseCoopers (PwC) on behalf of NSW Health Infrastructure to monitor vibration levels in facilities adjacent to the Paediatric Services Building and Multi-storey Car Park development sites to ensure facility operations are not excessively impacted by the construction works. This report summarises the vibration monitoring data recorded at CHW - L1 Lab during the period of the 01/07/2022 to 31/07/2022.

For the purposes of reporting, construction works are considered to be occurring at the following times:

Day	Construction Hours
Monday to Friday	7:00am to 6:00pm
Saturday	8:00am to 1:00pm
Sunday	No works
Public Holidays	No works

2. Monitor Location

The location of this monitor is shown below in Figure 2.

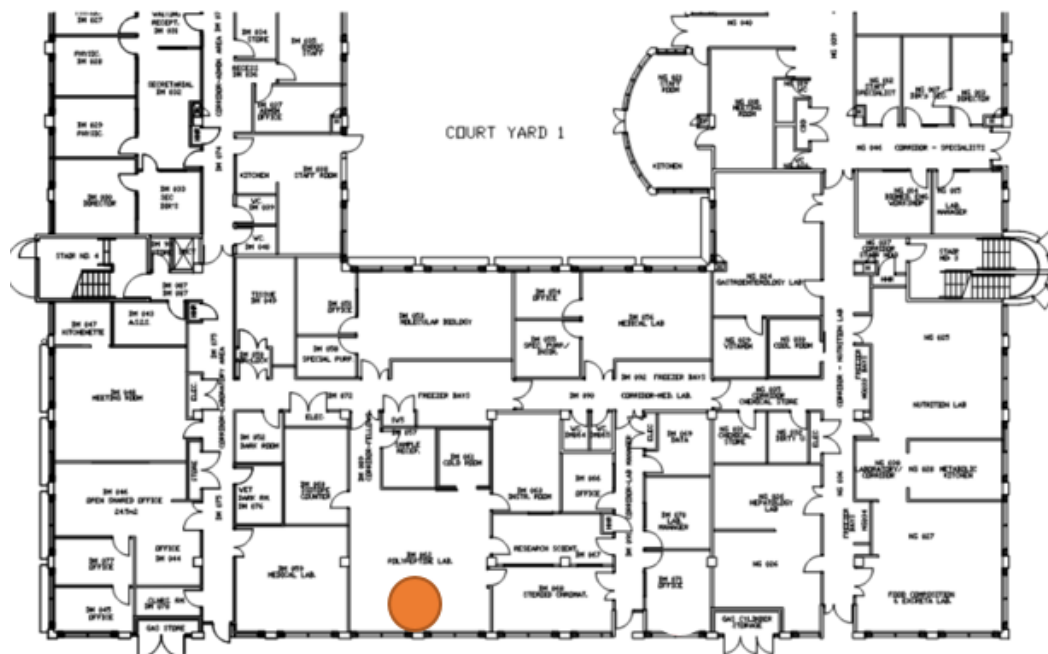


Figure 2: CHW - L1 Lab vibration monitor location shown in orange

Monitoring at this location utilises a GeoSIG GMSplus with a GeoSIG VE-11 geophone. The calibration certificate for the geophone is included in Appendix A.

3. Recorded Data

Figure 3 below shows the vibration levels (RMS velocity) recorded between 01/07/2022 and 31/07/2022. The recorded data is shown in blue, while the limit of 0.102mm/s (V_{RMS}) is shown in red.

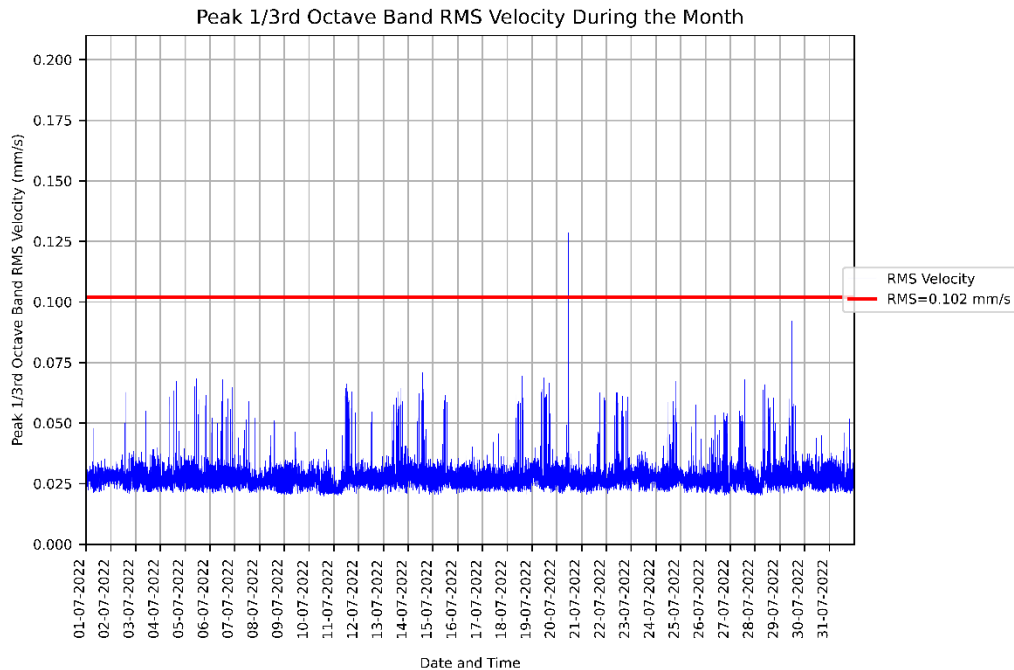
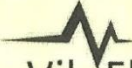


Figure 3: Measured RMSV vibration levels for 01/07/2022 to 31/07/2022 at the CHW - L1 Lab.

The table below summarises the number of RMS Velocity limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
1	0

Appendix A: Calibration Certificates

CERTIFICATE OF CALIBRATION	
CERTIFICATE NO: G30985	
EQUIPMENT TESTED : Geophone	
Manufacturer: GeoSIG	Serial No: 55910
Geophone Type: VE-11	
Owner: Arup Services Pty Ltd Barrack Place, Level 5, 151 Clarence Street Sydney NSW 2000	
Tests Performed:	Frequency Response, Linearity & Sensitivity at Selected Frequencies
Comments:	Detailed overleaf.
CONDITION OF TEST:	
Temperature	23 °C ±1° C
Relative Humidity	44 % ±5%
Date of Receipt :	25/10/2021
Date of Calibration :	01/11/2021
Date of Issue :	01/11/2021
Acu-Vib Test Procedure:	AVP15 (Low Frequency Transducer, Geophone) based on AS2187.2 & DIN45669-1
CHECKED BY:	AUTHORISED SIGNATURE: <i>Hein See</i>
Accredited for compliance with ISO/IEC 17025 - Calibration	
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.	
This report applies only to the item identified in the report and may not be reproduced in part.	
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.	
 WORLD RECOGNISED ACCREDITATION Accredited Lab No. 9262 Acoustic and Vibration Measurements	 Acu-Vib Electronics CALIBRATIONS SALES RENTALS REPAIRS Head Office & Calibration Laboratory Unit 14, 22 Hudson Ave. Castle Hill NSW 2134 (02) 9680 8133 www.acu-vib.com.au
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Frequency response and linearity characteristics for
 GeoSIG Velocity Geophone **VE-11** Serial No. **55910**
 Constant velocity of 10 mm/sec Peak applied for response
 (Except at 200.0 Hz where applied level limited to 1.0 mm/s peak)
 For amplitude linearity applied level varied at 15.92 Hz

12VDC Power Supply

Geophone Orientation.: Vertical

Frequency		Velocity mm/sec Peak	Indicated Sensitivity mV/mm s^{-1}	Expanded uncertainty
Hz	Radians/sec		Vertical Sensitivity	$U_{95} \%$
3.00	18.85	10.0	109.76	1.00%
4.00	25.13	10.0	111.50	0.90%
6.00	37.70	10.0	108.98	0.90%
10.00	62.83	10.0	103.80	0.90%
15.00	94.25	10.0	101.12	0.90%
15.92	94.25	1.0	N/A	0.90%
15.92	94.25	5.0	95.09	0.90%
15.92	94.25	10.0	94.96	0.90%
15.92	94.25	50.0	94.83	0.90%
15.92	94.25	100	N/A	0.50%
30.00	188.50	10.0	99.03	0.50%
60.00	376.99	10.0	100.56	0.50%
120.00	753.98	10.0	113.91	0.50%
150.00	942.48	10.0	119.09	0.50%
Hz	Radians/sec	Velocity mm/sec Peak	Vertical Sensitivity	$U_{95} \%$

Note1:

The laboratory has accreditation under ISO/IEC 17025 from NATA for calibration to ISO 16063-21 at frequencies from 0.5 Hz. Measurements at all frequencies and levels shown in the table above are made using reference equipment traceably calibrated to Australian National Standards.

Note2: The uncertainties quoted are estimated at a confidence level of 95% and a coverage factor of $k=2$ applies unless otherwise stated.



Health Infrastructure

Children's Hospital Westmead

**Vibration Monitoring - CASB Level 2
MRI - July 2022**

CVM/ CASB/202207

Issue 1 | 02/08/2022

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 271985

Arup Pty Ltd ABN 18 000 966 165

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www.arup.com



Revision	Date	Filename	Westmead Hospital – 103158 CASB Level 2 MRI - Summary of Recent Vibration Measurements (01-07 to 31-07).docx
Issue 1	02/08/2022	Description	Issue

Filename			
Description			
	Prepared by	Checked by	Approved by
Name			
Signature			

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Executive Summary

This report summarises the vibration monitoring data recorded at CASB Level 2 MRI, over one month – from 01/07/2022 to 31/07/2022. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMSV Vibration Levels

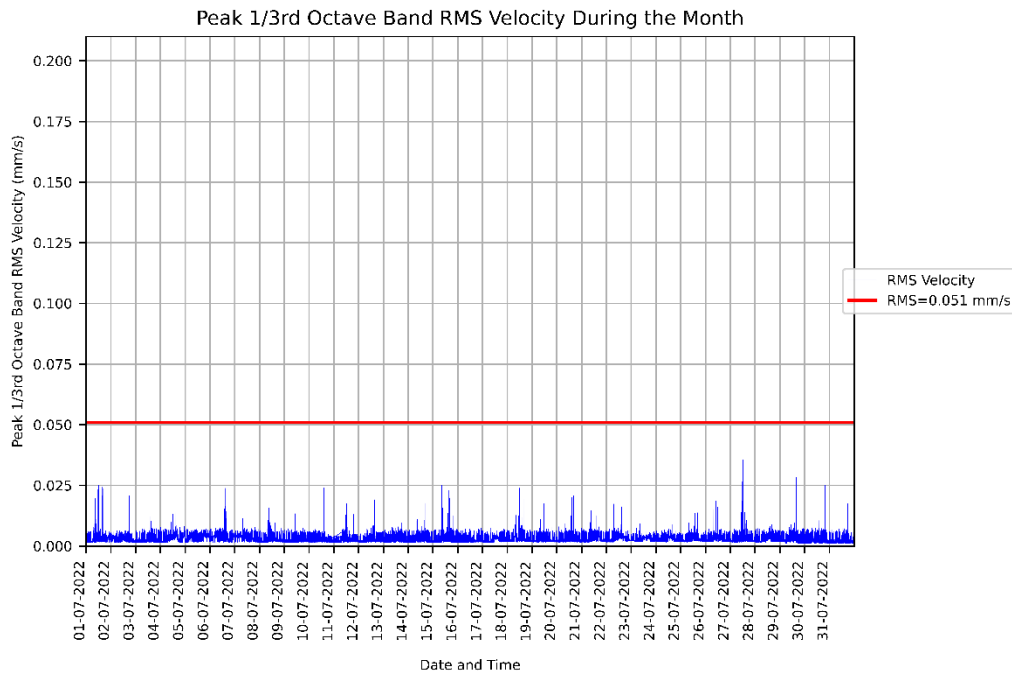


Figure 1: Measured RMSV vibration levels for 01/07/2022 to 31/07/2022 at the CASB Level 2 MRI.

The table below summarises the number of Root-Mean-Square Velocity (RMSV) limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
0	0

1. Introduction

Arup has been commissioned by PricewaterhouseCoopers (PwC) on behalf of NSW Health Infrastructure to monitor vibration levels in facilities adjacent to the Paediatric Services Building and Multi-storey Car Park development sites to ensure facility operations are not excessively impacted by the construction works. This report summarises the vibration monitoring data recorded at CASB Level 2 MRI during the period of the 01/07/2022 to 31/07/2022.

For the purposes of reporting, construction works are considered to be occurring at the following times:

Day	Construction Hours
Monday to Friday	7:00am to 6:00pm
Saturday	8:00am to 1:00pm
Sunday	No works
Public Holidays	No works

2. Monitor Location

The location of this monitor is shown below in Figure 2.

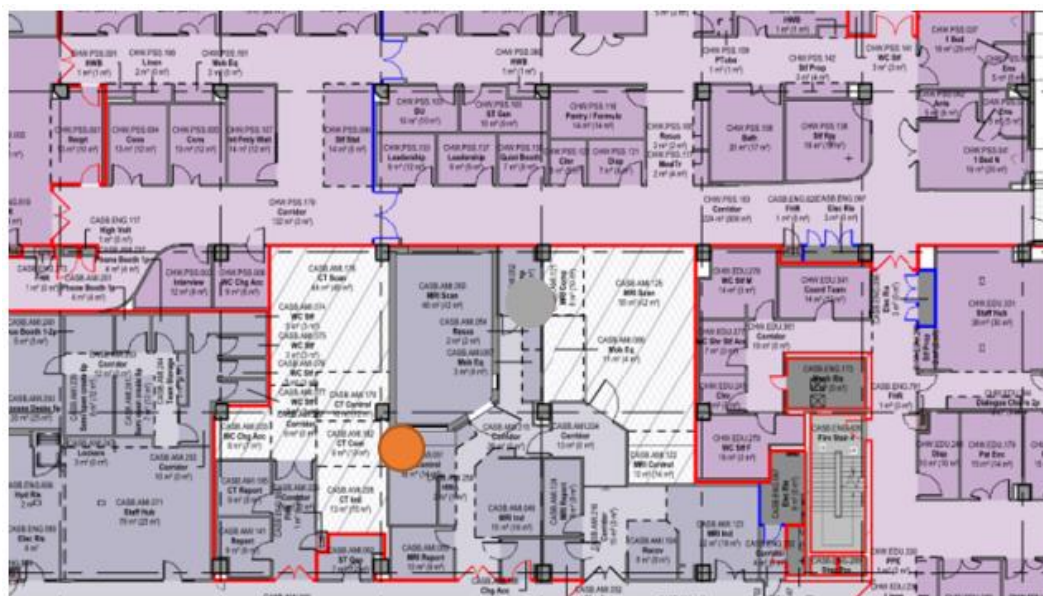


Figure 2: CASB Level 2 MRI vibration monitor location shown in orange

Monitoring at this location utilises a GeoSIG GMSplus with a GeoSIG VE-11 geophone. The calibration certificate for the geophone is included in Appendix A.

3. Recorded Data

Figure 3 below shows the vibration levels (RMS velocity) recorded between 01/07/2022 and 31/07/2022. The recorded data is shown in blue, while the limit of 0.051mm/s (V_{RMS}) is shown in red.

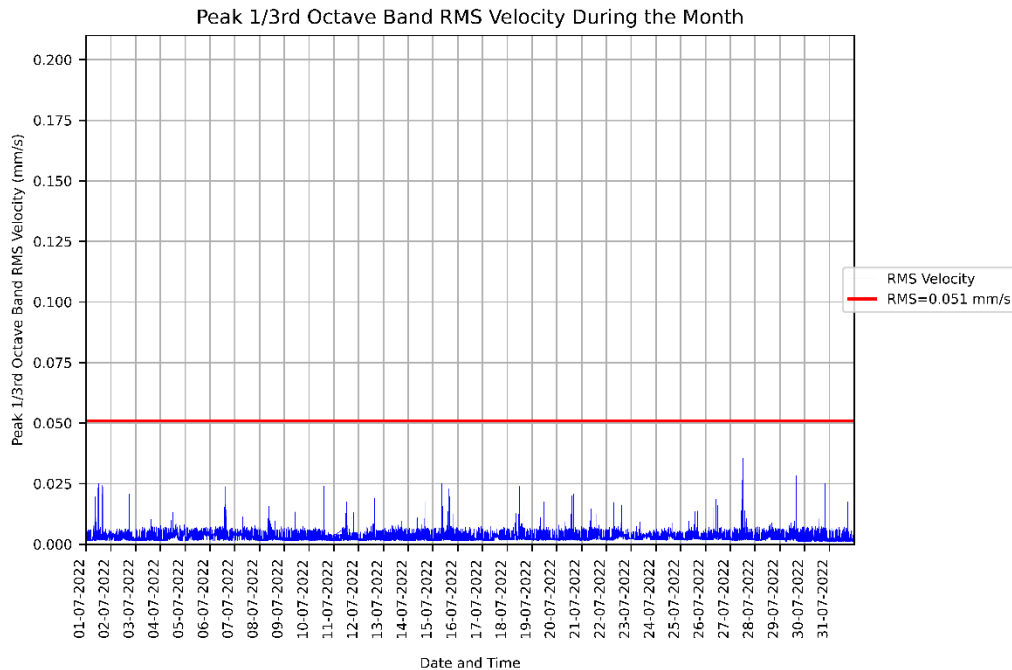
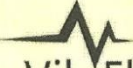


Figure 3: Measured RMSV vibration levels for 01/07/2022 to 31/07/2022 at the CASB Level 2 MRI.

The table below summarises the number of RMS Velocity limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
0	0

Appendix A: Calibration Certificates

CERTIFICATE OF CALIBRATION	
CERTIFICATE No: G30979	
EQUIPMENT TESTED : Geophone	
Manufacturer: GeoSIG	Serial No: 55911
Geophone Type: VE-11	
Owner: Arup Services Pty Ltd Barrack Place, Level 5, 151 Clarence Street Sydney NSW 2000	
Tests Performed:	Frequency Response, Linearity & Sensitivity at Selected Frequencies
Comments:	Detailed overleaf.
CONDITION OF TEST:	
Temperature	21 °C ±1° C
Relative Humidity	47 % ±5%
Date of Receipt :	25/10/2021
Date of Calibration :	01/11/2021
Date of Issue :	01/11/2021
Acu-Vib Test Procedure:	AVP15 (Low Frequency Transducer, Geophone) based on AS2187.2 & DIN45669-1
CHECKED BY: <i>[Signature]</i>	AUTHORISED SIGNATURE: <i>[Signature]</i> <i>Alan See</i>
Accredited for compliance with ISO/IEC 17025 - Calibration	
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.	
This report applies only to the item identified in the report and may not be reproduced in part.	
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.	
 WORLD RECOGNISED ACCREDITATION Accredited Lab No. 9262 Acoustic and Vibration Measurements	 Acu-Vib Electronics CALIBRATIONS SALES RENTALS REPAIRS Head Office & Calibration Laboratory Unit: 14, 22 Hudson Ave, Castle Hill NSW 2154 (02) 9680 8133 www.acu-vib.com.au
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Frequency response and linearity characteristics for
GeoSIG Velocity Geophone **VE-11** Serial No. **55911**
Constant velocity of 10 mm/sec Peak applied for response
(Except at 200.0 Hz where applied level limited to 1.0 mm/s peak)
For amplitude linearity applied level varied at 15.92 Hz

12VDC Power Supply

Geophone Orientation.: Vertical

Frequency		Velocity mm/sec Peak	Indicated Sensitivity mV/mms ⁻¹	Expanded uncertainty
Hz	Radians/sec		Vertical Sensitivity	U ₉₅ %
3.00	18.85	10.0	112.66	1.00%
4.00	25.13	10.0	112.97	0.90%
6.00	37.70	10.0	108.80	0.90%
10.00	62.83	10.0	101.91	0.90%
15.00	94.25	10.0	98.58	0.90%
15.92	94.25	1.0	N/A	0.90%
15.92	94.25	5.0	92.57	0.90%
15.92	94.25	10.0	92.49	0.90%
15.92	94.25	50.0	92.48	0.90%
15.92	94.25	100	N/A	0.50%
30.00	188.50	10.0	95.98	0.50%
60.00	376.99	10.0	96.13	0.50%
120.00	753.98	10.0	106.11	0.50%
150.00	942.48	10.0	116.46	0.50%
Hz	Radians/sec	Velocity mm/sec Peak	Vertical Sensitivity	U ₉₅ %

Note1:

The laboratory has accreditation under ISO/IEC 17025 from NATA for calibration to ISO 16063-21 at frequencies from 0.5 Hz. Measurements at all frequencies and levels shown in the table above are made using reference equipment traceably calibrated to Australian National Standards.

Note2: The uncertainties quoted are estimated at a confidence level of 95% and a coverage factor of k=2 applies unless otherwise stated.



Health Infrastructure

Children's Hospital Westmead

**Vibration Monitoring - CASB level 3
Surgical Suite - July 2022**

CVM/ CASB/202207

Issue 1 | 02/08/2022

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 271985

Arup Pty Ltd ABN 18 000 966 165

Arup Pty Ltd

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Document Verification

Project title Children's Hospital Westmead
Document title Monthly Vibration Monitoring Report
Job number 271985
Document ref CVM/CASB/202207
File reference -

Revision	Date	Filename	
		Westmead Hospital – 103160 CASB level 3 Surgical Suite - Summary of Recent Vibration Measurements (01-07 to 31-07).docx	

Issue 1	02/08/2022	Description	Issue
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	Prepared by	Checked by	Approved by
Name	PR	KF	KF
Signature			

Filename
Description

	Prepared by	Checked by	Approved by
Name			
Signature			

Filename
Description

	Prepared by	Checked by	Approved by
Name			
Signature			

Issue Document Verification with Document



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Executive Summary

This report summarises the vibration monitoring data recorded at CASB level 3 Surgical Suite, over one month – from 01/07/2022 to 31/07/2022. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMSV Vibration Levels

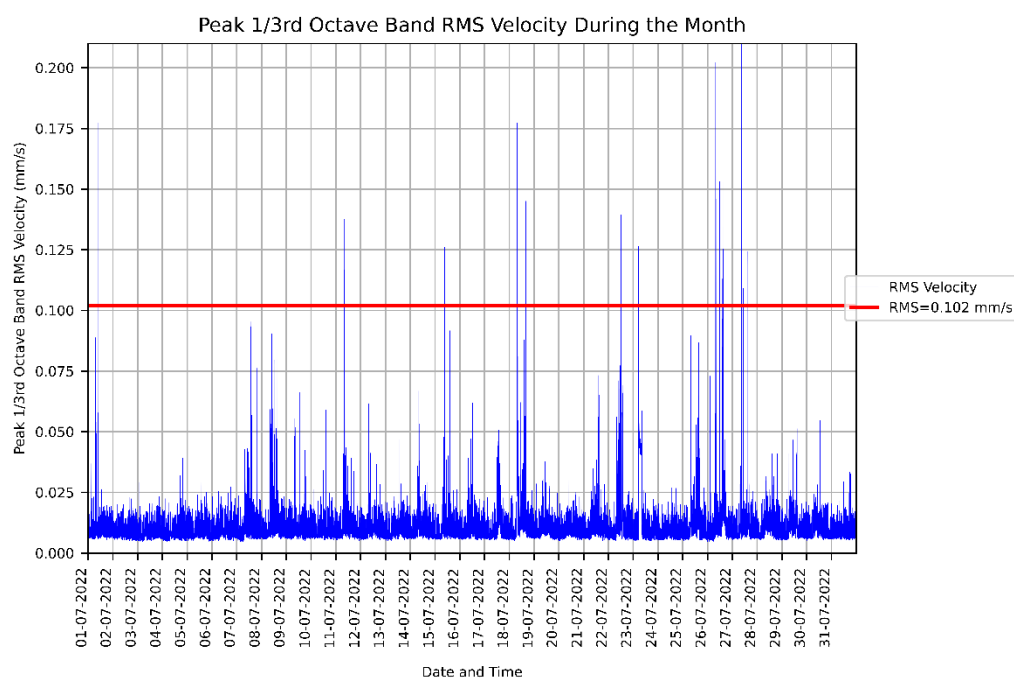


Figure 1: Measured RMSV vibration levels for 01/07/2022 to 31/07/2022 at the CASB level 3 Surgical Suite.

The table below summarises the number of Root-Mean-Square Velocity (RMSV) limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
38	1

1. Introduction

Arup has been commissioned by PricewaterhouseCoopers (PwC) on behalf of NSW Health Infrastructure to monitor vibration levels in facilities adjacent to the Paediatric Services Building and Multi-storey Car Park development sites to ensure facility operations are not excessively impacted by the construction works. This report summarises the vibration monitoring data recorded at CASB level 3 Surgical Suite during the period of the 01/07/2022 to 31/07/2022.

For the purposes of reporting, construction works are considered to be occurring at the following times:

Day	Construction Hours
Monday to Friday	7:00am to 6:00pm
Saturday	8:00am to 1:00pm
Sunday	No works
Public Holidays	No works

2. Monitor Location

The location of this monitor is shown below in Figure 2.

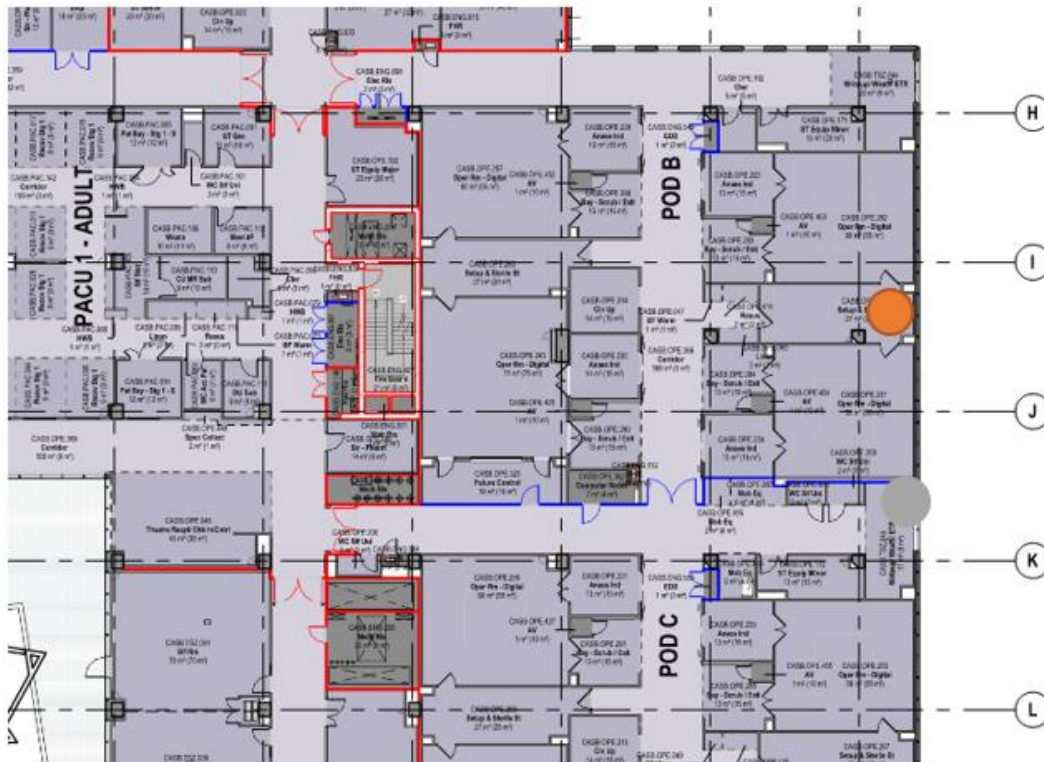


Figure 2: CASB level 3 Surgical Suite vibration monitor location shown in orange

Monitoring at this location utilises a GeoSIG GMSplus with a GeoSIG VE-11 geophone. The calibration certificate for the geophone is included in Appendix A.

3. Recorded Data

Figure 3 below shows the vibration levels (RMS velocity) recorded between 01/07/2022 and 31/07/2022. The recorded data is shown in blue, while the limit of 0.102mm/s (V_{RMS}) is shown in red.

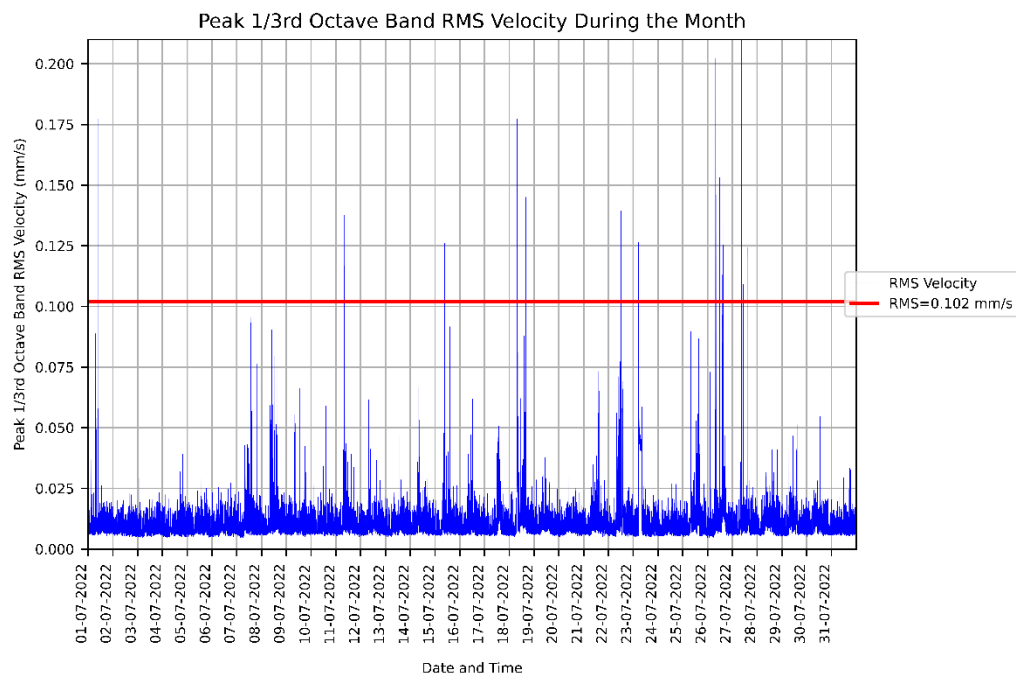


Figure 3: Measured RMSV vibration levels for 01/07/2022 to 31/07/2022 at the CASB level 3 Surgical Suite.

The table below summarises the number of RMS Velocity limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
38	1

Appendix A: Calibration Certificates

Frequency response and linearity characteristics for
GeoSIG Velocity Geophone **VE-11** Serial No. **55912**
Constant velocity of 10 mm/sec Peak applied for response
(Except at 200.0 Hz where applied level limited to 1.0 mm/s peak)
For amplitude linearity applied level varied at 15.92 Hz

12VDC Power Supply

Geophone Orientation.: Vertical

Frequency		Velocity mm/sec Peak	Indicated Sensitivity mV/mm ^s ⁻¹	Expanded uncertainty
Hz	Radians/sec		Vertical Sensitivity	U ₉₅ %
3.00	18.85	10.0	112.74	1.00%
4.00	25.13	10.0	113.82	0.90%
6.00	37.70	10.0	109.59	0.90%
10.00	62.83	10.0	100.79	0.90%
15.00	94.25	10.0	96.12	0.90%
15.92	94.25	1.0	N/A	0.90%
15.92	94.25	5.0	90.09	0.90%
15.92	94.25	10.0	89.99	0.90%
15.92	94.25	50.0	89.89	0.90%
15.92	94.25	100	N/A	0.50%
30.00	188.50	10.0	92.45	0.50%
60.00	376.99	10.0	92.89	0.50%
120.00	753.98	10.0	100.92	0.50%
150.00	942.48	10.0	117.80	0.50%
Hz	Radians/sec	Velocity mm/sec Peak	Vertical Sensitivity	U ₉₅ %

Note1:

The laboratory has accreditation under ISO/IEC 17025 from NATA for calibration to ISO 16063-21 at frequencies from 0.5 Hz. Measurements at all frequencies and levels shown in the table above are made using reference equipment traceably calibrated to Australian National Standards.

Note2:

The uncertainties quoted are estimated at a confidence level of 95% and a coverage factor of k=2 applies unless otherwise stated.

Frequency response and linearity characteristics for
GeoSIG Velocity Geophone **VE-11** Serial No. **55910**
Constant velocity of 10 mm/sec Peak applied for response
(Except at 200.0 Hz where applied level limited to 1.0 mm/s peak)
For amplitude linearity applied level varied at 15.92 Hz

12VDC Power Supply

Geophone Orientation.: Vertical

Frequency		Velocity mm/sec Peak	Indicated Sensitivity mV/mm s^{-1}	Expanded uncertainty
Hz	Radians/sec		Vertical Sensitivity	$U_{95} \%$
3.00	18.85	10.0	109.76	1.00%
4.00	25.13	10.0	111.50	0.90%
6.00	37.70	10.0	108.98	0.90%
10.00	62.83	10.0	103.80	0.90%
15.00	94.25	10.0	101.12	0.90%
15.92	94.25	1.0	N/A	0.90%
15.92	94.25	5.0	95.09	0.90%
15.92	94.25	10.0	94.96	0.90%
15.92	94.25	50.0	94.83	0.90%
15.92	94.25	100	N/A	0.50%
30.00	188.50	10.0	99.03	0.50%
60.00	376.99	10.0	100.56	0.50%
120.00	753.98	10.0	113.91	0.50%
150.00	942.48	10.0	119.09	0.50%
Hz	Radians/sec	Velocity mm/sec Peak	Vertical Sensitivity	$U_{95} \%$

Note1:

The laboratory has accreditation under ISO/IEC 17025 from NATA for calibration to ISO 16063-21 at frequencies from 0.5 Hz. Measurements at all frequencies and levels shown in the table above are made using reference equipment traceably calibrated to Australian National Standards.

Note2:

The uncertainties quoted are estimated at a confidence level of 95% and a coverage factor of $k=2$ applies unless otherwise stated.



Health Infrastructure

Children's Hospital Westmead

**Vibration Monitoring - KR - L4 Lab 9 -
July 2022**

CVM/ KR/202207

Issue 1 | 02/08/2022

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 271985

Arup Pty Ltd ABN 18 000 966 165

Arup Pty Ltd

Level 5

151 Clarence Street

Sydney NSW 2000

Australia

www.arup.com

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Executive Summary

This report summarises the vibration monitoring data recorded at KR - L4 Lab 9, over one month – from 01/07/2022 to 31/07/2022. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMSV Vibration Levels

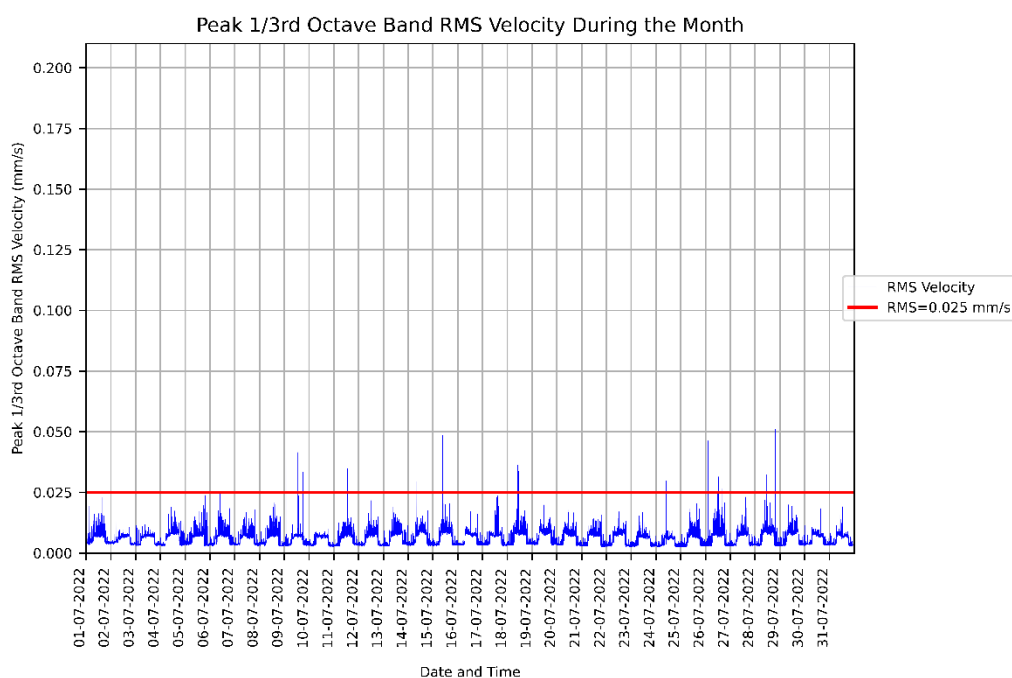


Figure 1: Measured RMSV vibration levels for 01/07/2022 to 31/07/2022 at the KR - L4 Lab 9.

The table below summarises the number of Root-Mean-Square Velocity (RMSV) limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
10	7

1. Introduction

Arup has been commissioned by PricewaterhouseCoopers (PwC) on behalf of NSW Health Infrastructure to monitor vibration levels in facilities adjacent to the Paediatric Services Building and Multi-storey Car Park development sites to ensure facility operations are not excessively impacted by the construction works. This report summarises the vibration monitoring data recorded at KR - L4 Lab 9 during the period of the 01/07/2022 to 31/07/2022.

For the purposes of reporting, construction works are considered to be occurring at the following times:

Day	Construction Hours
Monday to Friday	7:00am to 6:00pm
Saturday	8:00am to 1:00pm
Sunday	No works
Public Holidays	No works

2. Monitor Location

The location of this monitor is shown below in Figure 2.

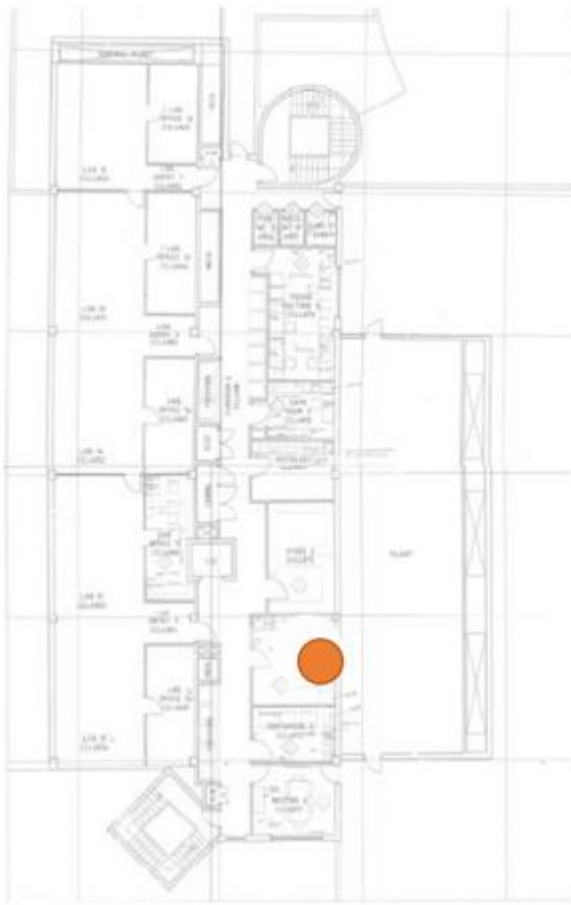


Figure 2: KR - L4 Lab 9 vibration monitor location shown in orange

Monitoring at this location utilises a GeoSIG GMSplus with a GeoSIG VE-11 geophone. The calibration certificate for the geophone is included in Appendix A.

3. Recorded Data

Figure 3 below shows the vibration levels (RMS velocity) recorded between 01/07/2022 and 31/07/2022. The recorded data is shown in blue, while the limit of 0.025mm/s (V_{RMS}) is shown in red.

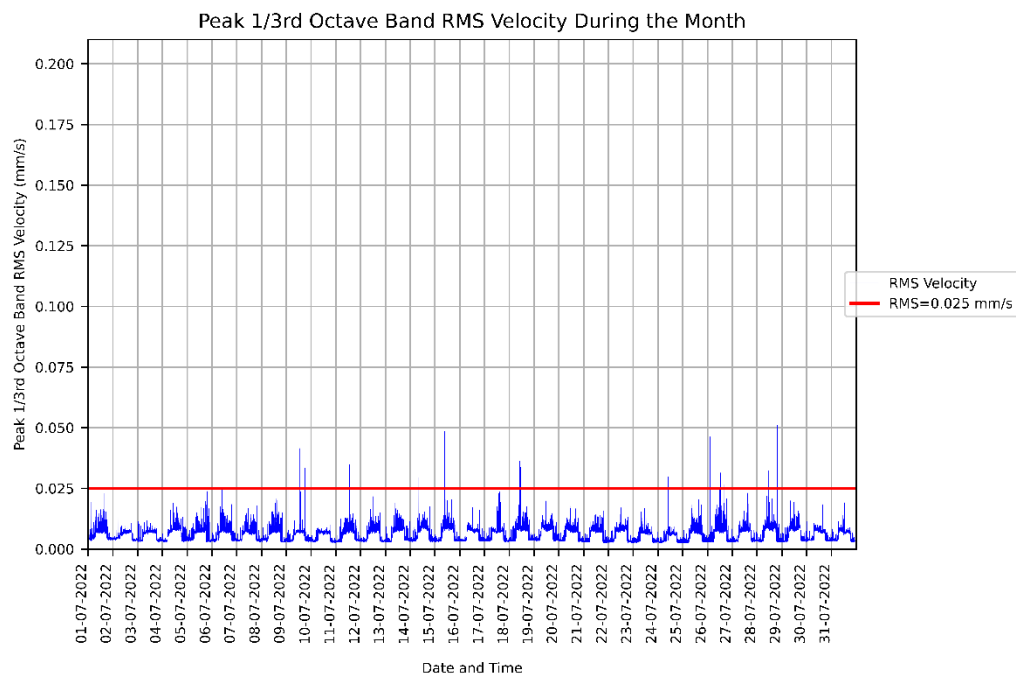
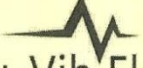


Figure 3: Measured RMSV vibration levels for 01/07/2022 to 31/07/2022 at the KR - L4 Lab 9.

The table below summarises the number of RMS Velocity limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
10	7

Appendix A: Calibration Certificates

CERTIFICATE OF CALIBRATION	
CERTIFICATE NO: G30976	
EQUIPMENT TESTED : Geophone	
Manufacturer: GeoSIG	Serial No: 55913
Geophone Type: VE-11	
Owner: Arup Services Pty Ltd Barrack Place, Level 5, 151 Clarence Street Sydney NSW 2000	
Tests Performed:	Frequency Response, Linearity & Sensitivity at Selected Frequencies
Comments:	Detailed overleaf.
CONDITION OF TEST:	
Temperature	21 °C ±1° C
Relative Humidity	47 % ±5%
Date of Receipt :	25/10/2021
Date of Calibration :	01/11/2021
Date of Issue :	01/11/2021
Acu-Vib Test Procedure:	AVP15 (Low Frequency Transducer, Geophone) based on AS2187.2 & DIN45669-1
CHECKED BY: 	AUTHORISED SIGNATURE:  Helen See
Accredited for compliance with ISO/IEC 17025 - Calibration	
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.	
This report applies only to the item identified in the report and may not be reproduced in part.	
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.	
 WORLD RECOGNISED ACCREDITATION Accredited Lab No. 9262 Acoustic and Vibration Measurements	 Acu-Vib Electronics CALIBRATIONS SALES RENTALS REPAIRS Head Office & Calibration Laboratory Unit 14, 22 Hudson Ave, Castle Hill NSW 2134 (02) 9580 8133 www.acu-vib.com.au
Page 1 of 2 Calibration Certificate AVCERT15 Rev.2.0 14.04.2021	

Frequency response and linearity characteristics for
 GeoSIG Velocity Geophone **VE-11** Serial No. **55913**
 Constant velocity of 10 mm/sec Peak applied for response
 (Except at 200.0 Hz where applied level limited to 1.0 mm/s peak)
 For amplitude linearity applied level varied at 15.92 Hz

12VDC Power Supply

Geophone Orientation.: Vertical

Frequency		Velocity mm/sec Peak	Indicated Sensitivity mV/mm s^{-1}	Expanded uncertainty
Hz	Radians/sec		Vertical Sensitivity	$U_{95} \%$
3.00	18.85	10.0	106.24	1.00%
4.00	25.13	10.0	105.59	0.90%
6.00	37.70	10.0	100.69	0.90%
10.00	62.83	10.0	94.25	0.90%
15.00	94.25	10.0	91.31	0.90%
15.92	94.25	1.0	N/A	0.90%
15.92	94.25	5.0	85.93	0.90%
15.92	94.25	10.0	85.77	0.90%
15.92	94.25	50.0	85.76	0.90%
15.92	94.25	100	N/A	0.50%
30.00	188.50	10.0	89.27	0.50%
60.00	376.99	10.0	90.17	0.50%
120.00	753.98	10.0	100.67	0.50%
150.00	942.48	10.0	115.82	0.50%
Hz	Radians/sec	Velocity mm/sec Peak	Vertical Sensitivity	$U_{95} \%$

Note1:

The laboratory has accreditation under ISO/IEC 17025 from NATA for calibration to ISO 16063-21 at frequencies from 0.5 Hz. Measurements at all frequencies and levels shown in the table above are made using reference equipment traceably calibrated to Australian National Standards.

Note2:

The uncertainties quoted are estimated at a confidence level of 95% and a coverage factor of $k=2$ applies unless otherwise stated.



Health Infrastructure

Children's Hospital Westmead

**Vibration Monitoring - CH - Mental
Health Utility - Wade Ward - July 2022**

CVM/ CH/202207

Issue 1 | 02/08/2022

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 271985

Arup Pty Ltd ABN 18 000 966 165

Arup Pty Ltd

Level 5

151 Clarence Street

Sydney NSW 2000

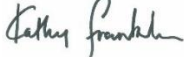
Australia

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Document Verification

Project title Children's Hospital Westmead
Document title Monthly Vibration Monitoring Report
Job number 271985
Document ref CVM/CH/202207
File reference -

Revision	Date	Filename			
			Westmead Hospital – 103678 CH - Mental Health Utility - Wade Ward - Summary of Recent Vibration Measurements (01-07 to 31-07).docx		
Issue 1	02/08/2022	Description	Issue		
			Prepared by	Checked by	Approved by
		Name	PR	KF	KF
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			

Issue Document Verification with Document



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Executive Summary

This report summarises the vibration monitoring data recorded at CH - Mental Health Utility - Wade Ward, over one month – from 01/07/2022 to 31/07/2022. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMSV Vibration Levels

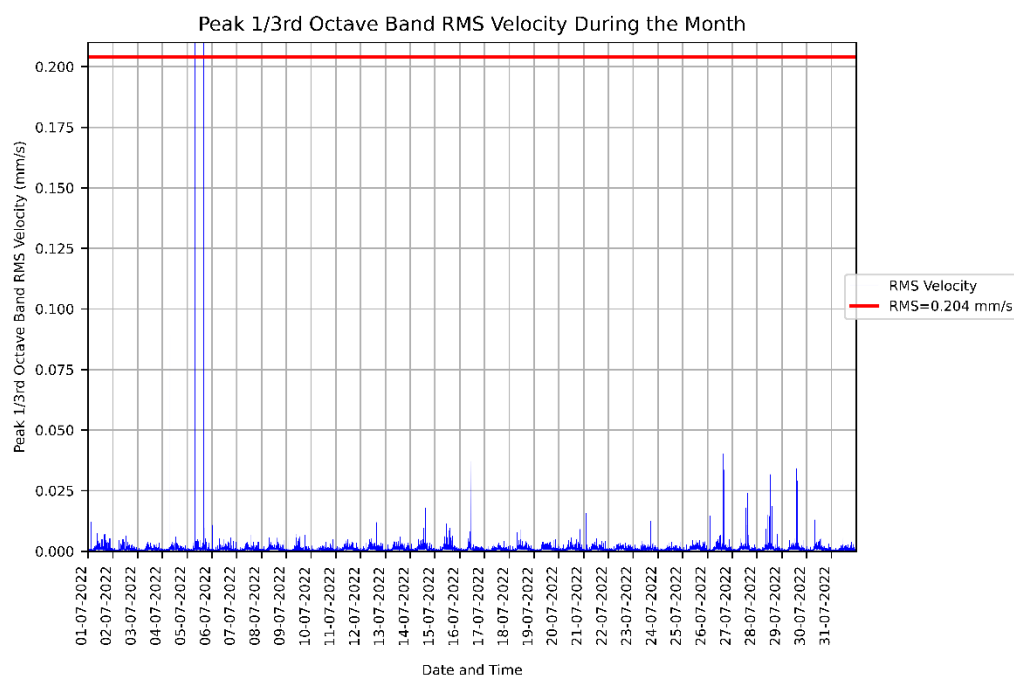


Figure 1: Measured RMSV vibration levels for 01/07/2022 to 31/07/2022 at the CH - Mental Health Utility - Wade Ward.

The table below summarises the number of Root-Mean-Square Velocity (RMSV) limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
2	0

1. Introduction

Arup has been commissioned by PricewaterhouseCoopers (PwC) on behalf of NSW Health Infrastructure to monitor vibration levels in facilities adjacent to the Paediatric Services Building and Multi-storey Car Park development sites to ensure facility operations are not excessively impacted by the construction works. This report summarises the vibration monitoring data recorded at CH - Mental Health Utility - Wade Ward during the period of the 01/07/2022 to 31/07/2022.

For the purposes of reporting, construction works are considered to be occurring at the following times:

Day	Construction Hours
Monday to Friday	7:00am to 6:00pm
Saturday	8:00am to 1:00pm
Sunday	No works
Public Holidays	No works

2. Monitor Location

The location of this monitor is shown below in Figure 2.

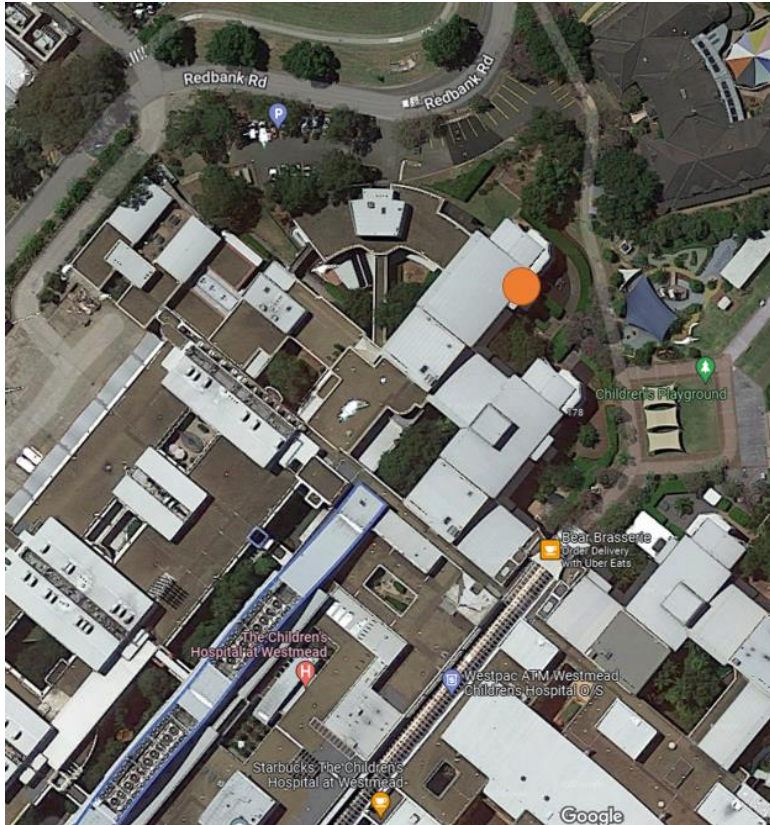


Figure 2: CH - Mental Health Utility - Wade Ward vibration monitor location shown in orange

Monitoring at this location utilises a GeoSIG GMSplus with a GeoSIG VE-11 geophone. The calibration certificate for the geophone is included in Appendix A.

3. Recorded Data

Figure 3 below shows the vibration levels (RMS velocity) recorded between 01/07/2022 and 31/07/2022. The recorded data is shown in blue, while the limit of 0.204mm/s (V_{RMS}) is shown in red.

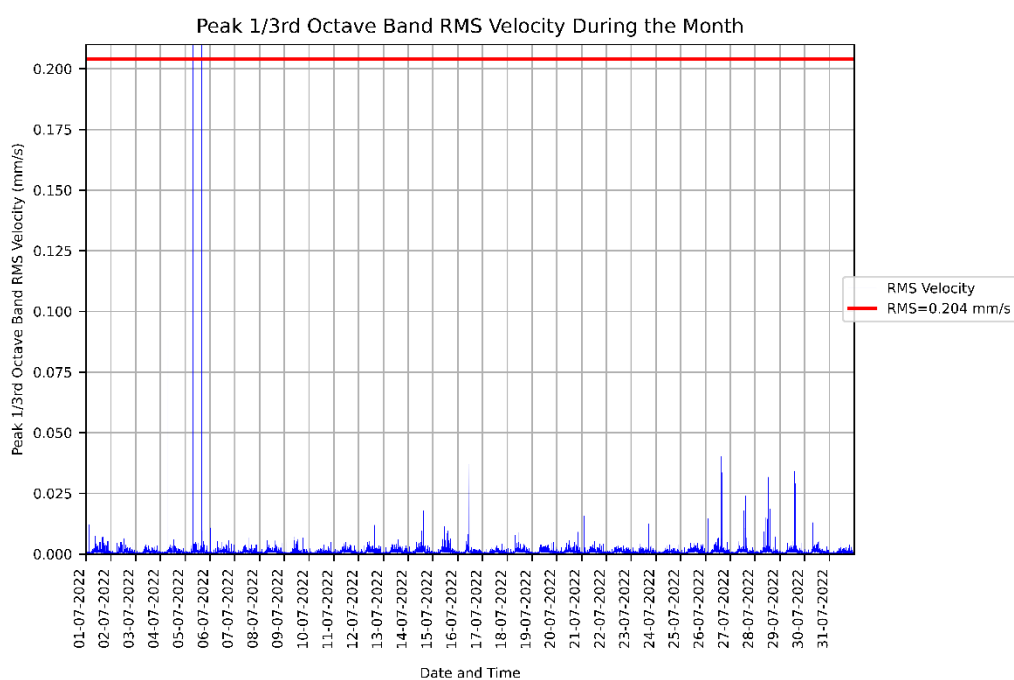


Figure 3: Measured RMSV vibration levels for 01/07/2022 to 31/07/2022 at the CH - Mental Health Utility - Wade Ward.

The table below summarises the number of RMS Velocity limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
2	0

Appendix A: Calibration Certificates

GeoSIG

103677_GS_Test_Record_GMSplus.docx

Page 1/2

Test Record GMSplus

Test Record	1	Job	31057		
S/N	103677	Test Procedure	GS_GMSplus_TestProcedure_V01		
Customer			AU_ARUP_Riddet	Date	01.02.2018
				Tested by	Ross Baradoy
Model	GMSplus	103677	Option 1		
Type	3Ch		Option 2		
Description	Recorder		Option 3		
Main board	GS_IA18_S-MN.V06.H2	160281	Option 4		
Conn. board	GS_IA18_S-MN.V06.H2	160305	Option 5		
Input range	± 10 V DIFF		Option 6		
Sensor 1	VE-11	56865	Ext. Option 1	GXX-3GUE	17738
Sensor 2	0		Ext. Option 2		
Power	15 VDC		Ext. Option 3		
Armdas/Predas	21.12.16		MAC	8C:8E:76:00:C2:01	
Linux	gms-linux-firmware-r121_20170321.gsfw		DSP	51.03.05	
			RTC	80.02.03	

Remarks:

1. Test Equipment

1.1. Test equipment is as per list and ready ☒ Ok

2. Visual Check

2.1. No defects found during visual check ☒ Ok

3. Configuration

3.1. Description	GMSplus GeoSIG Ltd
3.2. Memory	8 GB
3.3. Station	GSGMS
3.4. Location	Australia
3.5. Sampling rate	200 SPS
3.6. Units	mm/s
3.7. LSB value	0.0000132500000mm/s /count
3.8. Pre event	5 s
3.9. Post event	10 s
3.10. Trigger level	2 and 3 mm/s
3.11. Alarms Trigger level	n/a

4. Sensor input test

4.1. AC input test	☒ Ok
4.2. DC input test	☒ Ok
4.3. Noise test	☒ Ok

5. Real sensor test

5.1. Test pulse	☒ Ok	☐ n/a
5.2. Event X-Y-Z	☒ Ok	☐ n/a
5.3. Tilt	☒ Ok	☐ n/a
5.4. Over range	☒ Ok	☐ n/a

6. Options testing

6.1. GMS-Wi-Fi	☐ Ok	☒ n/a
6.2. GMS-GPS	☐ Ok	☒ n/a
6.3. GXX-3GUM	☒ Ok	☐ n/a
6.4. ALC, Config:	☐ Ok	☒ n/a
6.5. GMS-Interconnection	☐ Ok	☒ n/a
6.6. Serial modem	☐ Ok	☒ n/a
6.7. Ethernet modem	☐ Ok	☒ n/a
6.8. Sensor junction box	☐ Ok	☒ n/a

7. Physical inspection

7.1. Housing	☒ Ok
7.2. Fixation and screws	☒ Ok
7.3. Cables and connectors	☒ Ok
7.4. Labels	☒ Ok
7.5. Cleanness	☒ Ok

8. Configuration backup

8.1. Instrument configuration (*.xml)	☒ Ok
8.2. Software configuration (*.gsc)	☒ Ok
8.3. Test files archived	☒ Ok

Final Acceptance

All tests were executed according to the test procedure and all results were checked and are according to the specifications.

Tested by Ross Baradoy  on 26.02.2018

Approved by Tobias Liesching  on 02.03.2018