

Construction noise and vibration Monthly Report – June 2021

Birmingham City

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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 Birmingham City during the month of June 2021.

Within this period monitoring was undertaken at the following worksites:

- Noise monitoring was undertaken in the vicinity of the Curzon Street worksite (ref.: CS), where asphalt surfacing, temporary drainage works, installation of duct for power and water connections, excavation works, piling platform extension works, general site cleaning works, stockpile works, trial hole works, retaining wall demolition works and vegetation clearance were underway.
- Vibration monitoring was undertaken in the vicinity of the Museum Collection Centre worksite (ref.: MCC), where site set up works were underway.
- Noise and vibration monitoring was undertaken in the vicinity of the Twisted Oak Stables worksite (ref.: TOS), where cutting and filling, laying works, construction of bentonite plant, construction of guide walls, excavation of diaphragm walls, deliveries and drainage works were underway.
- Noise and vibration monitoring was undertaken in the vicinity of the Washwood Heath Depot worksite (ref.: WWHD), where earthworks, clay laying down works, removal of obstruction, soil testing, breaking out works, laying works of haul road area and asbestos surveys were underway.

Further works, where monitoring did not take place, were also undertaken at:

- Dorset Road, Saltley Business Park and Network Park (water utility works);
- Duddeston Mill Road (water utility works and substation diversion works);
- B4114 Saltley Viaduct (site setup, removal of building foundations, stockpiling works, water and power utility works);
- Landor Street (works at substation);
- Faraday Avenue (power utility diversion);
- M42/M6 Link Viaducts (Enabling works); and
- Bromford Tunnel Intermediate Shaft (Clearing vegetation, cabin foundations, setup welfare and cabin offices, breakout of kerbs, creation of reinforced concrete working platforms, and delivery of plant and equipment).

There were no exceedances of the HS2 threshold levels for significant noise impacts, which are defined in Information Paper E23 (<https://www.gov.uk/government/publications/hs2-information-papers-environment>), during the reporting period.

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

Two complaints were received during the monitoring period. A description of the complaints, the 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 $L_{Aeq,T}$	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.
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.
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.
LOAEL	Lowest Observed Adverse Effect Level - the level above which adverse effects on health and quality of life can be detected.
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.
SOAEL	Significant Observed Adverse Effect Level - the level above which significant adverse effects on health and quality of life occur.
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 HS2 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.

1.1.2 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 vibration data, and interpretation thereof, for monitoring carried out by HS2 within Birmingham City for the period 1st to 30th June 2021.

1.1.3 Construction sites in the local authority area where monitoring was undertaken during this period include:

- Curzon Street worksite ref.: CS (see plan 1 in Appendix A) where work activities included:
 - Asphalt surfacing;
 - Temporary drainage works, including installation of trench, concrete pouring and backfilling;
 - Installation of duct for power and water connections;
 - Excavation works;
 - Piling platform extension works;
 - General site cleaning works;
 - Stockpile works;
 - Removal of stockpile material;
 - Trial hole works;

- Retaining wall demolition works; and
- Vegetation clearance.
- Museum Collection Centre worksite ref.: MCC (see plan 1 in Appendix A), where work activities included:
 - Site set up.
- Twisted Oak Stables worksite, ref.: TOS (see plan 3 in Appendix A) where work activities included:
 - Cutting and filling works;
 - Laying works;
 - Construction of bentonite plant;
 - Construction of guide walls;
 - Excavation of diaphragm walls;
 - Deliveries; and
 - Drainage works, including installation of sump and pond inlet and outlet;
- Washwood Heath Depot worksite, ref.: WWHD (see plan 2 in Appendix A) where work activities included:
 - Earthworks for bentonite plant, clay laying down works and removal of obstruction;
 - Soil testing - shear and nuclear density testing (NDT);
 - Breaking out works;
 - Laying works of haul road area; and
 - Asbestos surveys.

1.1.4 Further work where monitoring did not take place, were also undertaken at the following locations:

- Dorset Road, Saltley Business Park and Network Park (water utility works);
- Duddeston Mill Road (water utility works and substation diversion works);
- B4114 Saltley Viaduct (site setup, removal of building foundations, stockpiling works, water and power utility works);
- Landor Street (works at substation);
- Faraday Avenue (power utility diversion);
- M42/M6 Link Viaducts (Enabling works); and
- Bromford Tunnel Intermediate Shaft (Clearing vegetation, cabin foundations, setup welfare and cabin offices, breakout of kerbs, creation of reinforced concrete working platforms, and delivery of plant and equipment).

1.1.5 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 Four noise and five vibration monitoring installations were active in June in the Birmingham City area
- 1.2.2 Table 2 summarises the position of noise and vibration monitoring installations within the Birmingham City area in June 2021.
- 1.2.3 Maps showing the position of noise and vibration monitoring installations are presented in Appendix B.

Table 2: Monitoring Locations

Worksite Reference	Measurement Reference	Address
Curzon Street (CS)	CS-N1	Curzon Street, Birmingham
Museum Collection Centre (MCC)	MCC-V1	25 Dolman Street, Birmingham (Top Floor)
	MCC-V2	25 Dolman Street, Birmingham (Outside)
Twisted Oak Stables (TOS)	TOS-N1	B4118-Birmingham Road, Water Orton, Birmingham
	TOS-V1	B4118-Birmingham Road, Water Orton, Birmingham
Washwood Heath Depot (WWHD)	WWHD-N1	Drews Lane, Birmingham
	WWHD-V1	Drews Lane, Birmingham
	WWHD-N2	Common Lane, Birmingham
	WWHD-V2	Common Lane, Birmingham

2 Summary of Results

2.1 Summary of Measured Noise and Vibration Levels

2.1.1 Table 3 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.

Table 3: Summary of Measured dB LAeq Data over the Monitoring Period

Worksite Reference	Measurement Reference	Site Address	Free-field or Façade Measurement	Weekly Average LAeq,T (highest day LAeq,T)					Saturday Average LAeq,T (highest day LAeq,T)					Sunday / Public Holiday Average LAeq,T (highest day LAeq,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
CS	CS-N1	Curzon Street, Birmingham	Free-field	63.9 (64.5)	64.6 (65.4)	63.3 (63.7)	63.0 (64.8)	59.9 (63.3)	61.5 (61.5)	62.4 (62.4)	62.4 (62.4)	62.9 (64.2)	59.5 (62.3)	62.4 (64.8)	59.7 (62.7)
TOS	TOS-N1	B4118-Birmingham Road, Water Orton, Birmingham	Free-field	64.4 (68.5)	67.8 (76.3)	64.1 (67.7)	63.4 (67.3)	61.2 (70.6)	64.4 (67.4)	65.6 (68.5)	63.2 (64.4)	63.2 (67.0)	58.4 (62.7)	62.6 (66.1)	61.0 (67.0)
WWHD	WWHD-N1	Drews Lane, Birmingham	Free-field	54.6 (57.5)	61.6 (66.9)	54.0 (55.4)	52.5 (56.7)	52.6 (58.3)	56.4 (57.3)	60.1 (62.4)	56.7 (56.7)	55.5 (57.3)	51.6 (56.5)	55.5 (58.1)	52.5 (59.6)
	WWHD-N2	Common Lane, Birmingham	Free-field	52.3 (55.2)	55.5 (57.6)	53.0 (53.2)	51.3 (55.0)	51.6 (58.6)	53.0 (54.8)	54.2 (55.3)	53.0 (53.0)	53.5 (55.3)	50.1 (54.5)	53.7 (56.4)	50.6 (60.1)

2.1.2 Table 4 presents a summary of the measured vibration levels at each monitoring location over the reporting period. The highest component PPV measured during periods of works along any axis is presented in the table.

Table 4: Summary of Measured Component PPV Data over the Monitoring Period

Worksite Reference	Measurement Reference	Monitor Address	Highest PPV measured in any axis, mm/s
MCC	MCC-V1	25 Dolman Street (Top Floor)	2.01 (Z-axis)
	MCC-V2	25 Dolman Street (Outside)	6.25 (Z-axis)
TOS	TOS-V1	B4118- Birmingham Road, Water Orton, Birmingham	14.98 (Z-axis) **
WWHD	WWHD-V1	Drews Lane, Birmingham	0.66 (X-axis)
WWHD	WWHD-V2	Common Lane, Birmingham	6.94 (X-axis)**

** High vibration levels are due to the proximity of the construction activities to the vibration monitor. The nearest residential receptors are further away from the works and vibration levels at the receptor will therefore be lower.

2.1.3 Appendix C presents graphs of the noise and vibration monitoring data over the month for each of the measurement locations. Noise data presented consists of 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). Vibration data presented consist of hourly PPV values. 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>.

2.2 Exceedances of the LOAEL and SOAEL

2.2.1 The lowest observed adverse effect level (LOAEL) is defined in the Planning Practice Guidance – Noise (PPG) as the level above which "noise starts to cause small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life".

- 2.2.2 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."
- 2.2.3 HS2 Phase One Information Paper E23: Control of Construction Noise and Vibration sets out the LOAELs and SOAELs for construction noise.
- 2.2.4 Where reported construction noise levels exceed the LOAEL and SOAEL, relevant periods will be identified. Summary statistics to evaluate ongoing qualification for noise insulation and temporary rehousing are also presented where relevant.
- 2.2.5 Table 5 presents a summary of recorded exceedances of the LOAEL and SOAEL at each measurement location over the reporting period, including the number of exceedances during each time period.

Table 5: Summary of Exceedances of LOAEL and SOAEL

Worksite Reference	Measurement Reference	Site Address	Day (Weekday, Saturday, Sunday, Night)	Time period	Number of exceedances of LOAEL	Number of exceedances of SOAEL
CS	CS-N1*	Curzon Street, Birmingham	All days	All periods	No exceedance	No exceedance
TOS	TOS-N1*	B4118- Birmingham Road, Water Orton, Birmingham	All days	All periods	No exceedance	No exceedance
WWHD	WWHD-N1*	Drews Lane, Birmingham	All days	All periods	No exceedance	No exceedance
WWHD	WWHD-N2*	Common Lane, Birmingham	All days	All periods	No exceedance	No exceedance

* A distance correction has been applied when calculating exceedances of the LOAEL and SOAEL.

- 2.2.6 No exceedances of the LOAEL and SOAEL were recorded due to HS2 construction works during June 2021.

2.3 Exceedances of Trigger Level

2.3.1 Table 6 provides a summary of exceedances of the S61 trigger vibration levels determined to be due to HS2 related construction vibration 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
-	-	-	-	-	-

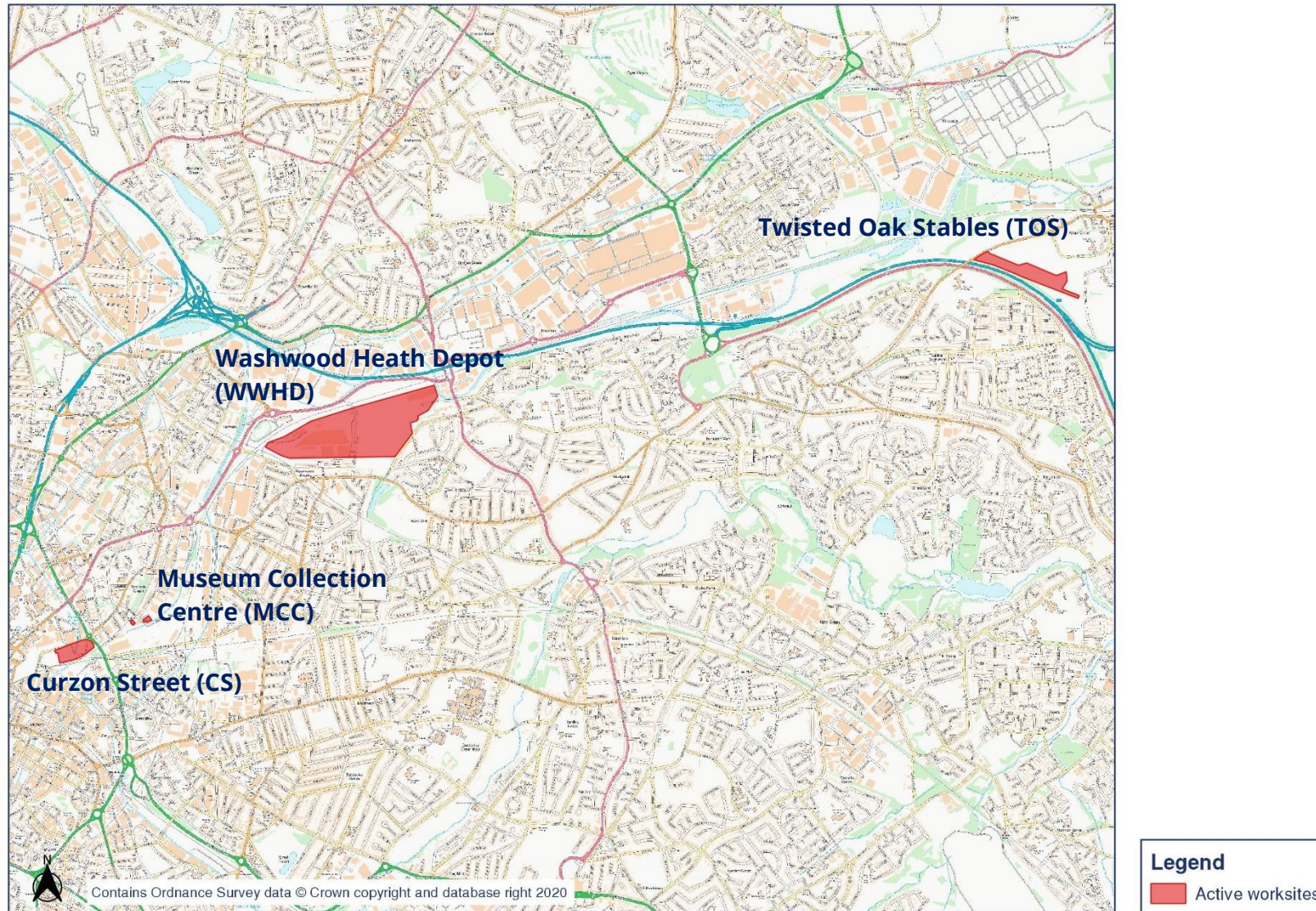
2.4 Complaints

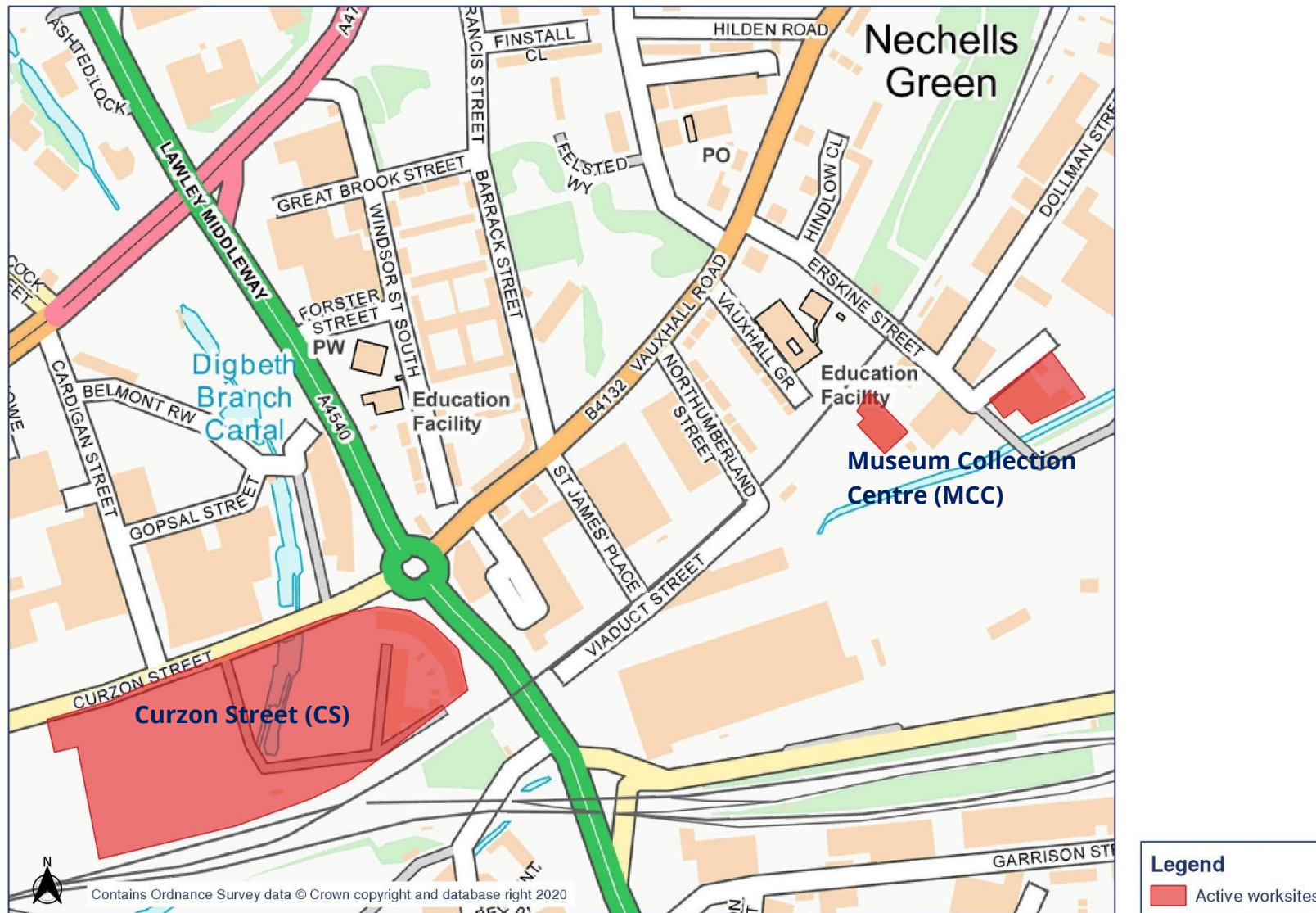
2.4.1 Table 7 provides a summary of complaint information related to noise and vibration received during the reporting period, along with the findings of any investigation.

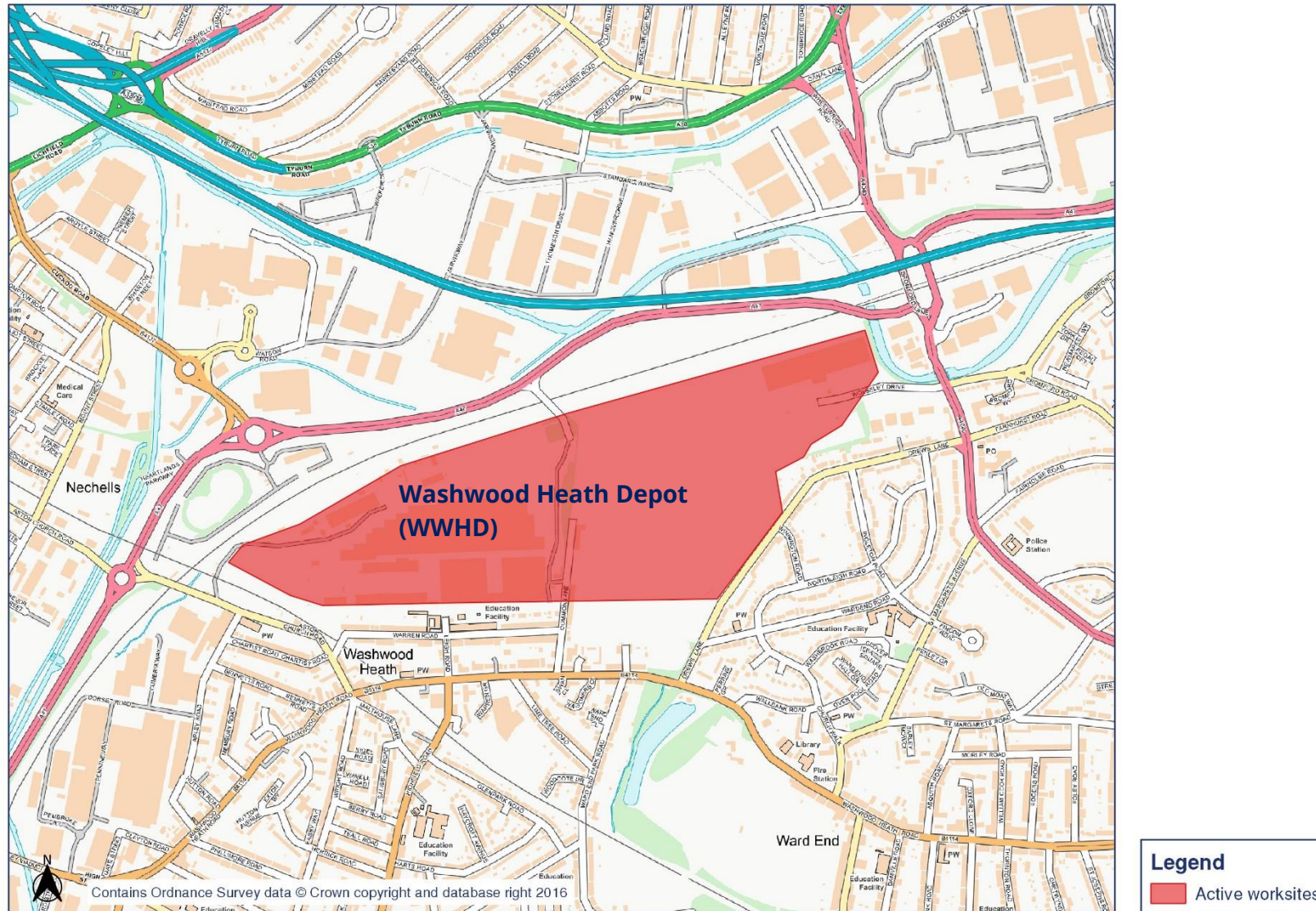
Table 7: Summary of Complaints

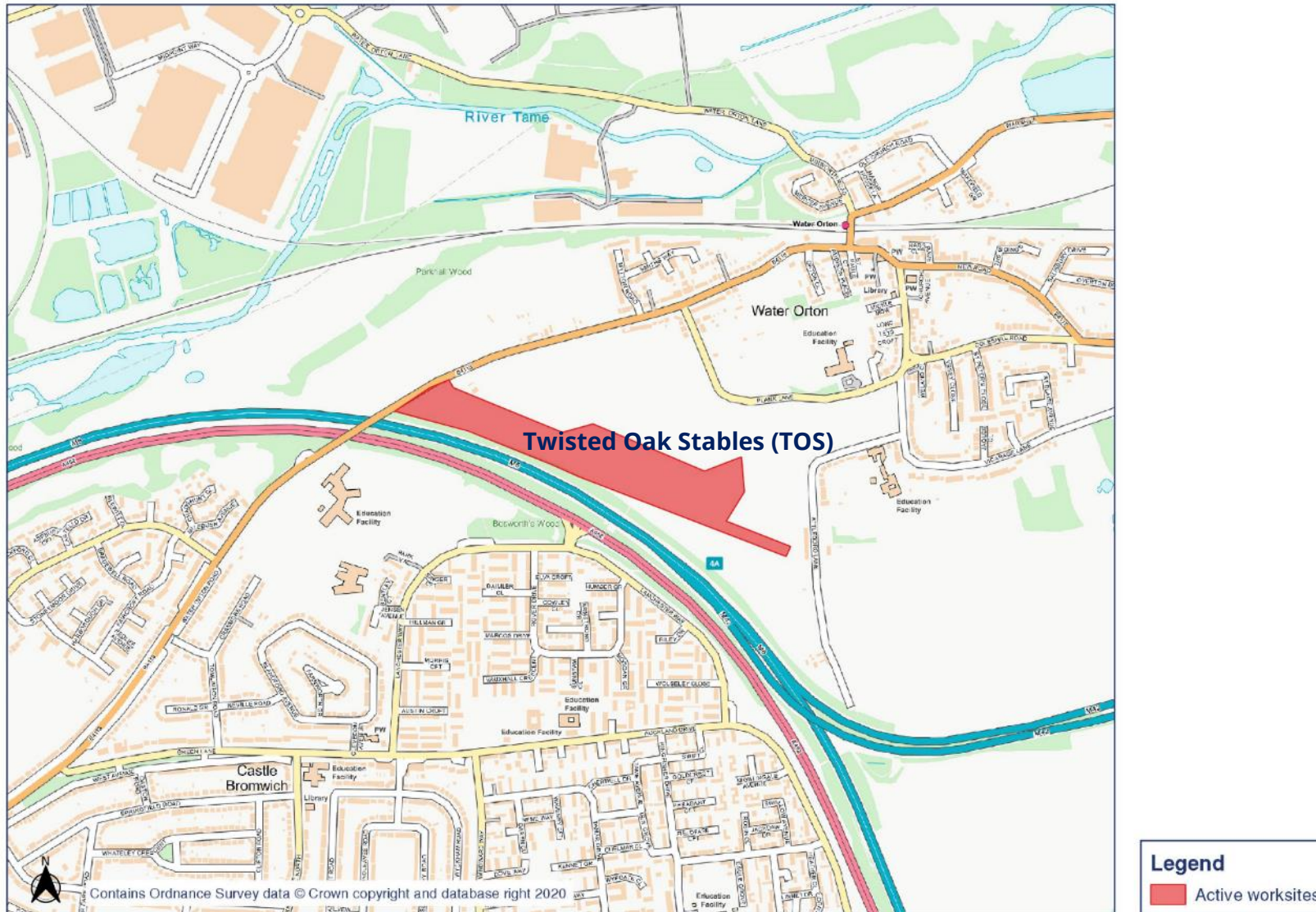
Complaint Reference Number	Worksite Reference	Description of Complaint	Results of Investigation	Actions Taken
HS2-21-42069-C	WWHD	Complaint due to Intermittent noise coming from the site.	Investigations confirmed that works were undertaken within the site at the time of the complaint.	Noise monitoring is on place nearby the worksite, and It has been confirmed that no exceedance of trigger noise levels occurred.
HS2-21-42076-C	WWHD	Complaint due to vibration causing cracks in houses.	Investigations shown that fill and stabilisation activities on haul road were being completed at the time the complaint was made. Works were occurring at approximately 175m from the property in question, and the main construction plant was a 12-ton self-propelled roller. In these circumstances and at these distances, risk assessed vibration has not being significant enough to cause cosmetic or structural damage to buildings. This has been confirmed by the measured levels of vibration at the boundary of our site adjacent to properties on Attleboro lane, which are barely perceptible, and way below the project criteria.	Contractor is looking into further monitoring in the area in response to the concerns raised. Information on small claims process has also been given to stakeholder.

Appendix A Site Locations

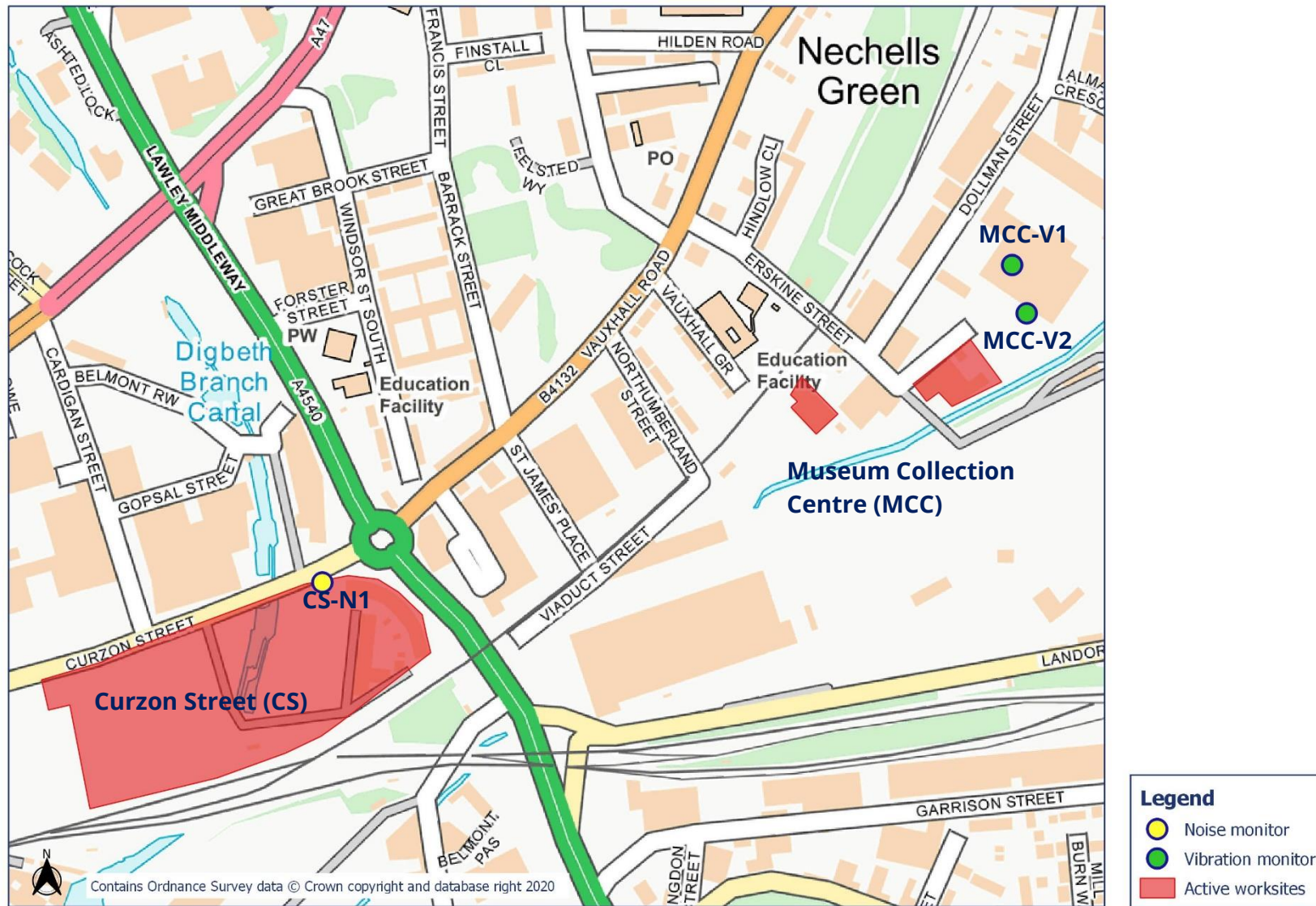






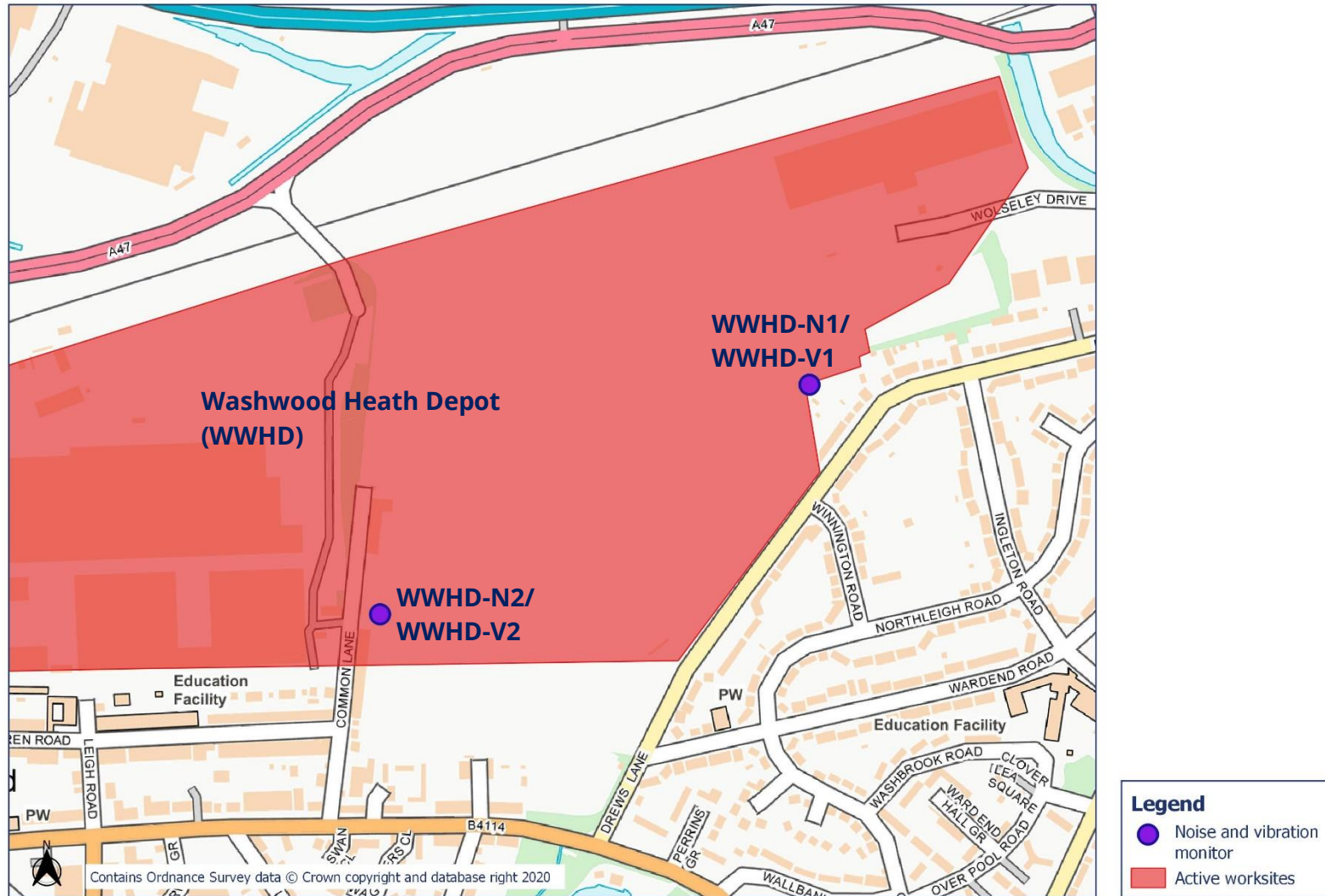


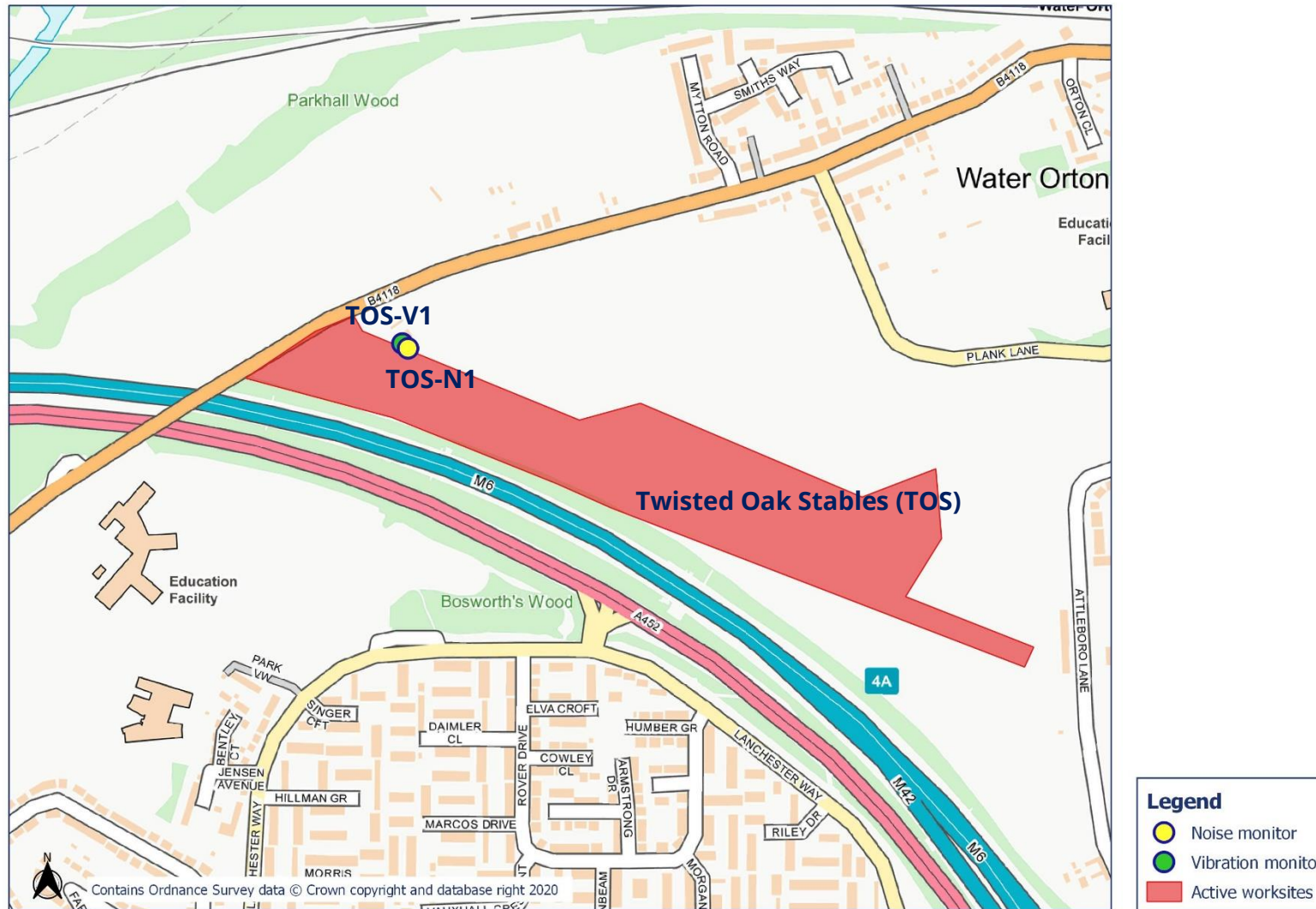
Appendix B Monitoring Locations



HS2

Noise and Vibration Monitoring Plan - 2



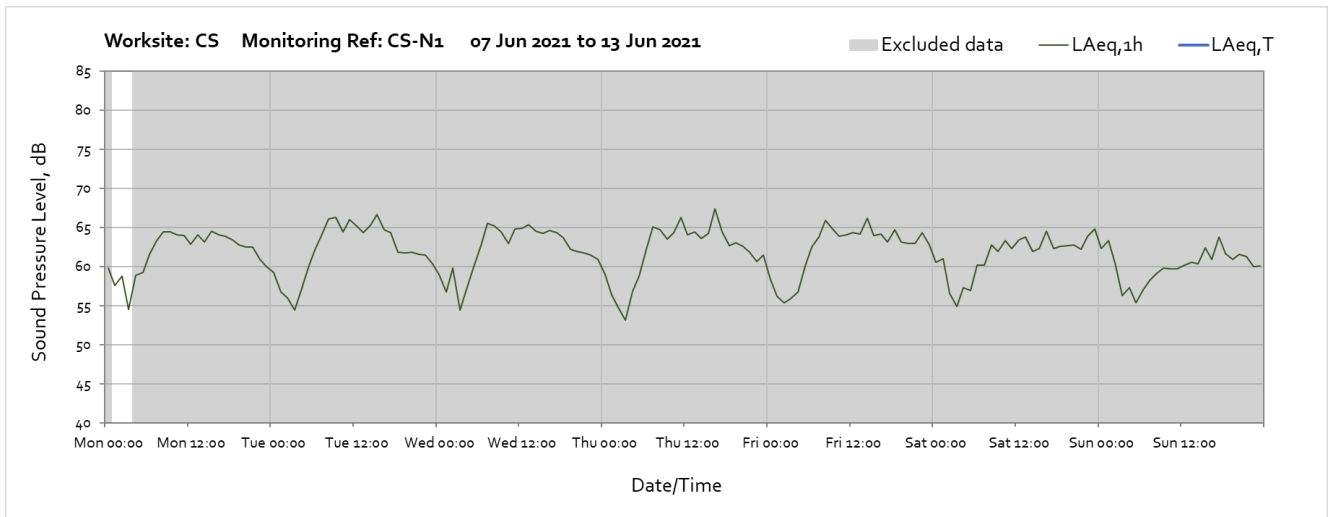
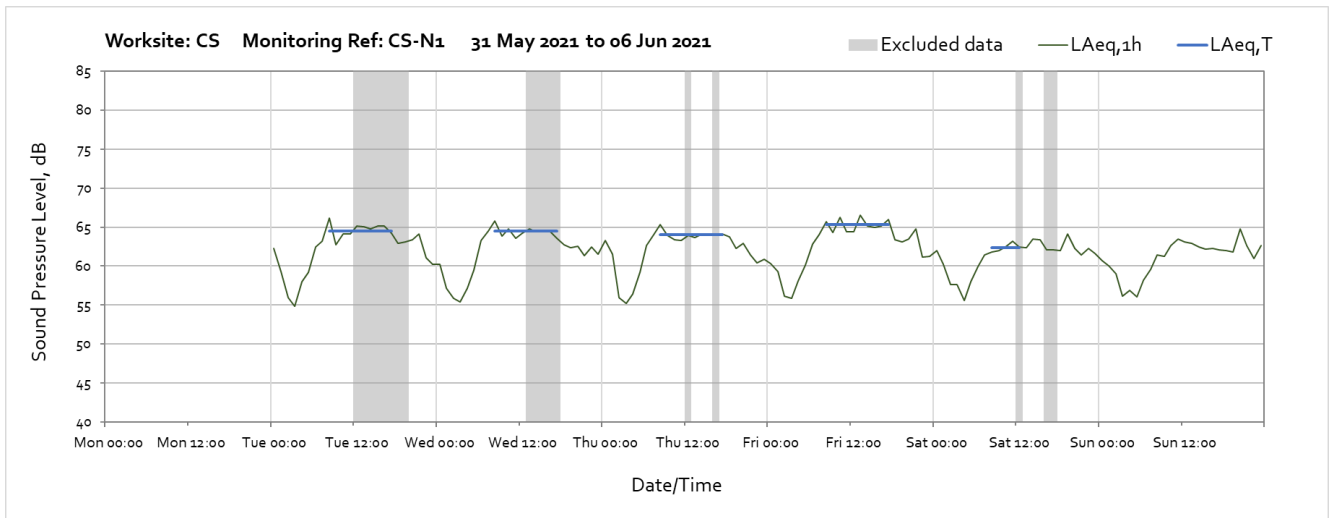


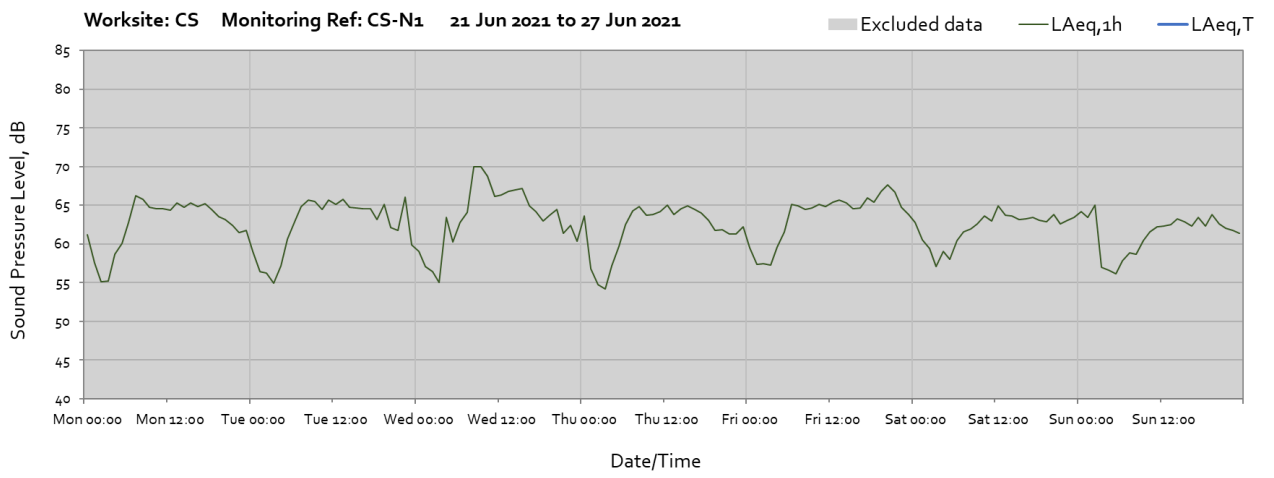
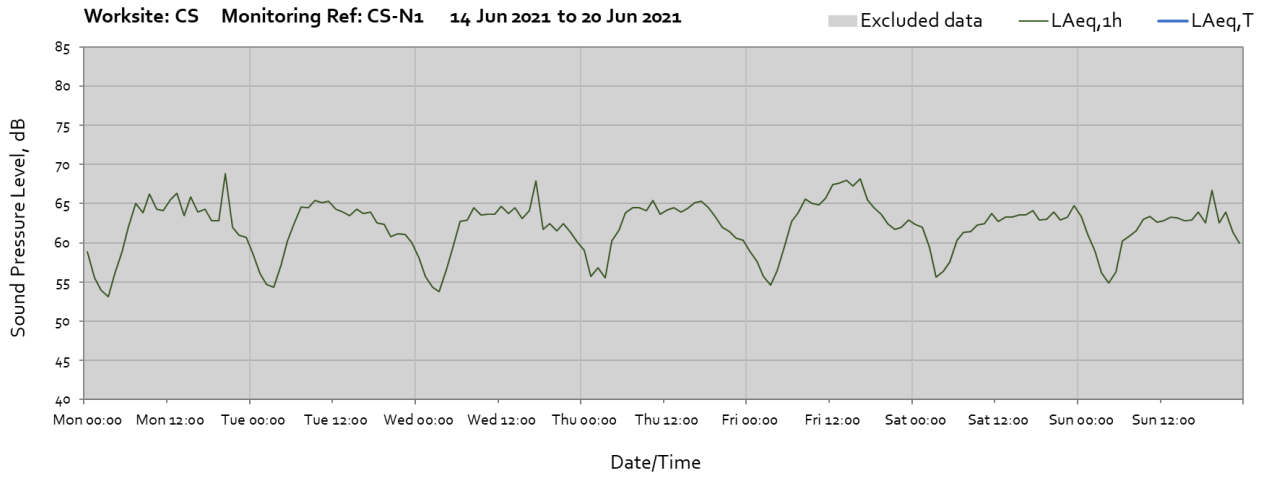
Appendix C Data

Noise

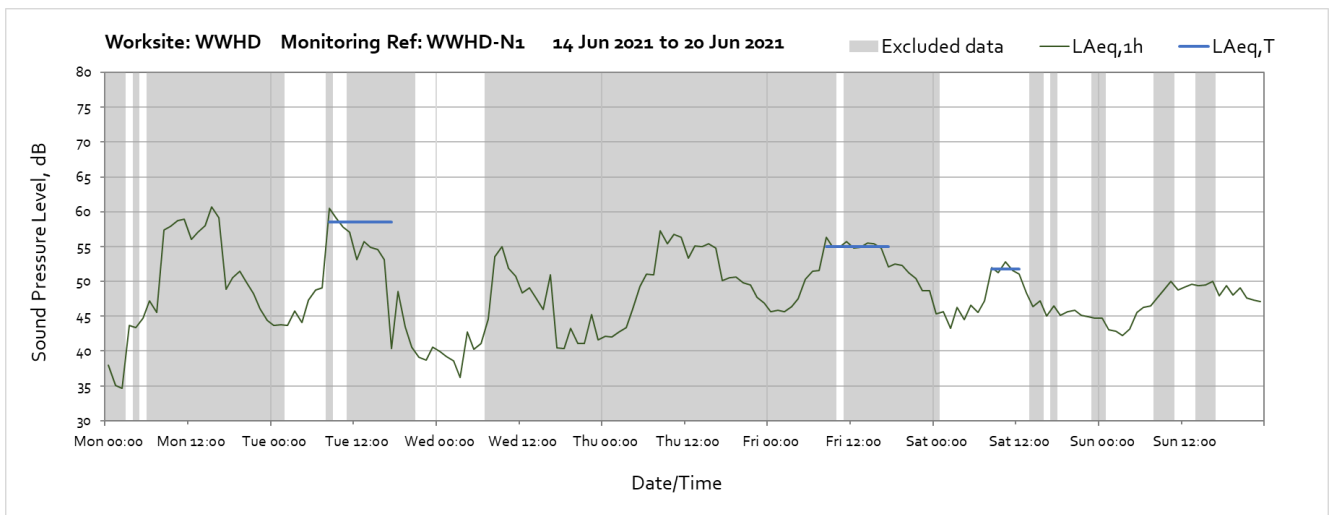
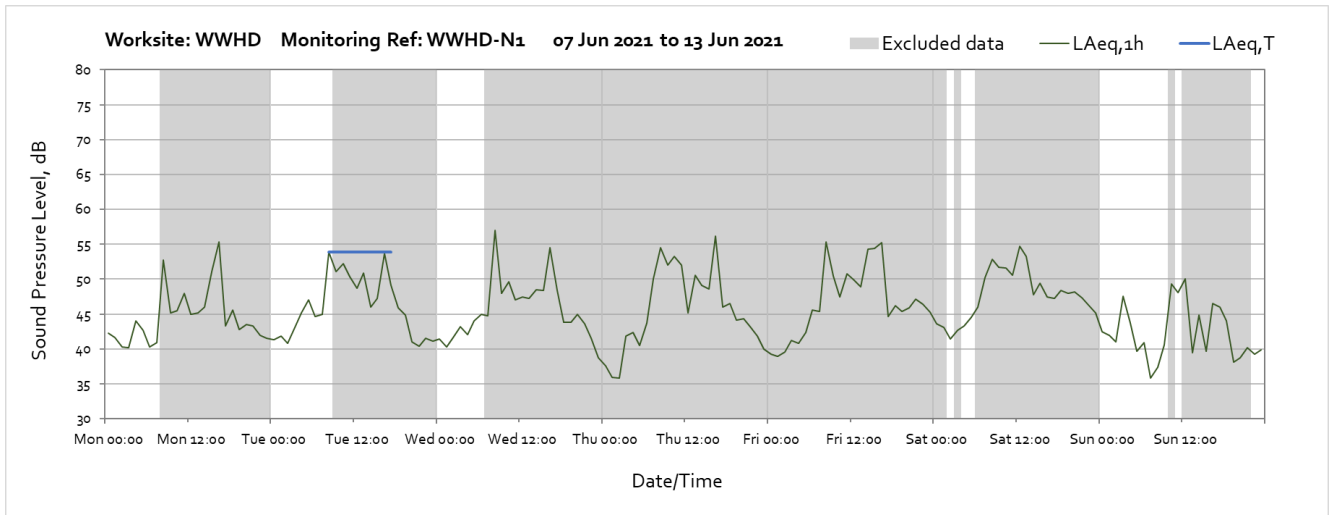
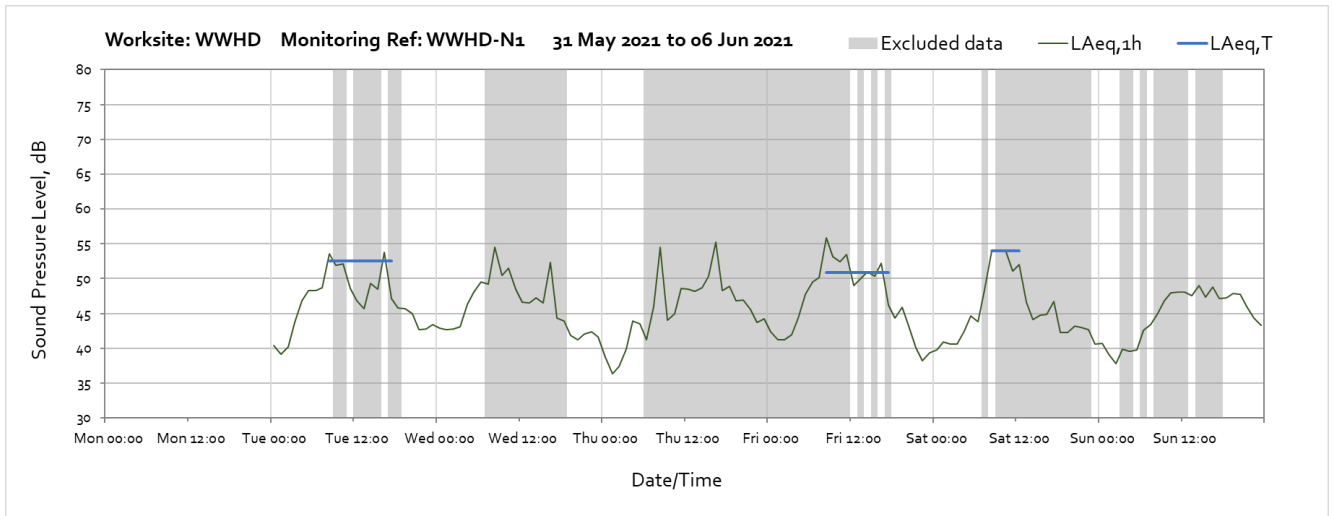
The following graphs show the hourly measured ambient noise level $L_{Aeq,1h}$ and, where relevant, the averaged noise level $L_{Aeq,T}$ values, where the time period T is as specified in Table 1 of HS2 Information Paper E23. Periods with adversely weather affected noise levels are greyed out and have been excluded from the calculation of the $L_{Aeq,T}$ values in Table 3 of the main report.

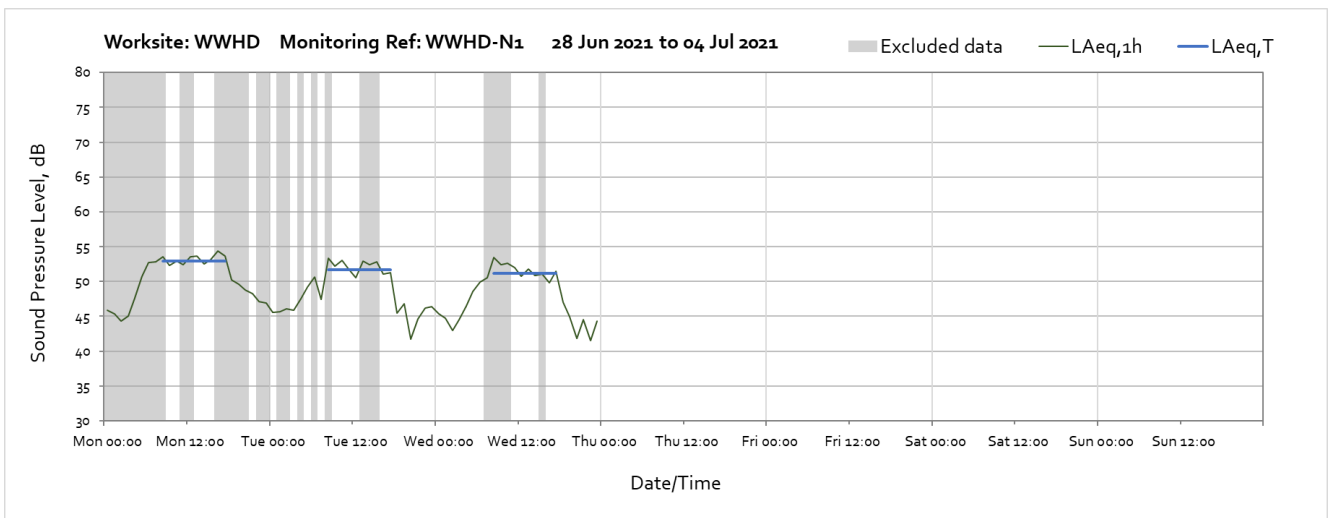
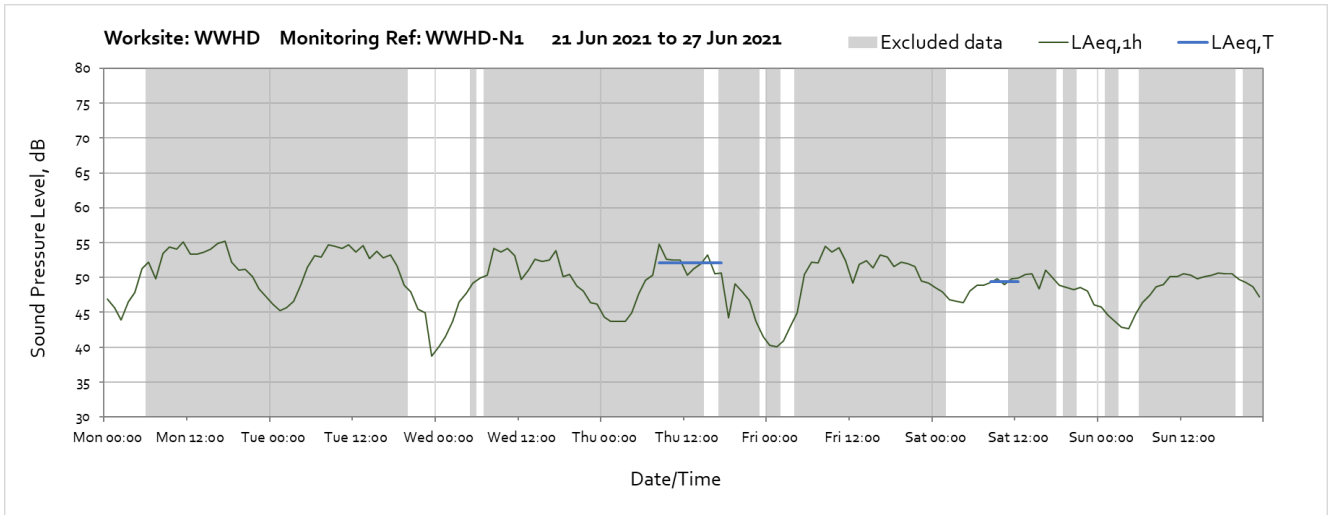
Worksite: Curzon Street (CS) – Monitoring Ref: CS-N1



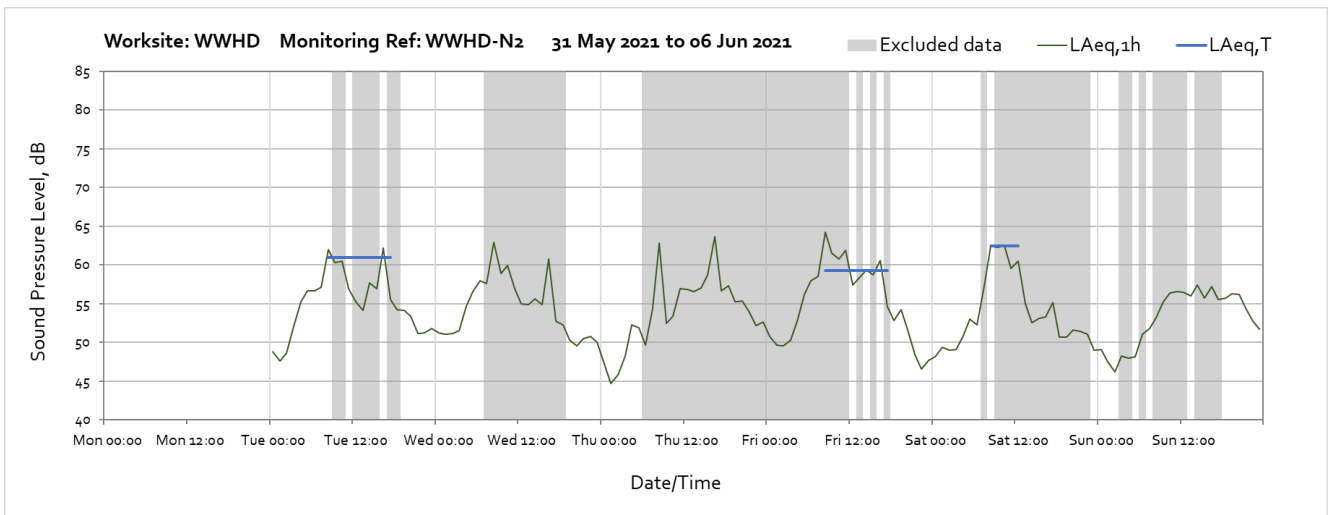


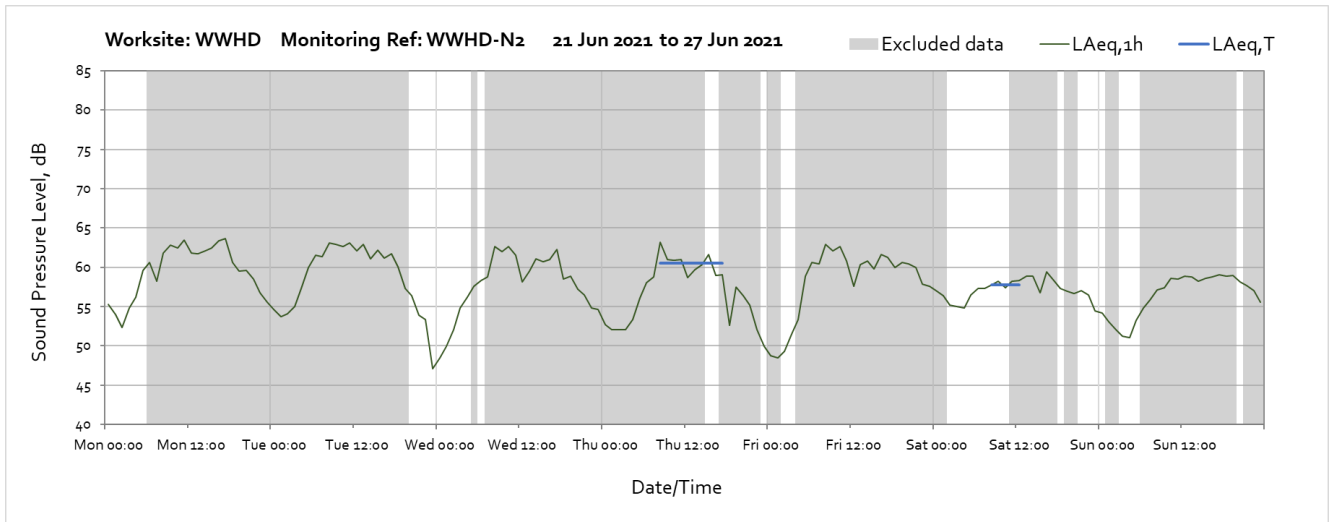
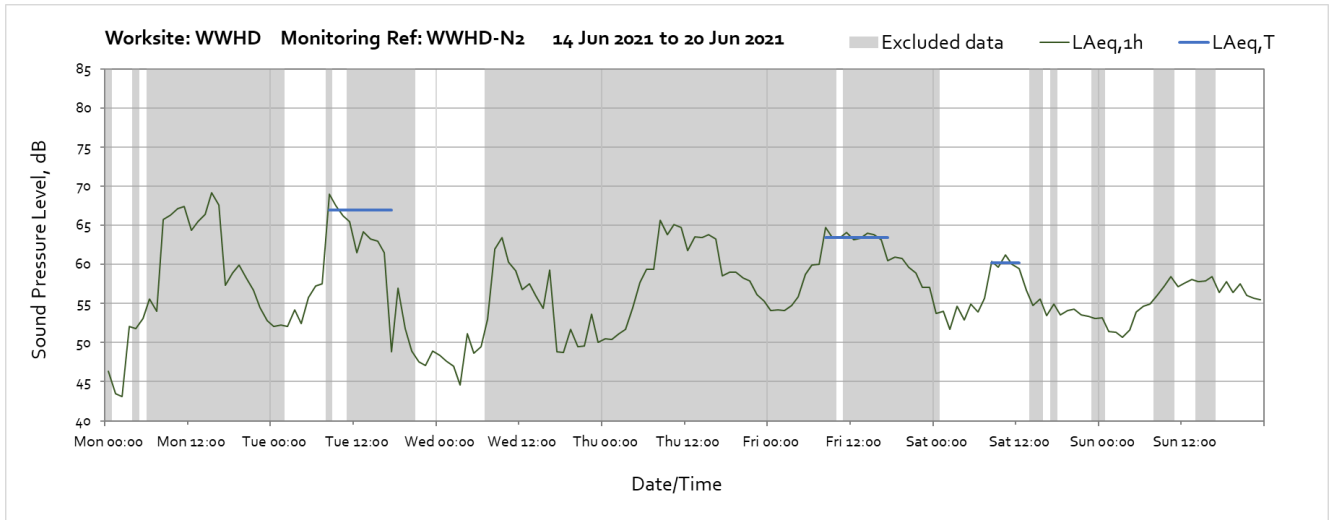
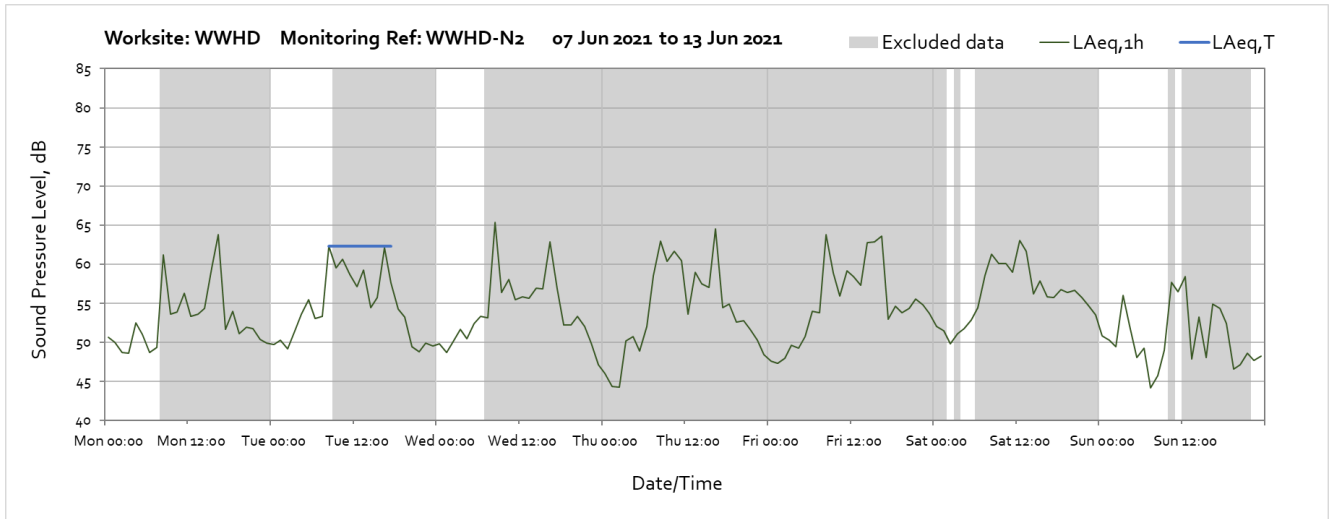
Worksite: Washwood Heath Depot (WWHD) – Monitoring Ref: WWHD-N1

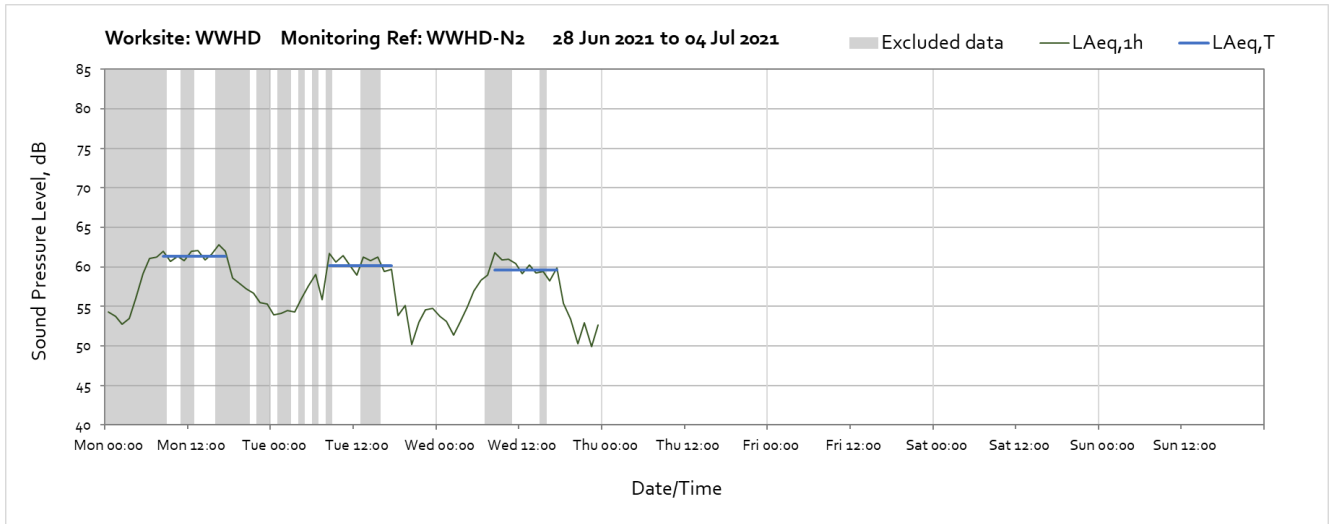




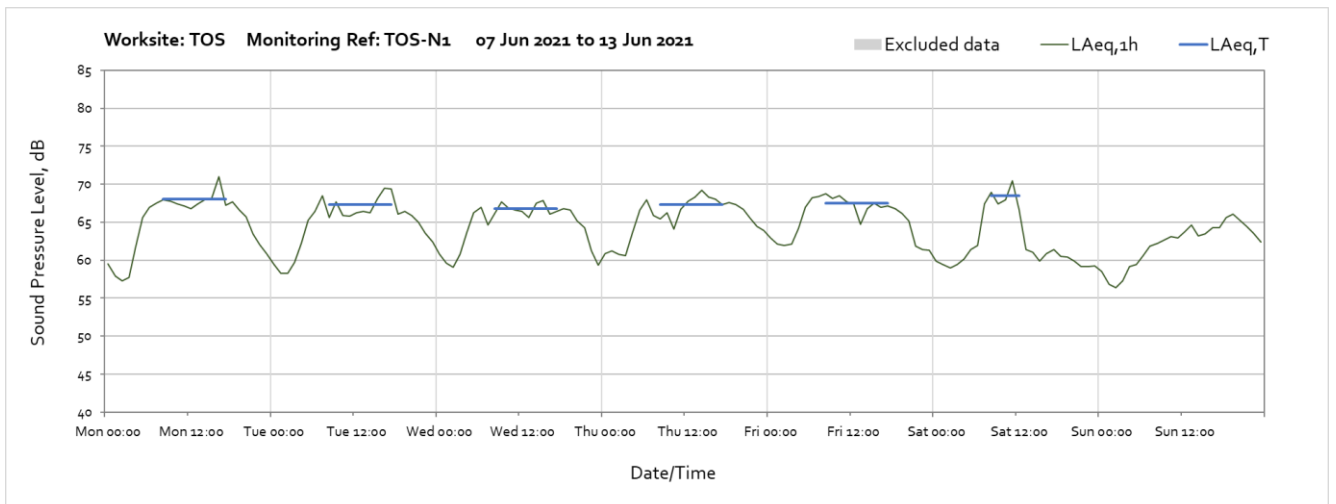
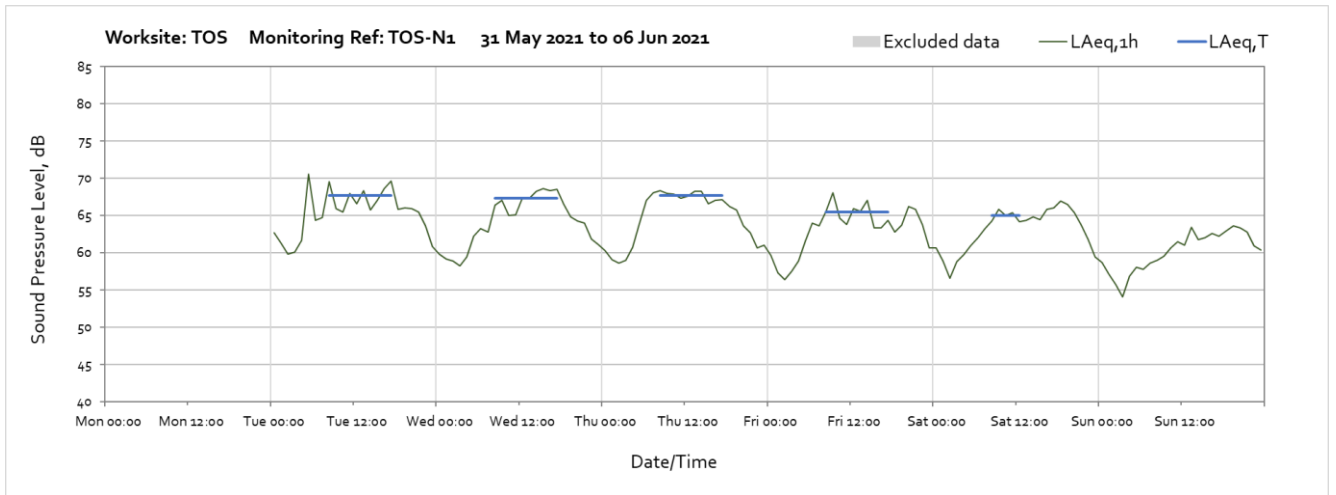
Worksite: Washwood Heath Depot (WWHD) – Monitoring Ref: WWHD-N2

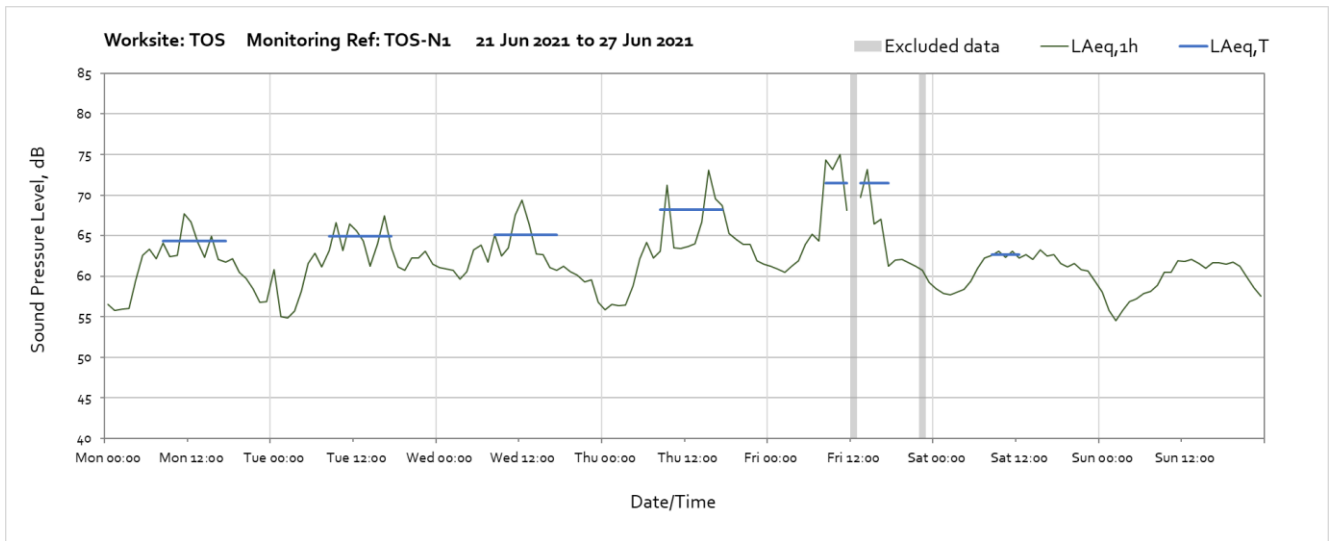
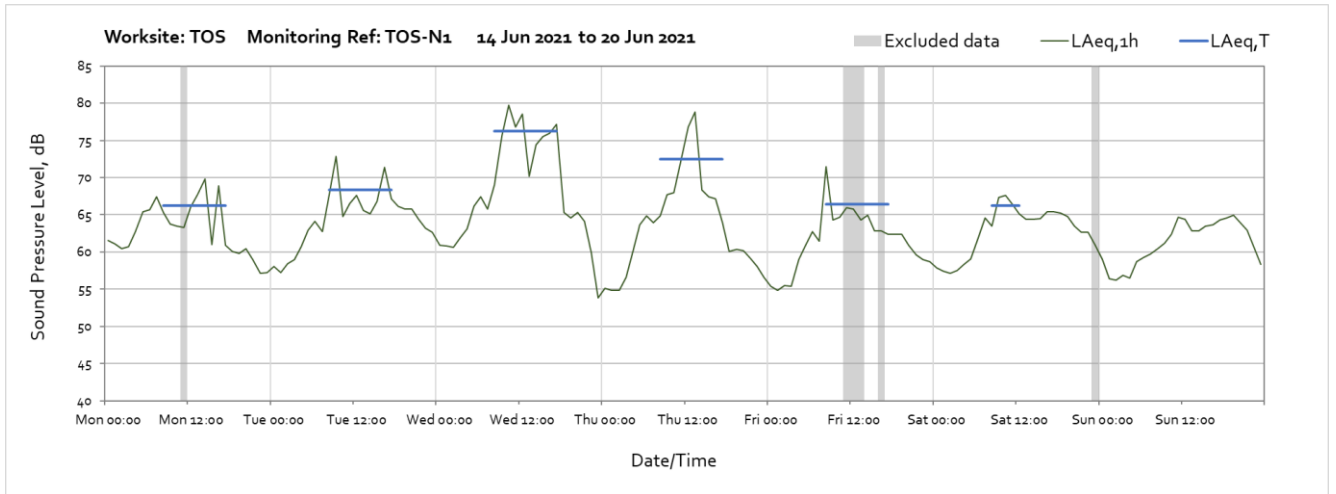




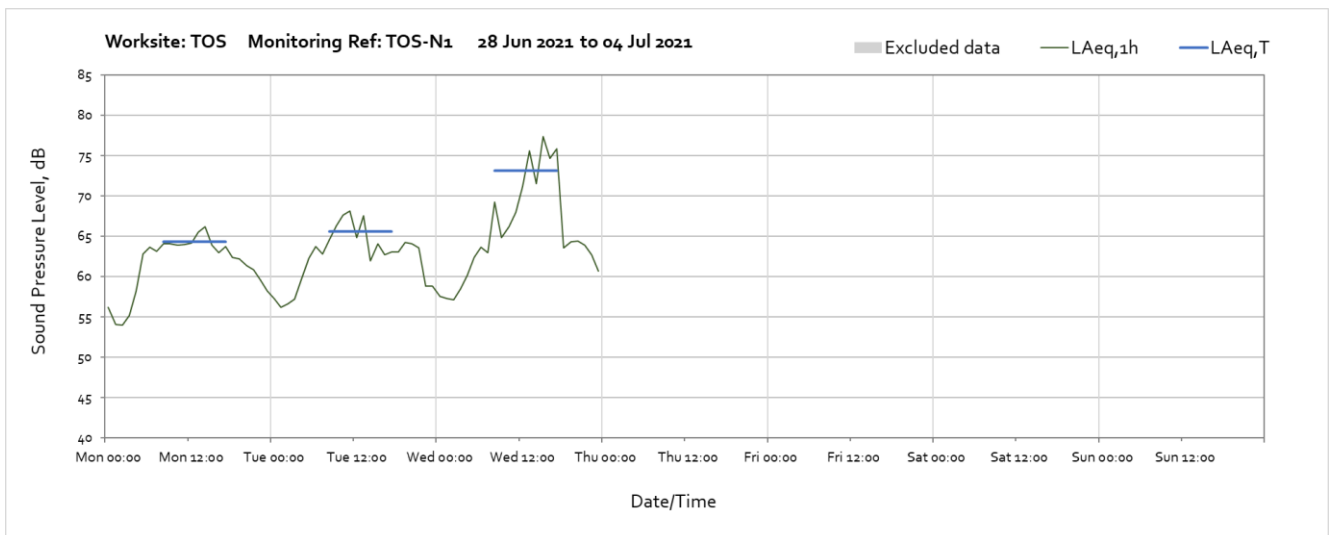


Worksite: Twisted Oak Stables (TOS) – Monitoring Ref: TOS-N1





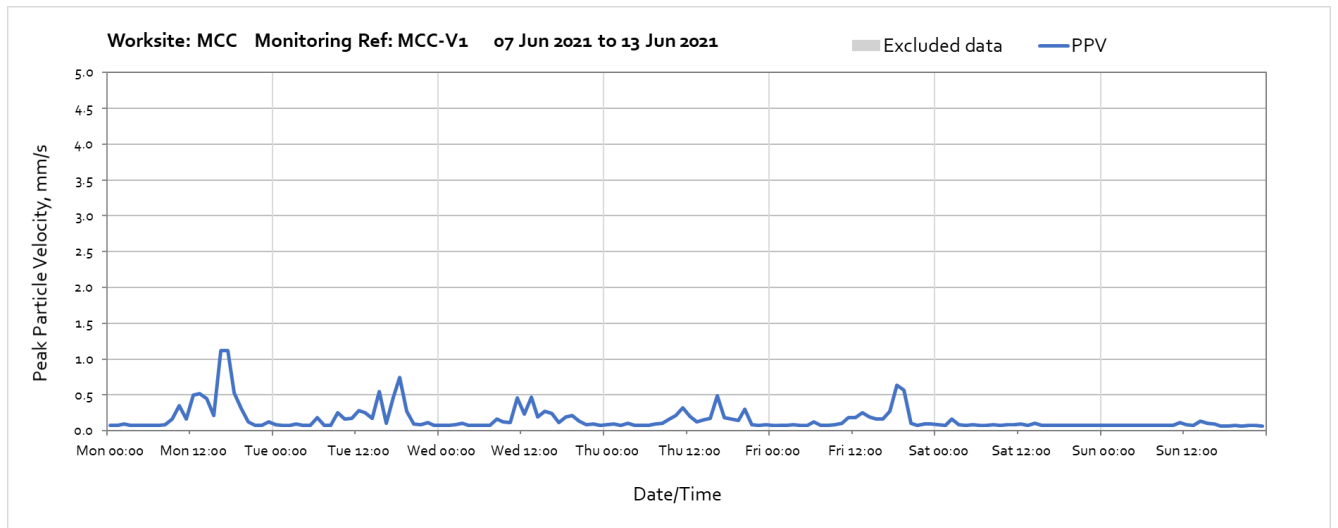
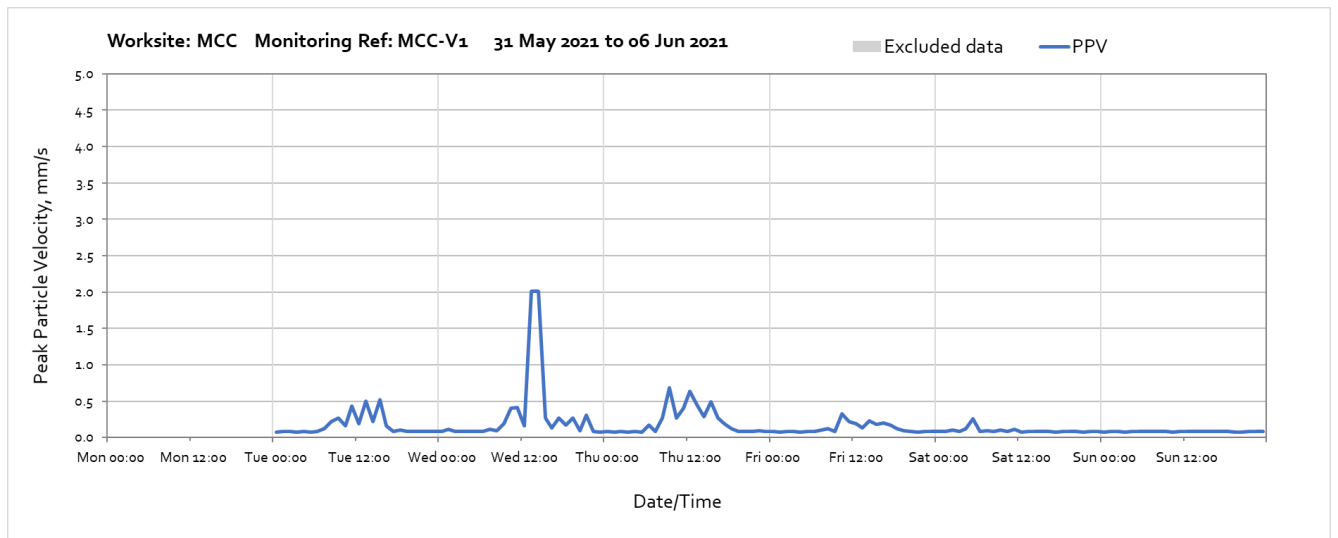
Note: missing data between 12:00 and 13:00 on Friday 25th June is due to relocation of weather equipment.

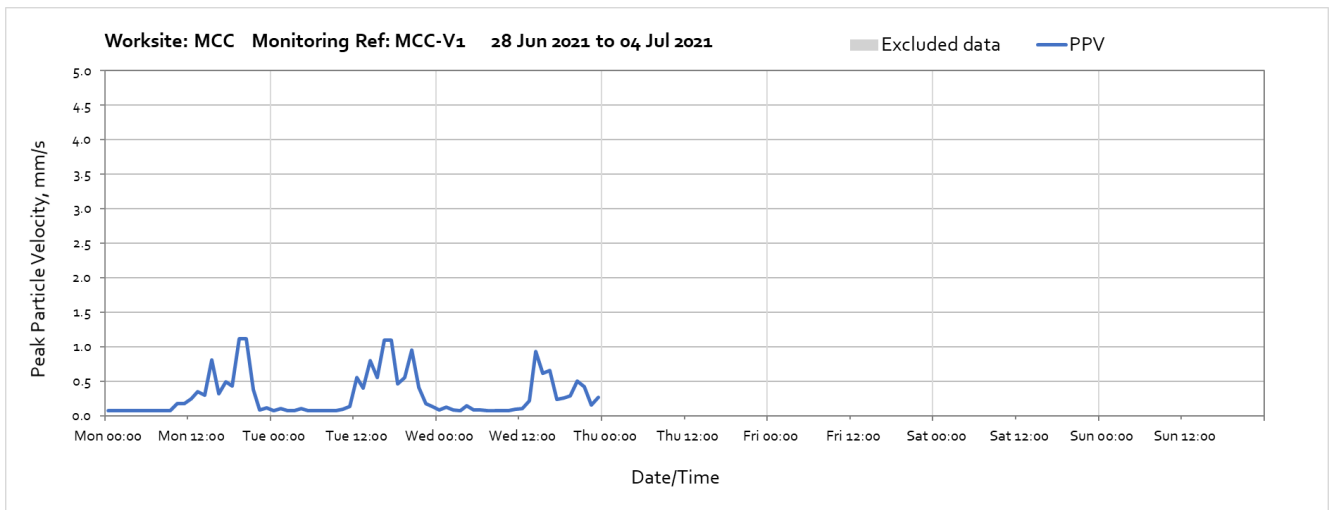
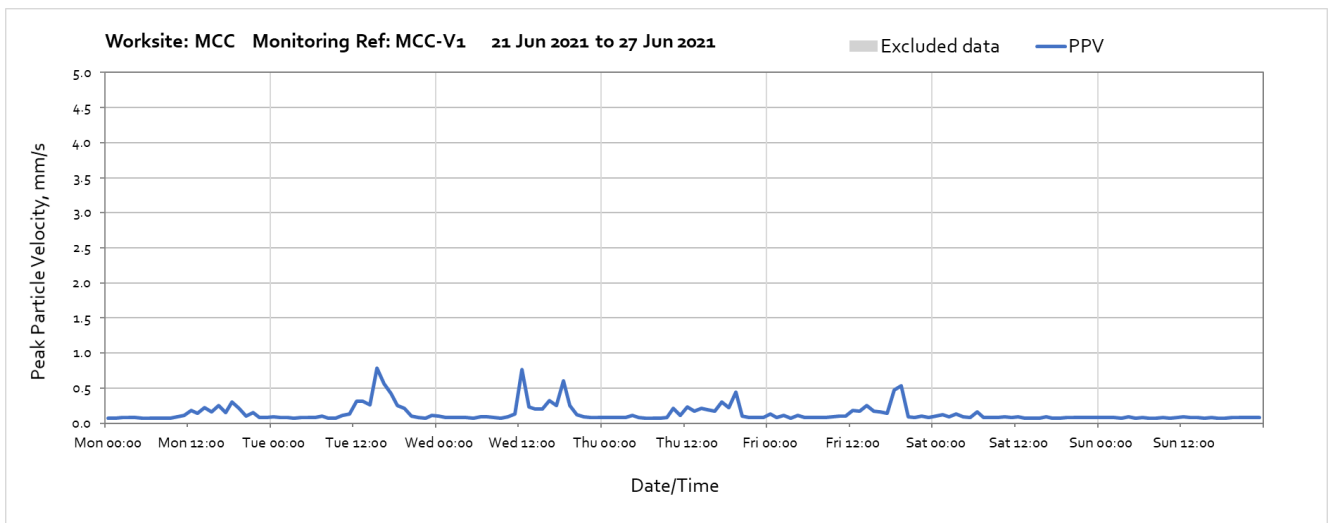
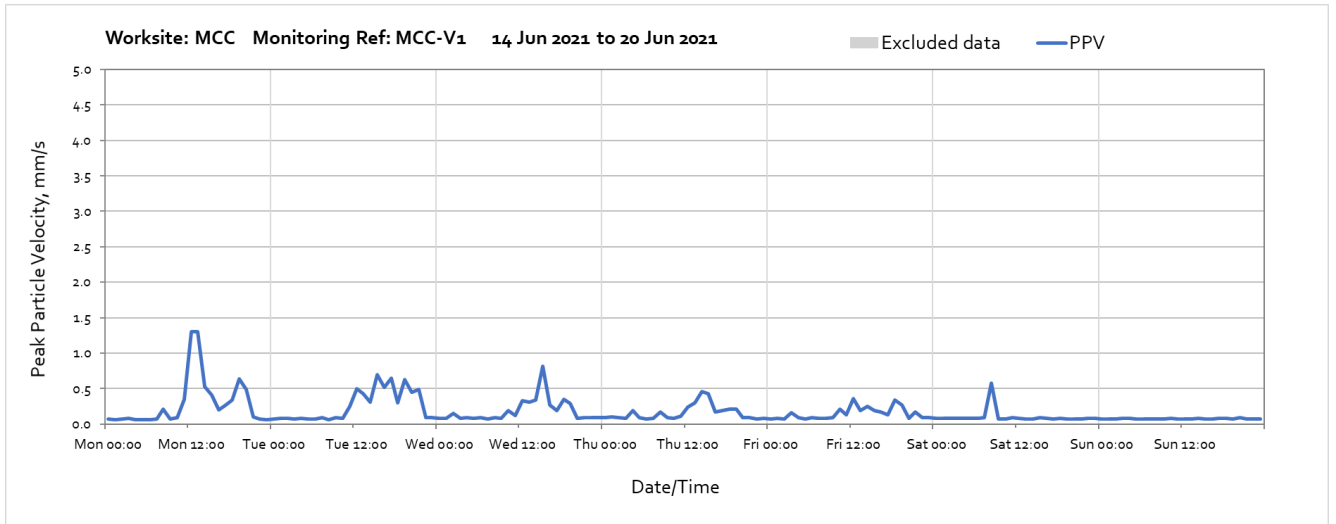


Vibration

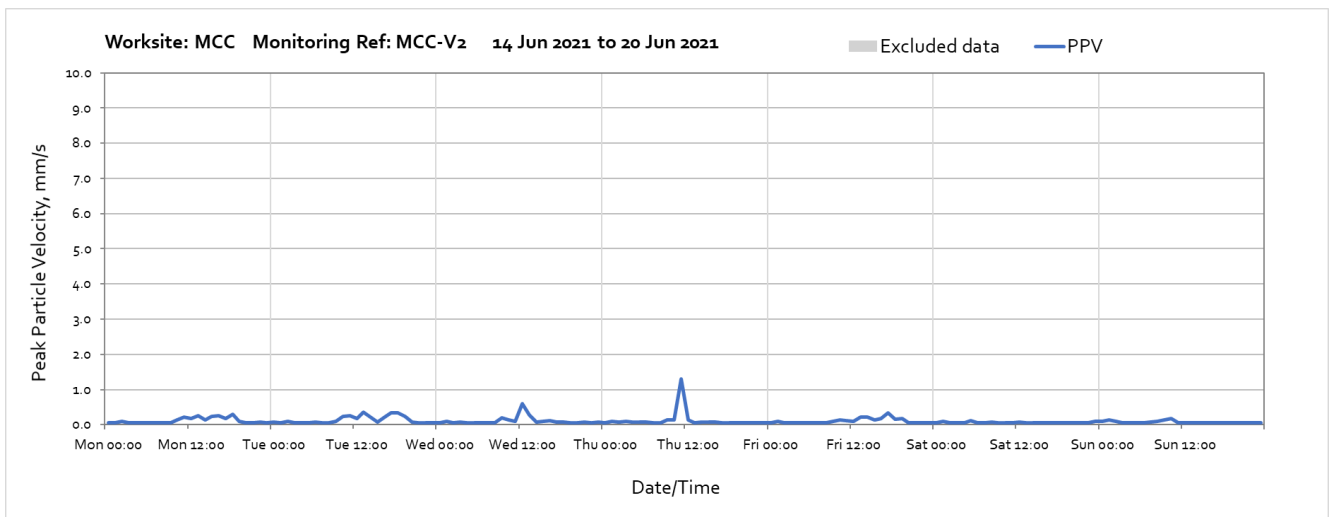
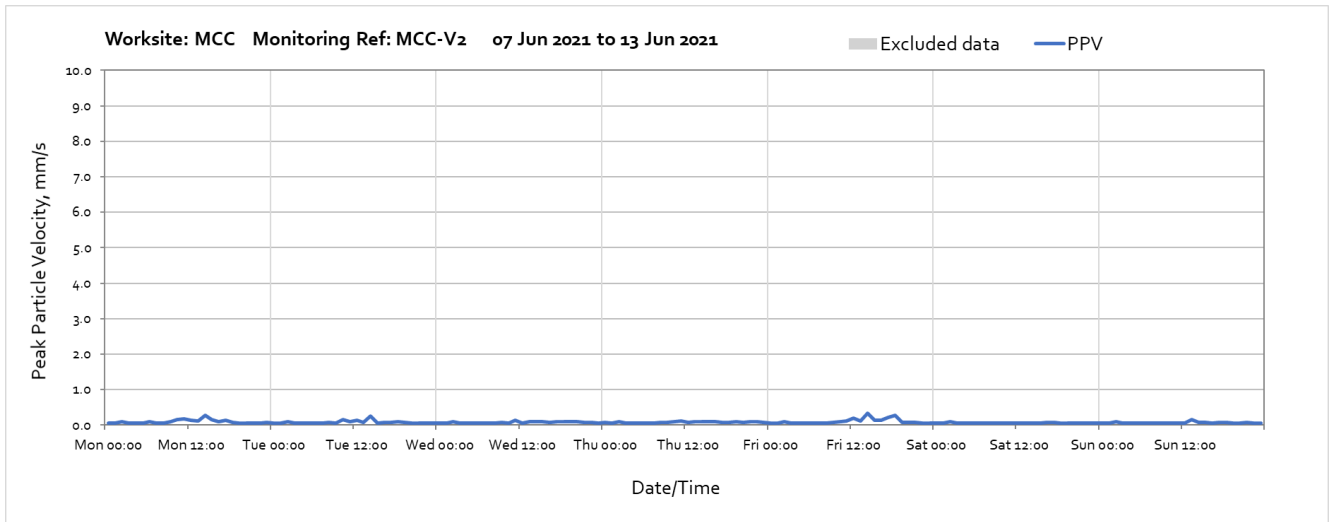
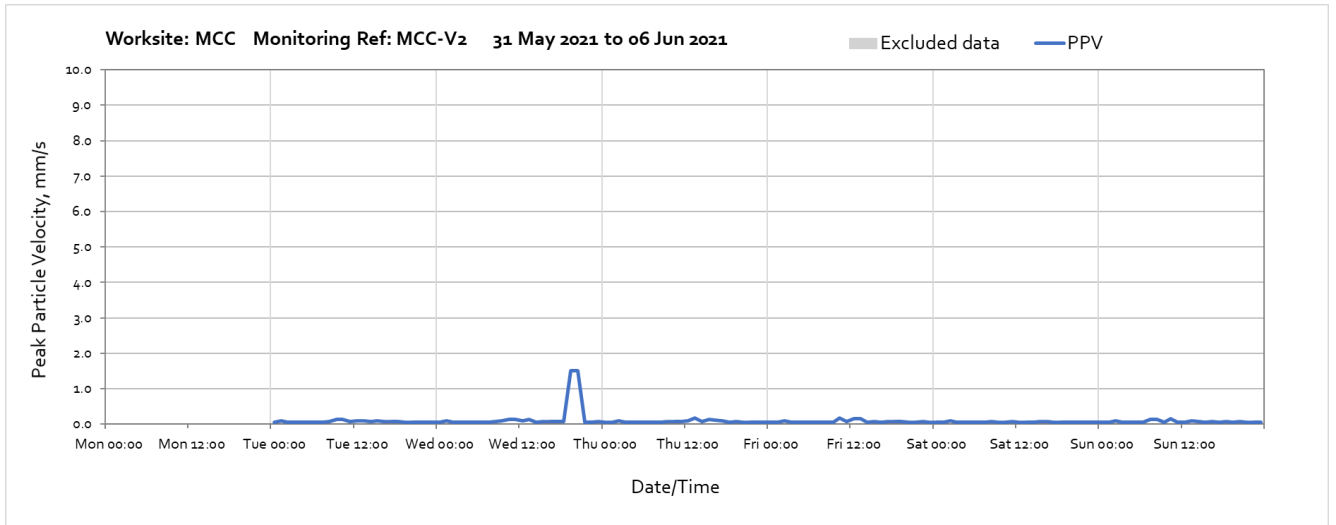
The following graphs show the hourly measured peak particle velocity PPV recorded during the monitoring period. The graphs show the highest PPV of the three orthogonal axis x, y and z. Where high values of PPV were caused by local interference with the vibration monitor, which are not representative of HS2 construction works, these values have been greyed out in the following charts and have been excluded to calculate values in Table 4 of the main report.

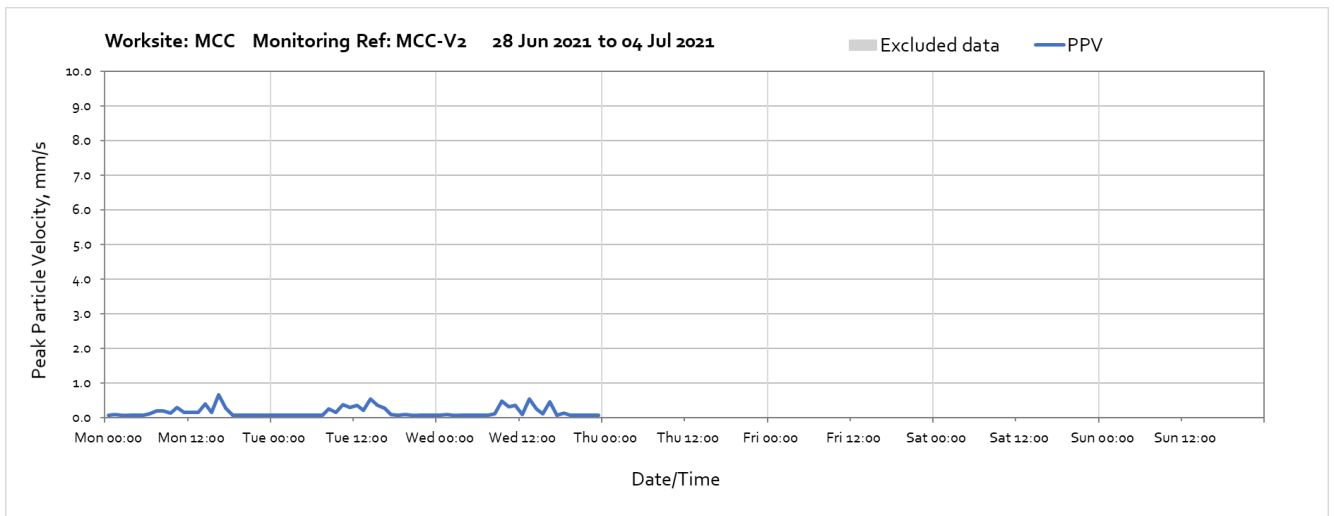
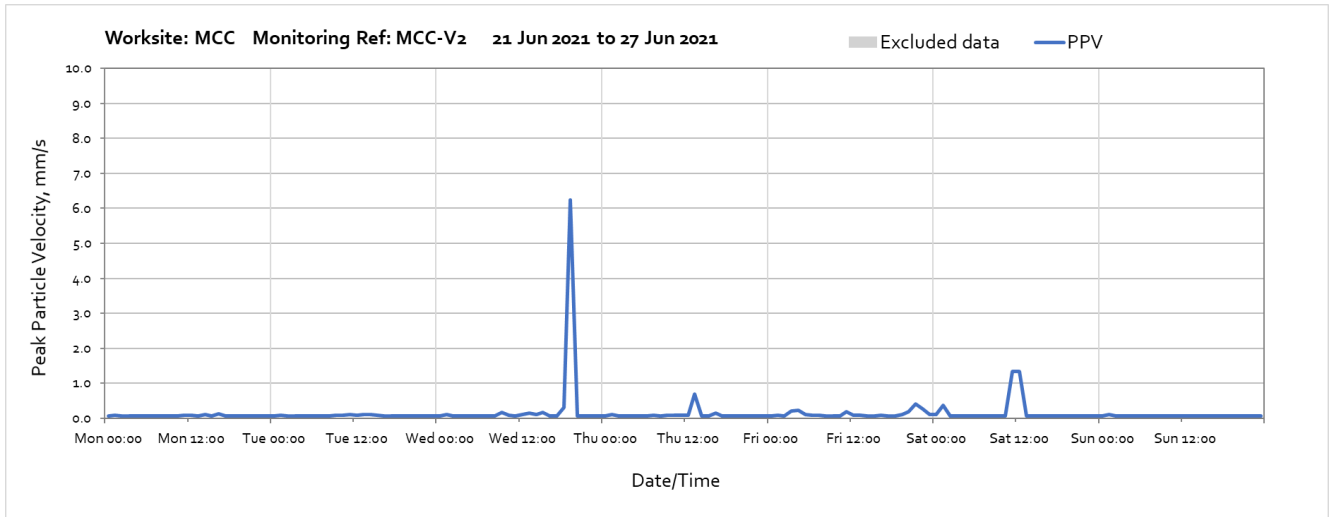
Worksite: Museum Collection Centre (MCC) – Monitoring Ref: MCC-V1



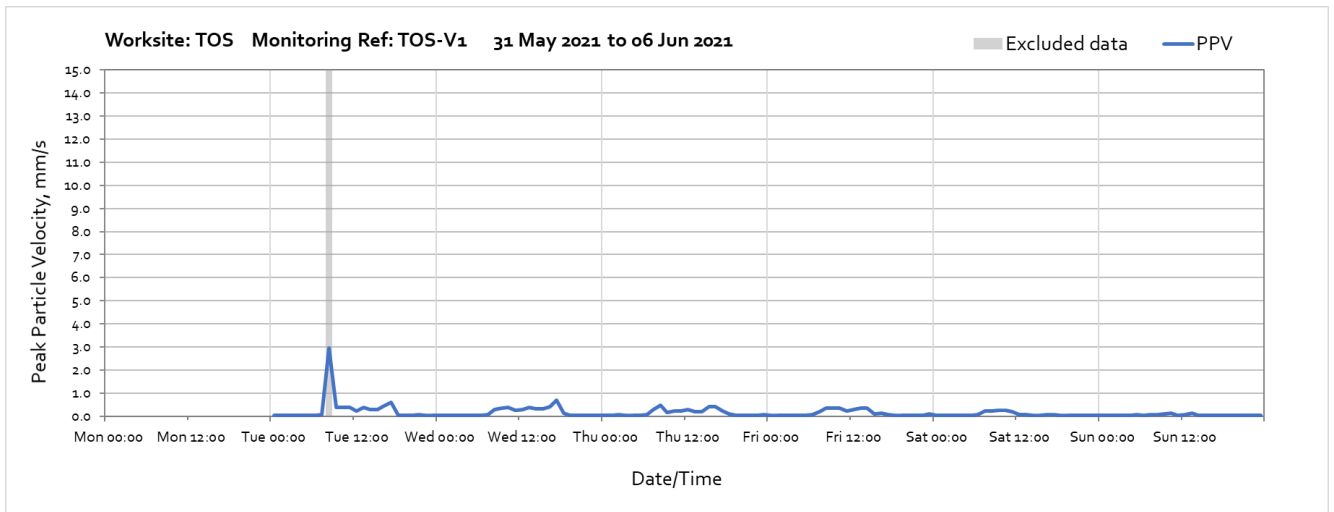


Worksite: Museum Collection Centre (MCC) – Monitoring Ref: MCC-V2

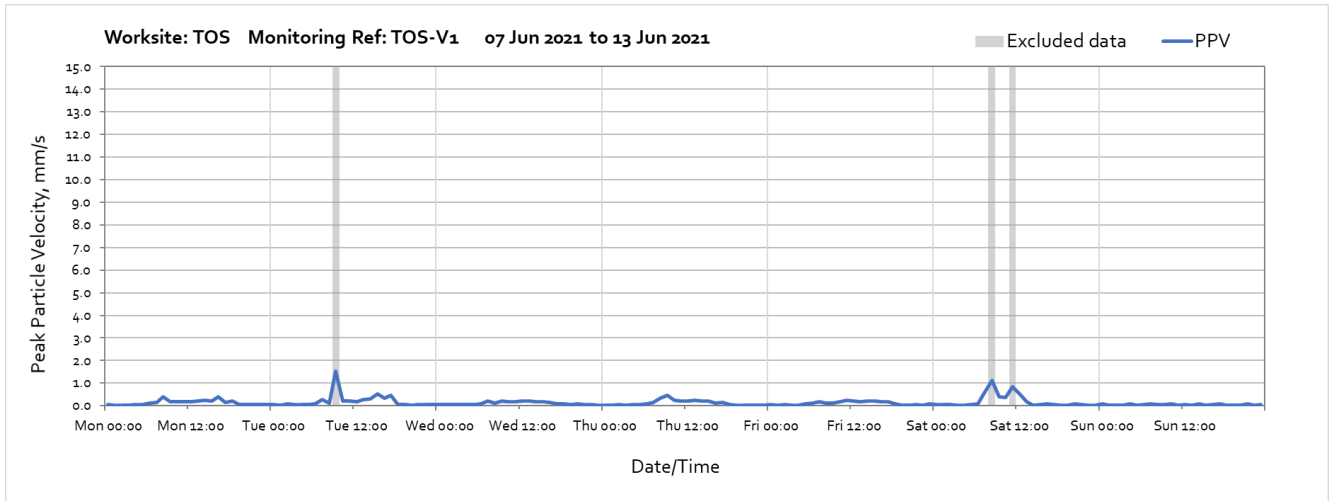




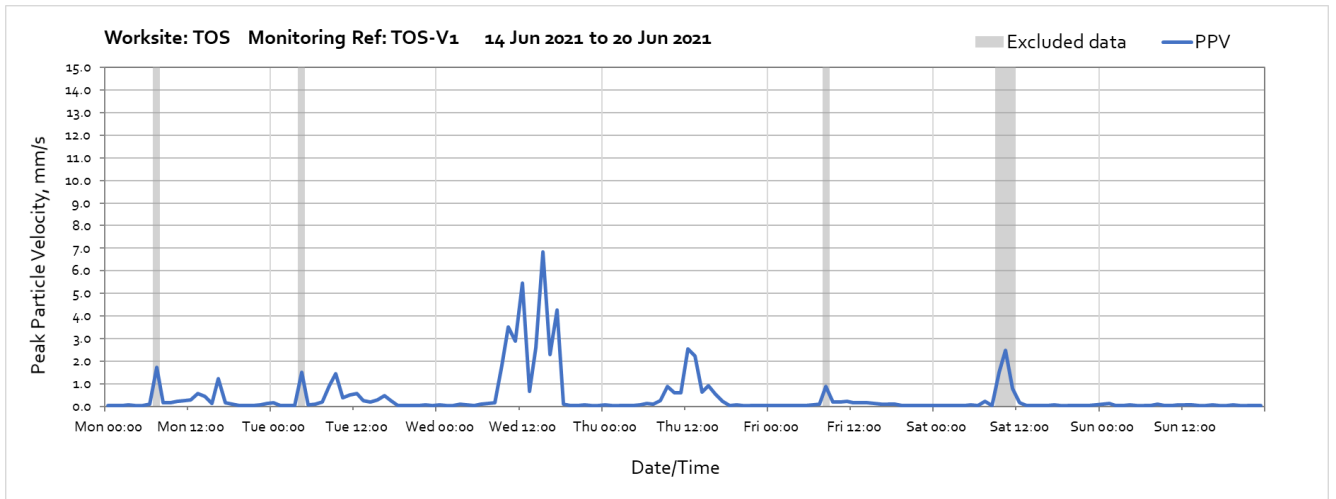
Worksite: Twisted Oak Stables (TOS) – Monitoring Ref: TOS-V1



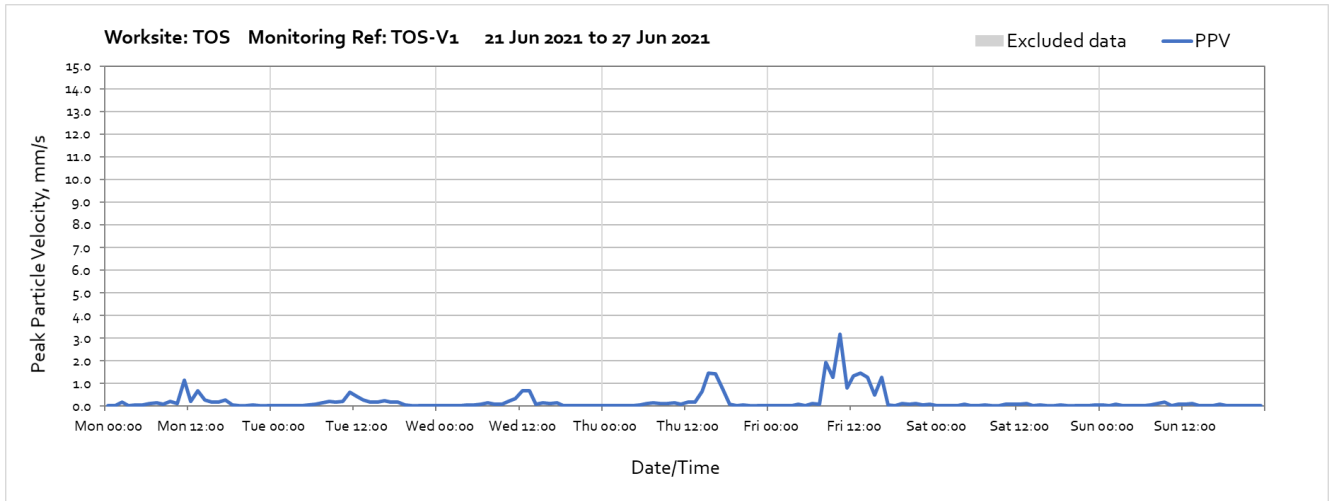
Note: High vibration levels at 08:00 on Tuesday 1st June were due to local interference of the monitor and not representative of HS2 vibration levels.



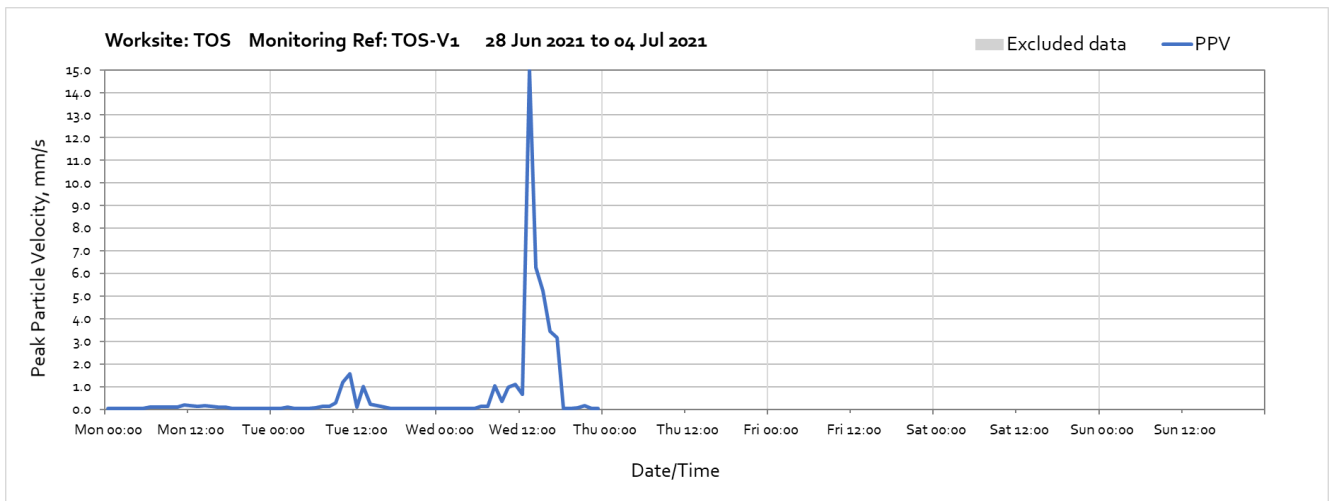
Note: High vibration levels at 09:00 on Tuesday 8th June; at 08:00 and at 11:00 on Saturday 12th June; were due to local interference of the monitor and not representative of HS2 vibration levels.



Note: High vibration levels at 07:00 on Monday 14th June; at 04:00 on Tuesday 15th June, at 08:00 on Friday 18th June and between 09:00 – 12:00 on Saturday 19th June were due to local interference of the monitor and are not representative of HS2 vibration levels. High vibration levels measured between 10:00 and 18:00 on Wednesday 16th June were due to excavation works undertaken near the monitoring location. The nearest residential receptors are further away from the works and vibration levels at the receptors will therefore be lower.

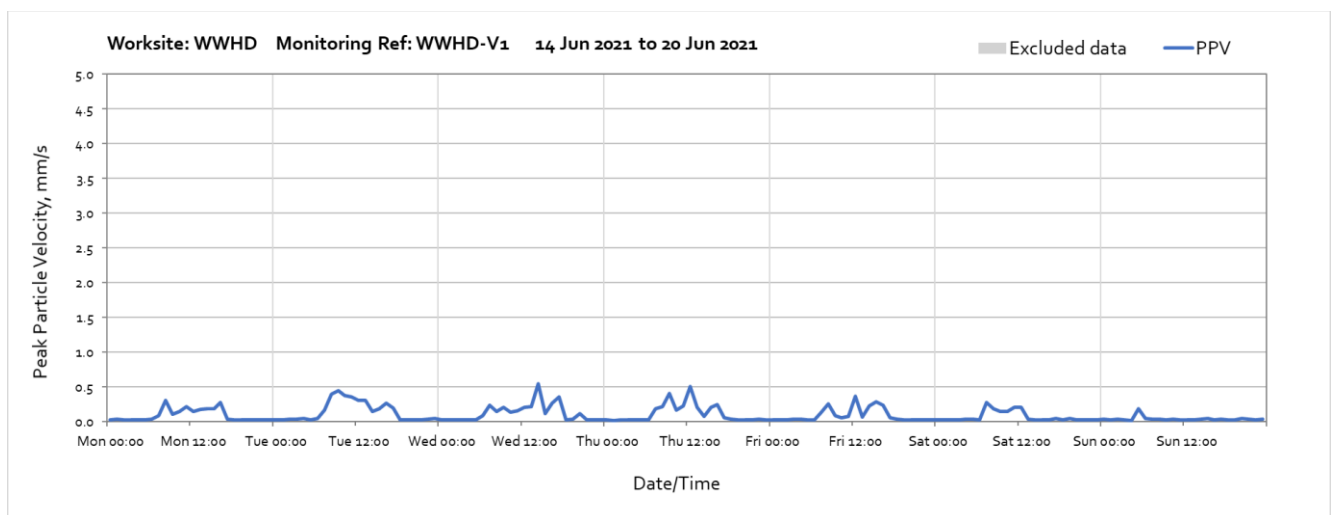
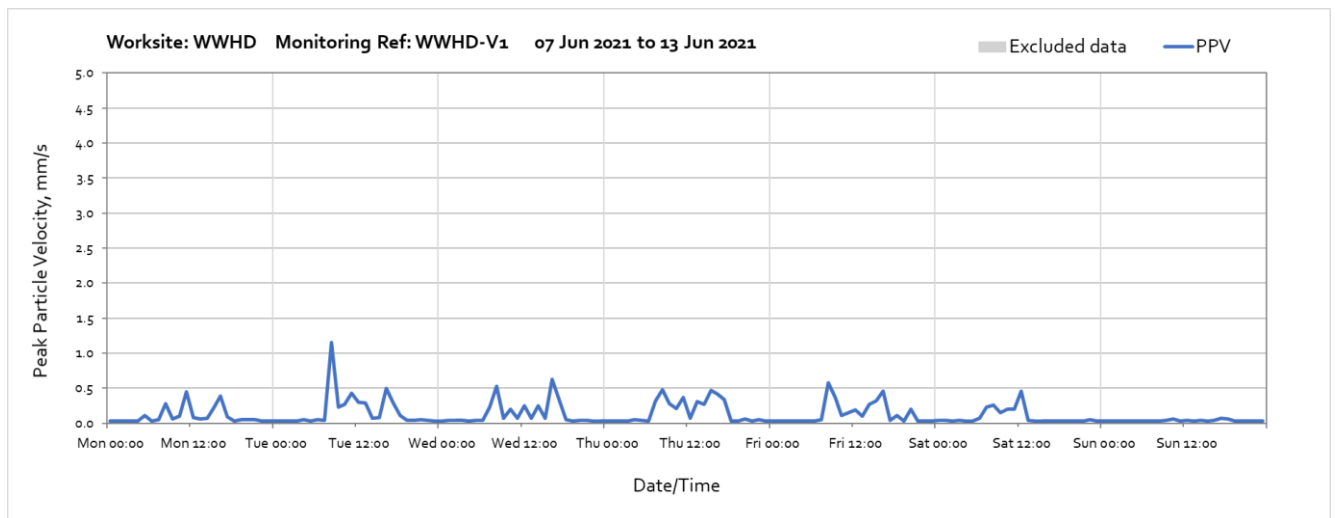
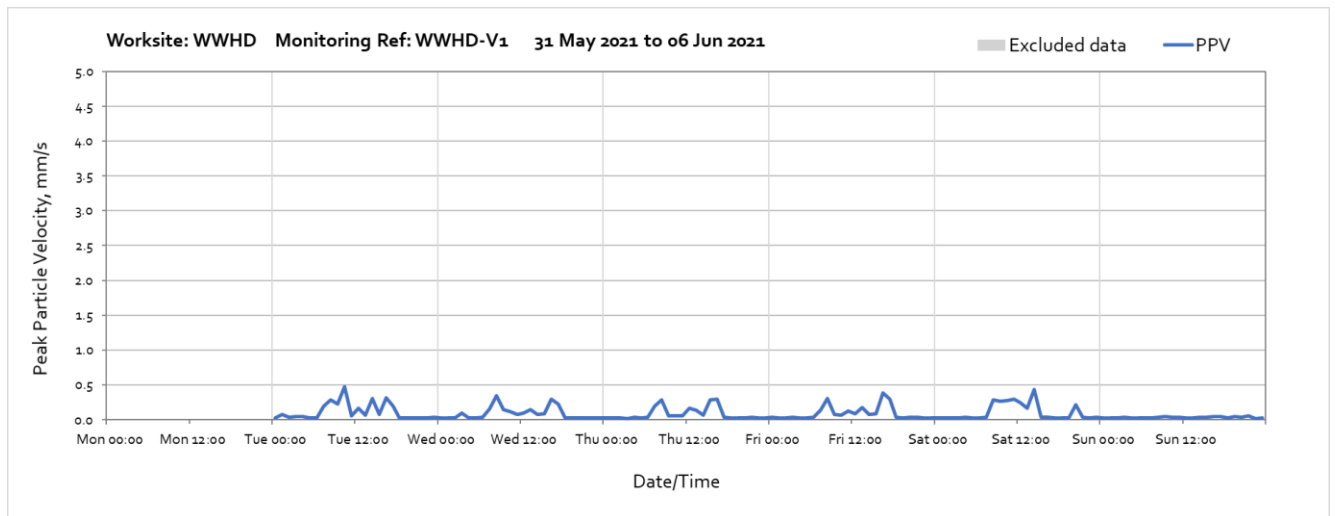


High vibration levels measured between 08:00 and 17:00 on Friday 25th June were due to excavation works undertaken near the monitoring location. The nearest residential receptors are further away from the works and vibration levels at the receptors will therefore be lower.

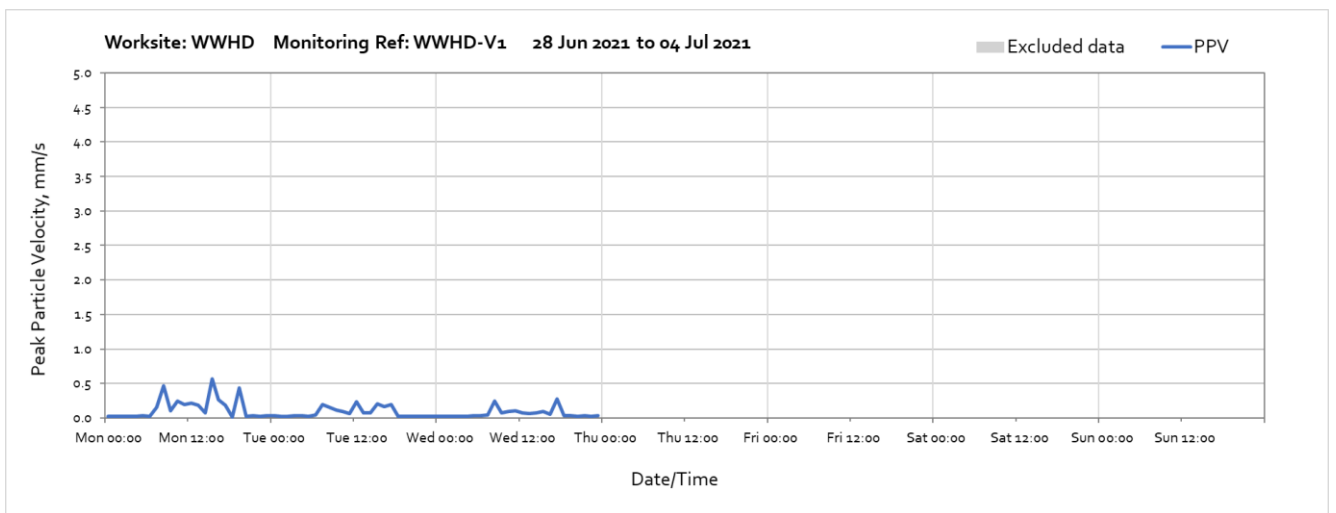
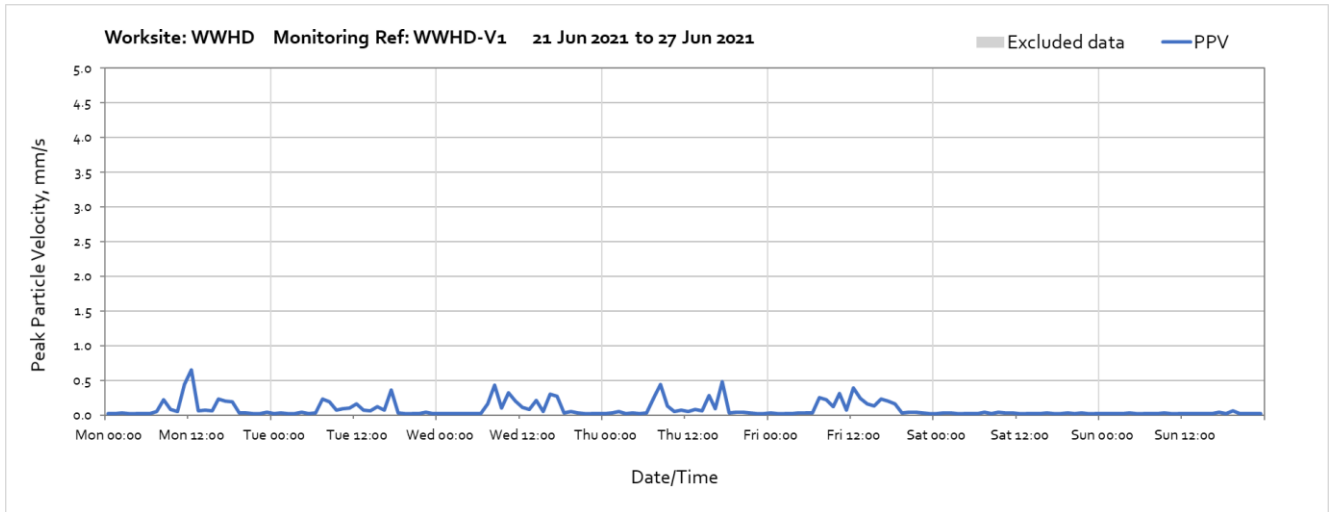


High vibration levels between 08:00 and 18:00 on Wednesday 30th June were due to work activities (ground raking works and removal of existing concrete slab) undertaken near the monitor location. The nearest residential receptors are further away from the works and vibration levels at the receptors will therefore be lower.

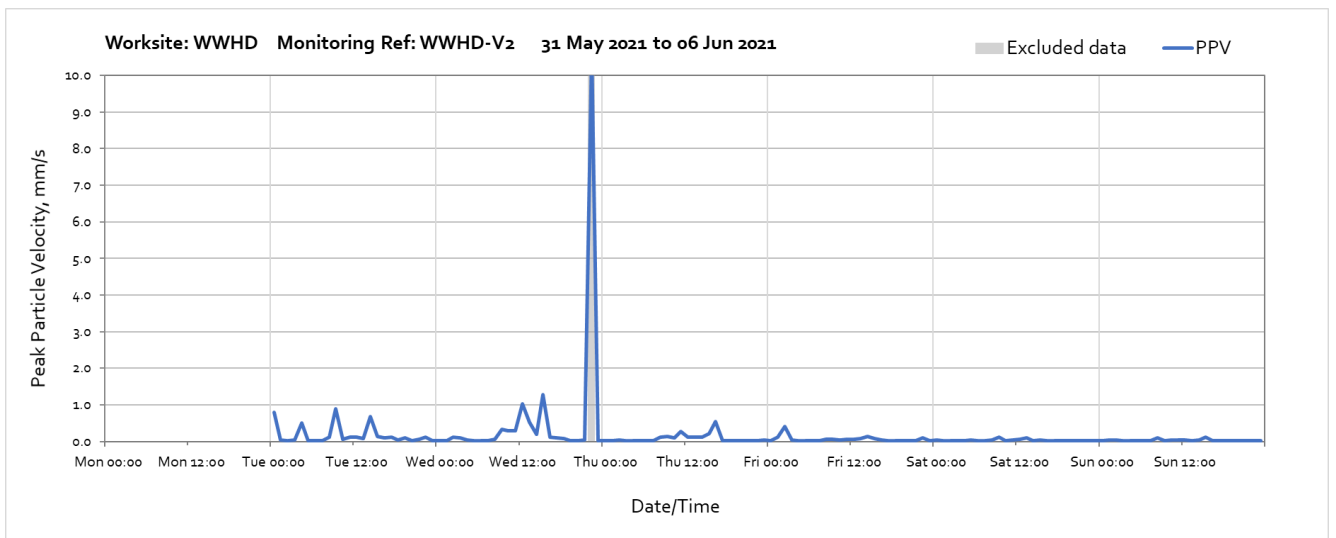
Worksite: Washwood Heath Depot (WWHD) – Monitoring Ref: WWHD-V1



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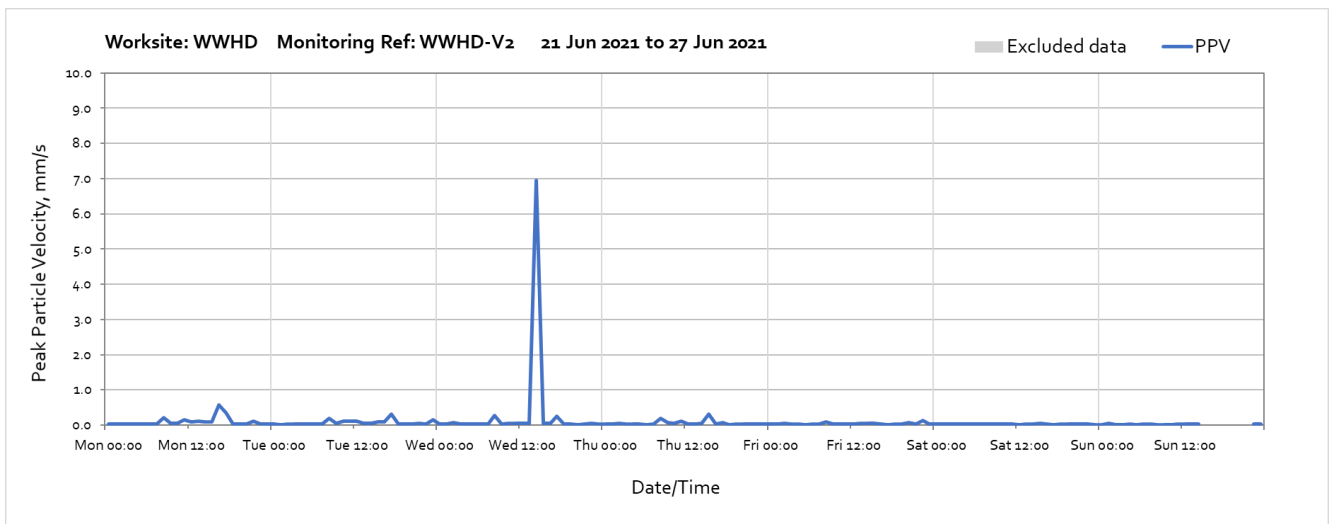
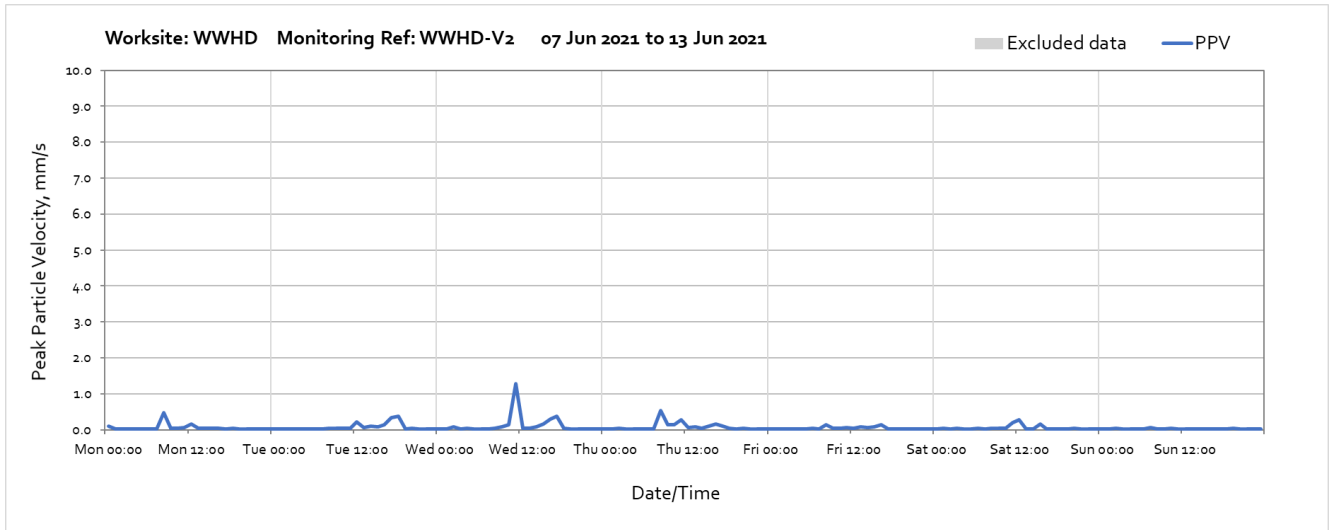


Worksite: Washwood Heath Depot (WWHD) - Monitoring Ref: WWHD-V2



Note: High vibration levels at 09:00 on Tuesday 1st June; at 12:00, at 15:00 and 22:00 on Wednesday 2nd June were due to local interference of the monitor and are not representative of HS2 vibration levels at nearby receptors.

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Note: High vibration levels at 14:00 on Wednesday 23rd June were due to earthworks undertaken near to the monitor location. The nearest residential receptors are further away from the works and vibration levels at the receptors will therefore be lower. Missing data between 15:00 and 22:00 on Sunday 27th June were due to lost of signal.

