HS2

July 2020

Construction noise and vibration Monthly Report – June 2020

London Borough of Ealing

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Non-technical summary

This noise and vibration monitoring report fulfils HS2 Limited's commitment detailed in the Environmental Minimum Requirements (EMRs), Annex 1, Code of Construction Practice, to present the results of noise and vibration monitoring carried out within the London Borough of Ealing (LBE) and London Borough of Hammersmith and Fulham (LBHF) during the month of June 2020.

The report presents data from monitoring installations at the following four active worksites within LBE and LBHF:

- Willesden EuroTerminal worksite (ref.: S001-WS03), where activities included excavation works, concrete breaking, slab construction and ground compaction.
- Old Oak Common Depot worksite (located in LBHF, ref.: S004-WS01), where activities included groundworks and remediation works were carried out.
- Atlas Road worksite (ref.: S001-WS02), where activities included site setup, demolitions, excavations and surveys/ground investigations.
- Victoria Road worksite (ref.: S002-WS01), where activities included earthworks, site setup and deliveries.

Noise monitoring was undertaken in proximity to all sites with vibration monitoring undertaken at Willesden EuroTerminal and Old Oak Common Depot worksites.

Noise monitoring was also undertaken in proximity of the Mandeville Road Badminton Close compound, however no construction activities took place during June 2020.

Additional works were undertaken at the Green Park Way Ventilation Shaft including site clearance, installation of pedestrian walkway and surveys; and in Horsenden Lane, Perivale, to divert water mains.

The measured noise levels in June did not exceed guideline criteria for significant adverse effects due to HS2 related works at any monitoring location. No exceedances of Section 61 trigger levels due to HS2 related works were measured during the monitoring period. There were five complaints during the monitoring period. Description of complaints, results of investigations and any actions taken are detailed in Table 7 of this report.

Abbreviations and descriptions

The abbreviations, descriptions and project terminology used within this report can be found in Table 1.

Table 1: Table of abbreviations

Acronym/Term	Definition
$L_{Aeq,T}$	See equivalent continuous sound pressure level
Ambient sound	A description of the all-encompassing sound at a given location and time which will include sound from many sources near and far. Ambient sound can be quantified in terms of the equivalent continuous sound pressure level, $L_{pAeq,T}$
Decibel(s), or dB	Between the quietest audible sound and the loudest tolerable sound there is a million to one ratio in sound pressure (measured in Pascal (Pa)). Because of this wide range, a level scale called the decibel (dB) scale, based on a logarithmic ratio, is used in sound measurement. Audibility of sound covers a range of approximately 0-140dB.
Decibel(s) A-weighted, or dB(A)	The human ear system does not respond uniformly to sound across the detectable frequency range and consequently instrumentation used to measure sound is weighted to represent the performance of the ear. This is known as the 'A weighting' and is written as 'dB(A)'.
Equivalent continuous sound pressure level, or $L_{pAeq,T}$	An index used internationally for the assessment of environmental sound impacts. It is defined as the notional unchanging level that would, over a given period of time (T), deliver the same sound energy as the actual time-varying sound over the same period. Hence fluctuating sound levels can be described in terms of an equivalent single figure value, typically expressed as a decibel level.
Façade	A facade noise level is the noise level 1m in front of a large reflecting surface. The effect of reflection, is to produce a slightly higher (typically +2.5 to +3 dB) sound level than it would be if the reflecting surface was not there.
Free-field	A free-field noise level is the noise level measured at a location where no reflective surfaces, other than the ground, lies within 3.5 metres of the microphone position.
Exclusion of data	Measurement of noise levels can be affected by weather conditions such as prolonged periods of rain, winds speeds higher than 5m/s and snow/ice ground cover. Noise levels measured during these periods are considered not representative of normal noise conditions at the site and, for the purposes of this report, are excluded from the assessment of exceedances and calculation of typical noise levels and are also greyed out in charts. Identifiable incongruous noise and vibration events not attributable to HS2 construction noise are also excluded.
Peak particle velocity, or PPV	Instantaneous maximum velocity reached by a vibrating element as it oscillates about its rest position. The PPV is a simple indicator of perceptibility and risk of damage to structures due to vibration. It is usually measured in mm/s.
Sound pressure level	The parameter by which sound levels are measured in air. It is measured in decibels. The threshold of hearing has been set at 0dB, while the threshold of pain is approximately 120dB. Normal speech is approximately 60dB at a distance of 1 metre and a change of 3dB in a time varying sound signal is commonly regarded as being just detectable. A change of 10dB is subjectively twice, or half, as loud.
Vibration dose value, or VDV	An index used to evaluate human exposure to vibration in buildings. While the PPV provides information regarding the magnitude of single vibration events, the VDV provides a measure of the total vibration experienced over a specified period of time (typically 16h daytime and 8h night-time). It takes into account the magnitude, the number and the duration of vibration events and can be used to quantify exposure to continuous, impulsive, occasional and intermittent vibration. The vibration dose value is measured in $m/s^{1.75}$.

1 Introduction

1.1.1 The nominated undertaker is required to undertake noise (and vibration) monitoring as necessary to comply with the requirements of the High Speed Rail (London-West Midlands) Environmental Minimum Requirements, including specifically Annex 1: Code of Construction Practice, in addition to any monitoring requirements arising from conditions imposed through consents under Section 61 of the Control of Pollution Act, 1974 or through Undertakings & Assurances given to third parties. Such monitoring may be undertaken for the following purposes:

- monitoring the impact of construction works;
- to investigate complaints, incidents and exceedance of trigger levels; or
- monitoring the effectiveness of noise and vibration control measures.

Monitoring data and interpretive reports are to be provided to each relevant local authority on a monthly basis and shall include a summary of the construction activities occurring, the data recorded over the monitoring period, any complaints received, any periods in exceedance of agreed trigger levels, the results of any investigations and any actions taken or mitigation measures implemented. This report provides noise data, and interpretation thereof, for monitoring carried out by HS2 within the London Borough of Ealing (LBE) for the period 1st to 30th June 2020.

1.1.2 Active construction sites where noise monitoring was undertaken in the local authority area during this period include:

- Atlas Road worksite, ref. S001-WS02 (see plan 2 in Appendix A), where works included continuation of setting up welfare facilities, concrete crushing and slab breakout, vegetation clearance, excavation of trial holes, setting up welfare facilities, ground investigations, CCTV survey of sewers and installation of power connection for tunnel boring machine;
- Willesden EuroTerminal worksite, ref. S001-WS03 (see plan 2 in Appendix A), where works included excavation works and removal of asphalt and concrete slabs in poor conditions, construction of replacement concrete slabs, laying and compacting sub-base foundations of concrete slabs for spoil placement areas;
- Victoria Road worksite, ref. S002-WS01 (see plan 3 in Appendix A), where works included continued earthworks operations including construction of working platforms and haul roads, removal of localised foundations, mains power works in the south-eastern part of the site, deliveries and setting up additional dust control measures;
- Flat Iron compound (within worksite ref.: S002-WS01) where works included continued movement of materials to Victoria Road site and deliveries;

- Old Oak Common depot worksite, ref. S004-WS01 (see plan 4 in Appendix A) and located in the London Borough of Hammersmith and Fulham (LBHF), where, groundworks and remediation works were carried out.

Noise monitoring was also undertaken in proximity of the Mandeville Road Badminton Close compound, however no construction activities took place during June 2020.

Further works were undertaken at the Green Park Way Ventilation Shaft including site clearance, vegetation clearance, removal of concrete wall in proximity to Rockware Avenue, utility surveys, construction of hard standings for welfare units and installation of new pedestrian walking route; and in Horsenden Lane, Perivale, to divert water mains.

1.1.3 The applicable standards, guidance, and monitoring methodology is outlined in the construction noise and vibration monitoring methodology report which can be found at the following location https://www.gov.uk/government/collections/monitoring-the-environmental-effects-of-hs2. Noise and vibration monitoring reports for previous months can also be found at this location.

1.2 Measurement Locations

1.2.1 Table 2 summarises the position of noise and vibration monitoring installations within the LBE area in June 2020. Maps showing the position of noise and vibration monitoring installations are presented in Appendix B.

1.2.2 An additional noise monitor (ref. N050) was installed in Acton Square on the 4th of June to monitor noise from construction activities at the Victoria Road worksite (ref.: S002-WS01).

1.2.3 An additional vibration monitor (ref. V052) was installed on Stephenson Street on the 22nd of June to monitor vibration from construction activities at the Willesden EuroTerminal worksite (ref.: S001-WS03).

Table 2: Monitoring locations

Worksite Reference	Measurement Reference	Address
S001-WS02	N032	Shaftesbury Gardens
	N033	Outside The Collective, Atlas Road / Victoria Road
S001-WS03	N034	Stephenson Street (north)
	N035	Stephenson Street (south)
	N041	Junction of Stephenson Street / Goodhall Street
	V052	Stephenson Street (north)
S002-WS01	N029	Braitrim House, Victoria Road

Worksite Reference	Measurement Reference	Address
	N030	Boden House Car Park
	N031	School Road, outside Acton Business Centre
	N049	Flat Iron compound railway fence, Victoria Rd North Acton
	N050	Acton Square, outside North Acton Station
S004-WS01	N027	Old Oak Common Lane
	N028	Old Oak Common Lane, Hilltop Works
	V045	Old Oak Common Lane
BC Compound	N040	Badminton Close

2 Summary of results

2.1 Exceedances of SOAEL

2.1.1 The significant observed adverse effect level (SOAEL) is defined in the 'Planning Practice Guidance – Noise' as the level above which "noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area."

2.1.2 Where construction noise levels exceed the SOAEL, relevant periods will be identified and summary statistics provided in order to evaluate ongoing qualification for noise insulation and temporary rehousing.

2.1.3 Table 3 presents a summary of recorded exceedances of the SOAEL due to HS2 related construction noise at each measurement location over the reporting period, including the number of exceedances during each time period.

Table 3: Summary of exceedances of SOAEL

Worksite Reference	Measurement Reference	Site Address	Day (Weekday, Saturday, Sunday, Night)	Time period	Number of exceedances of SOAEL
S001-WS02	N032	Shaftesbury Gardens	All days	All periods	No exceedance
	N033	Outside The Collective, Atlas Road / Victoria Road	All days	All periods	No exceedance
S001-WS03	N034	Stephenson Street (north)	All days	All periods	No exceedance
	N035	Stephenson Street (south)	All days	All periods	No exceedance

Worksite Reference	Measurement Reference	Site Address	Day (Weekday, Saturday, Sunday, Night)	Time period	Number of exceedances of SOAEL
	N041	Junction of Stephenson Street / Goodhall Street	All days	All periods	No exceedance
S002-WS01	N029	Braitrim House, Victoria Road	All days	All periods	No exceedance
	N030	Bodens Car Park	All days	All periods	No exceedance
	N031	School Road, outside Acton Business Centre	All days	All periods	No exceedance
	N049	Flat Iron compound	All days	All periods	No exceedance
	N050	Acton Square, outside North Acton Station	All days	All periods	No exceedance
S004-WS01	N027	Old Oak Common Lane	All days	All periods	No exceedance
	N028	Old Oak Common Lane, Hilltop Works	All days	All periods	No exceedance
BC Compound	N040	Badminton Close	All days	All periods	No exceedance

2.1.4 For this monitoring period, no exceedances of the SOAEL were recorded.

2.1.5 Monitoring of vibration peak particle velocity (PPV) was undertaken with the purpose to ensure construction generated vibration levels were below those with potential to damage adjacent buildings, in accordance with Annex 1: Code of Construction Practice of the High Speed Rail (London-West Midlands) Environmental Minimum Requirements. There are no LOAEL and SOAEL criteria based on PPV applicable to HS2 construction vibration.

2.2 Summary of measured noise and vibration levels

2.2.1 Table 4 presents a summary of the measured noise levels at each monitoring location over the reporting period. The $L_{Aeq,T}$ is presented for each of the relevant time periods averaged over the calendar month, along with the highest single period $L_{Aeq,T}$ that was found to occur within the month.

2.2.2 The measured noise levels were largely dominated by the underlying ambient noise levels rather than being attributable to HS2 related construction noise. However, concrete breaking/crushing, groundworks, along with other HS2 works, will have given rise to audible noise beyond the site boundary from time to time.

Table 4: Summary of measured dB L_{Aeq} data over the monitoring period

Worksite Reference	Measurement Reference	Site Address	Free-field or Façade measurement	Weekday Average $L_{Aeq,T}$ (highest day $L_{Aeq,T}$)					Saturday Average $L_{Aeq,T}$ (highest day $L_{Aeq,T}$)					Sunday / Public Holiday Average $L_{Aeq,T}$ (highest day $L_{Aeq,T}$)	
				0700 - 0800	0800 - 1800	1800 - 1900	1900 - 2200	2200 - 0700	0700 - 0800	0800 - 1300	1300 - 1400	1400 - 2200	2200 - 0700	0700 - 2200	2200 - 0700
S001-WS02	N032	Shaftesbury Gardens	Free field	64.6 (67.0)	65.4 (67.1)	64.3 (65.7)	62.8 (66.8)	59.9 (80.6)	61.1 (61.5)	63.6 (64.5)	64.2 (64.4)	63.9 (66.4)	59.1 (63.8)	62.9 (72.4)	59.2 (63.7)
	N033	Outside The Collective, Atlas Road/Victoria Road	Free field	67.2 (69.0)	67.7 (69.6)	65.5 (67.2)	64.4 (69.0)	61.1 (66.2)	63.6 (64.9)	65.7 (68.8)	65.2 (65.3)	65.6 (69.9)	61.9 (72.2)	64.4 (70.1)	61.0 (65.9)
S001-WS03	N034	Stephenson Street (north)	Free field	52.7 (60.7)	55.6 (60.1)	54.3 (65.1)	52.7 (68.3)	47.3 (69.1)	49.2 (51.4)	51.8 (55.3)	51.9 (53.0)	52.5 (58.6)	46.4 (53.2)	50.6 (55.2)	46.3 (50.7)
	N035	Stephenson Street (south)	Free field	55.6 (71.6)	57.0 (61.3)	52.6 (58.5)	51.7 (60.0)	48.9 (60.5)	52.0 (53.5)	53.1 (56.8)	56.4 (62.8)	55.0 (66.2)	47.5 (55.6)	51.5 (58.7)	48.6 (56.6)
	N041	Junction of Stephenson Street/Goodhall Street	Free field	56.1 (64.0)	56.4 (59.1)	55.2 (59.6)	54.4 (60.9)	50.5 (57.4)	54.6 (55.3)	56.2 (57.8)	56.2 (59.2)	55.4 (62.8)	50.9 (56.4)	53.9 (61.1)	49.7 (59.5)
S002-WS01	N029	Braitrim House, Victoria Road	Free field	50.9 (57.7)	56.2 (59.1)	52.6 (58.4)	53.8 (62.4)	51.3 (61.4)	48.6 (52.0)	54.7 (57.6)	54.1 (54.7)	54.1 (59.1)	52.5 (73.2)	52.6 (59.2)	50.5 (61.0)
	N030	Bodens car park	Free field	55.7 (57.8)	57.7 (60.6)	55.1 (58.5)	53.7 (58.1)	50.7 (56.2)	52.5 (54.6)	54.1 (56.5)	54.3 (55.5)	54.9 (58.6)	50.9 (59.5)	52.9 (57.5)	50.2 (54.9)
	N031	School Road, outside Acton Business Centre	Free field	61.4 (64.2)	63.5 (65.1)	61.5 (62.9)	59.2 (62.2)	55.0 (65.0)	59.3 (59.7)	60.7 (63.3)	61.8 (62.1)	61.1 (63.4)	53.8 (61.4)	59.1 (65.0)	54.6 (60.6)
	N049	Flat Iron compound	Free field	52.0 (57.2)	57.0 (62.8)	52.9 (57.8)	54.1 (59.4)	53.3 (61.5)	51.5 (53.6)	55.1 (58.2)	54.2 (55.2)	54.4 (61.6)	53.9 (71.3)	54.4 (68.4)	53.3 (60.6)

Worksite Reference	Measurement Reference	Site Address	Free-field or Façade measurement	Weekday Average $L_{Aeq,T}$ (highest day $L_{Aeq,T}$)					Saturday Average $L_{Aeq,T}$ (highest day $L_{Aeq,T}$)					Sunday / Public Holiday Average $L_{Aeq,T}$ (highest day $L_{Aeq,T}$)	
				0700 - 0800	0800 - 1800	1800 - 1900	1900 - 2200	2200 - 0700	0700 - 0800	0800 - 1300	1300 - 1400	1400 - 2200	2200 - 0700	0700 - 2200	2200 - 0700
	N050	Acton Square, outside North Acton Station	Free field	62.9 (69.5)	63.3 (67.2)	62.2 (65.1)	61.1 (65.9)	57.5 (64.7)	59.1 (60.6)	60.2 (60.8)	61.3 (61.7)	61.7 (66.3)	59.3 (73.6)	61.2 (71.3)	57.1 (63.7)
S004-WS01	N027	Old Oak Common Lane	Free field	66.0 (67.7)	67.3 (70.5)	65.6 (68.1)	64.4 (70.5)	60.2 (67.1)	62.5 (62.7)	64.3 (66.2)	64.4 (65.1)	64.9 (70.3)	59.3 (63.5)	63.2 (68.9)	58.9 (64.1)
	N028	Old Oak Common Lane, Hilltop Works	Free field	67.6 (68.7)	69.1 (70.9)	67.2 (69.2)	65.9 (73.5)	61.9 (70.4)	63.8 (64.1)	66.8 (67.7)	66.4 (66.8)	66.3 (67.7)	60.9 (66.0)	65.1 (72.2)	61.0 (65.8)
BC Compound	N040	Badminton Close	Free field	52.9 (55.6)	54.2 (63.2)	53.3 (56.6)	52.8 (56.2)	49.8 (56.7)	53.4 (56.1)	53.6 (55.9)	53.7 (56.5)	54.3 (56.4)	50.2 (54.6)	53.3 (56.8)	50.1 (54.8)

2.2.3 Table 5 presents a summary of the measured vibration levels at monitoring location V045 over the reporting period. The highest PPV measured during the monitoring along any axis is presented in the table.

Table 5: Summary of measured PPV data over the monitoring period

Worksite Reference	Measurement Reference	Monitor Address	Highest PPV measured in any axis, mm/s
S004-WS01	V045	Old Oak Common Lane	1.24 (Y-axis)
S001-WS03	V052	Stephenson Street (north)	1.88 (Y-axis)

2.2.4 Construction vibration during the month was mainly due to groundworks and may on occasion be perceptible at receptors nearby but was below levels that may cause structural damage to surrounding buildings.

2.2.5 Appendix C presents graphs of noise and vibration monitoring data over the month for each of the measurement locations. Data presented includes the hourly L_{Aeq} values and, where relevant, the $L_{Aeq,T}$ values (where the time period T has been taken to be the averaging period as specified in Table 1 of HS2 Information Paper E23). The full data set for the monitoring equipment can be found at the following location: https://data.gov.uk/dataset/24542ae7-dd44-444f-b259-871c4cc43b5e/environmental-monitoring-data.

2.3 Exceedances of trigger level

2.3.1 Table 6 provides a summary of exceedances of the Section 61 trigger noise levels determined to be due to HS2 related construction noise measured during the reporting period, along with the findings of any investigation.

Table 6: Summary of exceedances of trigger levels

Complaint Reference Number (if applicable)	Worksite Reference	Date and Time Period	Identified Source	Results of Investigation (including noise monitoring results)	Actions Taken
-	-	-	-	-	-

2.3.2 There were no exceedances of trigger levels as defined in section 61 consents during the reporting period at any monitoring position.

2.4 Complaints

2.4.1 Table 7 provides a summary of complaint information related to noise and vibration received during the reporting period, along with the findings of any investigation.

Table 7: Summary of complaints

Complaint reference number	Worksite reference	Description of complaint	Results of investigation	Actions taken
HS2-20-40003-C	S004-WS01	Complaint from a resident alleging that vehicles/lorries entered site prior to core working hours.	Investigation and review of site logistics log found that no vehicles entered site prior to 8am, which would contravene Section 61 consent conditions.	A response was provided to the complainant.
HS2-20-40101-C	S002-WS01	Complaint from Ebbett Court due to continuous noise from drilling.	Investigation found that the works did not trigger any noise alerts.	A response was provided to the complainant.
HS2-20-43018-E	S001-WS03	Complaint from a resident on Stephenson Street about vibration/structure-borne noise.	Complaint may be due to use of a vibratory roller to compact fill, however, extensive non-HS2 refurbishment works at a building in the same terrace are also likely to have played a part in the source of the complaint. An unattended vibration monitor was installed within site boundary on 22nd June with additional attended vibration measurements undertaken on the 23rd June in Stephenson Street. Vibration levels may have been perceptible but were below levels likely to cause structural damage.	Ground compaction paused on receipt of complaint. Use of roller in vibrating mode stopped and switched to deadweight.
HS2-20-40129-C	S001-WS02	Noise complaint from the Bashley Road Caravan site due to noise from the Atlas Road worksite.	Noise and vibration levels during periods of construction were within Section 61 limits.	A response was provided to the complainant advising that contractors are in constant contact with residents and levels are being monitored.

Complaint reference number	Worksite reference	Description of complaint	Results of investigation	Actions taken
HS2-20-40142-C	S004-WS01	Complaint from a resident on Wells House Road regarding vibration perceived within property and concern over the potential for damage to building.	Groundworks and processing were taking place involving the movement of tracked plant and vehicles not anticipated to give rise to significant vibration. Monitoring indicates that vibration levels were substantially below that at which there is any risk of superficial building damage and unlikely to be significant at complainant premises.	A response was provided to the complainant.

Appendix A Site Locations

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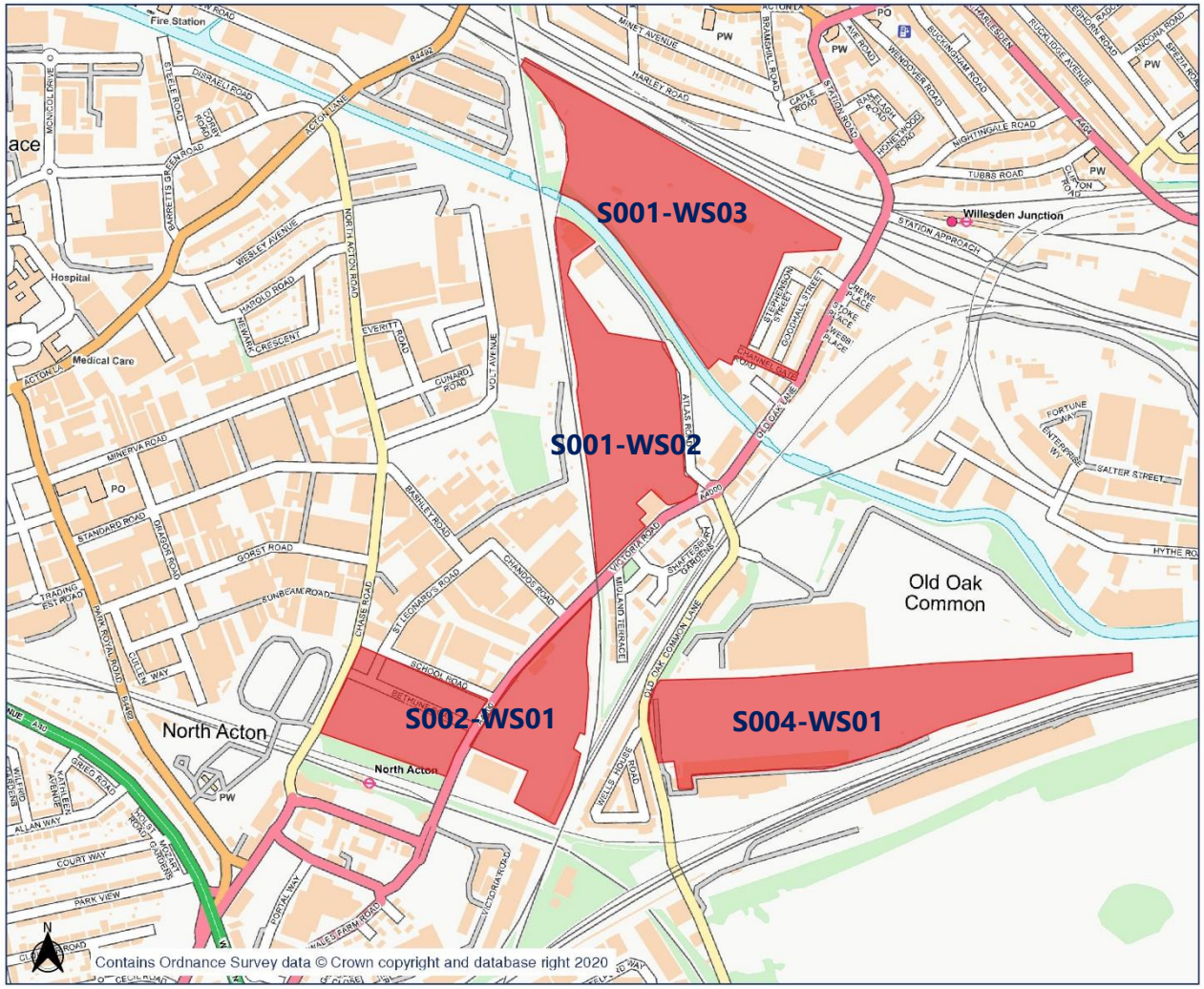
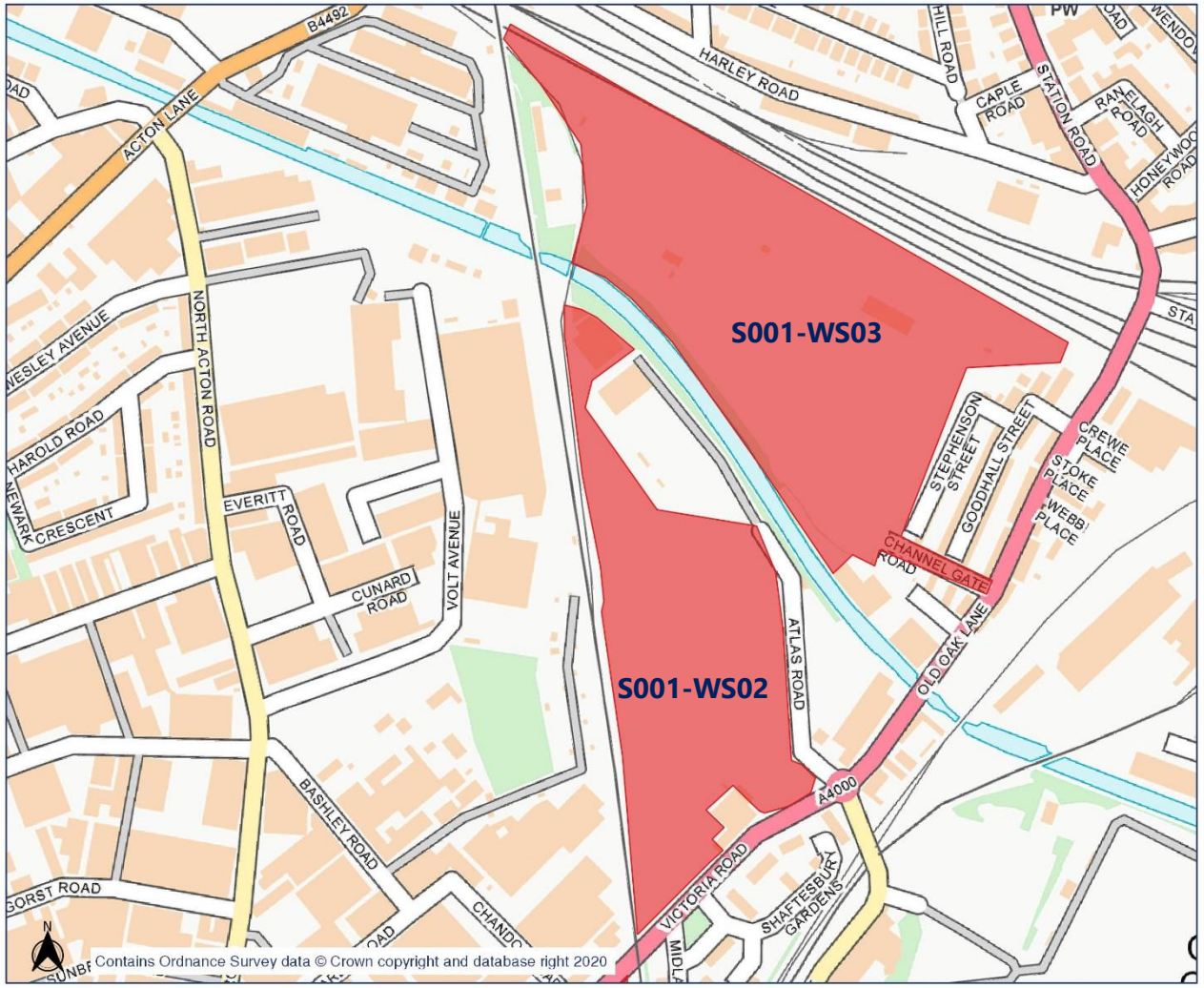
Worksite identification plan - 1



Worksite identification plan - 2



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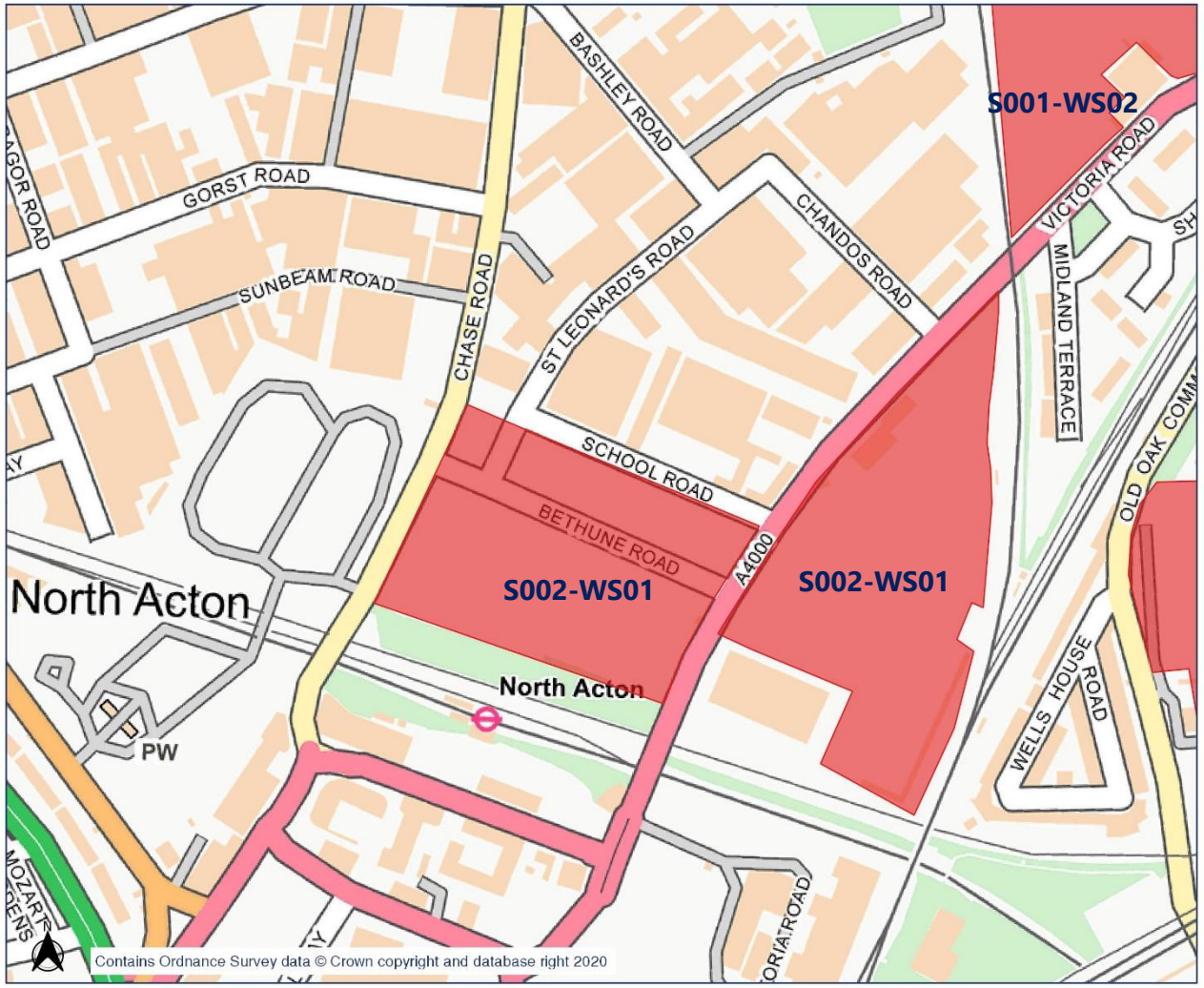
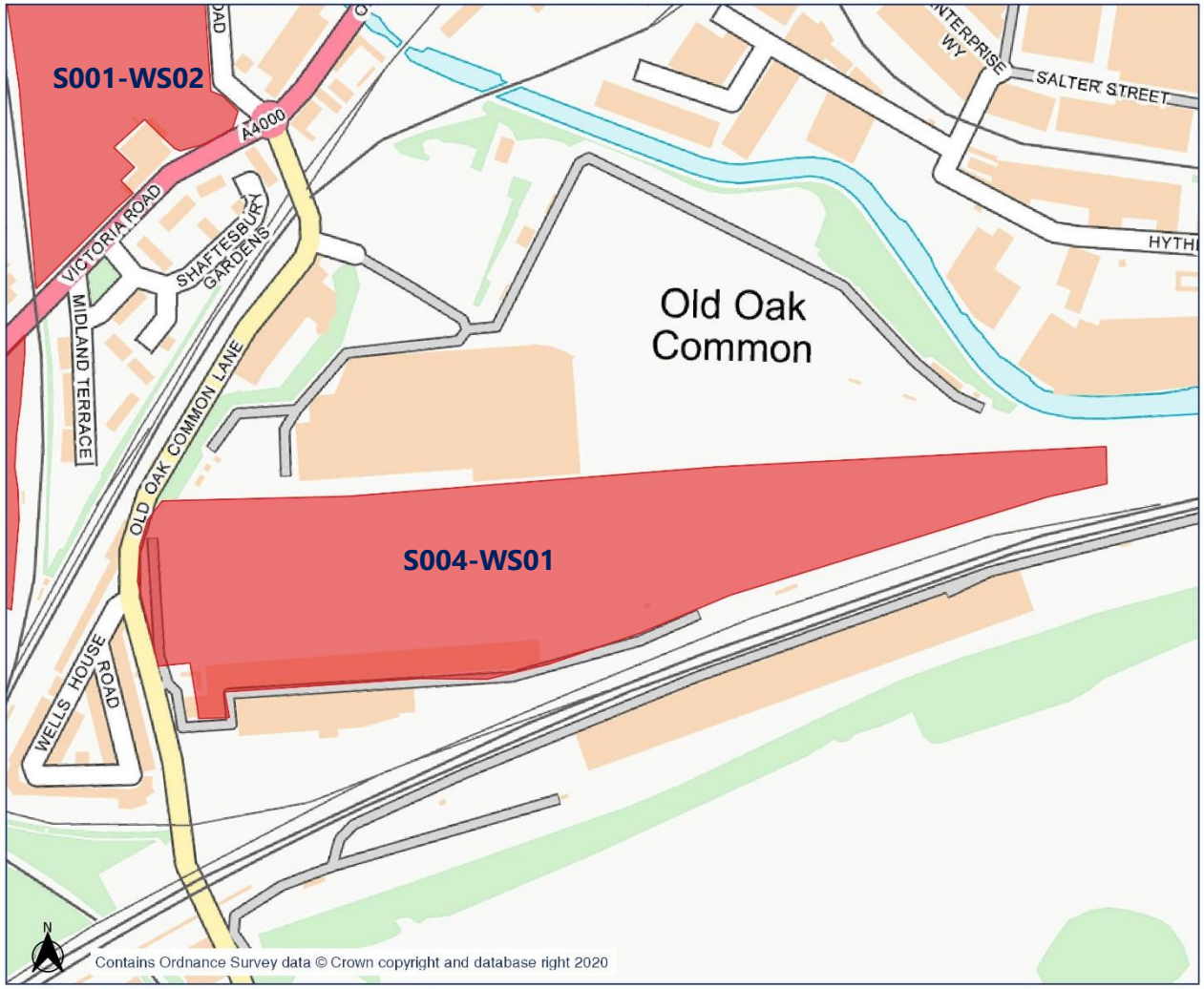
Worksite identification plan - 3



HS2 Worksite identification plan - 4



Appendix B Monitoring Locations

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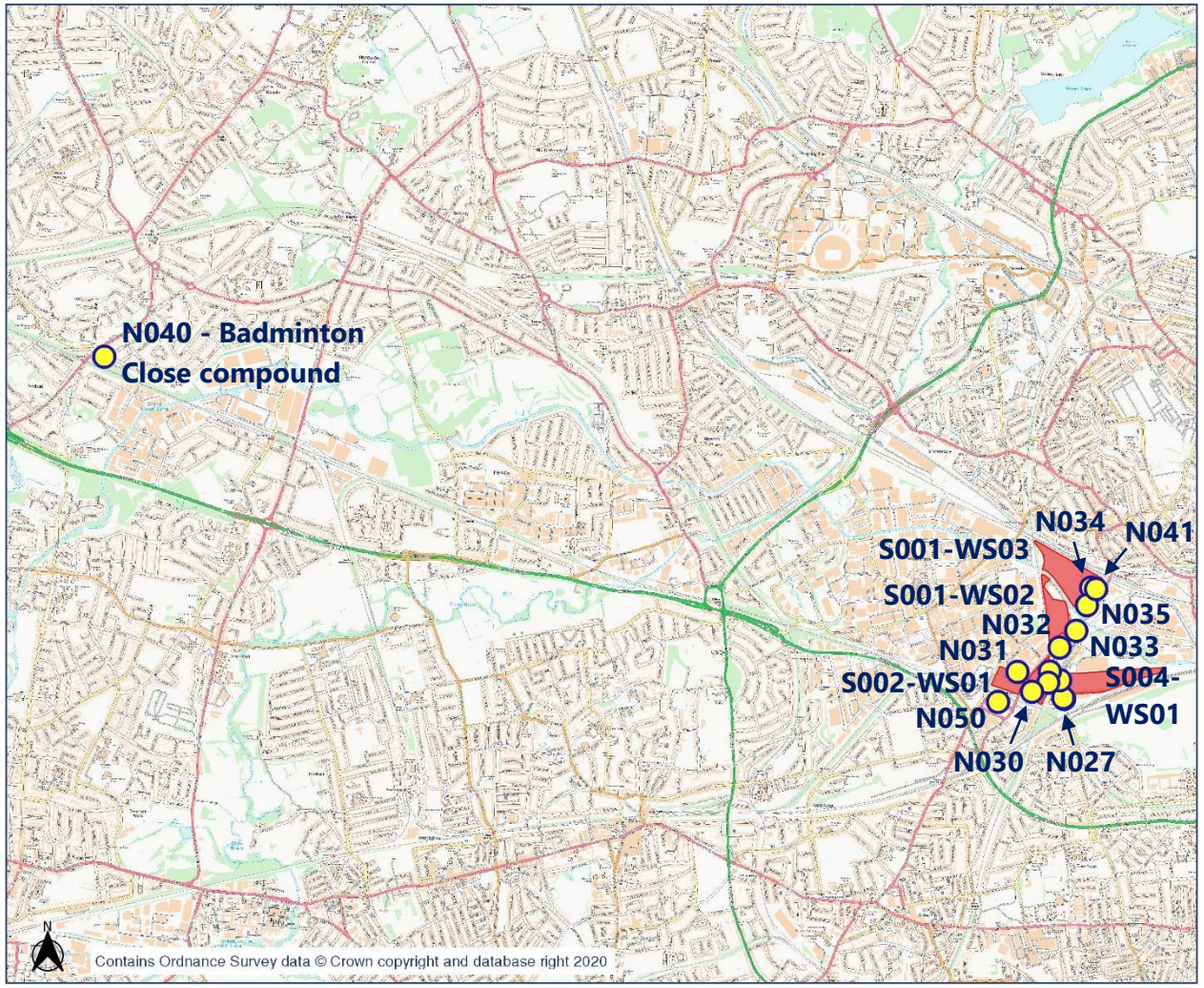
Noise monitoring plan - 1



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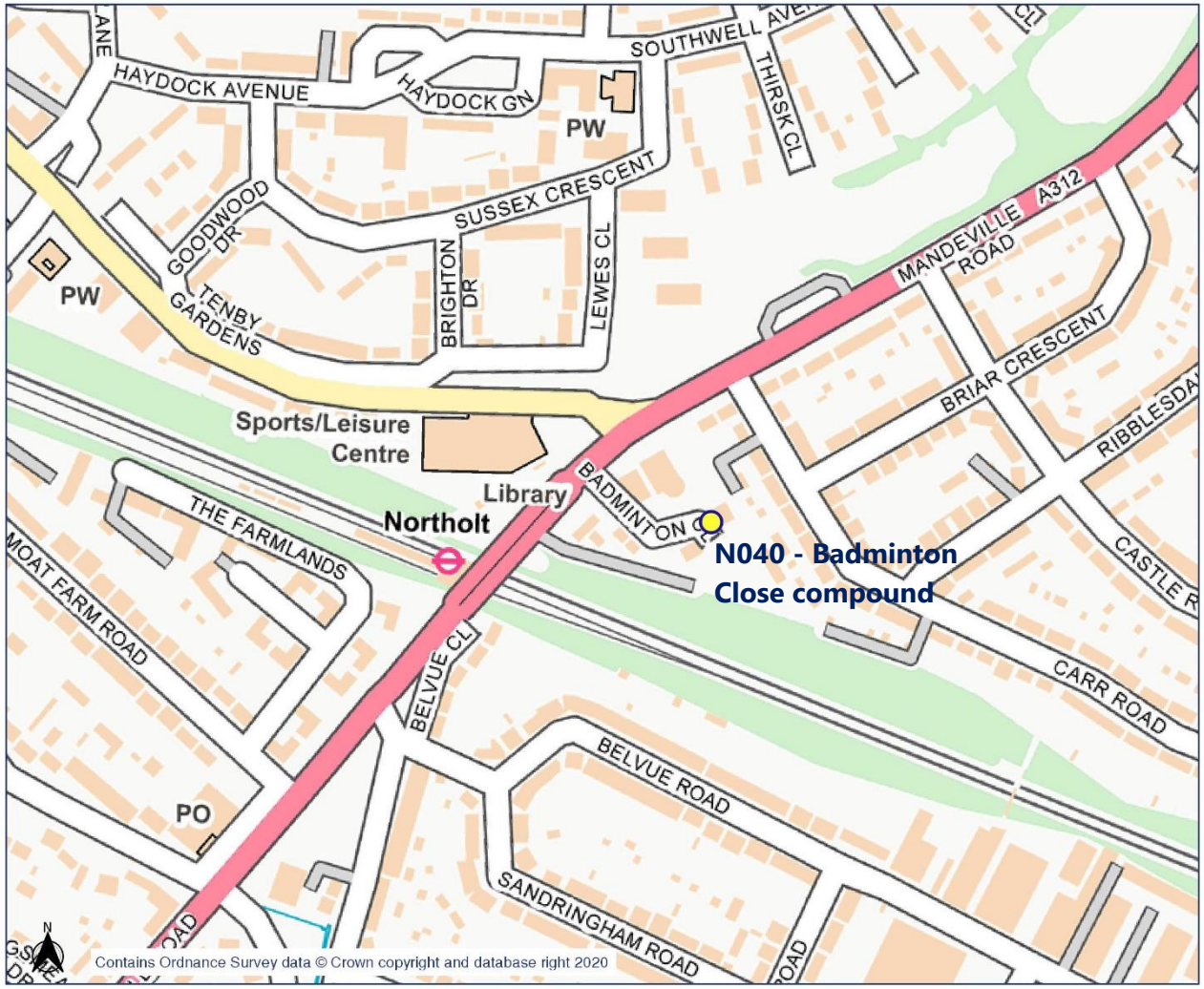
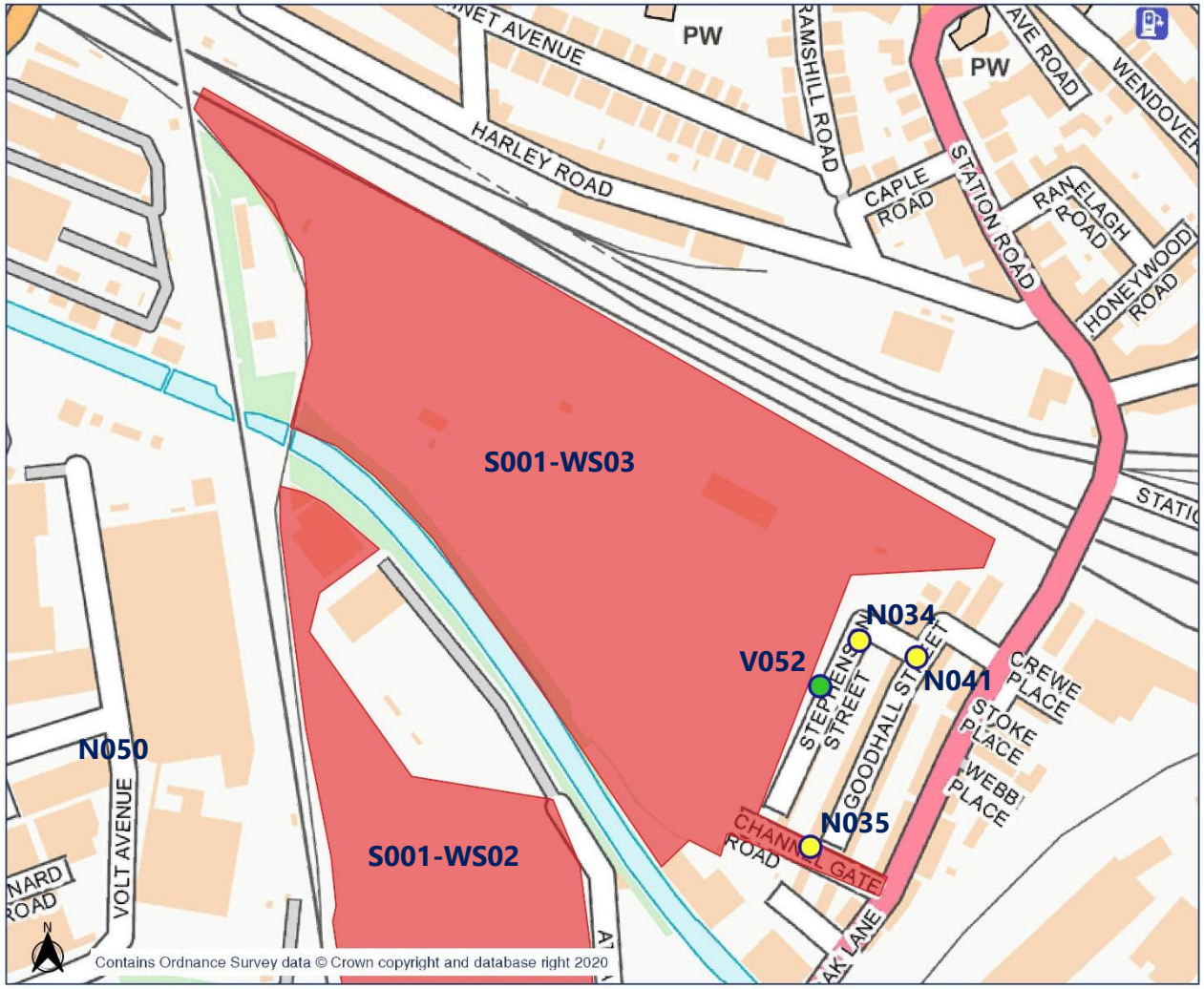


Noise monitoring plan - 3



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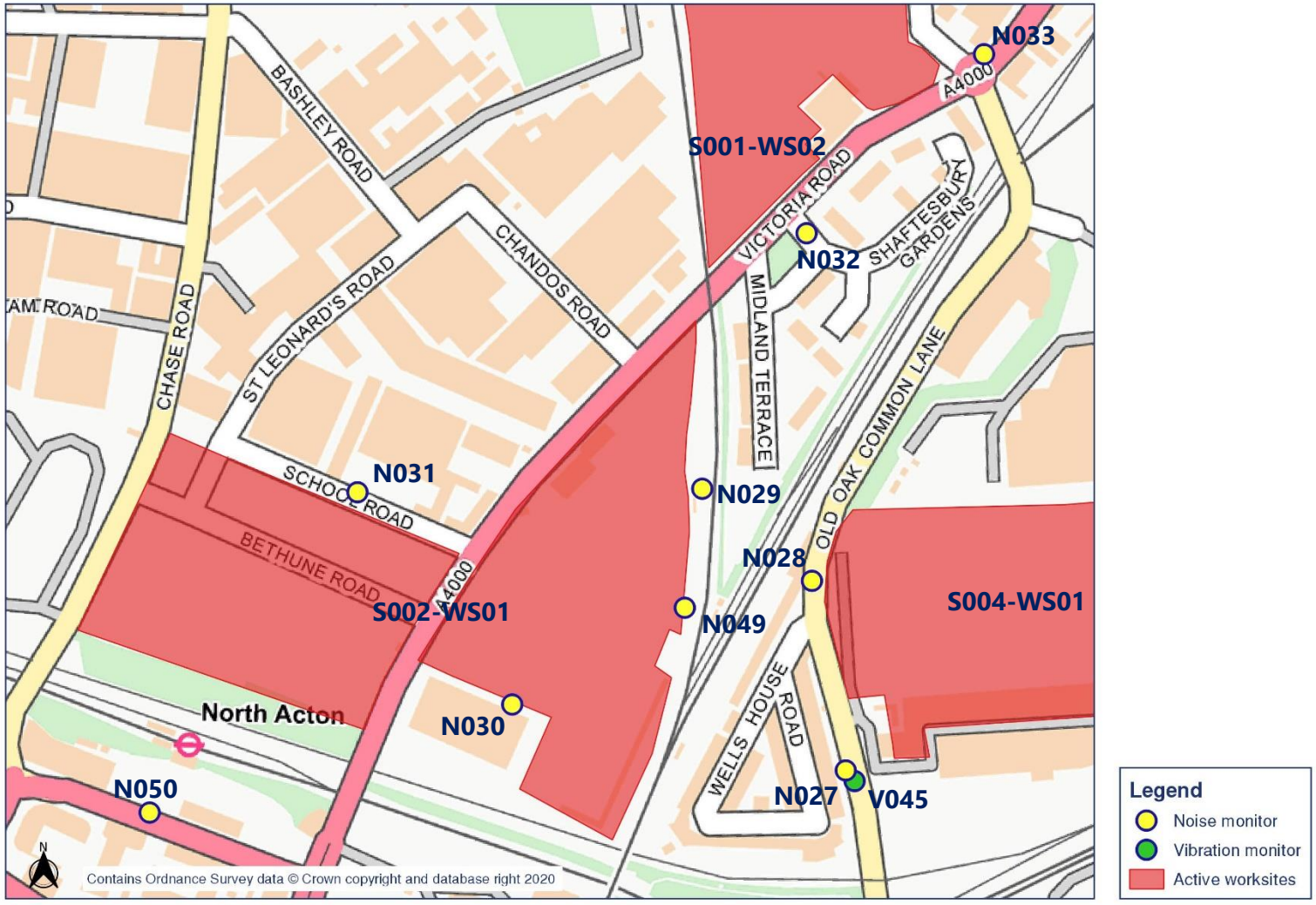
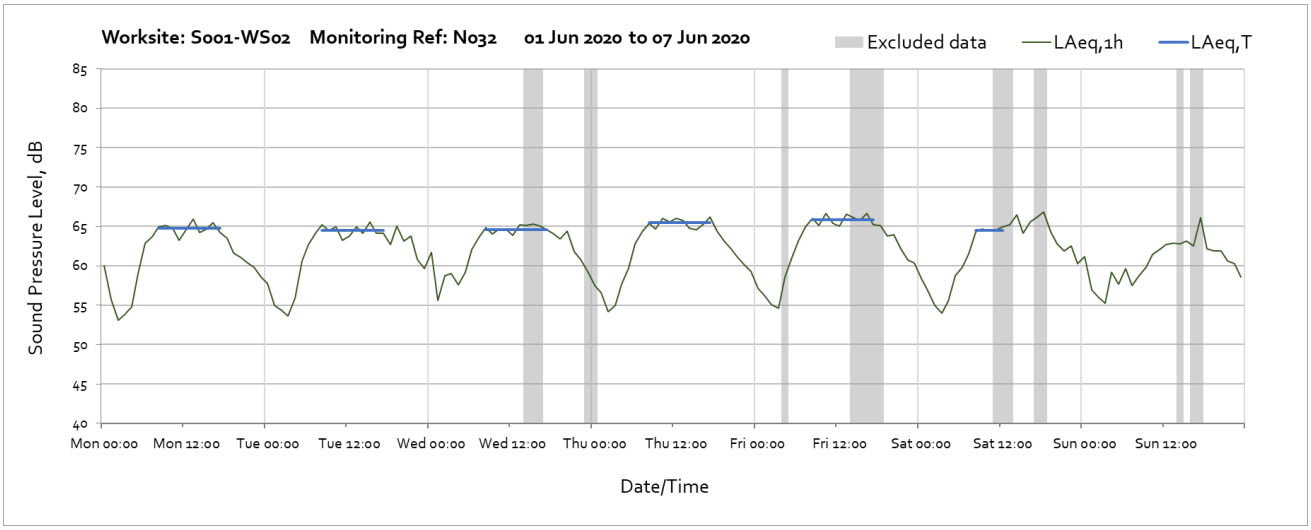
Noise monitoring plan - 4

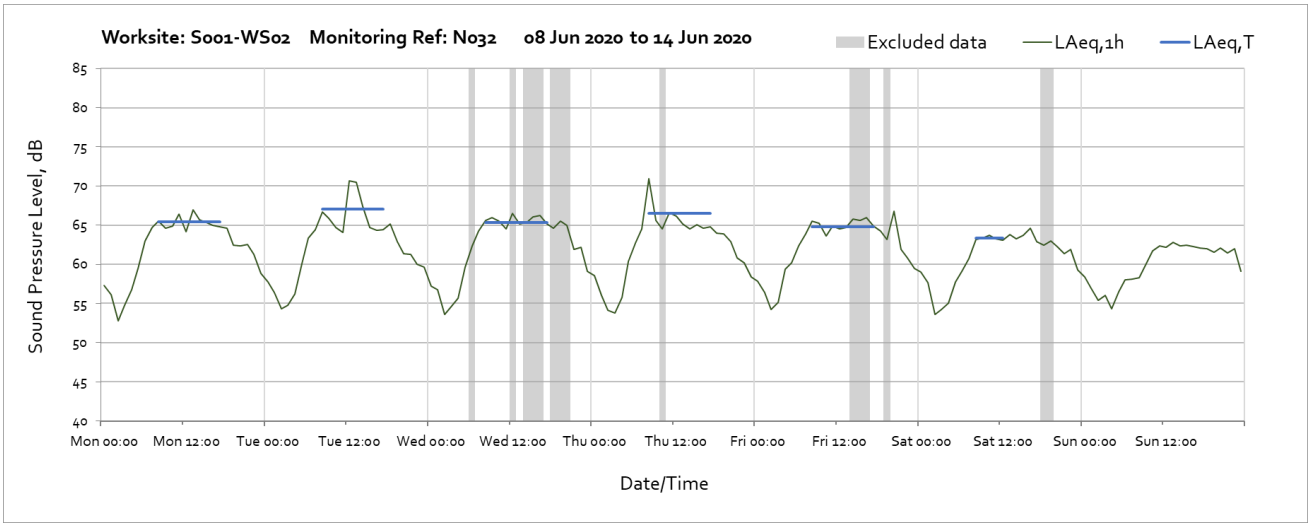


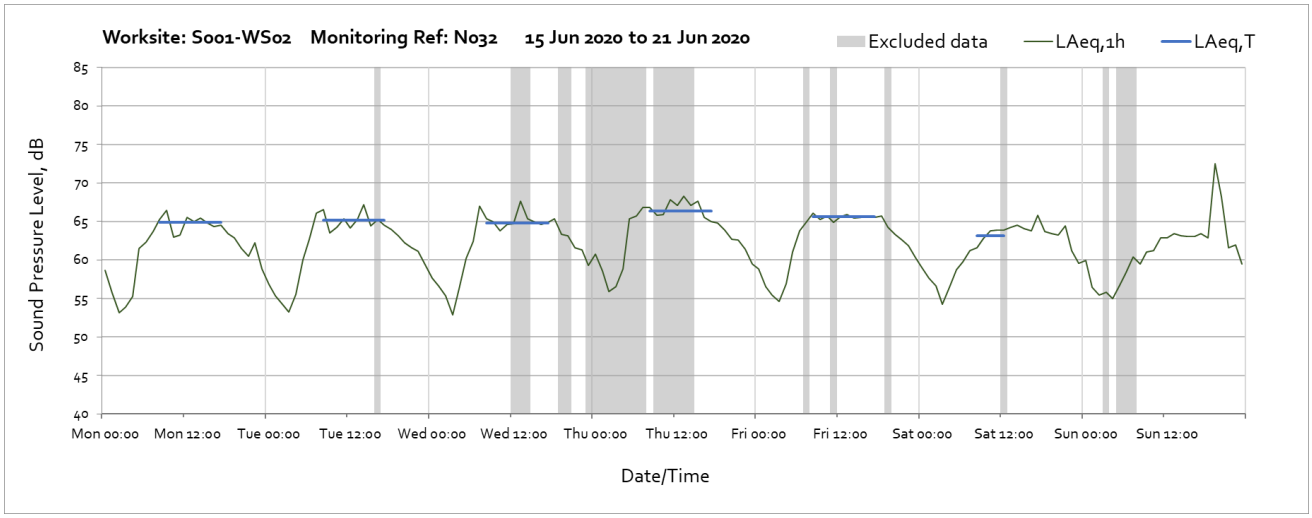
Appendix C Data

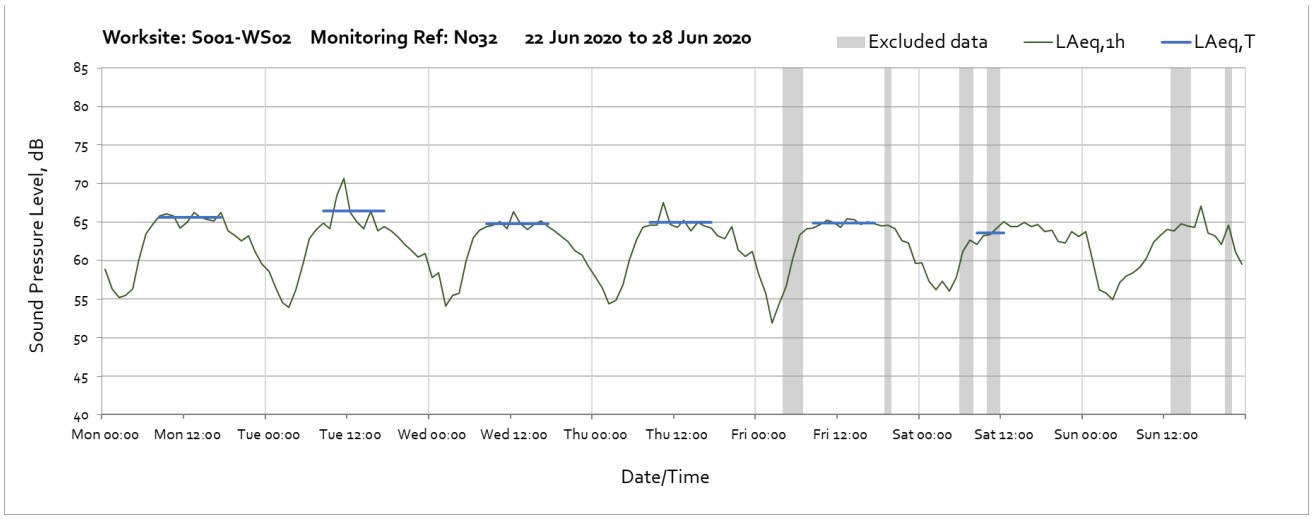
The following graphs show the hourly measured ambient noise level $L_{Aeq,1h}$ and, where relevant, the averaged noise level $L_{Aeq,T}$ values, where the time period T is as specified in Table 1 of HS2 Information Paper E23. Periods with adversely weather affected noise levels are greyed out and have been excluded from the calculation of the $L_{Aeq,T}$ values.

Worksite: S001-WS02 – Monitoring Ref: N032






Worksite: S001-WS02 Monitoring Ref: N032 15 Jun 2020 to 21 Jun 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
85
80
75
70
65
60
55
50
45
40
Mon 00:00
Mon 12:00
Tue 00:00
Tue 12:00
Wed 00:00
Wed 12:00
Thu 00:00
Thu 12:00
Fri 00:00
Fri 12:00
Sat 00:00
Sat 12:00
Sun 00:00
Sun 12:00
Date/Time


Worksite: S001-WS02 Monitoring Ref: N032 22 Jun 2020 to 28 Jun 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
85
80
75
70
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60
55
50
45
40
Mon 00:00
Mon 12:00
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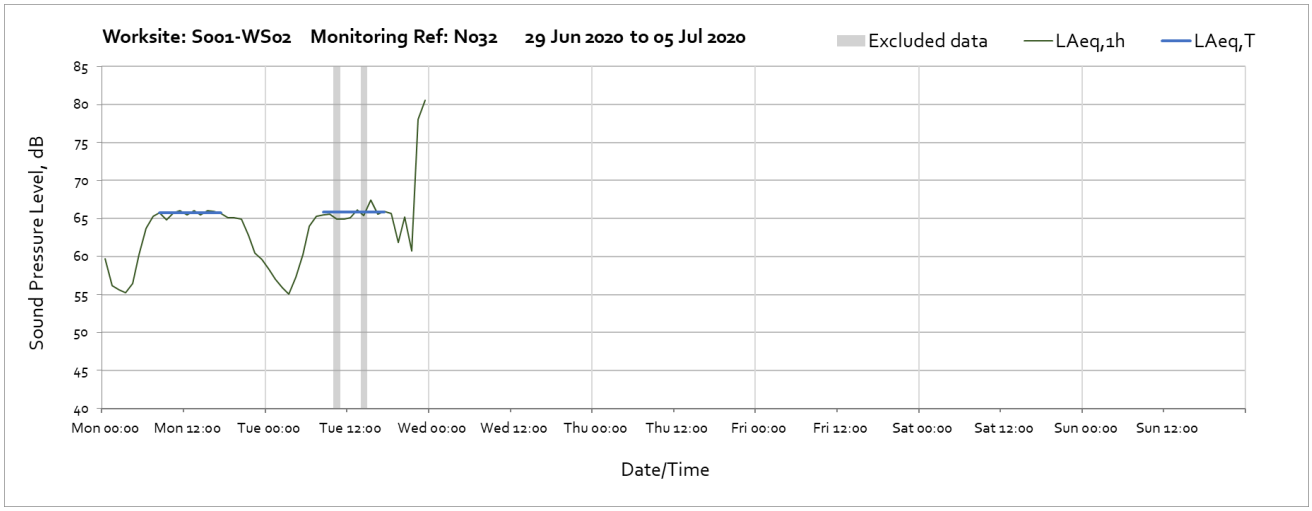
Date/Time


Worksite: S001-WS02 Monitoring Ref: N032 29 Jun 2020 to 05 Jul 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
85
80
75
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Mon 00:00
Mon 12:00
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Tue 12:00
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Sun 00:00
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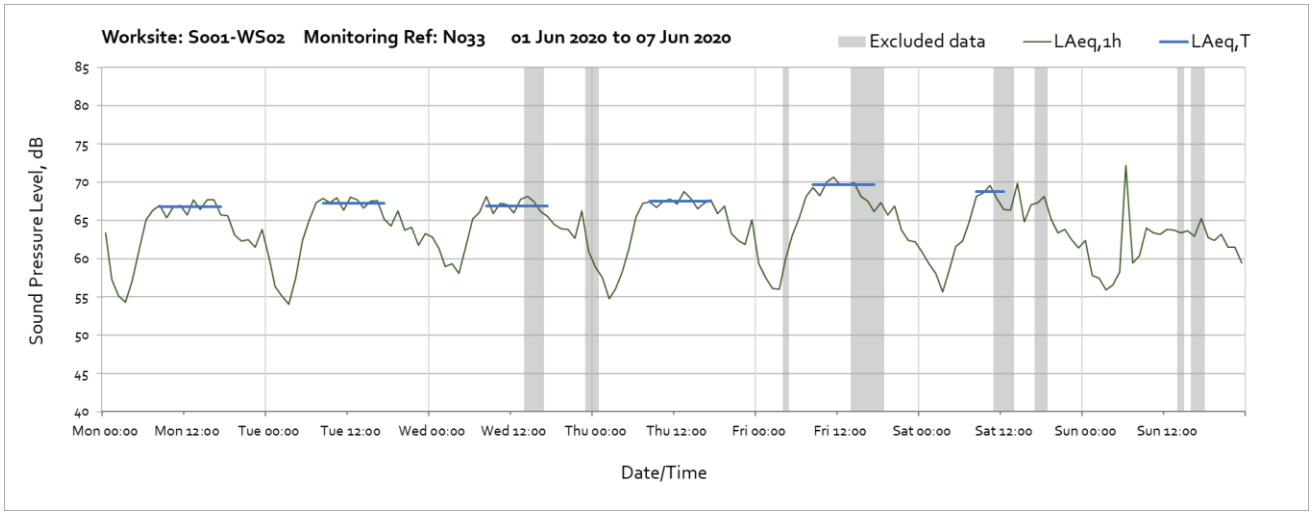
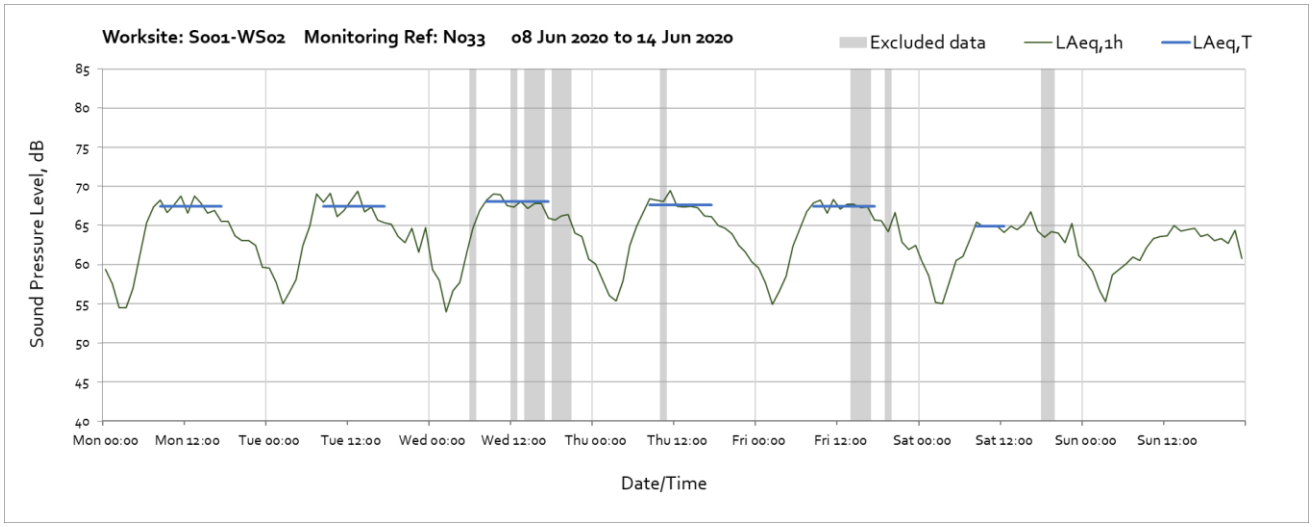
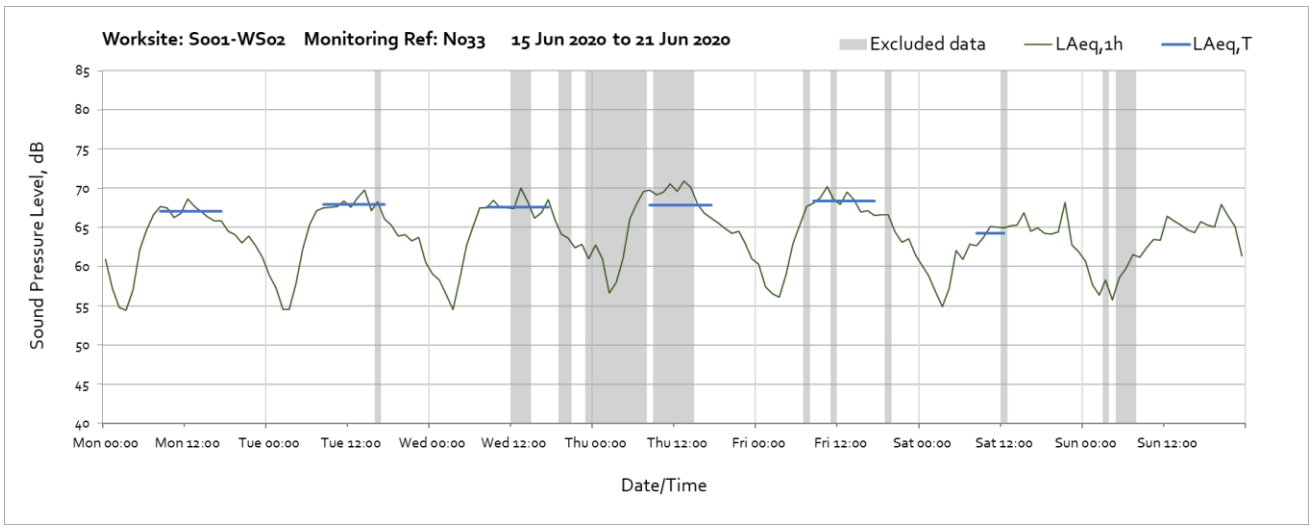
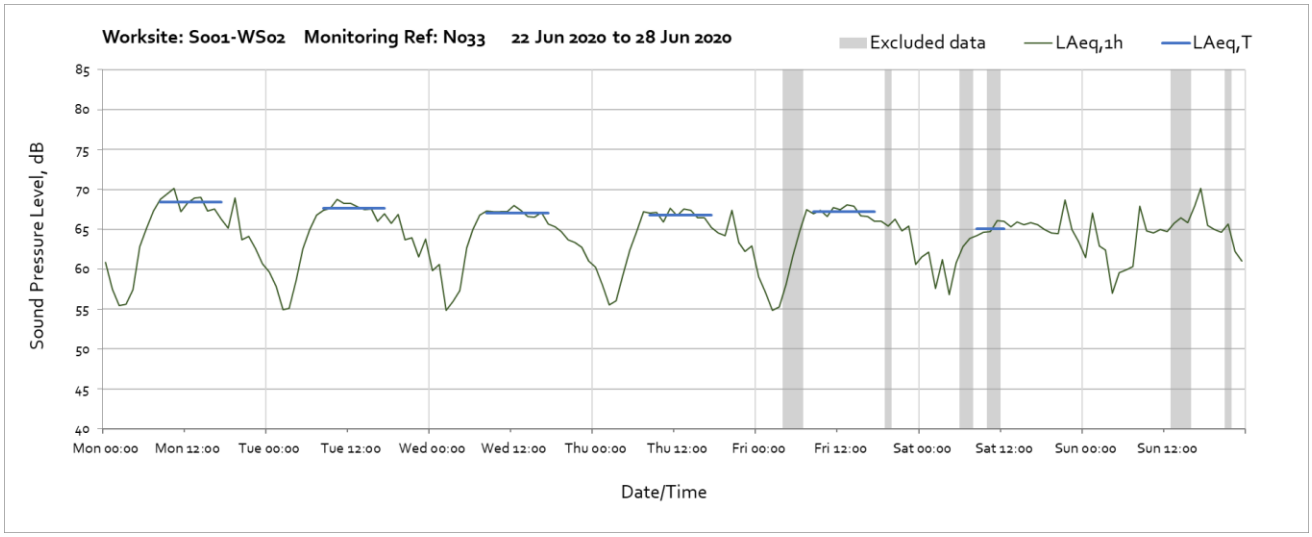
Date/Time

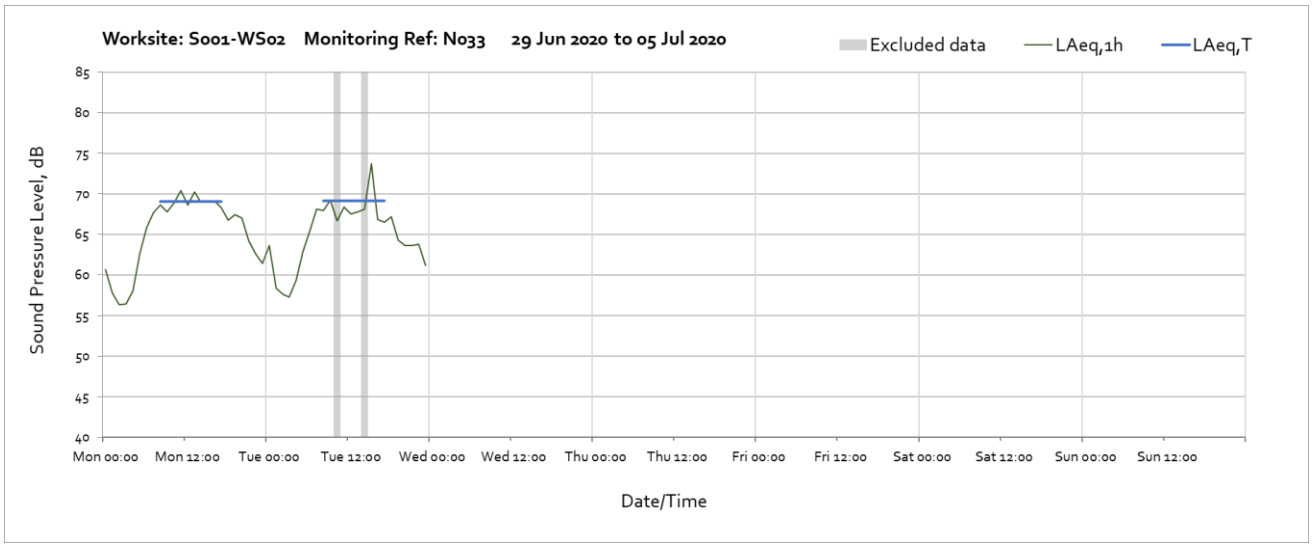
Worksite: S001-WS02 – Monitoring Ref: N033



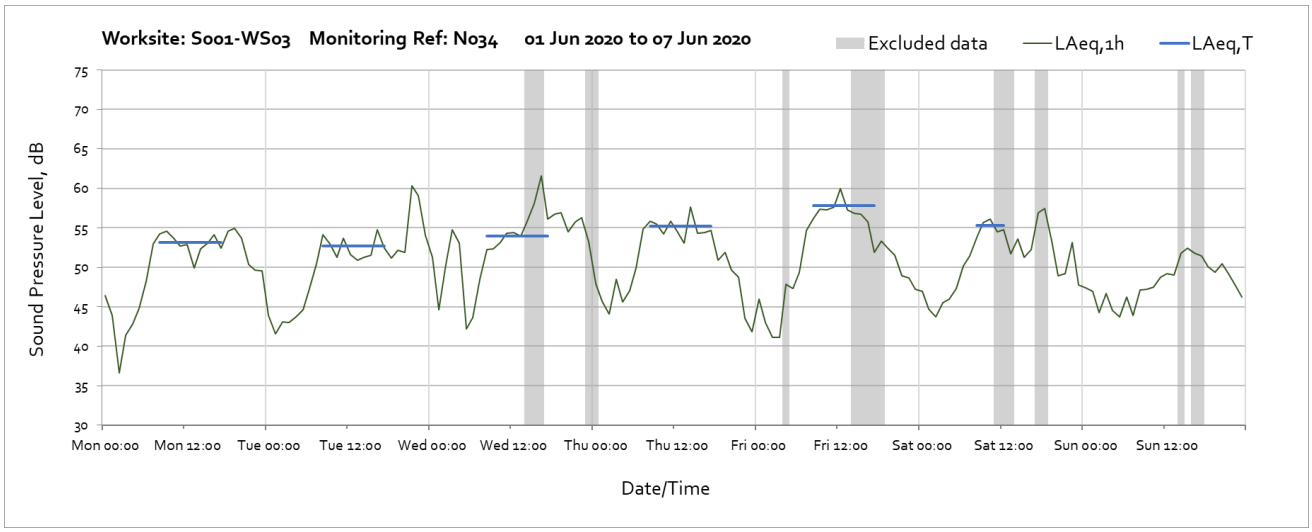


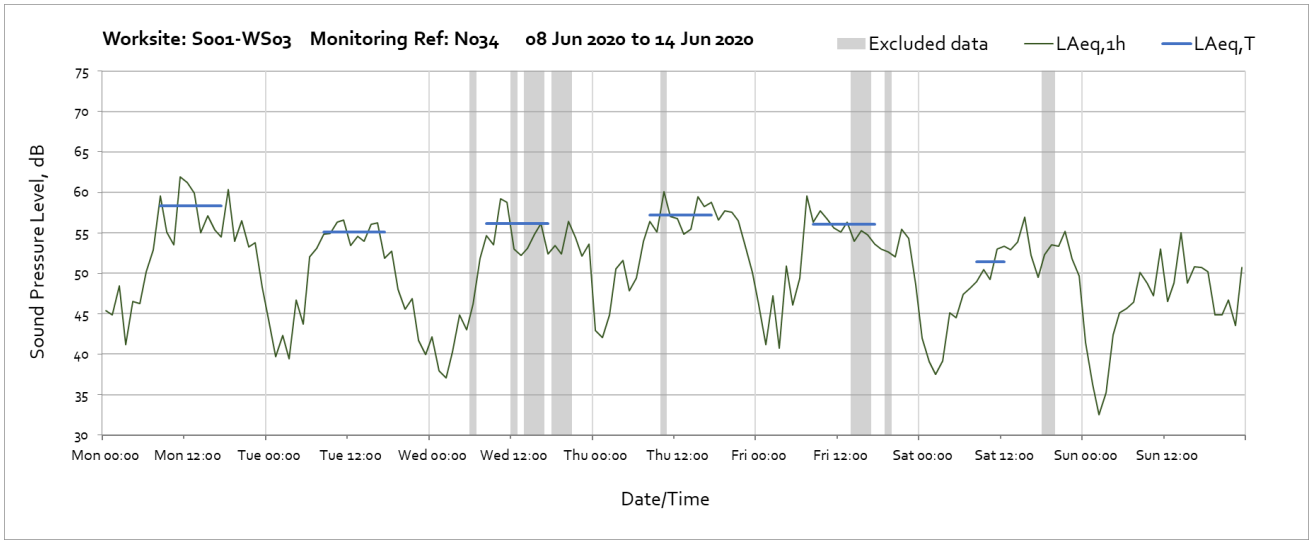






Worksite: S001-WS03 – Monitoring Ref: N034




Worksite: S001-WS03 Monitoring Ref: N34 08 Jun 2020 to 14 Jun 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
75
70
65
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30
Mon 00:00
Mon 12:00
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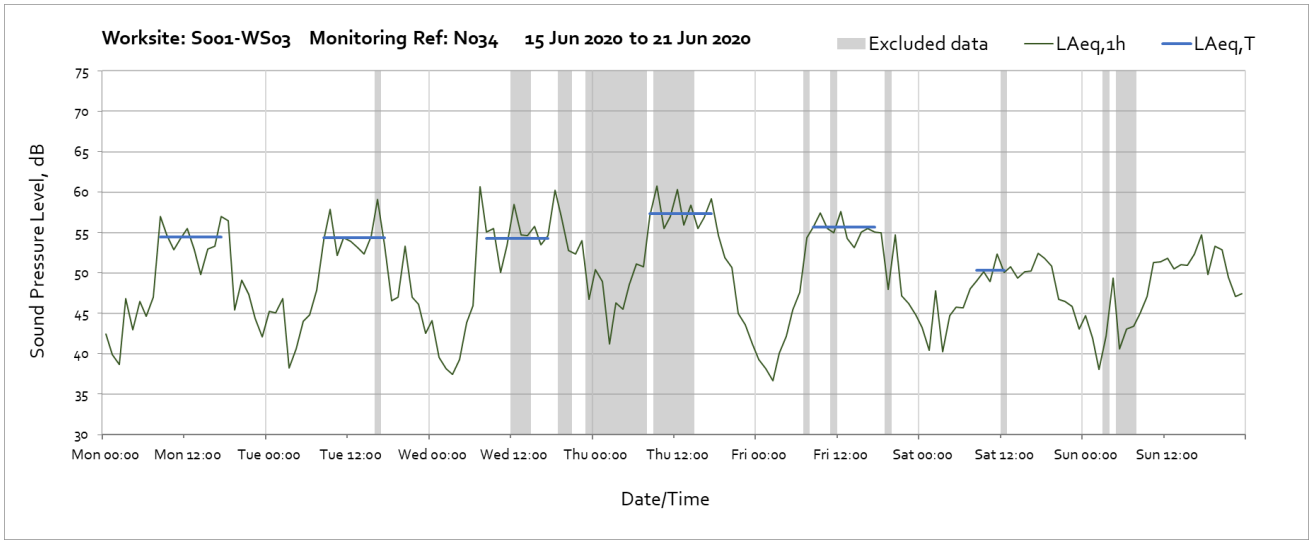
Date/Time


Worksite: S001-WS03 Monitoring Ref: N34 15 Jun 2020 to 21 Jun 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
75
70
65
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45
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30
Mon 00:00
Mon 12:00
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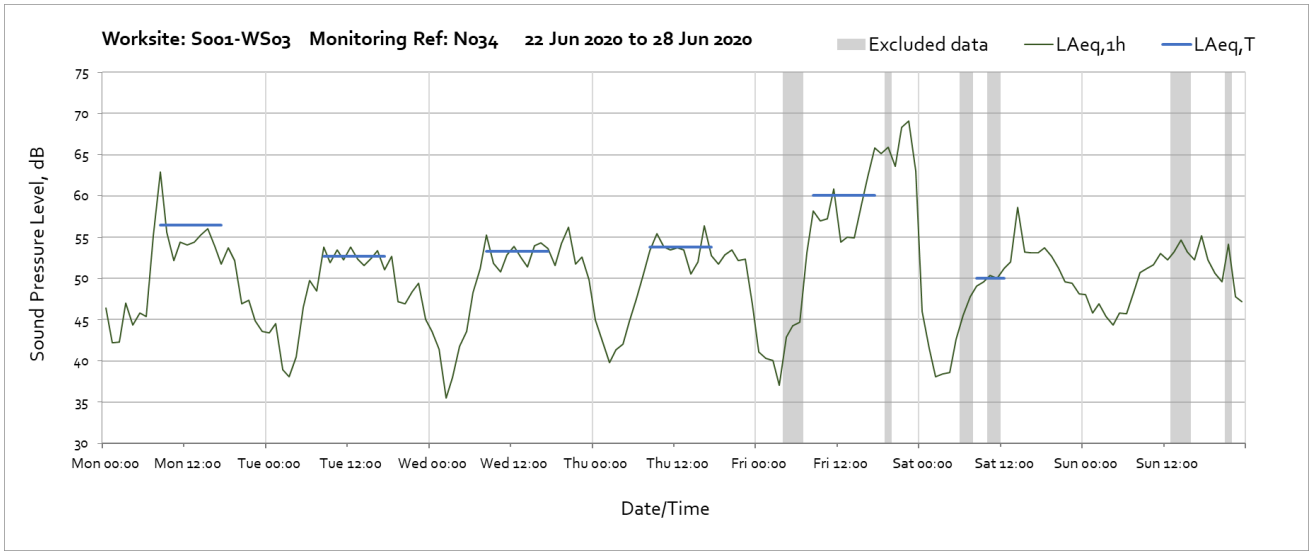
Date/Time


Worksite: S001-WS03 Monitoring Ref: N34 22 Jun 2020 to 28 Jun 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
75
70
65
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50
45
40
35
30
Mon 00:00
Mon 12:00
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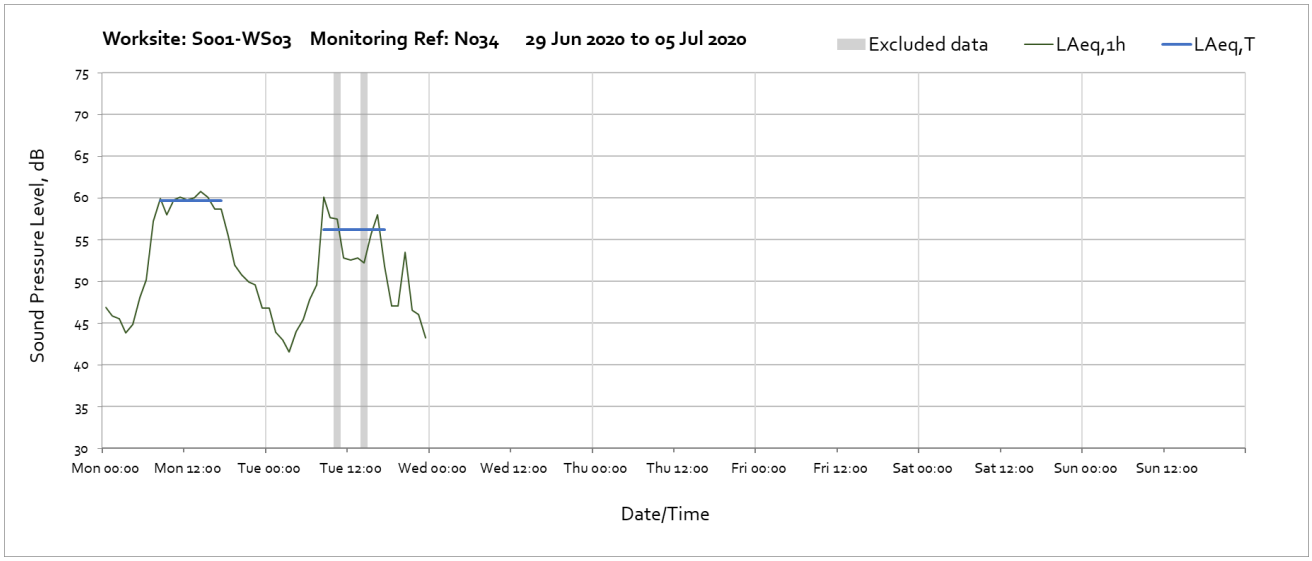
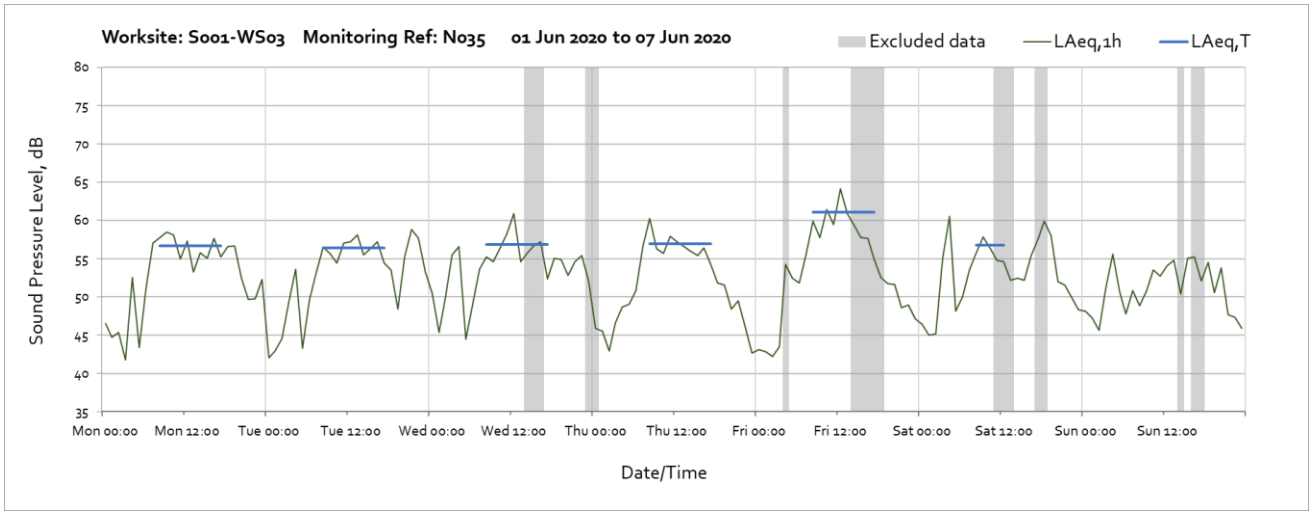
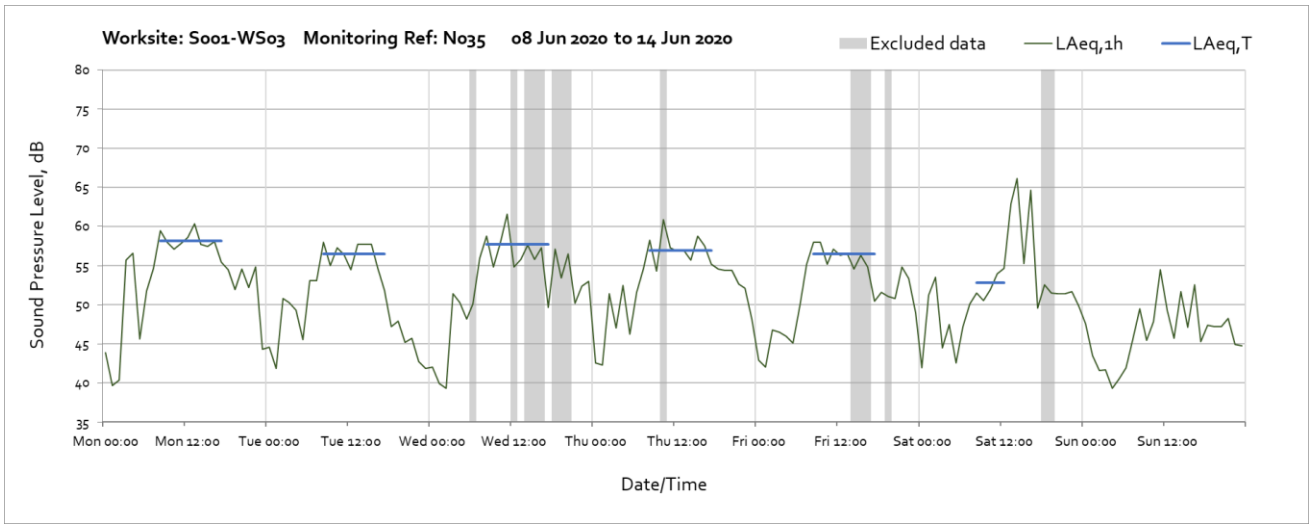
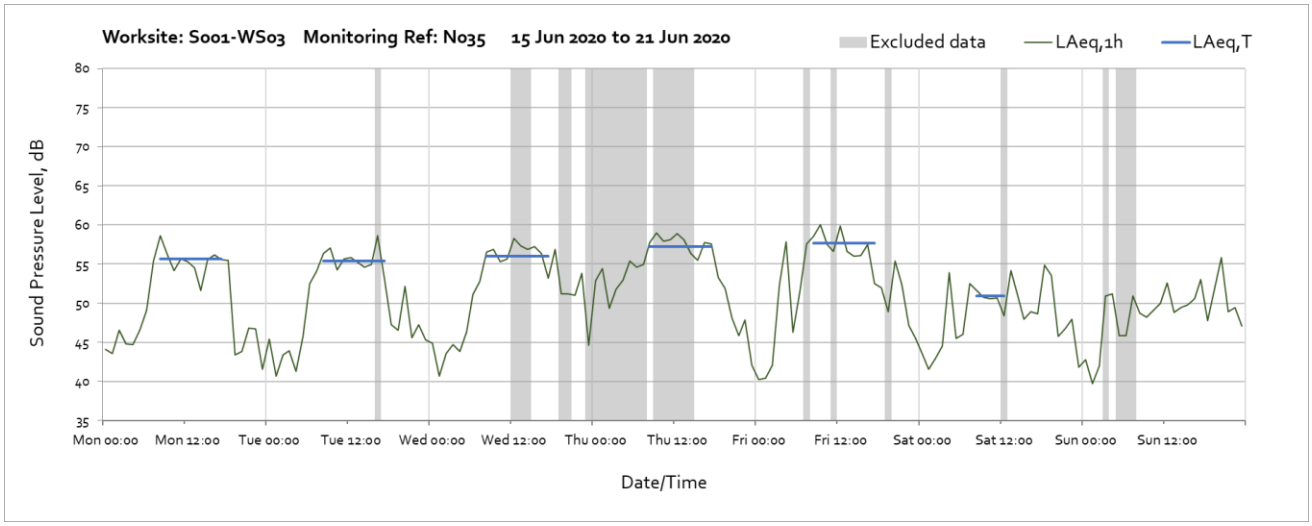
Date/Time



Worksite: S001-WS03 – Monitoring Ref: N035






Worksite: S001-WS03 Monitoring Ref: N035 15 Jun 2020 to 21 Jun 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
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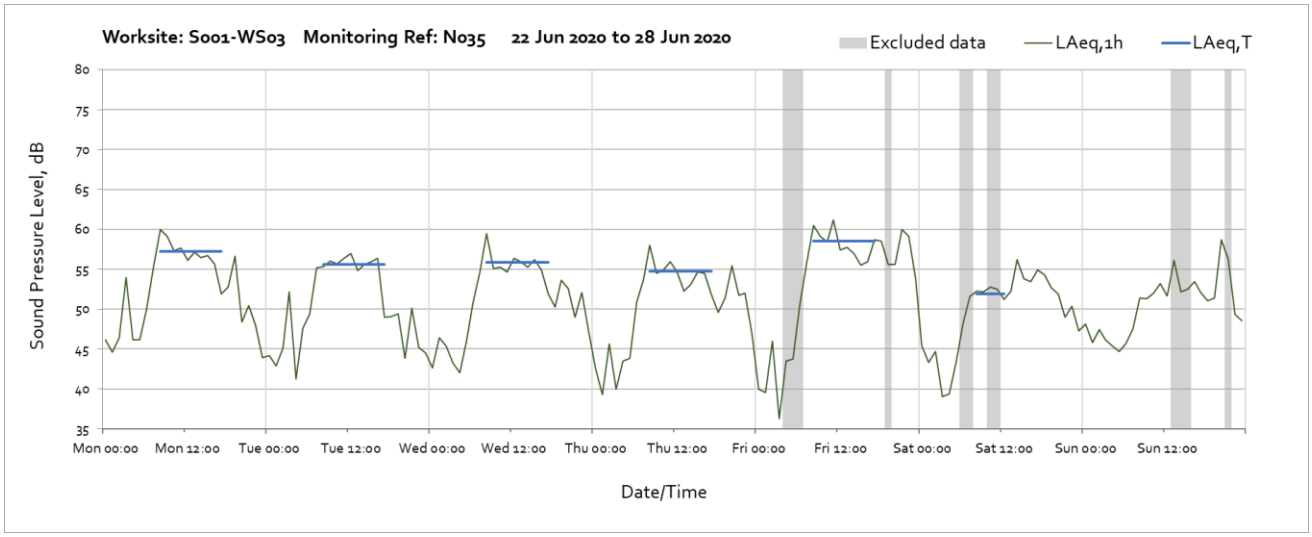
Date/Time


Worksite: S001-WS03 Monitoring Ref: N035 22 Jun 2020 to 28 Jun 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
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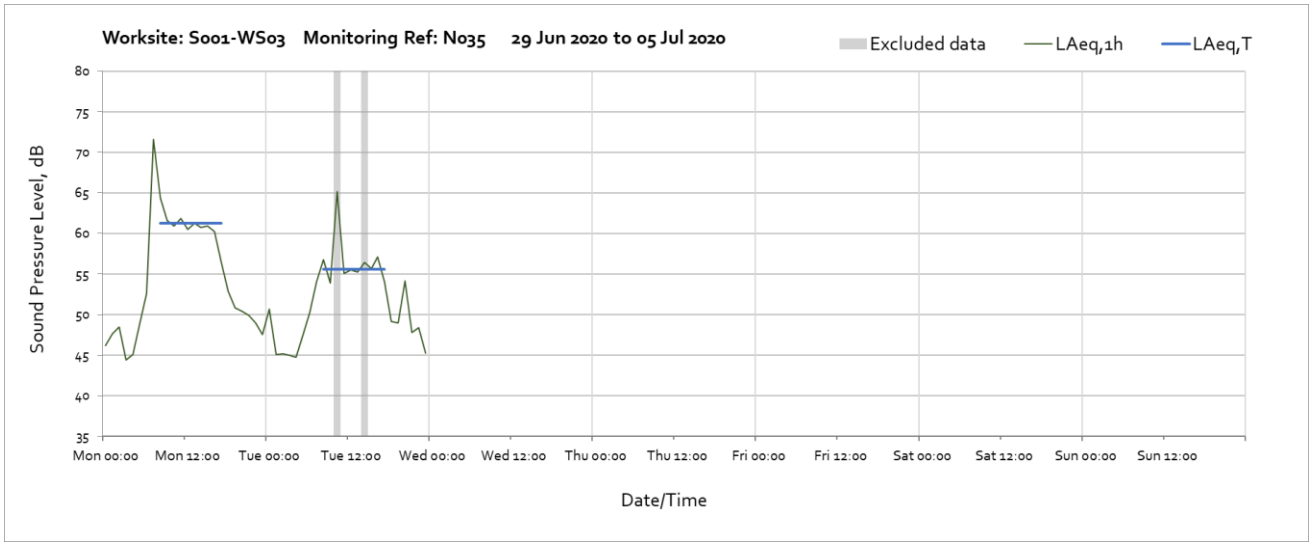
Date/Time


Worksite: S001-WS03 Monitoring Ref: N035 29 Jun 2020 to 05 Jul 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
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75
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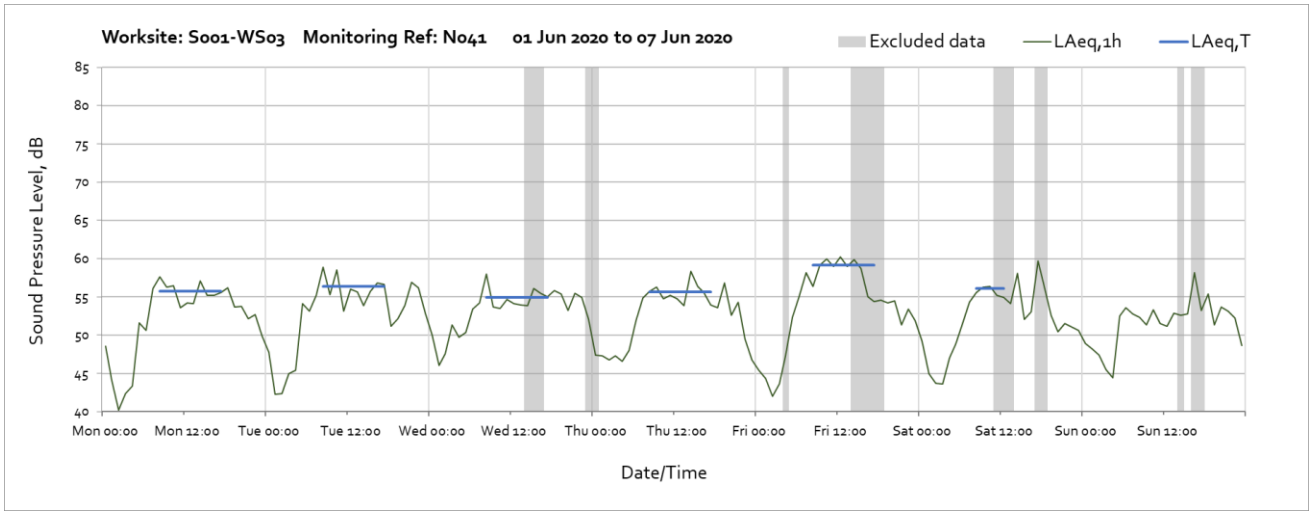
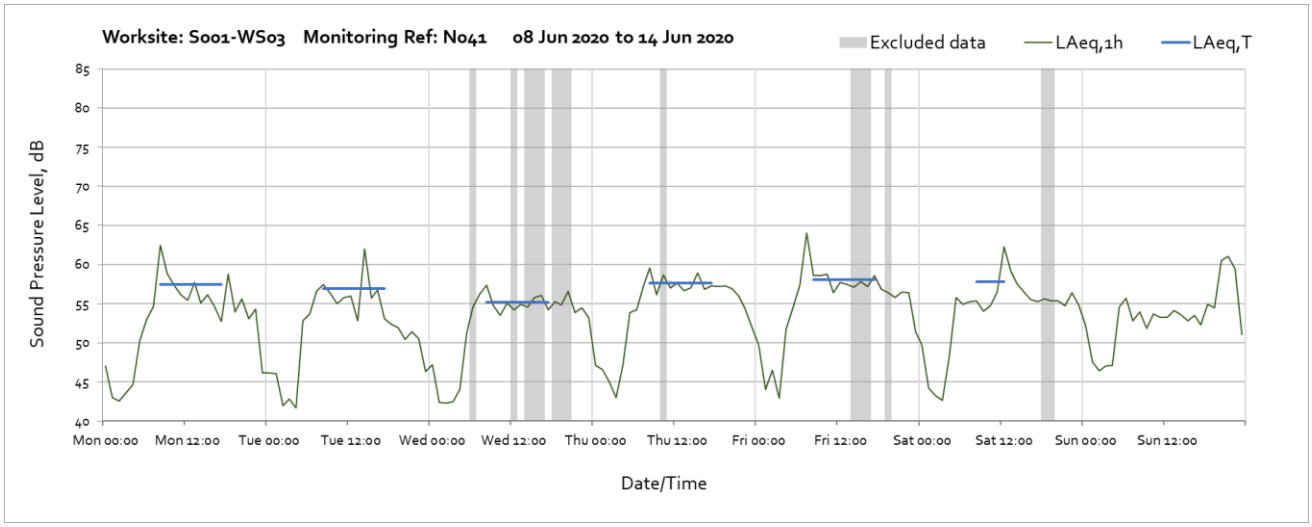
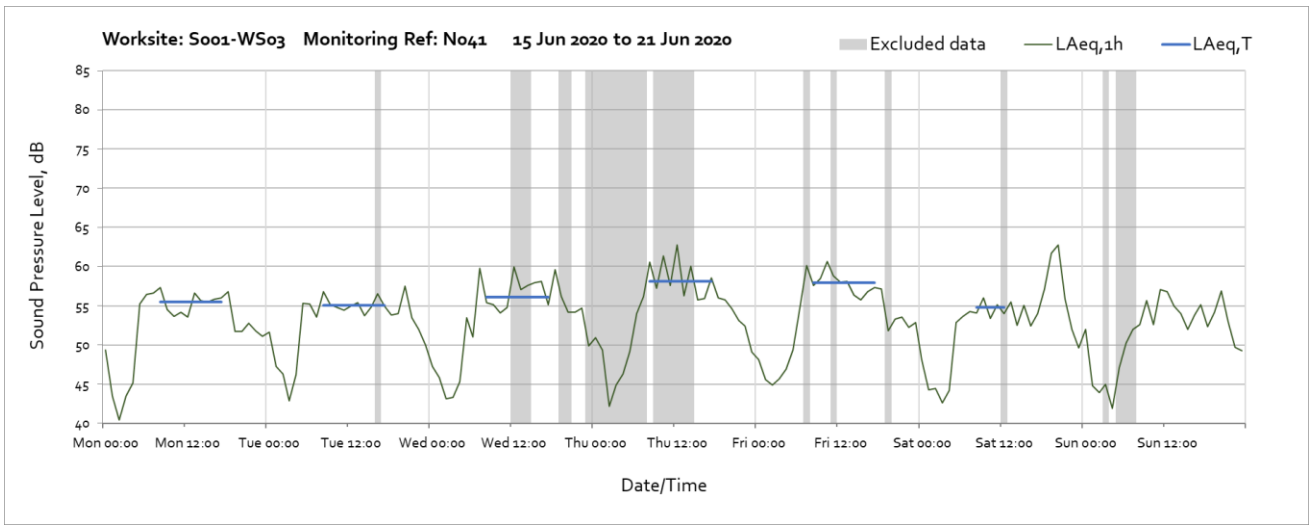
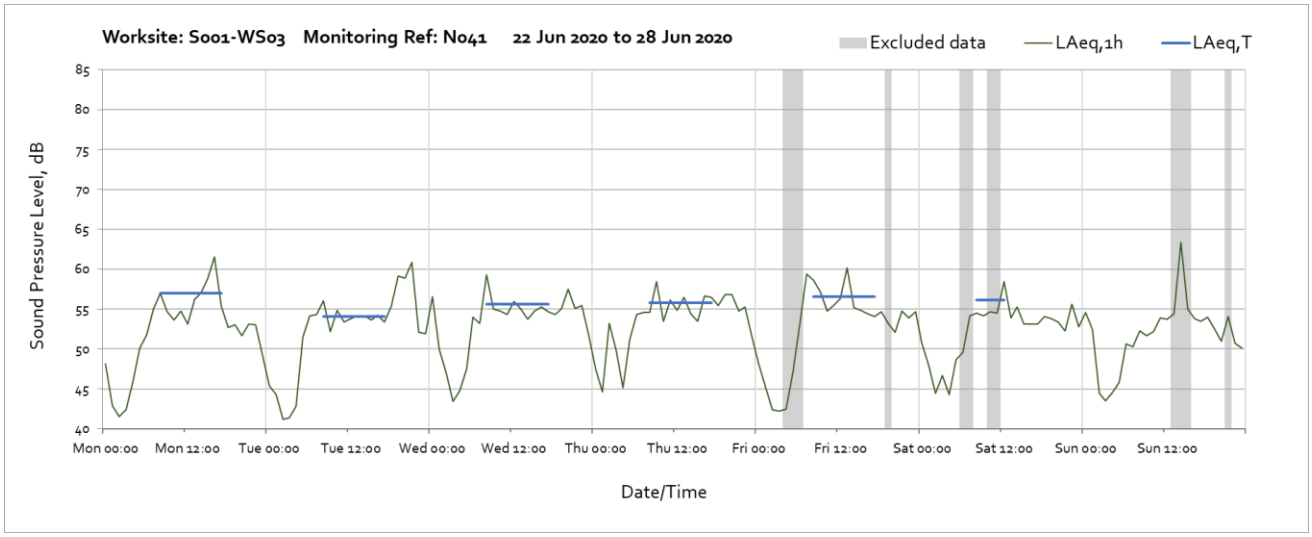
Date/Time

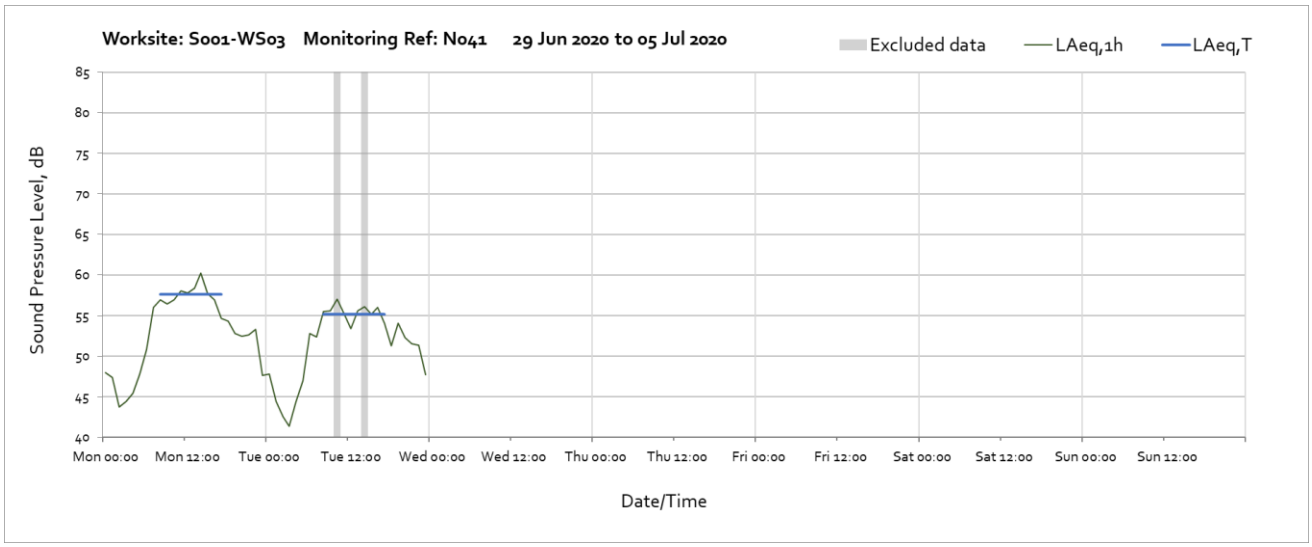
Worksite: S001-WS03 – Monitoring Ref: N041



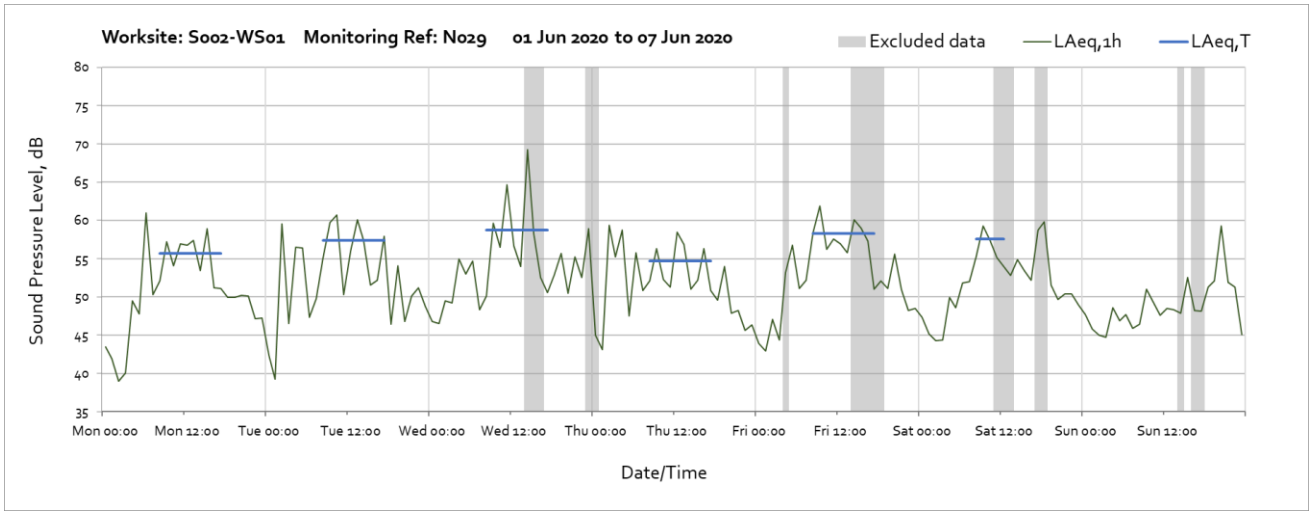


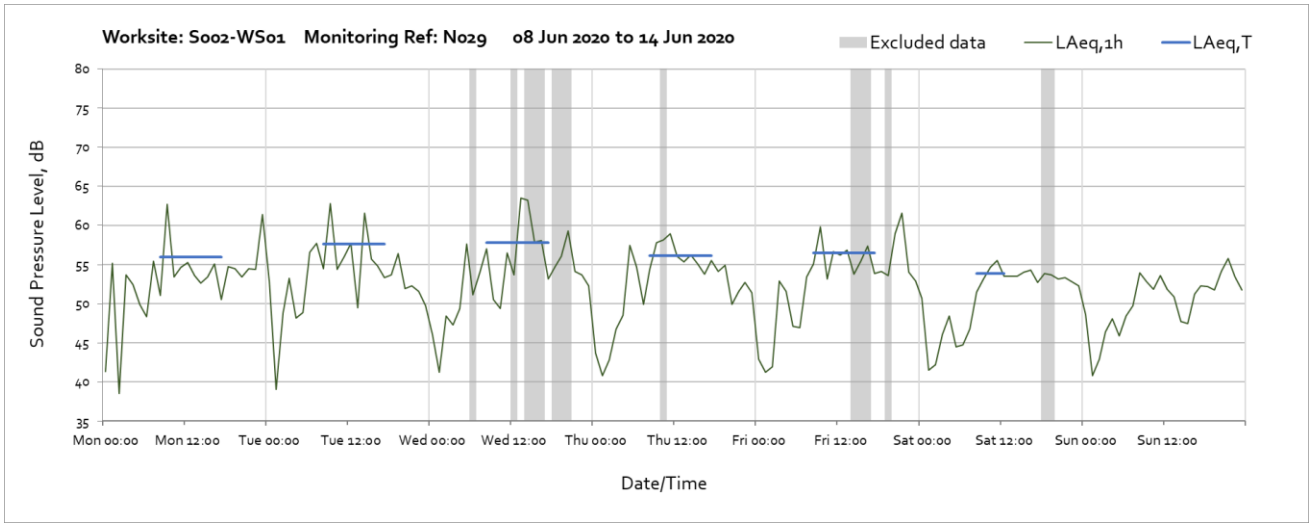






Worksite: S002-WS01 – Monitoring Ref: N029




Worksite: S002-WS01 Monitoring Ref: N029 08 Jun 2020 to 14 Jun 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
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75
70
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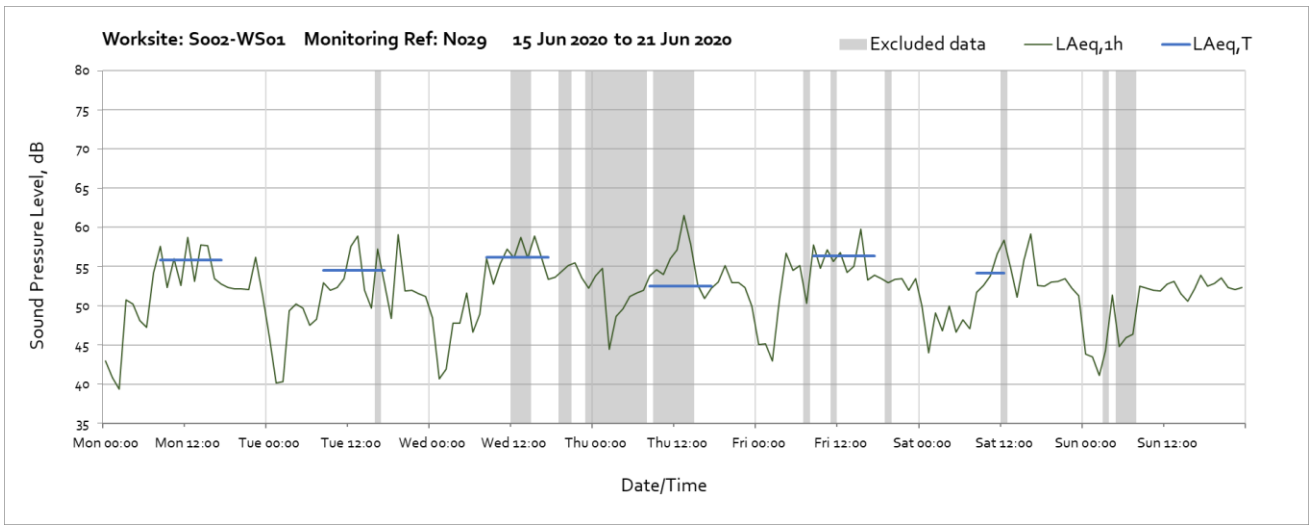
Date/Time


Worksite: S002-WS01 Monitoring Ref: N029 15 Jun 2020 to 21 Jun 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
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75
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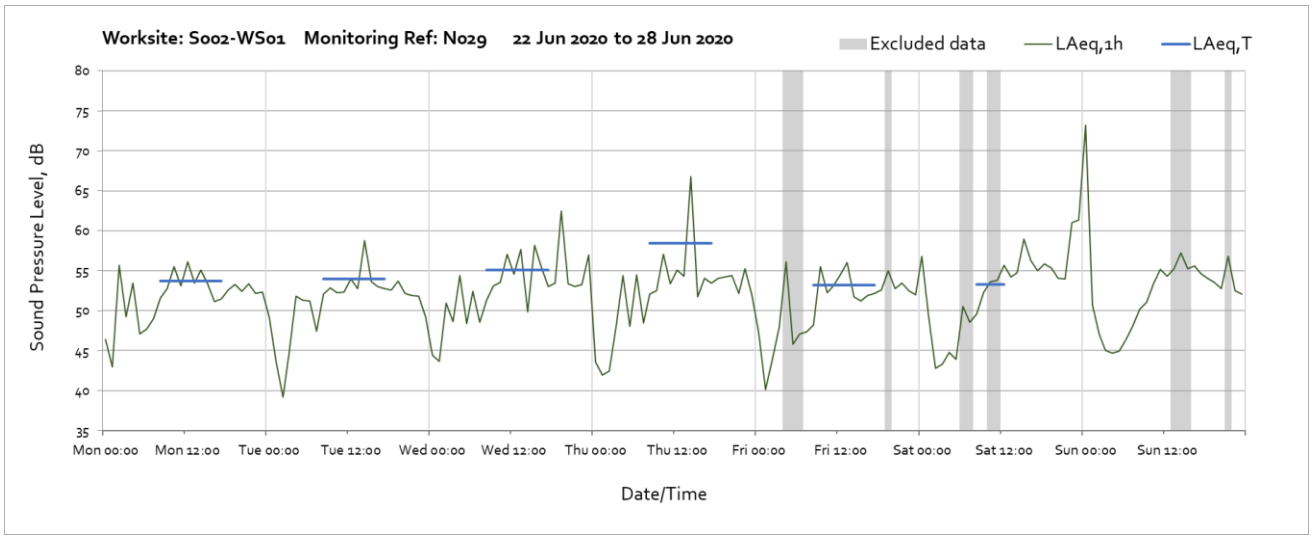
Date/Time


Worksite: S002-WS01 Monitoring Ref: N029 22 Jun 2020 to 28 Jun 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
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75
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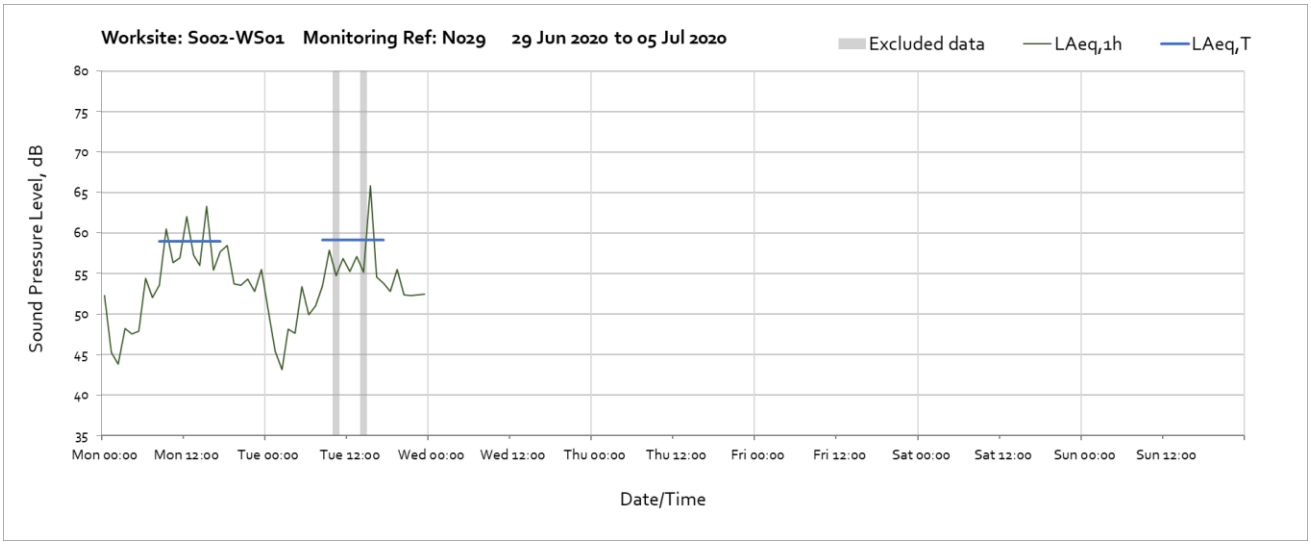
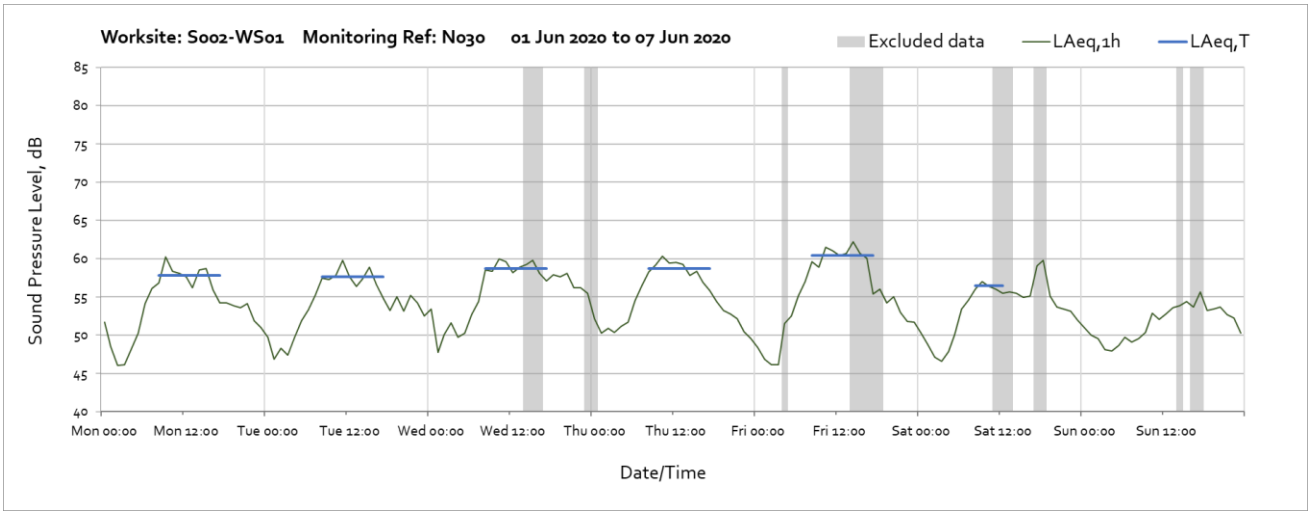
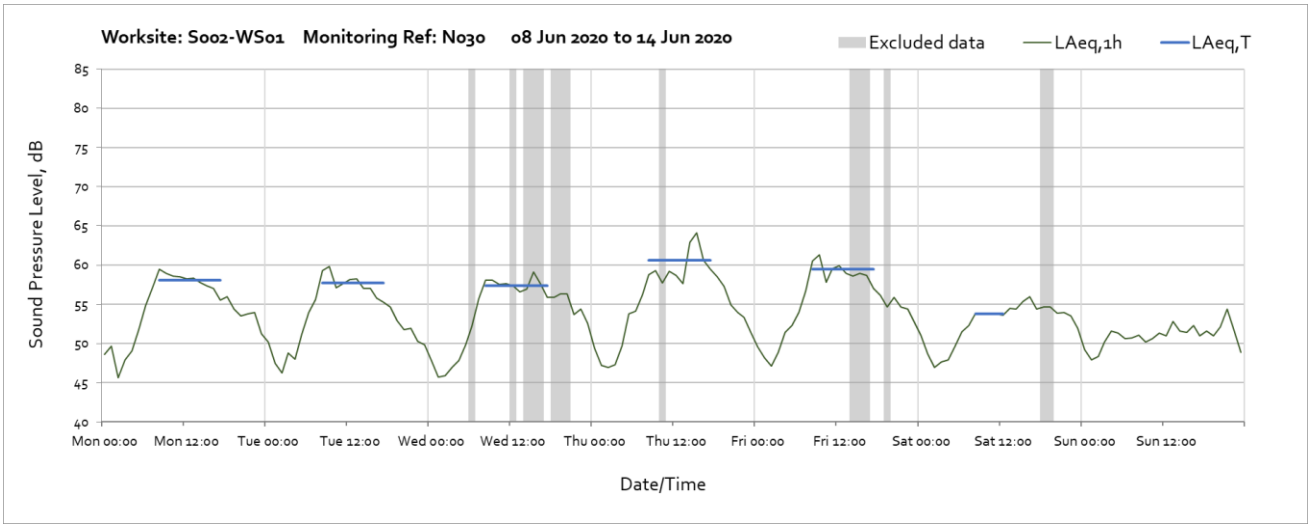
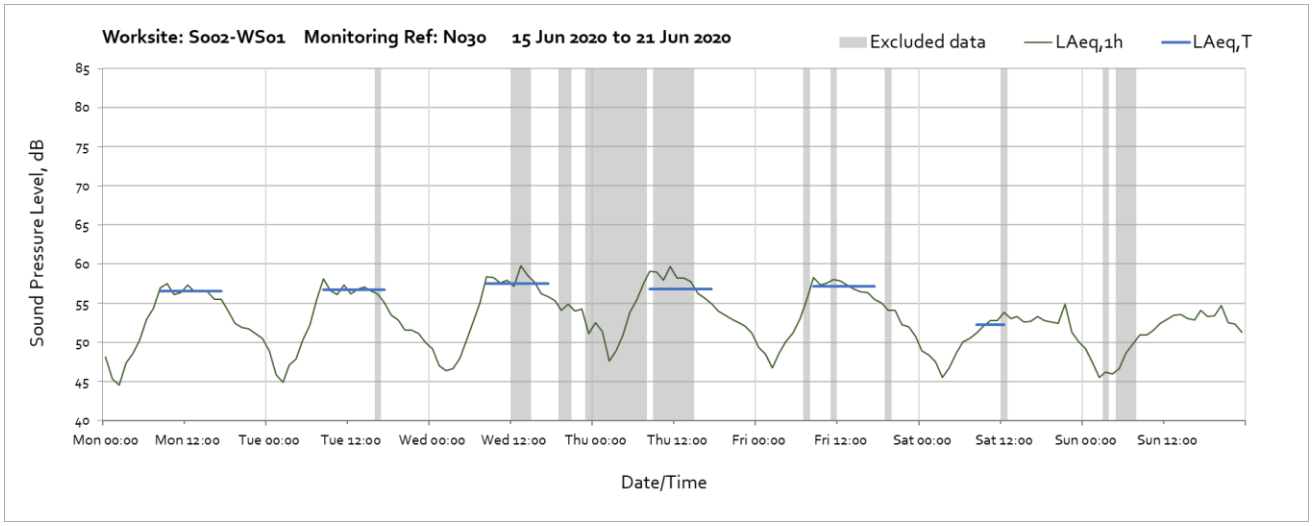
Date/Time



Worksite: S002-WS01 – Monitoring Ref: N030






Worksite: S002-WS01 Monitoring Ref: N030 15 Jun 2020 to 21 Jun 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
85
80
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Mon 00:00
Mon 12:00
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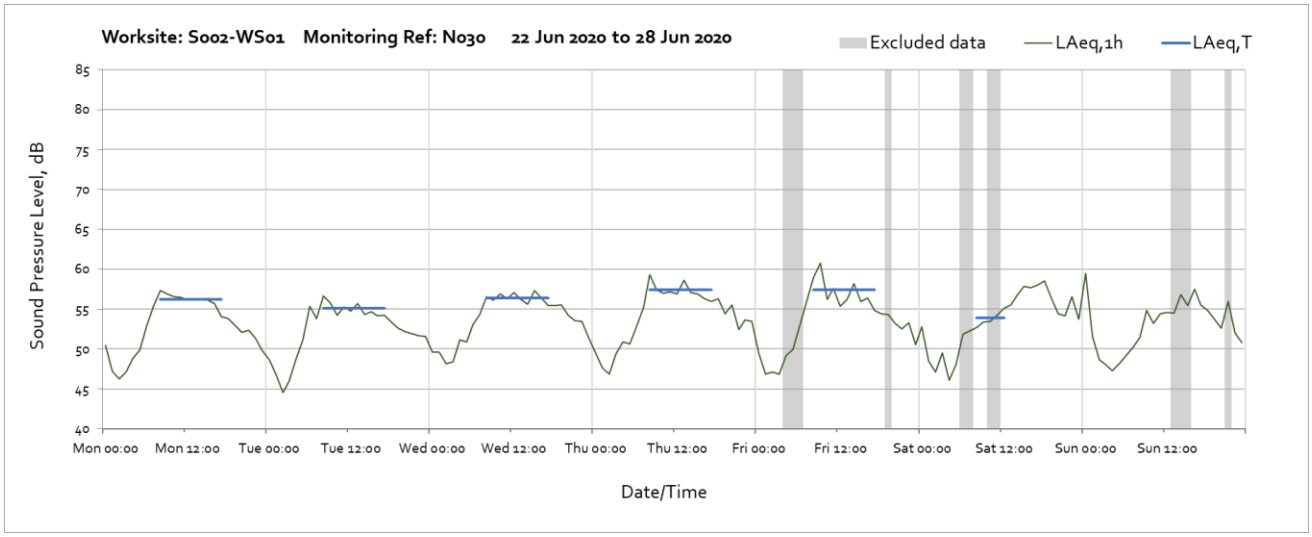
Date/Time


Worksite: S002-WS01 Monitoring Ref: N030 22 Jun 2020 to 28 Jun 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
85
80
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50
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Mon 00:00
Mon 12:00
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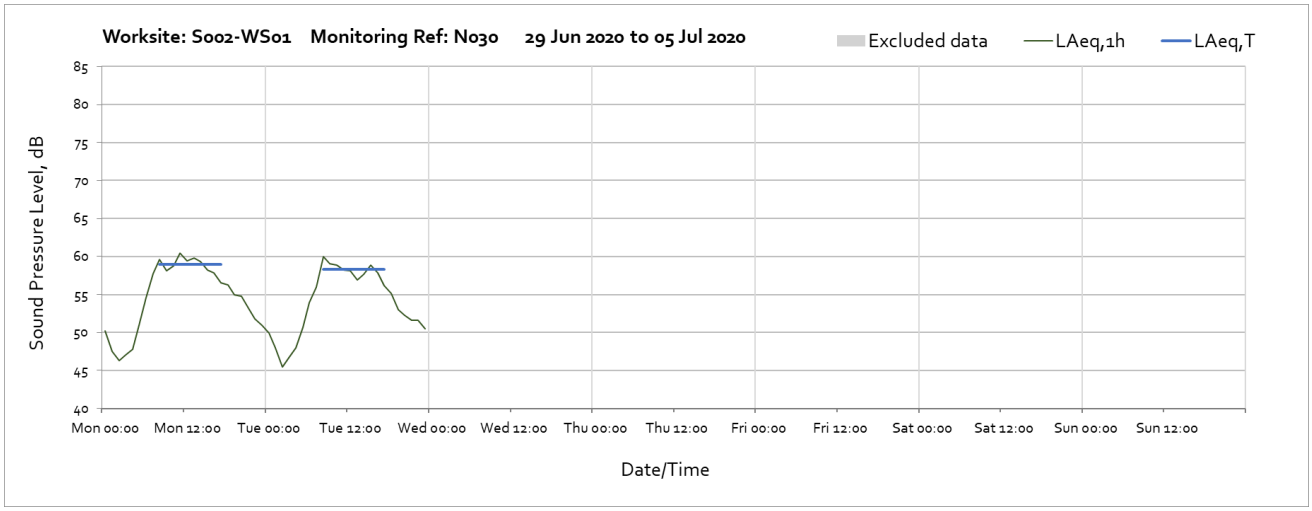
Date/Time


Worksite: S002-WS01 Monitoring Ref: N030 29 Jun 2020 to 05 Jul 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
85
80
75
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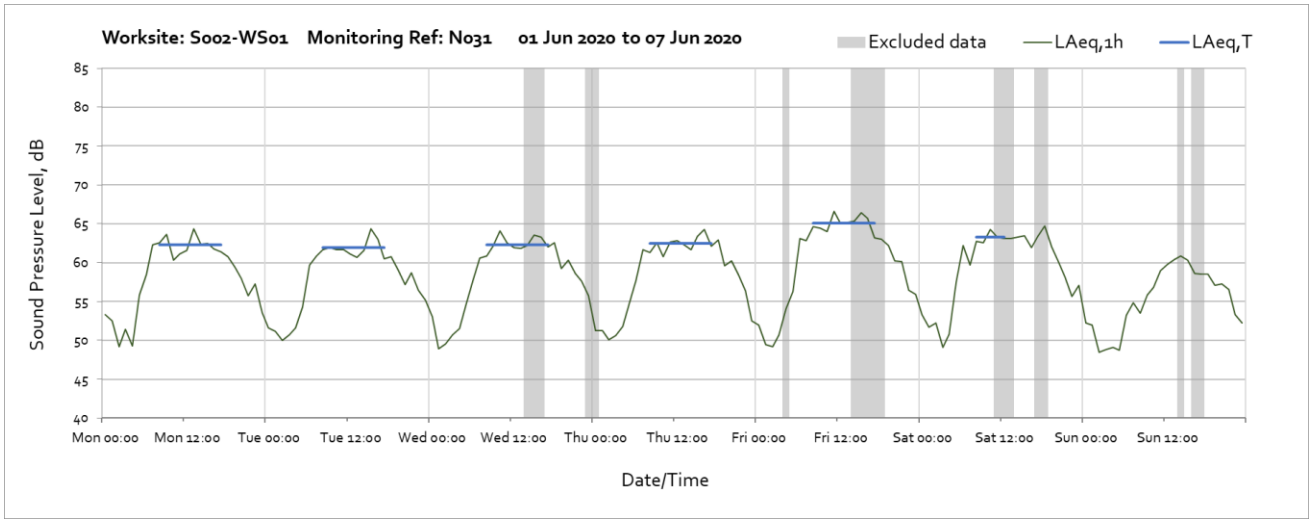
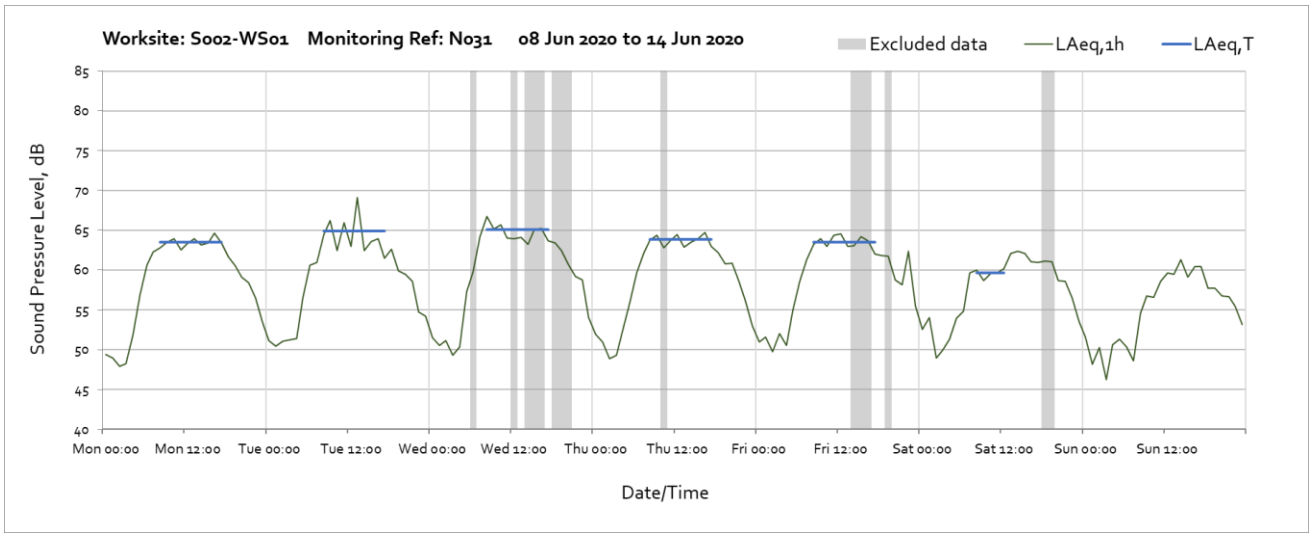
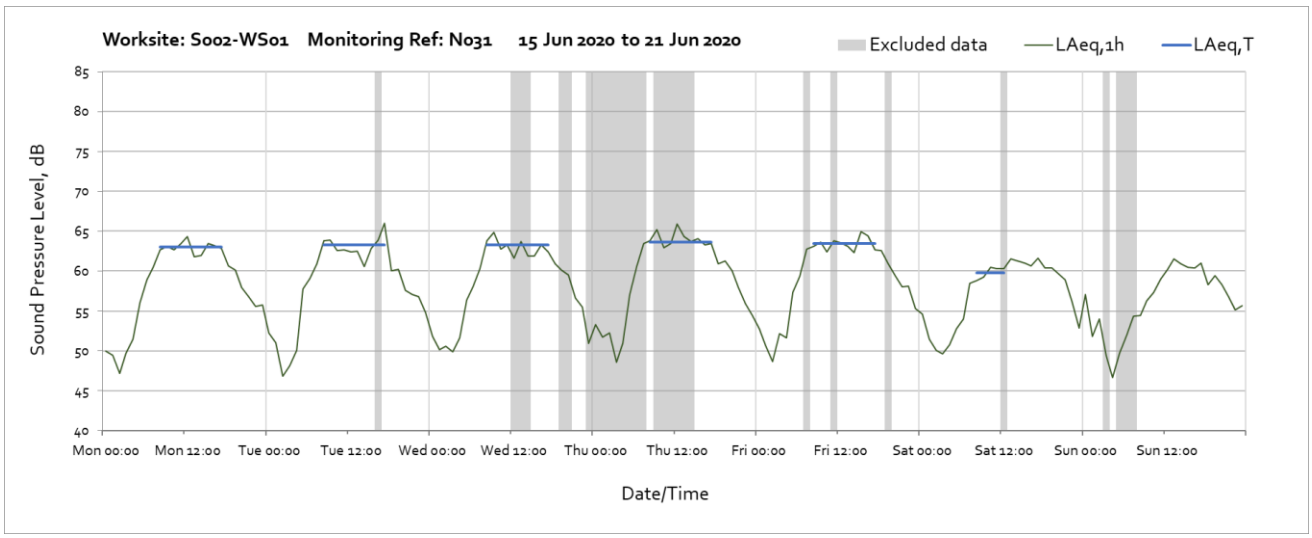
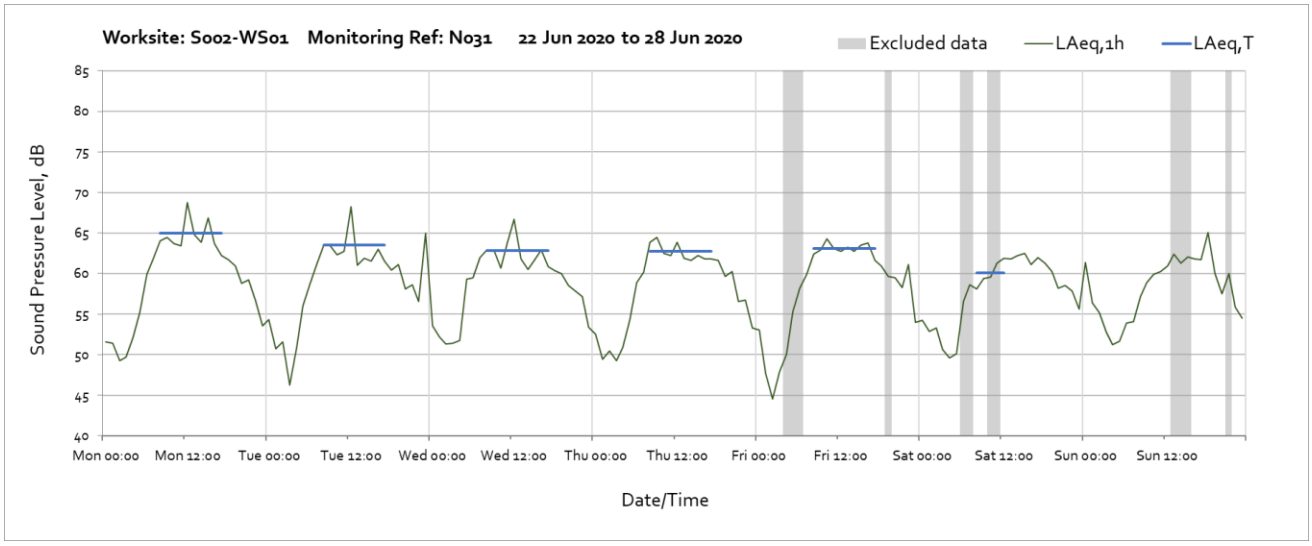
Date/Time

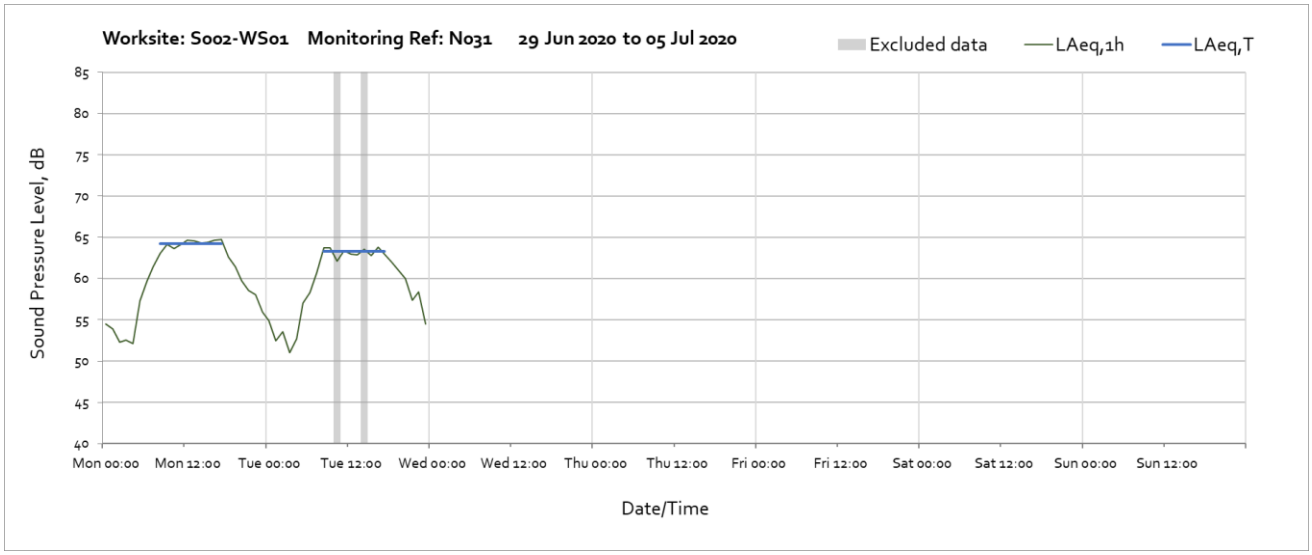
Worksite: S002-WS01 – Monitoring Ref: N031



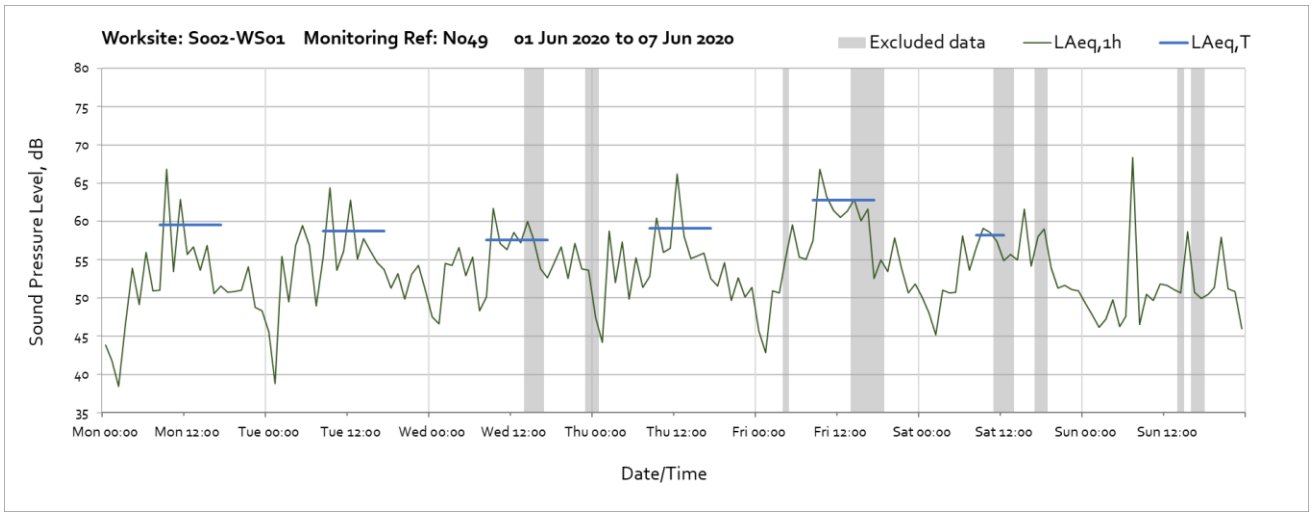


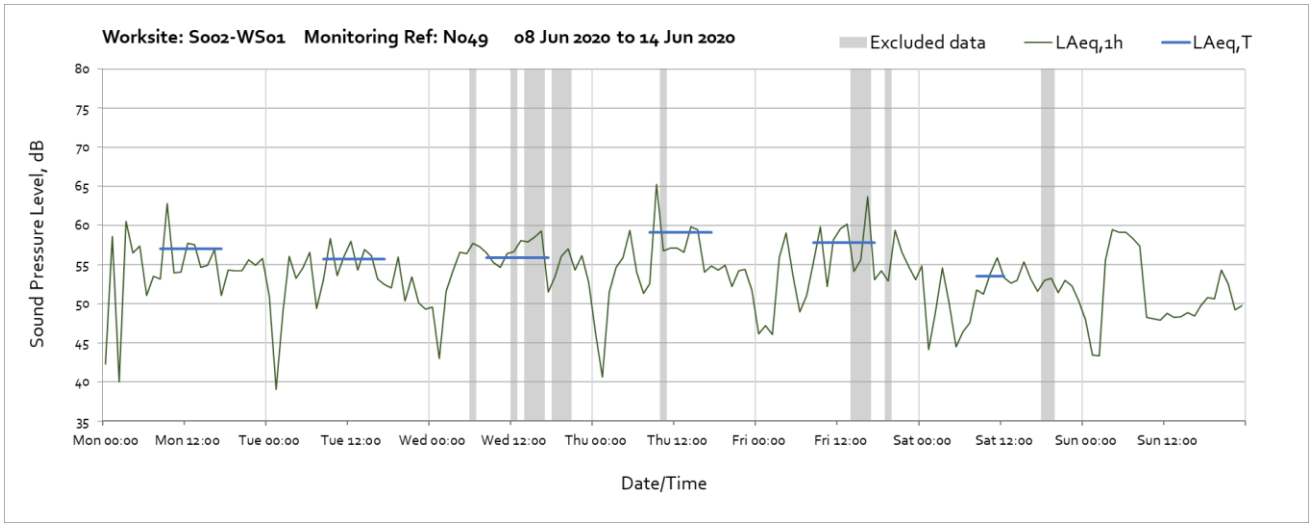






Worksite: S002-WS01 – Monitoring Ref: N049




Worksite: S002-WS01 Monitoring Ref: No49 08 Jun 2020 to 14 Jun 2020
Excluded data
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LAeq,T
Sound Pressure Level, dB
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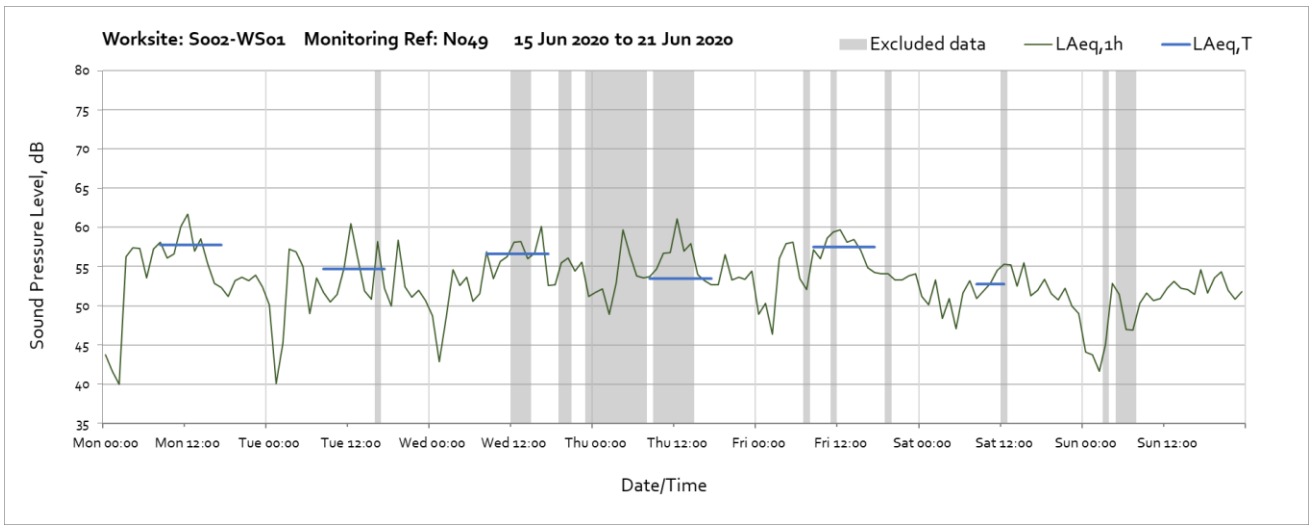
Sun 12:00
Date/Time


Worksite: S002-WS01 Monitoring Ref: No49 15 Jun 2020 to 21 Jun 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
80
75
70
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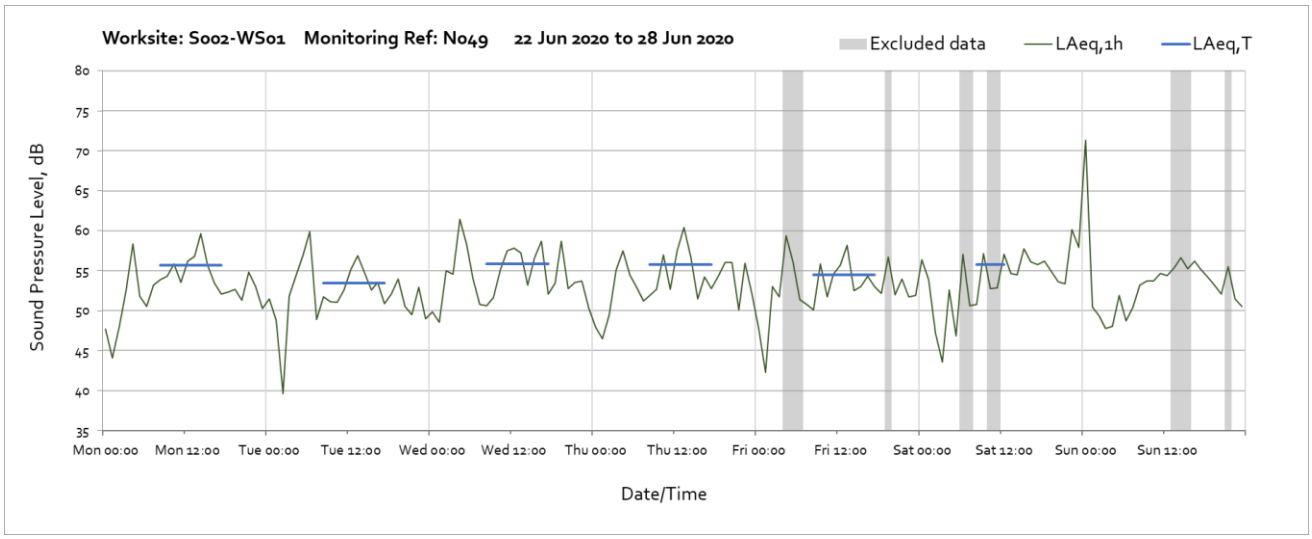
Date/Time


Worksite: S002-WS01 Monitoring Ref: No49 22 Jun 2020 to 28 Jun 2020
Excluded data
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LAeq,T
Sound Pressure Level, dB
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Mon 00:00
Mon 12:00
Tue 00:00
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Wed 00:00
Wed 12:00
Thu 00:00
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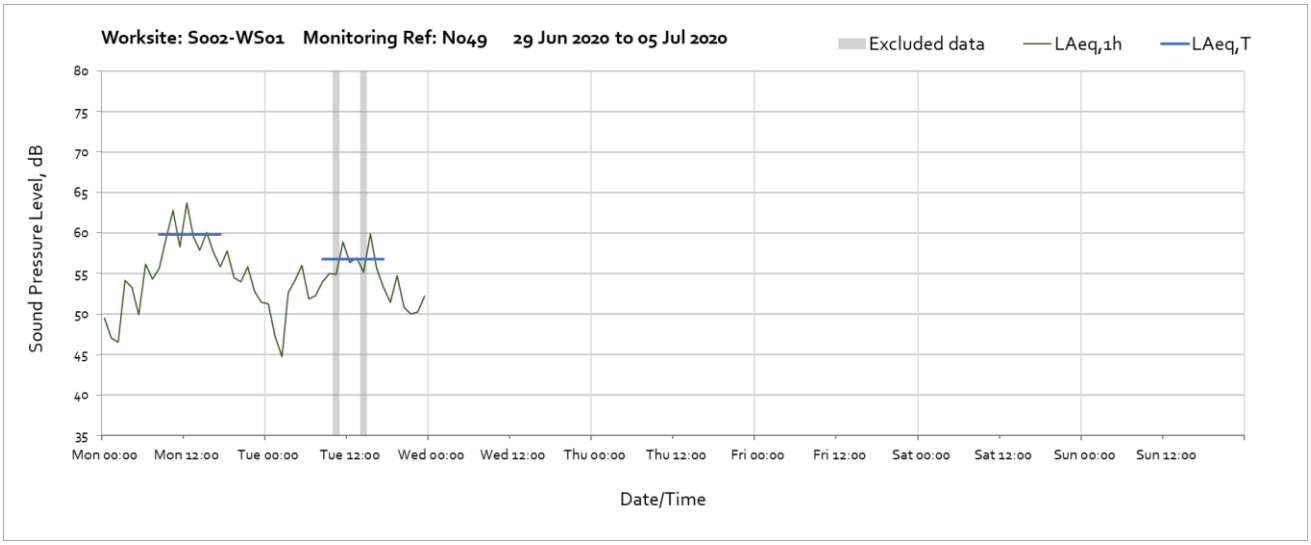
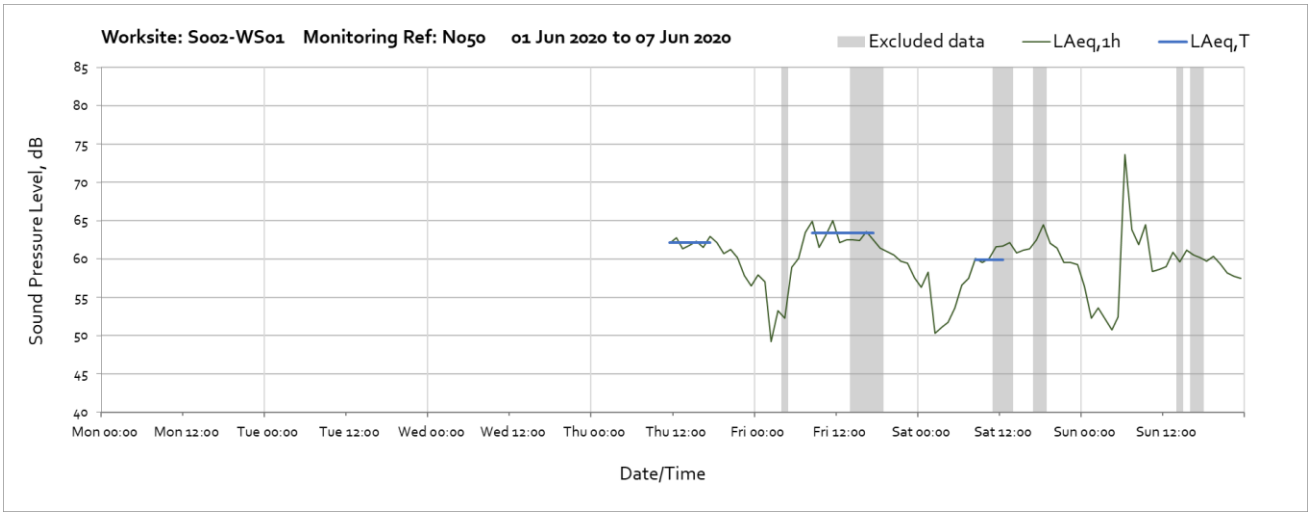
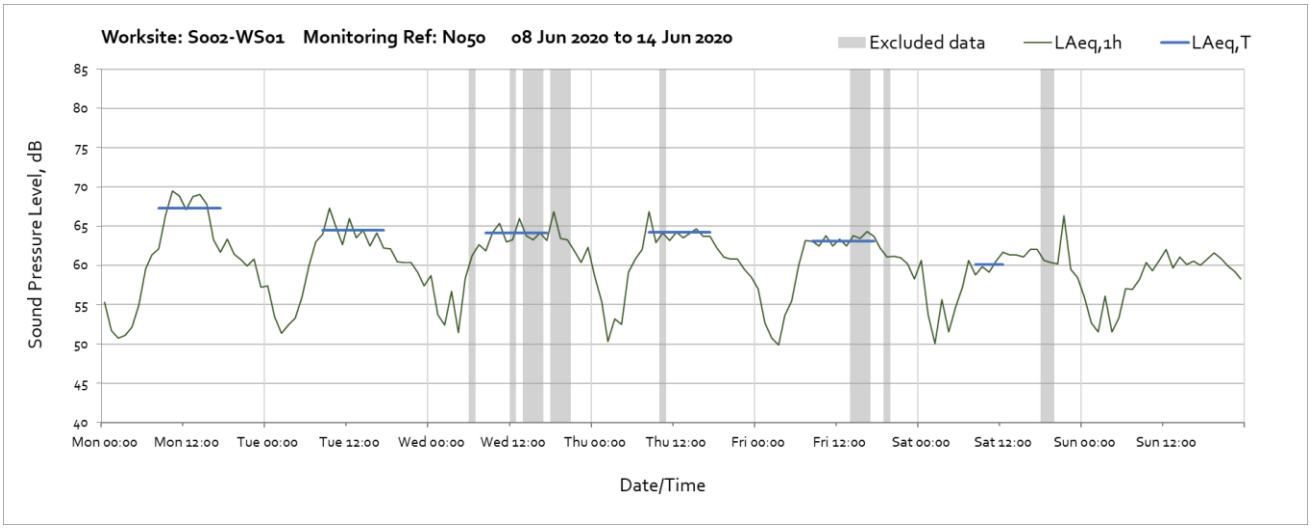
Fri 00:00
Fri 12:00
Sat 00:00
Sat 12:00
Sun 00:00
Sun 12:00
Date/Time

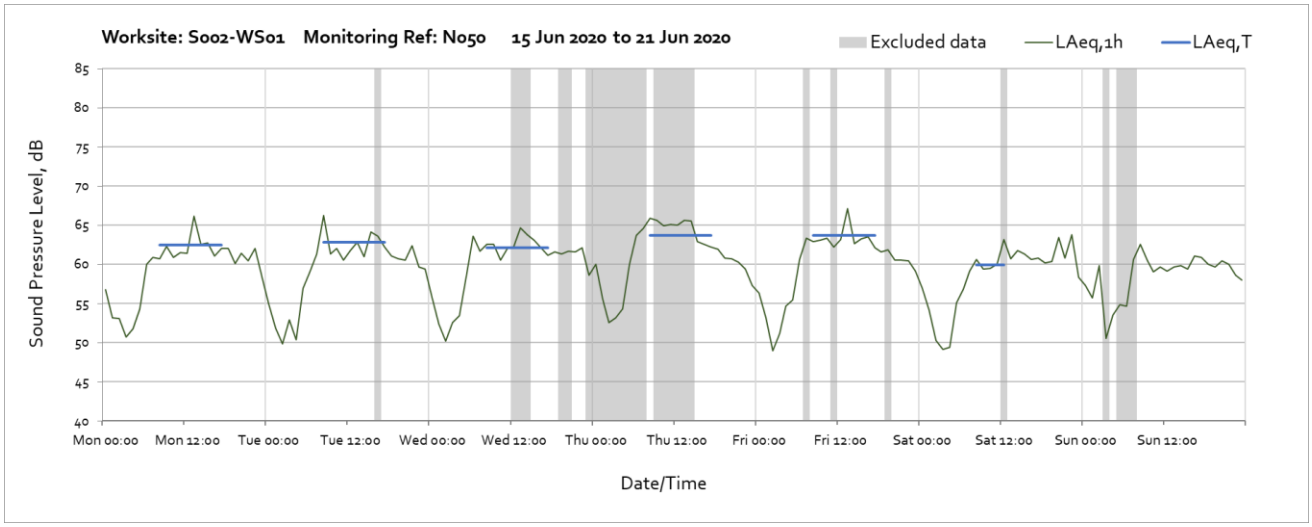


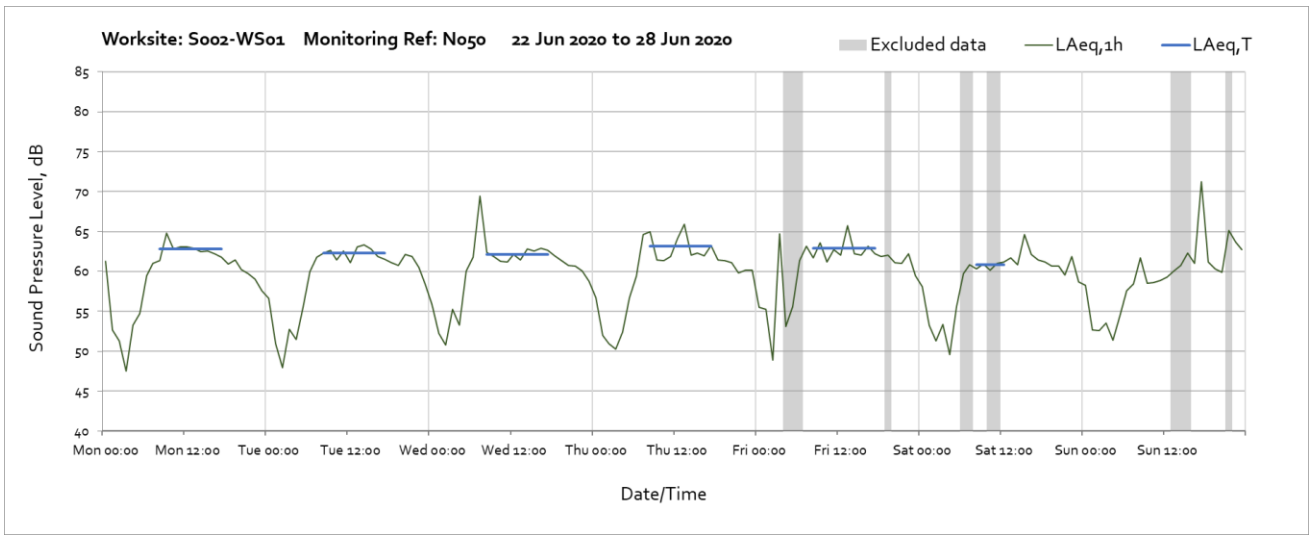
Worksite: S002-WS01 – Monitoring Ref: N050

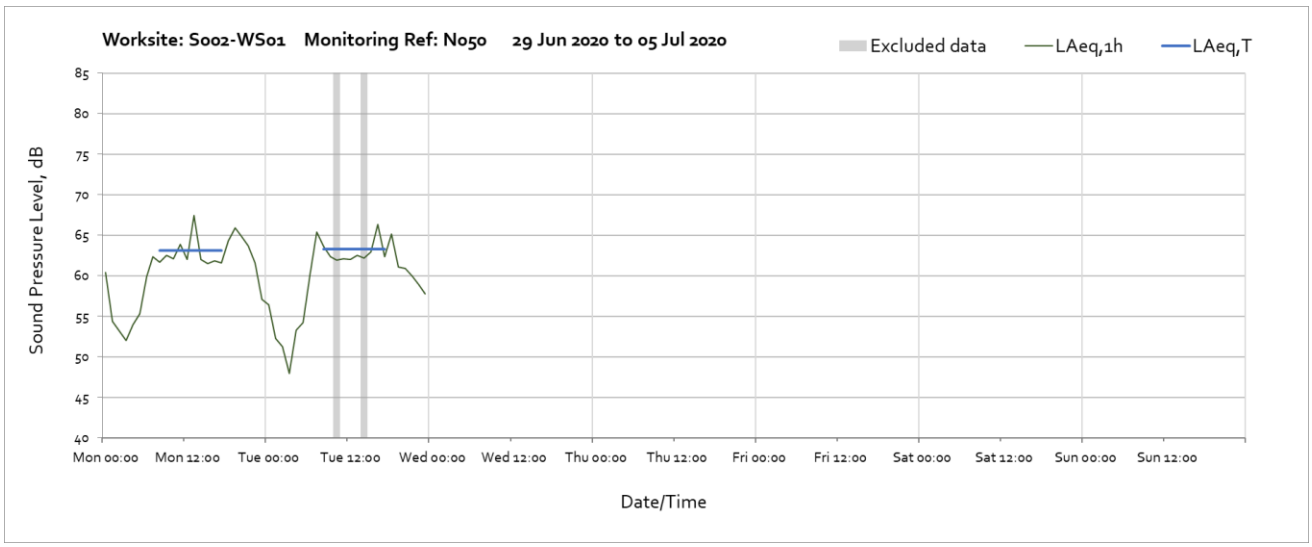


Note: The noise monitor was installed at 11:00 on Thursday 4th June.




Worksite: S002-WS01 Monitoring Ref: No50 15 Jun 2020 to 21 Jun 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
85
80
75
70
65
60
55
50
45
40
Mon 00:00
Mon 12:00
Tue 00:00
Tue 12:00
Wed 00:00
Wed 12:00
Thu 00:00
Thu 12:00
Fri 00:00
Fri 12:00
Sat 00:00
Sat 12:00
Sun 00:00
Sun 12:00
Date/Time


Worksite: S002-WS01 Monitoring Ref: No50 22 Jun 2020 to 28 Jun 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
85
80
75
70
65
60
55
50
45
40
Mon 00:00
Mon 12:00
Tue 00:00
Tue 12:00
Wed 00:00
Wed 12:00
Thu 00:00
Thu 12:00
Fri 00:00
Fri 12:00
Sat 00:00
Sat 12:00
Sun 00:00
Sun 12:00
Date/Time


Worksite: S002-WS01 Monitoring Ref: No50 29 Jun 2020 to 05 Jul 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
85
80
75
70
65
60
55
50
45
40
Mon 00:00
Mon 12:00
Tue 00:00
Tue 12:00
Wed 00:00
Wed 12:00
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Fri 12:00
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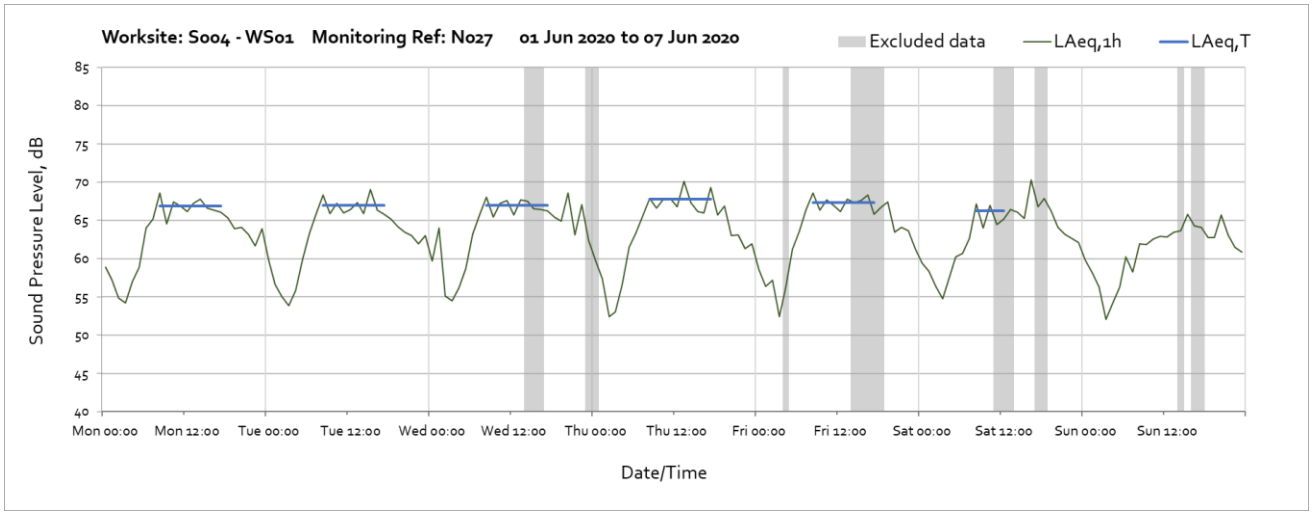
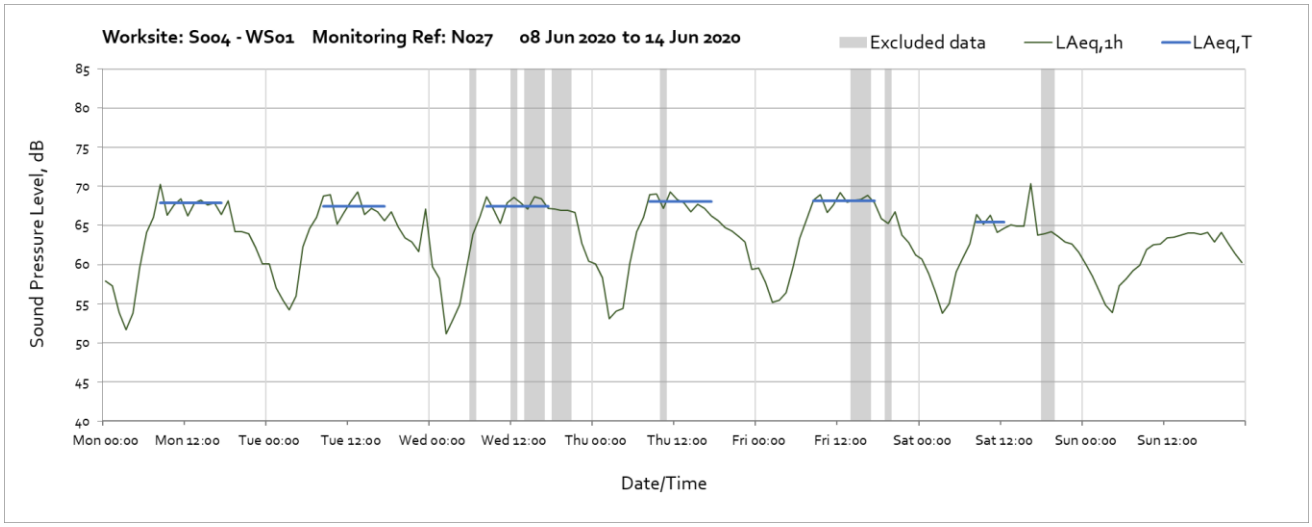
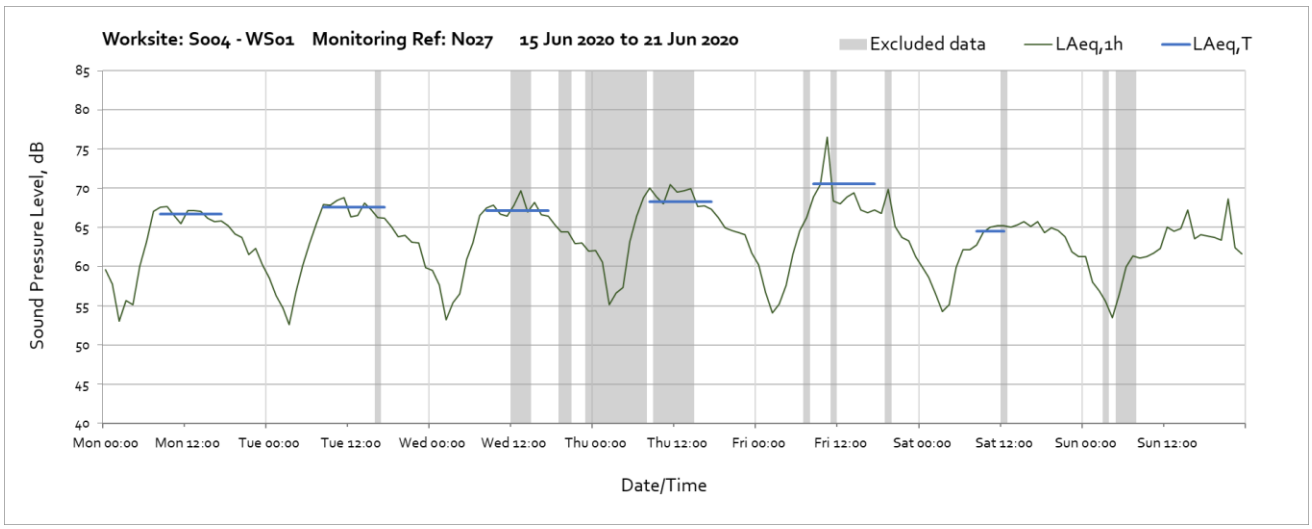
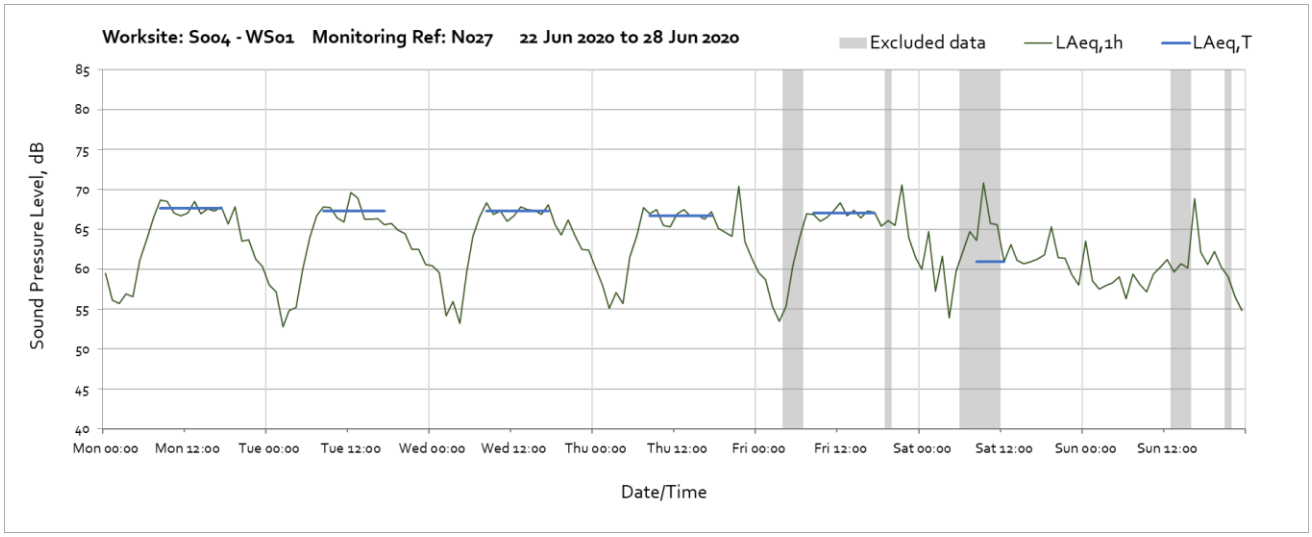
Sun 00:00
Sun 12:00
Date/Time

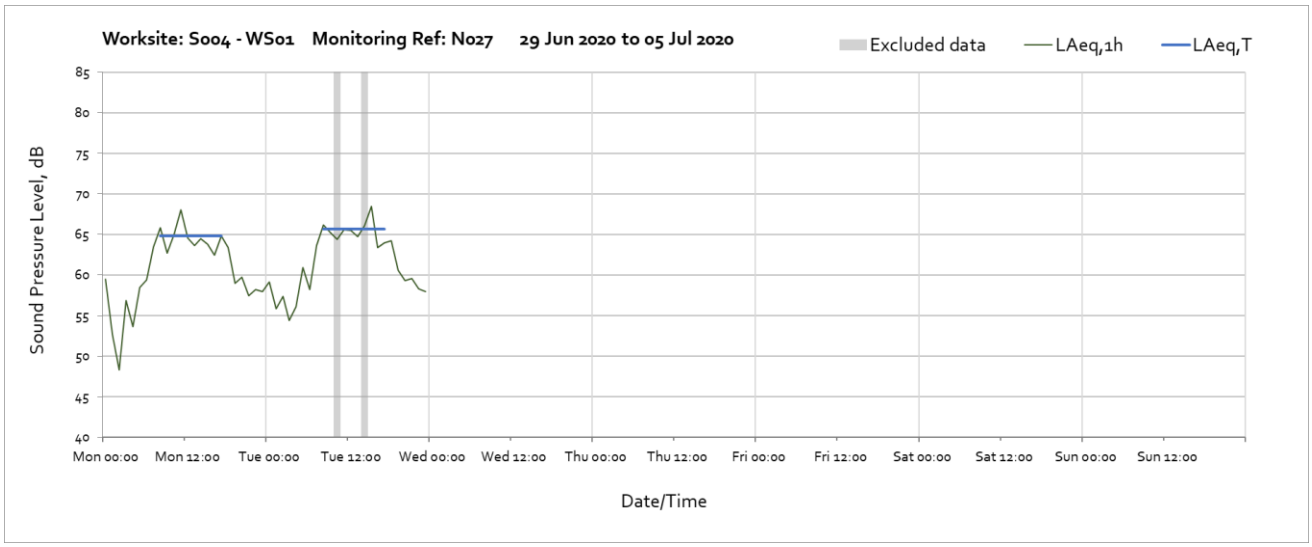
Worksite: S004-WS01 – Monitoring Ref: N027



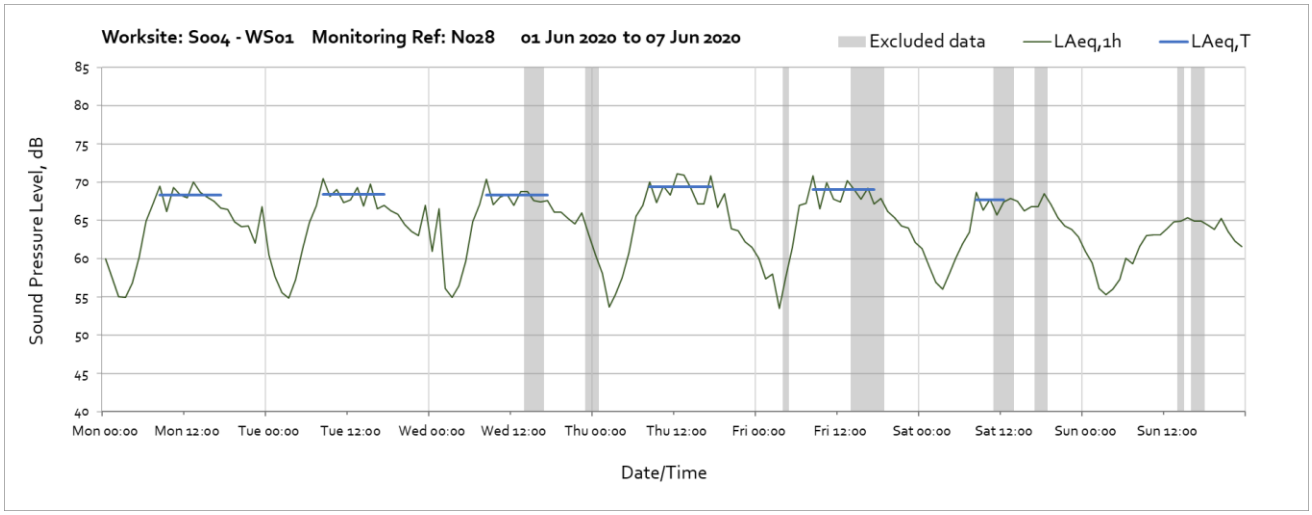


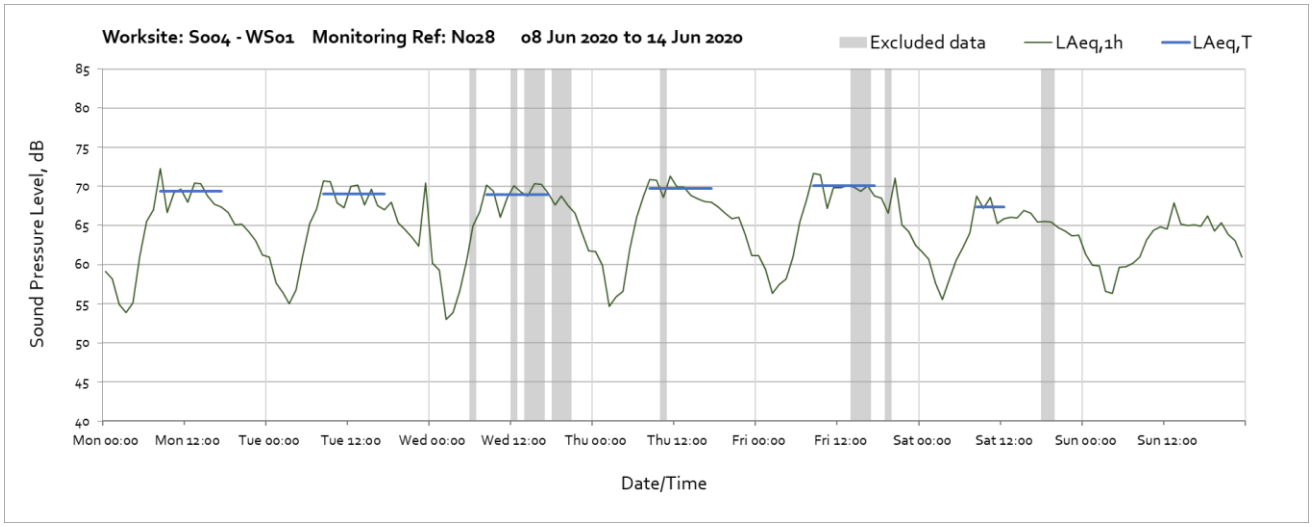






Worksite: S004-WS01 – Monitoring Ref: N028




Worksite: S004 - WS01 Monitoring Ref: N028 08 Jun 2020 to 14 Jun 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
85
80
75
70
65
60
55
50
45
40
Mon 00:00
Mon 12:00
Tue 00:00
Tue 12:00
Wed 00:00
Wed 12:00
Thu 00:00
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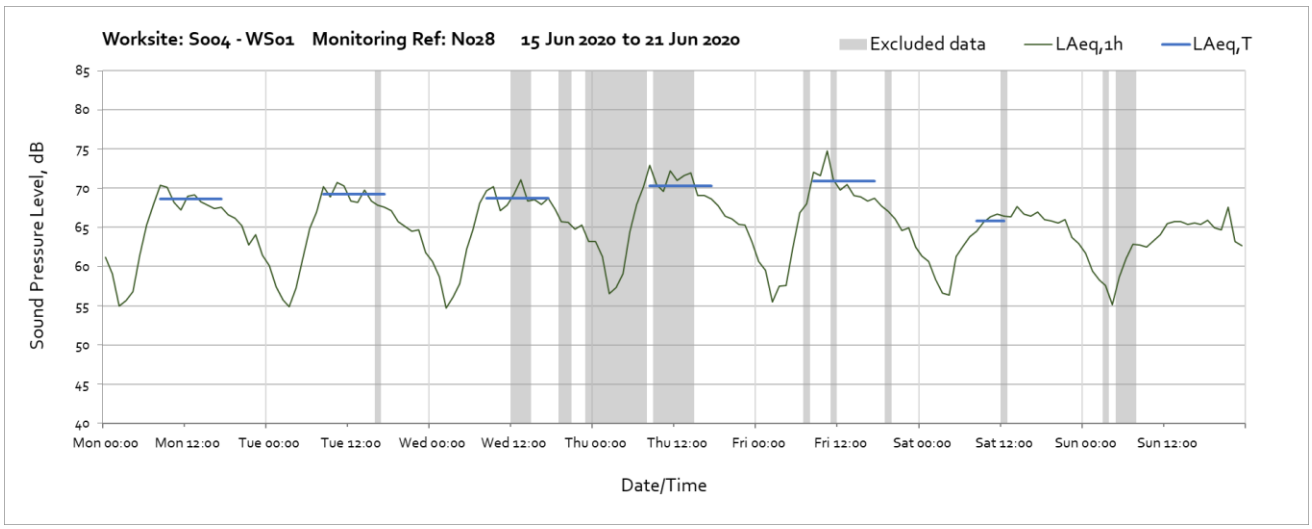
Sat 00:00
Sat 12:00
Sun 00:00
Sun 12:00
Date/Time


Worksite: S004 - WS01 Monitoring Ref: N028 15 Jun 2020 to 21 Jun 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
85
80
75
70
65
60
55
50
45
40
Mon 00:00
Mon 12:00
Tue 00:00
Tue 12:00
Wed 00:00
Wed 12:00
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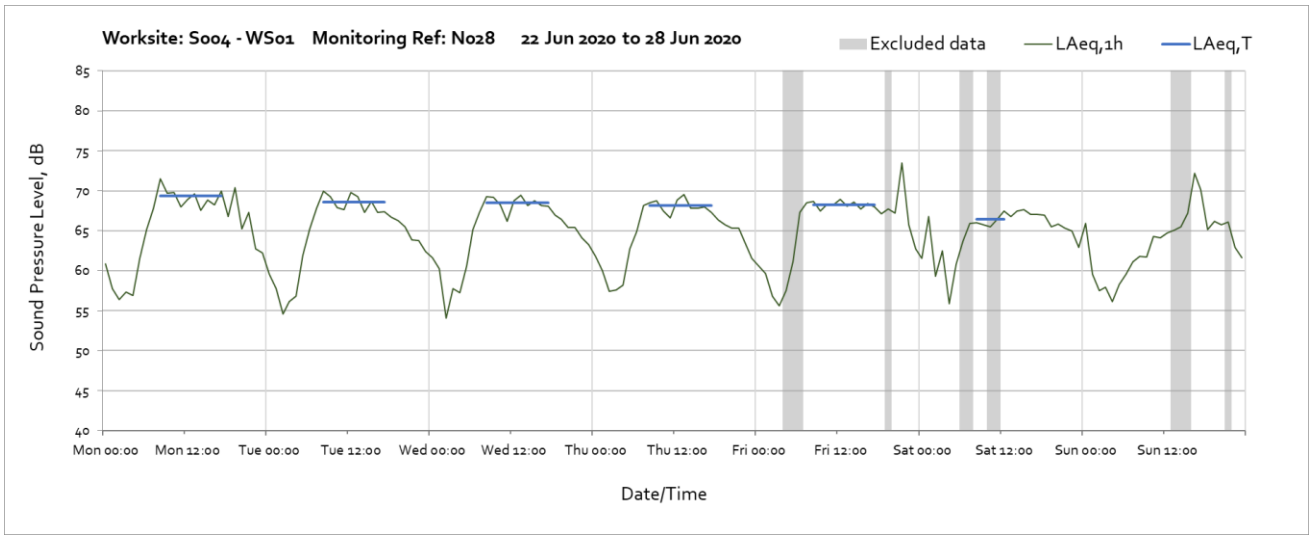
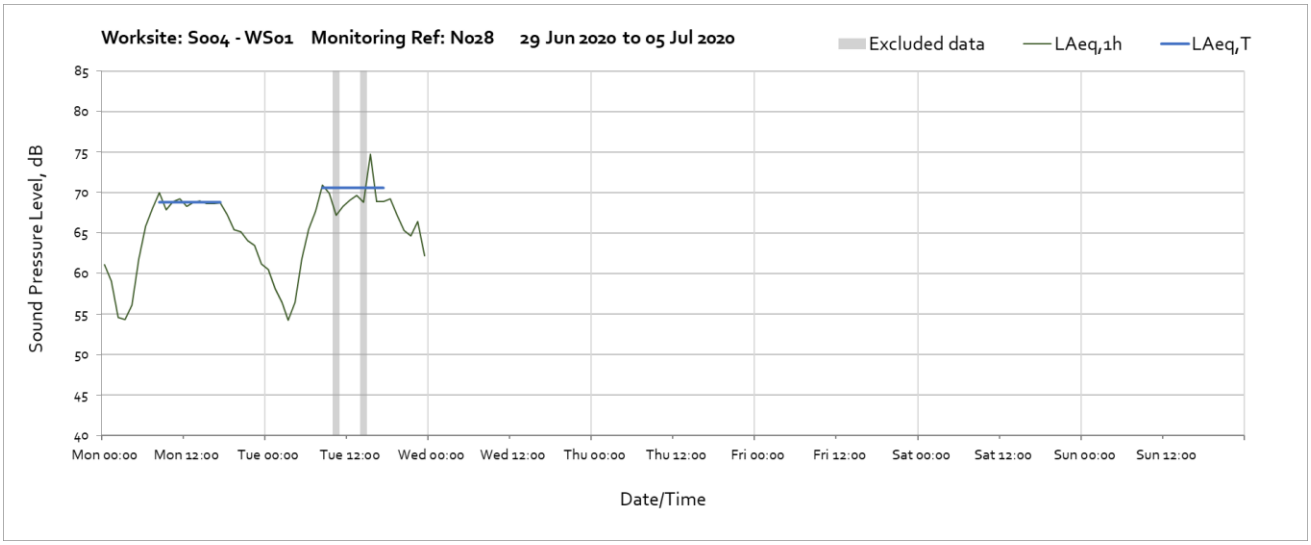
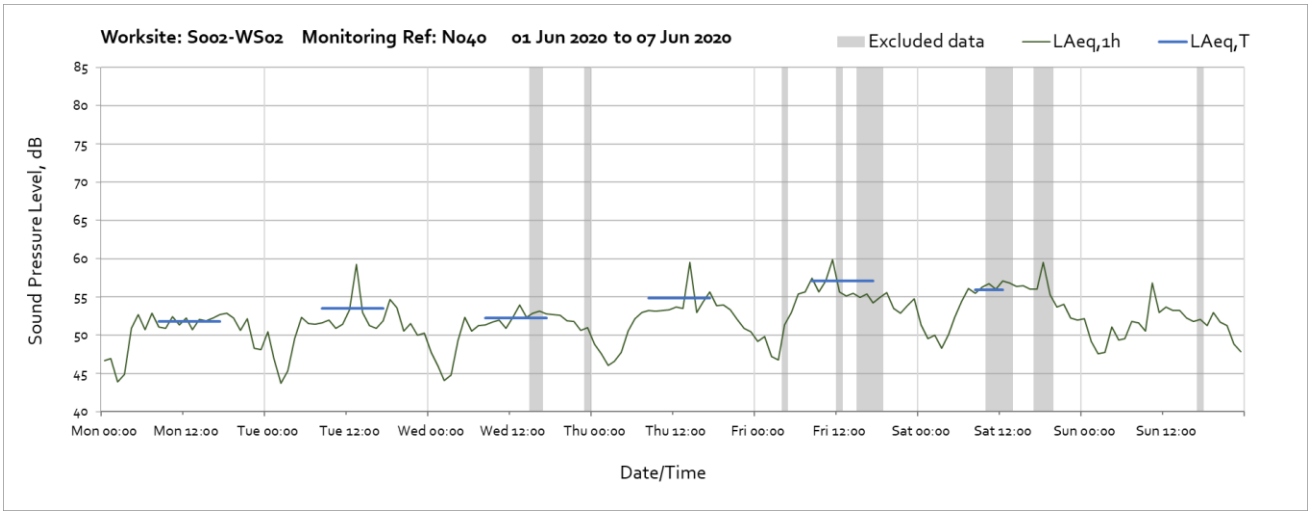
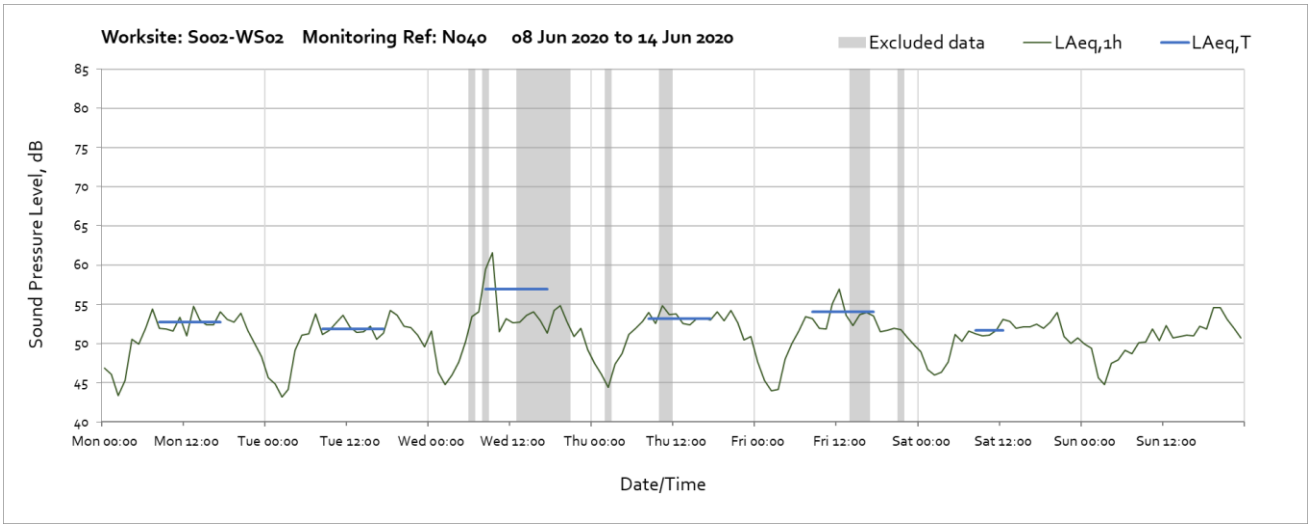
Sat 00:00
Sat 12:00
Sun 00:00
Sun 12:00
Date/Time

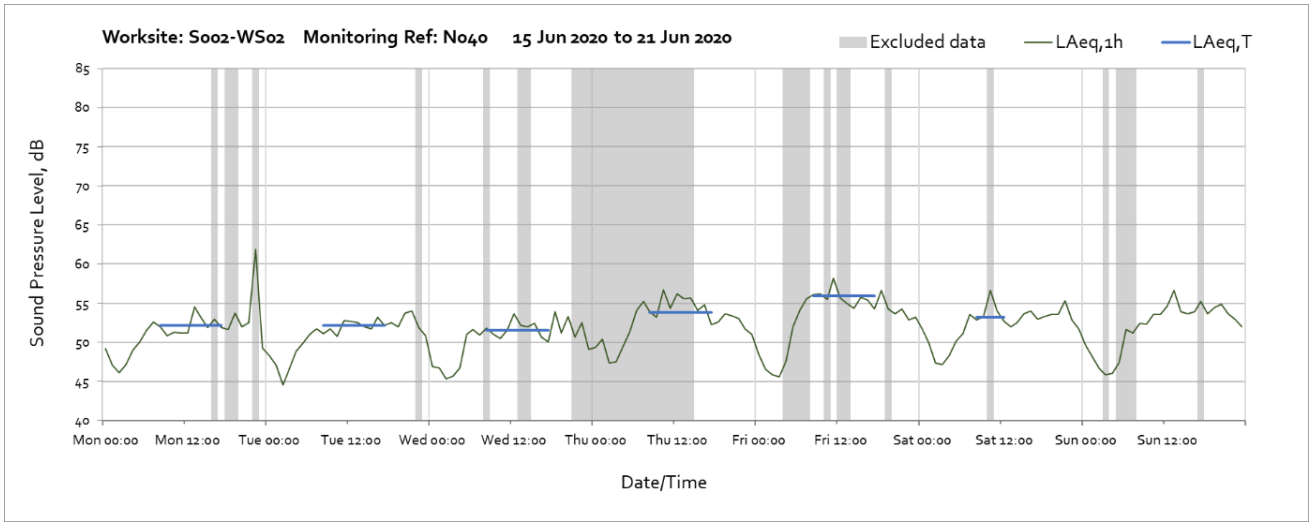

Worksite: S004 - WS01 Monitoring Ref: N028 22 Jun 2020 to 28 Jun 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
85
80
75
70
65
60
55
50
45
40
Mon 00:00
Mon 12:00
Tue 00:00
Tue 12:00
Wed 00:00
Wed 12:00
Thu 00:00
Thu 12:00
Fri 00:00
Fri 12:00
Sat 00:00
Sat 12:00
Sun 00:00
Sun 12:00
Date/Time



Worksite: BC Compound – Monitoring Ref: N040






Worksite: S002-WS02 Monitoring Ref: No40 15 Jun 2020 to 21 Jun 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
85
80
75
70
65
60
55
50
45
40
Mon 00:00
Mon 12:00
Tue 00:00
Tue 12:00
Wed 00:00
Wed 12:00
Thu 00:00
Thu 12:00
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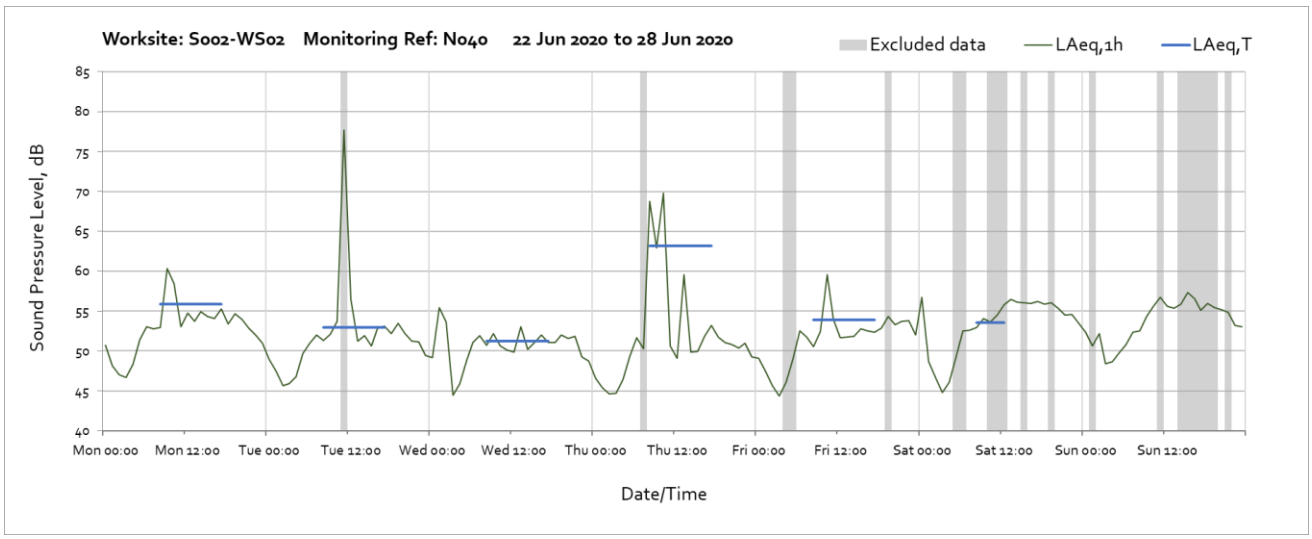
Fri 12:00
Sat 00:00
Sat 12:00
Sun 00:00
Sun 12:00
Date/Time


Worksite: S002-WS02 Monitoring Ref: No40 22 Jun 2020 to 28 Jun 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
85
80
75
70
65
60
55
50
45
40
Mon 00:00
Mon 12:00
Tue 00:00
Tue 12:00
Wed 00:00
Wed 12:00
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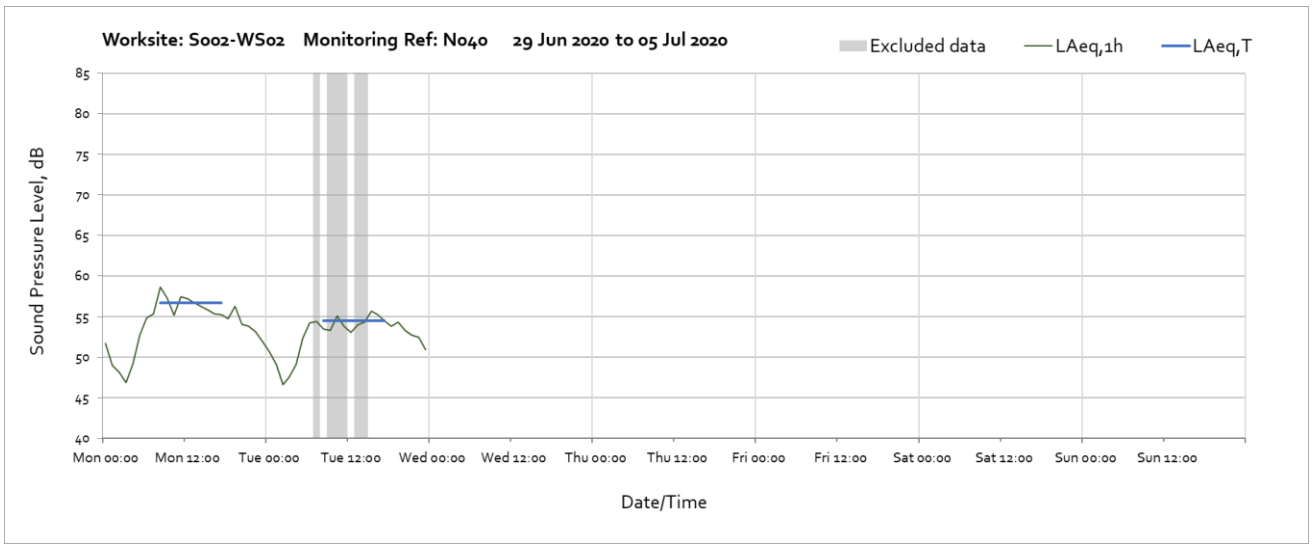
Date/Time


Worksite: S002-WS02 Monitoring Ref: No40 29 Jun 2020 to 05 Jul 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
85
80
75
70
65
60
55
50
45
40
Mon 00:00
Mon 12:00
Tue 00:00
Tue 12:00
Wed 00:00
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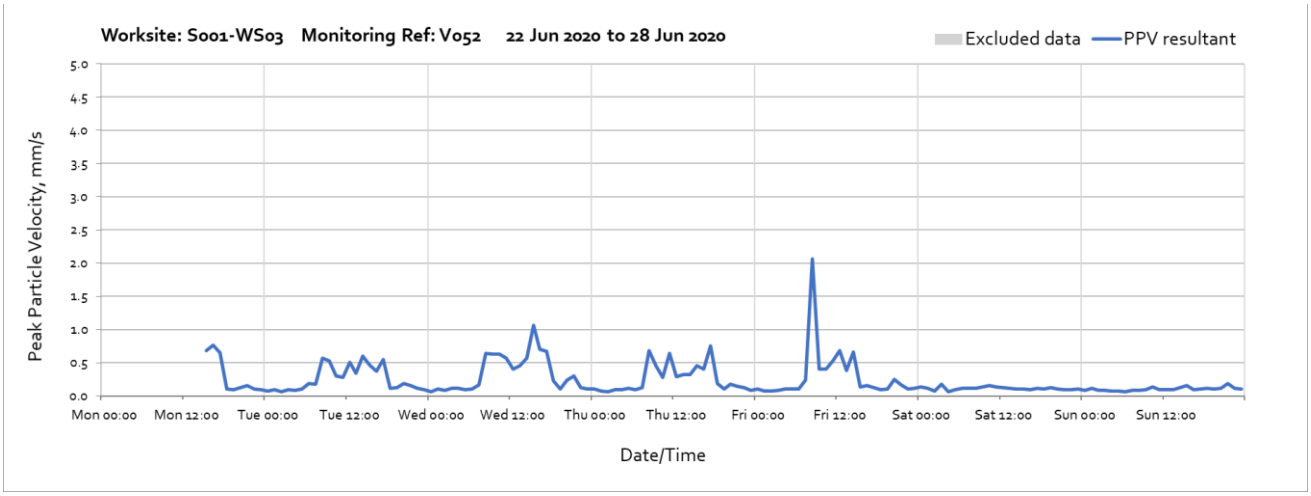
Date/Time

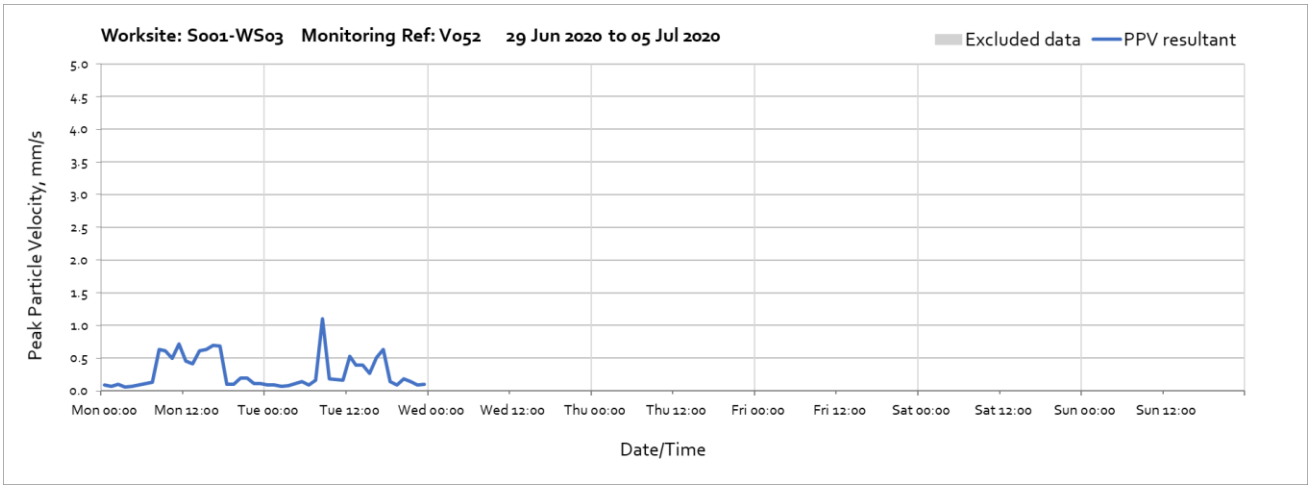
Vibration

The following graphs show the hourly measured peak particle velocity PPV recorded during the monitoring period. The graphs show the resultant PPV due to vibration components on three orthogonal axis x, y and z. High values of PPV were measured on occasions at V045. These were due to local interference with the vibration monitor and are not representative of HS2 construction works. These data entries have been greyed out in the following charts and have been excluded to calculate values in Table 6.

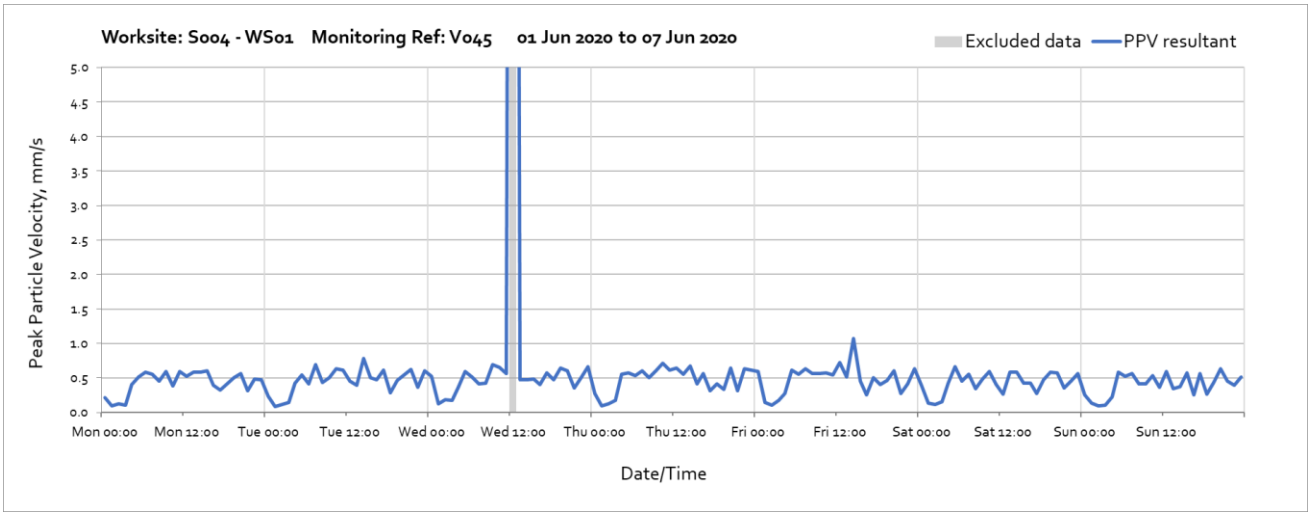
Worksite: S001-WS03 – Monitoring Ref: V052



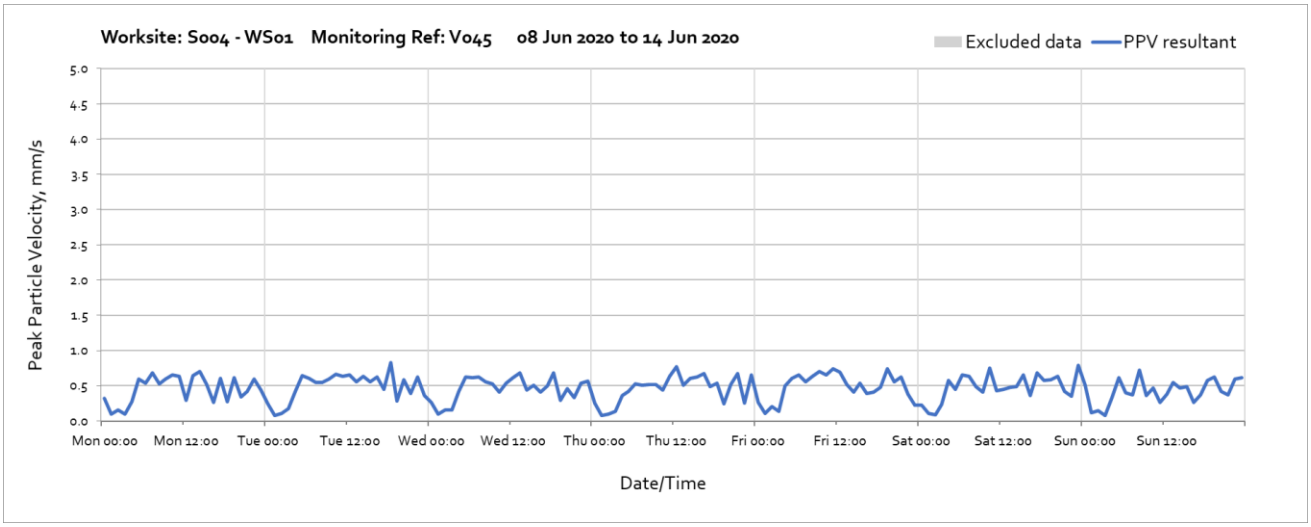
Note: The vibration monitor was installed at 15:00 on the 22nd of June.

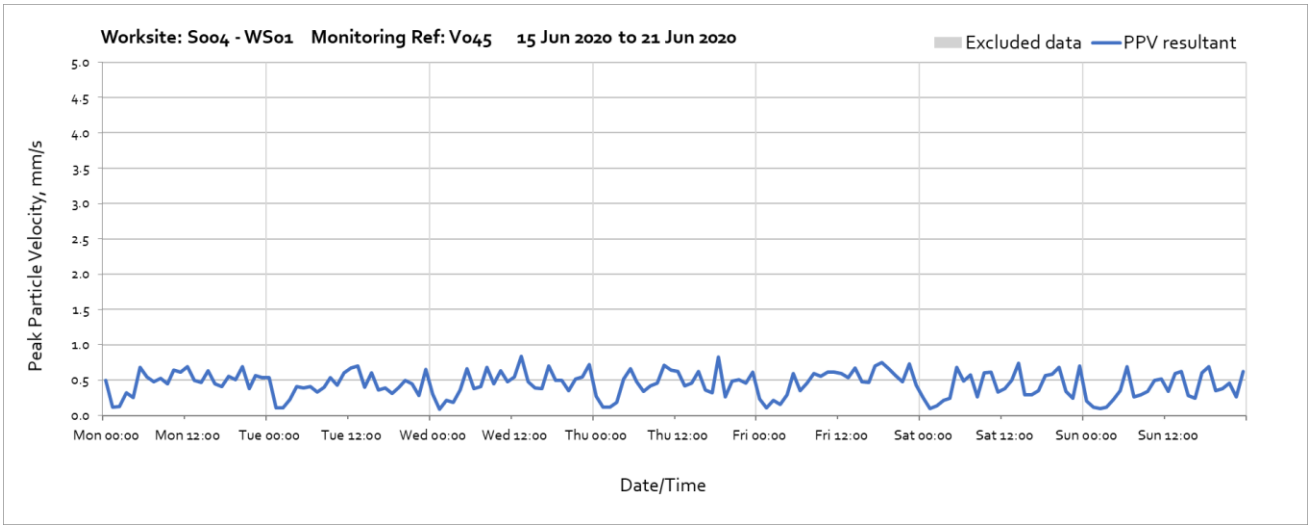


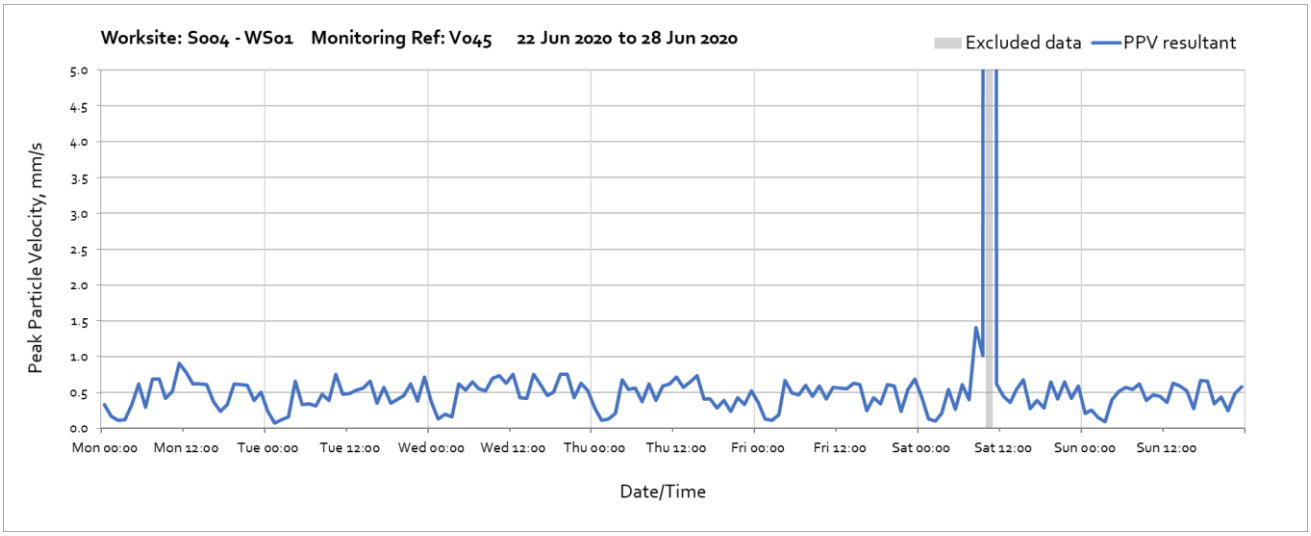
Worksite: S004-WS01 – Monitoring Ref: V045



Note: High vibration levels measured at 12:00 on Wednesday 3rd June were due to local disturbance of the vibration monitor and are not representative of HS2 vibration levels.







Note: High vibration levels measured at 10:00 on Saturday 27th June were due to local disturbance of the vibration monitor for battery replacement and are not representative of HS2 vibration levels.