1MC04 Main Works - Contract Lot S2

Noise Impact Assessment – Northolt Storage & Treatment Area – Material Treatment

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C01	Patrick Schafstein	Matthew Weston				
						
C02	Patrick Schafstein	Matthew Weston				Report updated in response to Client Comments
						
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C05	Patrick Schafstein	Matthew Weston				Report updated in response to Client Comments
						

SECURITY CLASSIFICATION: OFFICIAL

Handling instructions: None

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1 Introduction

1.1.1 The intent of this report is to investigate and assess the sound impact of the proposed waste management facilities associated with the westernmost section of the Skanska Costain Strabag Joint Venture (SCSjv) High Speed 2 (HS2) works. The waste management facility is commonly known as the Northolt Storage & Treatment Area (S&T).

1.1.2 The Northolt Storage & Treatment Area (S&T) is bounded by Harvil Road to the west, train tracks to the north, and agricultural land immediately to the south and east. The residential property, Shorthill Cottage, occupies a segment within the western portion of site. There are few residential properties located immediately surrounding the site off Harvil Road and Breakspear Road. A more densely populated area of West Ruislip is located east of Breakspear Road.

1.1.3 In brief, excavated material will be transported to the S&T area by conveyors. Material will undergo onsite treatment with lime, through the lime mixing plant, and deposited in muck bins. The material will then be transported to stockpiles using heavy machinery such as dump trucks, the material will be spread out in layers using excavators and compacted by repeated movement of earthmoving machinery.

1.1.4 During certain periods, it will be necessary for spoil arising from the TBM excavation to be transported via heavy goods vehicles to the storage and treatment area. TBM excavated spoil will be treated prior to arrival negating the need for the lime station operation.

1.1.5 The receptors Shorthill Cottage, Brackenbury House, Brackenbury Barn, Oak Farm, The Bungalow, Harvil Farm, 160 Hoylake Crescent, 178 Hoylake Crescent and 77 The Greenway are identified as potentially affected by sound due to their relative proximity to the S&T area boundaries. As such these receptors are considered representative locations for the basis of the sound impact assessment and represent other groups of properties. Figure 1 below illustrates the receptors location in relation to the S&T Area.

1.1.6 This sound assessment will form part of the requested waste permitting documentation.

1.1.7 The report has been produced by Patrick Schafstein (AMIOA) who also undertook attended environmental monitoring at Harvil Road. Patrick has over three years' experience in acoustic consultancy. Sound modelling was undertaken by Robin Bolt (AMIOA). The modelling and calculations have been checked and updated as necessary by Sam Geering (MIOA). Matthew Weston (MIOA) managed and directed the assessment. Matthew has over 18 years' experience of work in the

field of environmental sound assessment including a significant number of projects where assessment in accordance with the principles of BS 4142 was required.

Figure 1: Area surrounding S&T Area – Representative Receptors and Works Area

2 Methodology

2.1.1 An investigation and assessment of noise impact has been undertaken using guidance outlined in British Standard (BS) 4142:2014 Methods for rating and assessing industrial and commercial sound. This assessment has been undertaken in line with Environment Agency Guidance.

2.1.2 In principle, when determining noise impact in line with BS 4142:2014, the assessment must include the following:

- *Background noise survey at relevant local receptors.*
- *Specific noise levels at these receptors due to site operations (usually by calculation).*
- *Assessment of the impact of characteristic features of the site noise (e.g. tonality, irregularity, impulsiveness).*
- *Comparison of the rating noise level (specific noise level + any feature correction applied) in relation to the background noise level to assess the noise impact. and*
- *General consideration of all of the above in context of the situation in addition to uncertainty to conclude on the overall acceptability of the noise impact.*

2.1.3 When assessing the magnitude of impacts determining the differences between the rating level and the background $L_{A90,T}$ noise level is paramount. The Standard states that:

- *Typically, the greater this difference, the greater the magnitude of the impact.*
- *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context. (EA definition of 'Unacceptable level of audible or detectable noise').*
- *A difference of around +5 dB is likely to be an indication of an adverse impact, depending on context. (EA definition of Audible or detectable noise') and*
- *The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact depending on the context. (EA definition of 'No noise, or barely audible or detectable noise').*

2.1.4 The rating level ($L_{Ar,Tr}$) is defined in BS 4142: 2014 and is used to rate the industrial source (known as the specific noise source) outside residential dwellings. This

level is obtained by adding suitable correction values (outlined in Table 1) to the specific sound level.

2.1.5 Reference time intervals, Tr, of 1 hour and 15 minutes are specified for the determination of rating levels during the day and night, respectively, as stated in BS 4142:2014:

"The shorter reference time interval at night means that short duration sounds with an on time of less than 1 h can lead to a greater specific sound level when determined over the reference time interval during the night than when determined during the day."

Table 1: BS 4142 feature correction

Section 9.2 Subjective Method	Perceptibility to noise sensitive façades	Correction
Tonality Ranging from not tonal to prominently tonal	Not tonal	+0
	Just perceptible	+2
	Clearly perceptible	+4
	Highly perceptible	+6
Impulsivity Considering both the rapidity and any overall change in sound levels	Not impulsive	+0
	Just impulsive	+3
	Clearly impulsive	+6
	Highly impulsive	+9
Readily Distinctive Characteristic is neither tonal nor impulsive	Is not present	+0
	Is present	+3
Intermittency Identifiable "on/off" conditions	Is not present	+0
	Is present	+3

3 Noise Monitoring

3.1.1 Noise data obtained from noise monitors has been analysed to determine representative background noise levels at nearby sensitive receptor groups. The locations of all monitors are shown on Figure 1.

3.1.2 In advance of significant construction works, semi-permanent unattended noise monitoring systems were installed at monitoring positions MP01, MP04 and MP05 where long-term works were anticipated. Site logs were analysed to identify periods of non-site activity and this data was processed to provide indicative background noise levels for the sensitive receptors identified in the assessment.

3.1.3 MP02 and MP03 were installed as temporary monitors to obtain ambient and background sound levels and provide representative data to receptors not represented by semi-permanent monitors.

3.1.4 For the purposes of this assessment the following sensitive receptors, followed by the ES ID where applicable, have been identified. Receptors R2, R5, R6, R7 and R8 are noted to represent multiple residential locations:

- R1 – Shorthill Cottage - 408811;
- R2 – 2 Harvil Farm - 406098;
- R3 – Brackenbury House – N/A;
- R4 – Brackenbury Barn - 419116;
- R5 – The Bungalow – N/A;
- R6 – 160 Hoylake Crescent - 419214;
- R7 – 178 Hoylake Crescent - 419186;
- R8 – 77 The Greenway - 700377; and
- R9 – Oak Farm – N/A.

3.1.5 The MP01 monitoring location was considered to represent the ambient and background noise levels for R1 - Shorthill Cottage.

3.1.6 Monitoring location MP02 was considered to represent the ambient and background noise levels for R2 - 2 Harvil Farm.

3.1.7 MP03 was considered to represent the ambient and background noise levels for the receptors R3 - Brackenbury House, R4 - Brackenbury Barn and R5 - The Bungalow due to its proximity to the neighbouring road network.

3.1.8 MP04 location was considered to represent the ambient and background noise levels for the receptors R6 - 160 and R7 - 178 Hoylake Crescent and R9 - Oak Farm, due to their proximity to residential roads and the undeveloped area to the North.

3.1.9 MP05 location was considered to represent the ambient and background noise levels for the receptors represented by R8 - 77 The Greenway.

3.1.10 The grid references for the noise monitoring data used for this assessment are as follows:

- Monitoring Position 1 (MP01) – Latitude 51.573324; Longitude -0.46691052;
- Monitoring Position 2 (MP02) – Latitude 51.569561; Longitude -0.465902;
- Monitoring Position 3 (MP03) – Latitude 51.568997; Longitude -0.459082;
- Monitoring Position 4 (MP04) – Latitude 51.572833; Longitude - 0.452528; and
- Monitoring Position 5 (MP05) – Latitude 51.57172; Longitude -0.44515.

3.1.11 Figures 2 to 6 below show the monitoring systems as set-up in situ.

Figure 2: Noise monitoring systems setup, MP01.

Figure 3: Noise monitoring systems setup, MP02.

Figure 4: Noise monitoring systems setup, MP03.

Figure 5: Noise monitoring systems setup, MP04.

Figure 6: Noise monitoring systems setup, MP05.

3.2 Weather Conditions

3.2.1 The weather conditions during the unattended noise measurements for all noise monitors are summarised in Table 3 in Appendix B.

3.2.2 Weather data was obtained from an additional noise monitor, N048, fitted with a weather station within West Ruislip Portal Compound. The grid reference for the N048 monitor is as follows:

- Monitoring Position N048 – Latitude 51.570641; Longitude -0.438294

3.3 Background sound levels

3.3.1 The $L_{A90,T}$ levels from MP01 and MP05 presented in this document were measured during the Covid-19 pandemic, during a government lockdown. It is considered that this may have led to unusually low weekday and weekend $L_{90,T}$ daytime and night-time levels, as road traffic is likely to have reduced due to restrictions in place at the time.

3.3.2 Unattended weather data from monitoring location N048 has been analysed to identify where periods of elevated wind or higher levels of precipitation occurred. Corresponding measured noise levels during the adverse weather periods were reviewed and excluded from the assessment if judged to have been adversely influenced.

3.3.3 The MP01 background sound levels used in this assessment have been obtained from the semi-permanent unattended noise monitoring systems, the following periods were identified where there was no site activity and data is considered to be representative of background noise levels in the absence of construction noise:

- weekend of the 6th February 2021;
- 9th February 2021;
- weekend of the 13th February 2021; and
- weekend of the 20th February 2021.

3.3.4 The MP02 and MP03 background sound levels used in this assessment have been obtained from unattended noise monitoring systems. Both monitors were installed on the 25th March 2022 and retrieved on the 8th April 2022. The following periods were identified where there was no site activity and data is considered to be representative of background noise levels in the absence of construction noise:

- From 25th March 2022 to 30th March 2022; and
- 3rd April 2022.

3.3.5 The noise monitor labelled as MP04 is a semi-permanent noise monitor deployed by SCS for the management of construction noise levels from nearby sites The background sound levels used in the assessment have been obtained from the following periods where there was no significant site activity and data is considered to be representative of levels in the absence of construction noise:

- 4th and 5th February 2022; and
- from 15th April 2022 to 19th April 2022.

3.3.6 MP05 background sound levels used in the assessment have been obtained from the semi-permanent unattended noise monitoring systems, the following periods were identified where there was no significant site activity and data considered to be representative of levels in the absence of construction noise:

- from 1st November 2020 to 19th December 2020.

3.3.7 The proposed S&T area will be operational during daytime and night-time hours, weekdays Monday to Friday, Saturday, and Sunday.

3.3.8 Analysis of the most frequently occurring background sound levels for all time periods, has been undertaken using the data sets obtained in the absence of significant construction at MP01, MP02, MP03, MP04 and MP05.

3.3.9 It is noted that BS 4142 type assessments are typically based on daytime (07:00 - 23:00 hrs) and night-time (23:00 - 07:00 hrs) periods, however, the Storage & Treatment site will have reduced evening activities. To provide greater detail the daytime assessment period of 07:00 to 23:00 hrs is separated in to two separate working patterns which are 07:00 - 19:00 hrs and 19:00 - 23:00 hrs. The assessments below therefore follows these more detailed assessment periods.

3.3.10 Statistical analysis showing the frequency of background level occurrences in the absence of significant construction is presented graphically in Figures A1 to A5 of Appendix A.

Table 2: Breakdown of $L_{A90,T}$ Results from MP01

Monitoring Period		MP01 – Measured Sound Pressure Level
Hours	Period	dB $L_{A90,T}$
07:00 - 19:00 hrs	Daytime	48
19:00 - 23:00 hrs	Evening	48
23:00 - 07:00 hrs	Night-time	45

Table 3: Breakdown of $L_{A90,T}$ Results from MP02

Monitoring Period		MP02 – Measured Sound Pressure Level
Hours	Period	dB $L_{A90,T}$
07:00 - 19:00 hrs	Daytime	50
19:00 - 23:00 hrs	Evening	43
23:00 - 07:00 hrs	Night-time	40

Table 4: Breakdown of $L_{A90,T}$ Results from MP03

Monitoring Period		MP03 – Measured Sound Pressure Level
Hours	Period	dB $L_{A90,T}$
07:00 - 19:00 hrs	Daytime	46
19:00 - 23:00 hrs	Evening	40
23:00 - 07:00 hrs	Night-time	37

Table 5: Breakdown of $L_{A90,T}$ Results from MP04

Monitoring Period		MP04 – Measured Sound Pressure Level
Hours	Period	dB $L_{A90,T}$
07:00 - 19:00 hrs	Daytime	41
19:00 - 23:00 hrs	Evening	41
23:00 - 07:00 hrs	Night-time	38

Table 6: Breakdown of $L_{A90,T}$ Results from MP05

Monitoring Period		MP05 – Measured Sound Pressure Level
Hours	Period	dB $L_{A90,T}$
07:00 - 19:00 hrs	Daytime	47
19:00 - 23:00 hrs	Evening	44
23:00 - 07:00 hrs	Night-time	38

3.4 Unattended Survey Results

3.4.1 To provide context on a comparison with pre-existing ambient levels, an analysis of the unattended survey is presented in Appendix C. This context will be discussed in section 6.6 A summary of the results is presented overleaf in Table 7.

Table 7: Summary of unattended sound monitoring results for all monitors

Monitor	Measured Sound Levels, dB re. 2 x 10^{-5} Pa.					
	Daytime (07:00 hrs - 23:00 hrs)			Night-time (23:00 hrs - 07:00 hrs)		
	$L_{Amax,F}$	$L_{Aeq,16hr}$	$L_{A90,16hr}$	$L_{Amax,F}$	$L_{Aeq,8hr}$	$L_{A90,8hr}$
MP01	62 (60-65)	58 (53-63)	50 (48-52)	56 (51-60)	52 (48-59)	48 (44-58)
MP02	77 (75-78)	64 (62-66)	47 (45-49)	73 (73-74)	60 (56-61)	41 (36-44)
MP03	69 (68-70)	54 (52-55)	44 (43-46)	62 (59-64)	50 (48-53)	38 (31-43)
MP04	77 (76-77)	56 (55-56)	42 (40-46)	62 (60-63)	51 (49-53)	39 (35-40)
MP05	83 (77-85)	61 (59-64)	44 (33-48)	61 (47-82)	54 (45-58)	38 (28-46)

4 Storage & Treatment Area Plant

4.1 Site Operation Utilising Conveyor

4.1.1 The plant sound levels outlined in Tables 8 to 10 below are understood to be representative of the plant to be used on site.

4.1.2 The plant listed below has been processed and using a sound modelling software, the receptor associated Sound Power Level has been determined.

4.1.3 The conveyor and muck storage bins, and lime station plant will operate on a 24-hour basis within the area marked on Figure 7.

Table 8: Plant and Equipment Assumptions – Conveyor / Muck Storage Bins – Conveyor Operational

Plant	No.	Daytime % on-time	Evening % on-time	Night-time % on-time	Overall Sound Power Level [dB(A)]	Reference
30-35t ADT dumpers	3	60	60	60	106	BS 5228-1:2009+A1:2014 Table C.4:2
30-40t Excavators	1	60	60	60	107	BS 5228-1:2009+A1:2014 Table C.2:14
Tractors	1	30	-	-	108	BS 5228-1:2009+A1:2014 Table C.4:74
Loading shovel	1	60	60	60	113	BS 5228-1:2009+A1:2014 Table C.10:16
4x4 Vehicles	2	10	10	10	82	Southdowns Measured
4x4 Diesel tankers	1	10	-	-	110	BS 5228-1:2009 Table C.11:4-20
Conveyor In	1	100	100	100	81	BS 5228-1:2009 Table C.10:23
Conveyor Out	1	100	-	-	81	BS 5228-1:2009 Table C.10:23
Wheel Wash	1	12	-	-	91	BS 5228-1:2009+A1:2014 Table C.3:13

Table 9: Plant and Equipment Assumptions – Lime Station Operation – Conveyor Operational

Plant	No.	Daytime % on-time	Evening % on-time	Night-time % on-time	Overall Sound Power Level [dB(A)]	Reference
Delivery Lorries	4	60	20	-	110	BS 5228-1:2009 Table C.11:4-20
Compressor	4	60	20	-	106	BS 5228-1:2009 Table D.7:10
Pugmill / Mixer	3	100	100	100	104	BS 5228-1:2009+A1:2014 Table C.4:22
Hopper (Discharge Point)	1	100	100	100	101	Southdowns Measured

4.1.4 The stockpile plant and equipment listed below in Table 10 will operate between 07:00 and 19:00 within the Daytime area marked on Figure 7.

Table 10: Plant and Equipment Assumptions – Stockpile Plant – Conveyor Operational

Plant	No.	Daytime % on-time	Evening % on-time	Night-time % on-time	Overall Sound Power Level [dB(A)]	Reference
Dozer D6	1	60	-	-	111	BS 5228-1:2009 Table C.5.15
Roller 20T	1	60	-	-	108	BS 5228-1:2009 Table C.5.19
40 T Excavator	1	60	-	-	107	BS 5228-1:2009+A1:2014 Table C.2:14
30-35 T ADT Dumpers	5	60	-	-	106	BS 5228-1:2009+A1:2014 Table C.4:2

4.2 Site Operation with Spoil Arriving Via Road

4.2.1 The plant sound levels outlined in Tables 11 to 12 below are understood to be representative of the plant to be used on site during the phase of site operation during which spoil will arrive on site via heavy goods vehicle (HGV).

4.2.2 The plant listed below has been processed and using a sound modelling software, the receptor associated Sound Power Level has been determined.

Table 11: Plant and Equipment Assumptions – Muck Storage Bins – Spoil Arriving Via Road

Plant	No.	Daytime % on-time	Evening % on-time	Night-time % on-time	Overall Sound Power Level [dB(A)]	Reference
Tractors	1	30	-	-	108	BS 5228-1:2009+A1:2014 Table C.4:74
4x4 Vehicles	2	10	10	10	82	Southdowns Measured
4x4 Diesel tankers	1	10	-	-	110	BS 5228-1:2009 Table C.11:4-20
Wheel Wash	1	80	80	-	91	BS 5228-1:2009+A1:2014 Table C.3:13

Table 12: Plant and Equipment Assumptions – Stockpile Plant – Spoil Arriving Via Road

Plant	No.	Daytime % on-time	Evening % on-time	Night-time % on-time	Overall Sound Power Level [dB(A)]	Reference
Dozer D6	1	60	60	-	111	BS 5228-1:2009 Table C.5.15
Roller 20T	1	60	60	-	108	BS 5228-1:2009 Table C.5.19
40 T Excavator	1	60	60	-	107	BS 5228-1:2009+A1:2014 Table C.2:14
30-35 T ADT Dumpers	2	60	60	-	106	BS 5228-1:2009+A1:2014 Table C.4:2

4.2.3 In addition to the plant listed above there will be c. 15 HGV deliveries per day for spoil delivery.

5 Noise Management

5.1 Summary of adopted noise management

5.1.1 Discussions with the construction team were undertaken to identify noise management measures which could be adopted to reduce noise impacts. Based on these discussions the following measures were agreed:

- Working Areas - restricted working hours within the stockpile area; and
- Introduction of 2.4 m and 3.6 m high noise barriers.

5.1.2 Further detail on the mitigations is provided in the sub-sections below.

5.2 Working Areas

5.2.1 The Storage & Treatment Area (S&T) will operate as two distinct areas with different operating periods as part of the noise management plan.

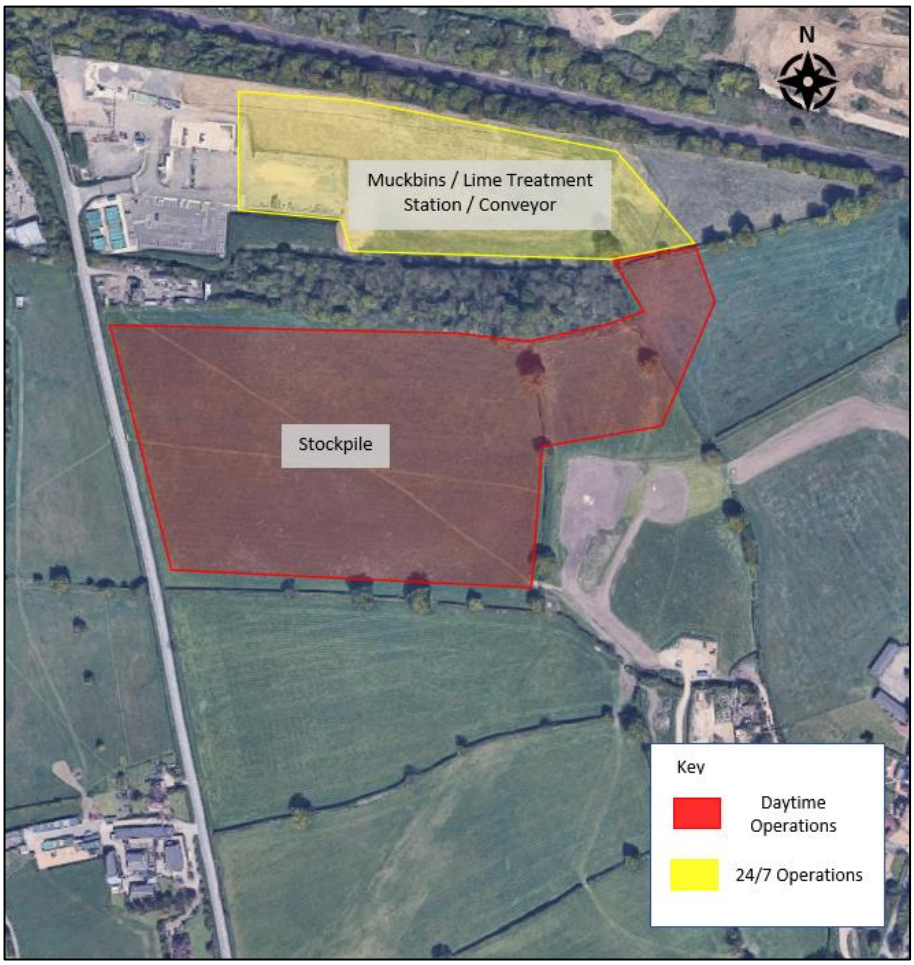
5.2.2 When the conveyor is in operation, noise from activities in the southern stockpile area would be reduced by restricting activities to daytime (07:00-19:00 hrs) periods only, and the northern area which includes muck bins, conveyors and lime treatment station will be operational on a 24 hour shift, but there will be no material transport to the stockpiles in the southern area.

5.2.3 During periods when TBM arisings/spoil is delivered to site via road, it will be necessary to undertake activities in the southern stockpile area between 07:00 and 23:00 hrs.

5.2.4 Figure 7 overleaf indicates the total working area of the Storage & Treatment activities.

5.2.5 Reversing alarms are to comprise broadband ‘white noise’ whenever possible, and not have tonal characteristics such as standard reversing alarms.

Figure 7: Working areas.



5.3 Noise Barriers

5.3.1 The noise assessment considers 2.4m and 3.6m barriers installed at strategic locations to provide mitigation to the residential receptors groups detailed in this assessment. The locations of proposed and pre-existing noise barriers are shown in Figure 8 overleaf.

5.3.2 Earlier assessments indicated that Shorthill cottage was impacted by site activities due to its close proximity to the works. Therefore, noise barriers were installed both to the north and south of this receptor. The northern barrier is 3.6m high to provide additional screening during the night-time operation of the lime treatment station which is required to operate 24 hours per day during conveyor use.

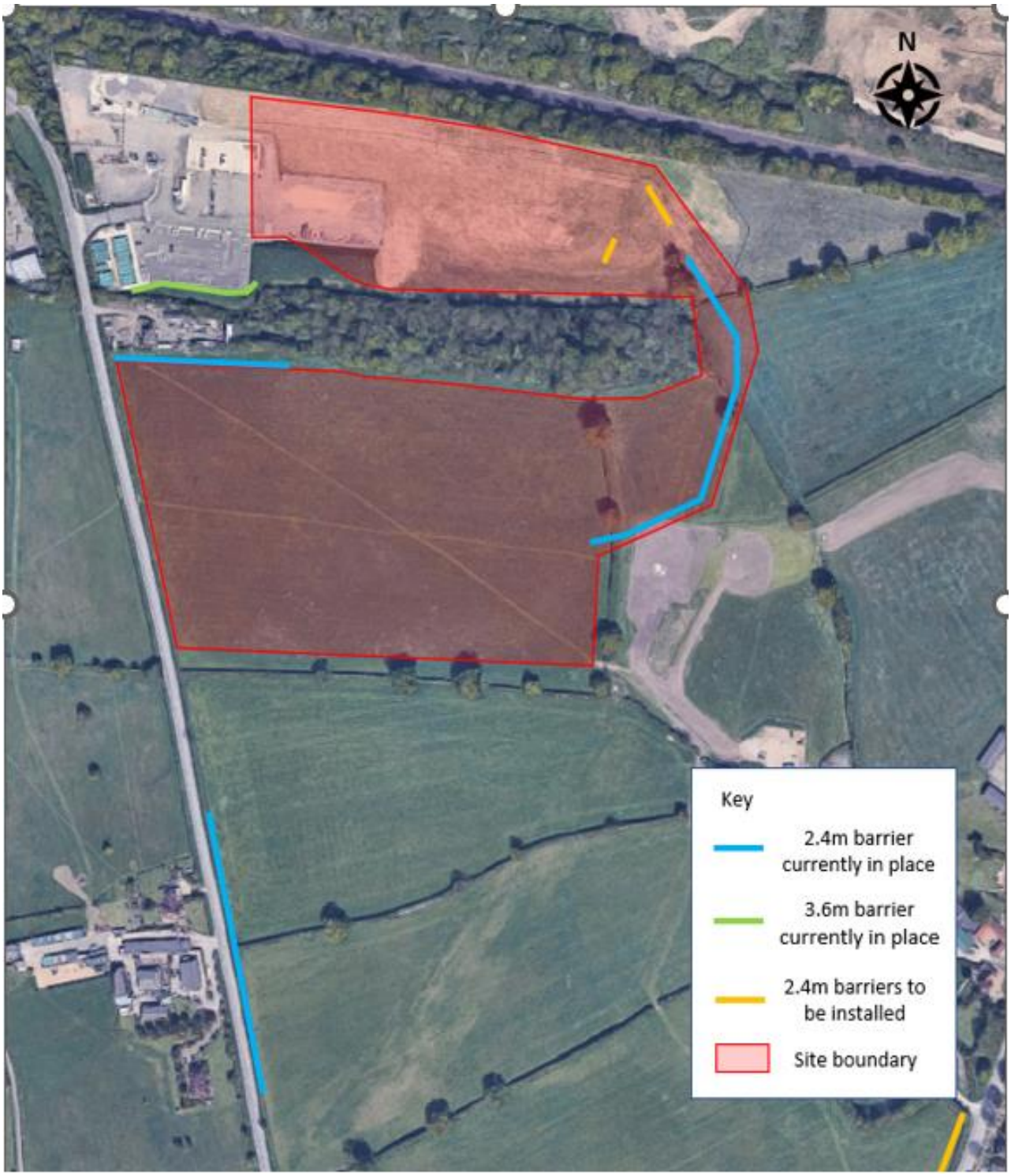
5.3.3 It has also been identified that Brackenbury House (R3) and Farm (R4) are potentially impacted by Lime Station operations. To mitigate this as far as is reasonably practicable a 2.4m high barrier has been installed along the eastern boundary. A further extension will be made to this barrier to maximise its benefit;

however it will be necessary to leave a small gap in this barrier to allow vehicle passage to the northeast portion of the site.

5.3.4 The hopper has been identified as a significant noise contributor to Brackenbury House (R3) and Farm (R4). Therefore, to mitigate hopper noise impacts at these receptors, a 2.4m local noise barrier will be installed adjacent to this noise source.

5.3.5 The pugmills are also noted to make a significant noise contribution to R3 and R4, however, this noise source is elevated to c. 4 m. It has been confirmed by the construction manager that a barrier to screen this noise source would not be practicable.

Figure 8: Implementation of noise barriers.



6 Sound Impact Assessment – Calculated Levels

6.1 Background Noise level

6.1.1 A summary of which receptors have been associated with each noise monitoring station, and the background noise levels adopted for assessment are presented in Table 13 below.

6.1.2 As previously indicated, daytime periods were split to distinct working hours as daytime assessment period (07:00 - 19:00) and evening period (19:00 - 23:00) to provide additional detail on potential noise impacts.

Table 13: Background levels adopted per receptor.

Monitor	Receptor	Daytime	Evening	Night-time
		07:00 - 19:00 hrs $L_{A90,12hr}$	19:00 - 23:00 hrs $L_{A90,4hr}$	23:00 - 07:00 hrs $L_{A90,8hr}$
MP01	R1	48	48	45
MP02	R2	50	43	40
MP03	R3, R4, R5	46	40	37
MP04	R6, R7 and R9	41	41	38
MP05	R8	47	44	38

6.2 Sound Level Calculations of Plant at Nearest Receptors

6.2.1 The sound power levels presented in Tables 8 to 12 have been used to calculate the receptor sound pressure levels associated with the Storage & Treatment area operation.

6.2.2 The sound modelling has been undertaken using the SoundPLAN (version 8.2) sound modelling software. SoundPLAN is a propriety software package which allows the calculation of sound levels using acoustical ray-tracing techniques through implementing the prediction procedure detailed in ISO 9613-2:1996.

6.2.3 Areas of hard and soft ground have been estimated from Google aerial mapping images and proposed site layouts.

6.2.4 All sources have been modelled as omnidirectional point sources except for the conveyor and any plant utilising haul roads which have been modelled as line sources.

6.2.5 All plant within the assessment has been assumed to operate at height of 1.5 metre relative to the local ground height, with the following plant exceptions:

- Conveyor belt – modelled at 2.5 m to 9.0 m above local ground ; and
- Pugmills – modelled at 4.0 m above local ground.

6.2.6 Noise barriers have been positioned to provide sound attenuation to the closest and potentially worse affected noise sensitive receptors. Locations and heights of barriers are described above in Section 5.3.

6.2.7 Calculations have been carried out based upon machinery operating for a reasonable worse case daytime hour and 15-minute night-time period. Calculations include all the construction activities identified for the operation of the Storage & Treatment Area.

6.2.8 Sound pressure levels have been calculated as $L_{Aeq,T}$ levels at 1 metre from the facades of noise sensitive receptors. The modelled specific sound levels are for construction noise only (i.e., they exclude any ambient noise). Resulting levels are presented in Tables 14 to 19 below for day (07:00 – 19:00 hrs), evening (19:00 – 23:00 hrs) and night (23:00 – 07:00 hrs) time periods, firstly for the conveyor operation and, secondly for the delivery of TBM arisings/spoil by road.

Table 14: Specific Noise Level dB at Receptors (07:00-19:00 hrs) Daytime – Conveyor Operational

Receptor ID / ES ID	Highest Calculated Sound Pressure Level dB L_{Aeq} – Full operation of S&T Areas.
R1 - Shorthill Cottage / 408811	52.5
R2 - Harvil Farm / 406098	51.2
R3 - Brackenbury House / N/A	47.9
R4 - Brackenbury Barn / 419116	47.2
R5 - The Bungalow / N/A	44.5
R6 - 160 Hoylake Crescent / 419214	40.1
R7 - 178 Hoylake Crescent / 419186	39.6
R8 - 77 The Greenway / 700377	35.5
R9 - Oak Farm / N/A	32.8

Table 15: Specific Noise Level dB at Receptors (19:00-23:00 hrs) Evening – Conveyor Operational

Receptor ID	Highest Calculated Sound Pressure Level dB L_{Aeq} – Full operation of S&T Areas.
R1 - Shorthill Cottage / 408811	51.4
R2 - Harvil Farm / 406098	46.0
R3 - Brackenbury House / N/A	45.9
R4 - Brackenbury Barn / 419116	45.4
R5 - The Bungalow / N/A	41.0
R6 - 160 Hoylake Crescent / 419214	37.8
R7 - 178 Hoylake Crescent / 419186	37.5
R8 - 77 The Greenway / 700377	33.3
R9 - Oak Farm / N/A	27.7

Table 16: Specific Noise Level dB at Receptors (23:00-07:00 hrs) Night-time – Conveyor Operational

Receptor ID	Highest Calculated Sound Pressure Level dB L_{Aeq} – Northern S&T Area
R1 - Shorthill Cottage / 408811	51.2[1]
R2 - Harvil Farm / 406098	46.6
R3 - Brackenbury House / N/A	46.8
R4 - Brackenbury Barn / 419116	46.8
R5 - The Bungalow / N/A	43.2
R6 - 160 Hoylake Crescent / 419214	39.3
R7 - 178 Hoylake Crescent / 419186	37.9
R8 - 77 The Greenway / 700377	35.0
R9 - Oak Farm / N/A	30.3

Note: [1] – Calculated level for ground floor as receptor is understood to be a single story dwelling.

Table 17: Specific Noise Level dB at Receptors (07:00-19:00 hrs) Daytime – Road Spoil Deliveries

Receptor ID / ES ID	Highest Calculated Sound Pressure Level dB L_{Aeq} – Full operation of S&T Areas.
R1 - Shorthill Cottage / 408811	46.5
R2 - Harvil Farm / 406098	49.2
R3 - Brackenbury House / N/A	40.3
R4 - Brackenbury Barn / 419116	38.5
R5 - The Bungalow / N/A	41.5
R6 - 160 Hoylake Crescent / 419214	33.5
R7 - 178 Hoylake Crescent / 419186	33.7
R8 - 77 The Greenway / 700377	29.4
R9 - Oak Farm / N/A	30.7

Table 18: Specific Noise Level dB at Receptors (19:00-23:00 hrs) Evening – Road Spoil Deliveries

Receptor ID	Highest Calculated Sound Pressure Level dB L_{Aeq} – Full operation of S&T Areas.
R1 - Shorthill Cottage / 408811	46.1
R2 - Harvil Farm / 406098	49.0
R3 - Brackenbury House / N/A	39.7
R4 - Brackenbury Barn / 419116	37.6
R5 - The Bungalow / N/A	41.1
R6 - 160 Hoylake Crescent / 419214	32.6
R7 - 178 Hoylake Crescent / 419186	33.0
R8 - 77 The Greenway / 700377	28.6
R9 - Oak Farm / N/A	30.7

Table 19: Specific Noise Level dB at Receptors (23:00-07:00 hrs) Night-time – Road Spoil Deliveries

Receptor ID	Highest Calculated Sound Pressure Level dB L_{Aeq} – Northern S&T Area
R1 - Shorthill Cottage / 408811	13.2
R2 - Harvil Farm / 406098	6.8
R3 - Brackenbury House / N/A	4.7
R4 - Brackenbury Barn / 419116	4.8
R5 - The Bungalow / N/A	2.4
R6 - 160 Hoylake Crescent / 419214	-0.2
R7 - 178 Hoylake Crescent / 419186	-2.5
R8 - 77 The Greenway / 700377	-7.3
R9 - Oak Farm / N/A	-20.9

6.3 Acoustic Character

6.3.1 Acoustic character corrections have been applied in this assessment, as proposed items of plant such as conveyors or compressors may have a slight perceivable tonality, or other characteristic requiring a feature correction.

6.3.2 Character corrections have been applied to different receptors groups as acoustic characteristics are not expected to be the same for each receptor. Potentially an impulsive plant noise may be just perceptible at receptors in close proximity to site works as there might be a low level of audibility when deposited material is collected from material piles. It is not anticipated that impulsivity will be noticeable at distant receptors.

6.3.3 A +3dB correction is proposed for other sound characteristics that are neither tonal, impulsive or intermittent but could be perceptible. This has not been applied to distant receptors.

6.3.4 Where appropriate characteristic penalties have been reviewed and are presented in Tables 20 to 25 overleaf.

Conveyor Operating

6.3.5 Receptor R1 has had a +6dB correction applied for the daytime and evening periods (+3dB for impulsivity; +3dB for other characteristics). The night-time period has had a +6dB correction (+3dB for impulsivity; +3dB for intermittency) due to its proximity to the site noise sources and the specific sound levels being 2dB lower than the pre-existing ambient levels.

6.3.6 An impulsivity or intermittency correction has not been applied to other receptors at any time periods as the dominating noise sources are noted to be from the loading shovel and it is not anticipated for the loading shovel to have impulsivity or intermittency characteristics perceptible at the more distant receptors.

6.3.7 Receptors R2 to R4 have had a +3dB correction applied for other characteristics, as the pre-existing ambient levels are at least 2 dB higher than the specific sound levels at all time periods, therefore, site sources are expected to be less perceptible at these receptors. The same correction has been applied to R5 as the pre-existing ambient levels are at least 7 dB higher than the specific sound levels at all time periods.

6.3.8 Receptors R6 to R9 have not had any characteristic adjustments applied, as the pre-existing ambient levels are 12 dB or more higher than the day and evening specific sound levels. Therefore, site noise characteristics are not expected to be perceptible at these receptors. During night-time periods specific noise sources are calculated to be 10 dB or more below pre-existing ambient noise levels, as such no characteristic adjustments are judged necessary.

6.3.9 It has been deemed that no other characteristic correction needs to be applied. Reversing alarms are to comprise broadband ‘white noise’ whenever possible, and not have tonal characteristics such as standard reversing alarms.

Deliveries of spoil/TBM arisings by road

6.3.10 During daytime operation when spoil is delivered to site via road, specific noise levels at receptors R1 to R5 are calculated to be between 1 and 7 dB below background noise levels, however, it is anticipated there may be a distinguishing character and a +3 dB character correction has been applied to derive the rating level. At the remaining receptors no characteristic adjustment has been applied.

6.3.11 During evening operation, it is anticipated there may be a distinguishing character at receptors R1 to R5 and a +3 dB character correction has been applied to derive the rating level. At the remaining receptors no characteristic adjustment has been applied.

6.3.12 During night-time operation specific noise levels are calculated to be significantly below background levels and characteristic adjustments for derivation of the rating levels are not considered appropriate.

6.4 Assessment – Conveyor Operation

6.4.1 The BS 4142 assessments are presented below in Tables 20 to 22 with calculated specific sound levels, for the affected receptors and character corrections. Also presented is a comparison between existing background sound levels and the resulting final rating levels for this assessment.

Table 20: BS 4142 Assessment Summary Calculations – Daytime 07:00-19:00 hrs – Conveyor Operational

Receptor	Representative $L_{A90,\,T}$	BS4142 Specific Sound Level $L_{ar,T}$ dB	Character Correction dB	BS4142 Rating Level $L_{ar,T}$ dB	BS4142 Assessment Level dB
R1 - Shorthill Cottage / 408811	48	53	6	59	11
R2 - Harvil Farm / 406098	50	51	3	54	4
R3 - Brackenbury House / N/A	46	48	3	51	5
R4 - Brackenbury Barn / 419116	46	47	3	50	4
R5 - The Bungalow / N/A	46	45	3	48	2
R6 - 160 Hoylake Crescent / 419214	41	40	0	40	-1
R7 - 178 Hoylake Crescent / 419186	41	40	0	40	-1
R8 - 77 The Greenway / 700377	47	36	0	36	-11
R9 - Oak Farm / N/A	41	33	0	33	-8

6.4.2 From the daytime levels presented above in Table 20, it is noted that at receptor R1, calculated assessment levels indicate a significant adverse impact, depending on the context, as levels are around +10 dB above the pre-existing background level. Differences between rating and background levels at receptors R2, R3, R4 and R5 are around + 5 dB indicating an adverse impact depending on the context. Rating levels at receptors R6 to R9 are below the pre-existing background levels

which is an indication of the specific sound source having a low impact depending on the context.

Table 21: BS 4142 Assessment Summary Calculations – Evening 19:00-23:00 hrs – Conveyor Operational

Receptor	Representative $L_{A90, T}$	BS4142 Specific Sound Level $L_{ar,T}$ dB	Character Correction dB	BS4142 Rating Level $L_{ar,T}$ dB	BS4142 Assessment Level dB
R1 - Shorthill Cottage / 408811	48	51	6	57	9
R2 - Harvil Farm / 406098	43	46	3	49	6
R3 - Brackenbury House / N/A	40	46	3	49	9
R4 - Brackenbury Barn / 419116	40	45	3	48	8
R5 - The Bungalow / N/A	40	41	3	44	4
R6 - 160 Hoylake Crescent / 419214	41	38	0	38	-3
R7 - 178 Hoylake Crescent / 419186	41	38	0	38	-3
R8 - 77 The Greenway / 700377	41	33	0	33	-8
R9 - Oak Farm / N/A	41	28	0	28	-13

6.4.3 Differences between daytime rating and background levels presented in Table 21, at receptors R1, R3 and R4 indicate a significant adverse impact, depending on the context as rating levels are around +10 dB or more above the pre-existing background levels. Differences at receptors R2, and R5 are around +5 indicating an adverse impact depending on the context. Rating levels at R6 to R9 are below pre-existing background levels which is an indication of the specific sound source having a low impact depending on the context.

Table 22: BS 4142 Assessment Summary Calculations – Night-time 23:00-07:00 hrs – Conveyor Operational

Receptor	Representative $L_{A90, T}$	BS4142 Specific Sound Level $L_{ar,T}$ dB	Character Correction dB	BS4142 Rating Level $L_{ar,T}$ dB	BS4142 Assessment Level dB
R1 - Shorthill Cottage / 408811	45	51	6	56	11
R2 - Harvil Farm / 406098	40	47	3	50	10
R3 - Brackenbury House / N/A	37	47	3	50	13
R4 - Brackenbury Barn / 419116	37	47	3	50	13
R5 - The Bungalow / N/A	37	43	3	46	9
R6 - 160 Hoylake Crescent / 419214	38	39	0	39	1
R7 - 178 Hoylake Crescent / 419186	38	38	0	38	0
R8 - 77 The Greenway / 700377	38	35	0	35	-3
R9 - Oak Farm / N/A	38	30	0	30	-8

6.4.4 Night-time assessment levels presented above for receptors R1 to R5 indicate a significant adverse impact, depending on the context, as rating levels are around 10 dB or more above background levels. Rating levels at R7 and R9 are equal or below pre-existing background levels which is an indication of the specific sound source having a low impact depending on the context.

6.5 Assessment – Road Spoil Deliveries

6.5.1 The BS 4142 assessments are presented below in Tables 23 to 25 with calculated specific sound levels, for the affected receptors and character corrections. Also presented is a comparison between existing background sound levels and the resulting final rating levels for this assessment.

Table 23: BS 4142 Assessment Summary Calculations – Daytime 07:00-19:00 hrs – Road Spoil Deliveries

Receptor	Representative $L_{A90, T}$	BS4142 Specific Sound Level $L_{ar,T}$ dB	Character Correction dB	BS4142 Rating Level $L_{ar,T}$ dB	BS4142 Assessment Level dB
R1 - Shorthill Cottage / 408811	48	47	3	50	2
R2 - Harvil Farm / 406098	50	49	3	52	2
R3 - Brackenbury House / N/A	46	40	3	43	-3
R4 - Brackenbury Barn / 419116	46	39	3	42	-4
R5 - The Bungalow / N/A	46	42	3	45	-1
R6 - 160 Hoylake Crescent / 419214	41	34	0	34	-7
R7 - 178 Hoylake Crescent / 419186	41	34	0	34	-7
R8 - 77 The Greenway / 700377	47	29	0	29	-18
R9 - Oak Farm / N/A	41	31	0	31	-10

6.5.2 From the daytime levels presented above in Table 23, it is noted that at receptors R1 and R2 calculated assessment levels are below the level of adverse impact, depending on the context. Rating levels at receptors R3 to R9 are below the pre-existing background levels which is an indication of the specific sound source having a low impact depending on the context.

Table 24: BS 4142 Assessment Summary Calculations – Evening 19:00-23:00 hrs – Road Spoil Deliveries

Receptor	Representative $L_{A90, T}$	BS4142 Specific Sound Level $L_{ar,T}$ dB	Character Correction dB	BS4142 Rating Level $L_{ar,T}$ dB	BS4142 Assessment Level dB
R1 - Shorthill Cottage / 408811	48	46	3	49	1
R2 - Harvil Farm / 406098	43	49	3	52	9
R3 - Brackenbury House / N/A	40	40	3	43	3
R4 - Brackenbury Barn / 419116	40	38	3	41	1
R5 - The Bungalow / N/A	40	41	3	44	4
R6 - 160 Hoylake Crescent / 419214	41	33	0	33	-8
R7 - 178 Hoylake Crescent / 419186	41	33	0	33	-8

Receptor	Representative $L_{A90, T}$	BS4142 Specific Sound Level $L_{ar,T}$ dB	Character Correction dB	BS4142 Rating Level $L_{ar,T}$ dB	BS4142 Assessment Level dB
R8 - 77 The Greenway / 700377	41	29	0	29	-12
R9 - Oak Farm / N/A	41	31	0	31	-10

6.5.3 Differences between evening rating and background levels presented in Table 24, at receptor R2 indicate a significant adverse impact, depending on the context as the rating level is around +10 dB above the pre-existing background level. Differences at receptors R3 and R5 is around +5 dB indicating an adverse impact depending on the context, and at R1 and R4 less than adverse (+1dB). Rating levels at R6 to R9 are equal or below pre-existing background levels which is an indication of the specific sound source having a low impact depending on the context.

Table 25: BS 4142 Assessment Summary Calculations – Night-time 23:00-07:00 hrs – Road Spoil Deliveries

Receptor	Representative $L_{A90, T}$	BS4142 Specific Sound Level $L_{ar,T}$ dB	Character Correction dB	BS4142 Rating Level $L_{ar,T}$ dB	BS4142 Assessment Level dB
R1 - Shorthill Cottage / 408811	45	13	0	13	-32
R2 - Harvil Farm / 406098	40	7	0	7	-33
R3 - Brackenbury House / N/A	37	5	0	5	-32
R4 - Brackenbury Barn / 419116	37	5	0	5	-32
R5 - The Bungalow / N/A	37	2	0	2	-35
R6 - 160 Hoylake Crescent / 419214	38	0	0	0	-38
R7 - 178 Hoylake Crescent / 419186	38	-3	0	-3	-41
R8 - 77 The Greenway / 700377	38	-7	0	-7	-45
R9 - Oak Farm / N/A	38	-21	0	-21	-59

Night-time assessment levels presented above for all receptors are significantly below pre-existing background levels which is an indication of the specific sound source having a low impact depending on the context.

6.6 Uncertainty

6.6.1 Uncertainty should be considered at each step of the design process and in each step of the source/receiver chain, including:

- Propagation of sound from the sources to the receptors.
- Determination of the background sound level.
- Measurement and commissioning of the system.

6.6.2 The rounding of integer values, as required by BS 4142, has been used in the derivation of the background sound levels and calculations, to avoid an impression of false precision to decimal places.

6.6.3 A qualitative estimate has been made of the uncertainty of the measured sound levels based on several site-specific factors, as outlined in BS4142:2014. Some potential measurement uncertainties that have been considered are listed below:

- Selected monitoring location - The monitoring locations have been selected as free field away from reflecting surfaces. The monitoring locations were located at locations considered to be representative of the property facades that will face the future HS2 works and thus representative of the background sound at the most exposed façade.
- The monitoring location MP01 was positioned at a location considered to be representative of Shorthill Cottage that will face the future HS2 works and thus representative of the background sound at the most exposed façade.
- Brackenbury House and Brackenbury Barn are located c. 400 m to the north of the MP03 monitor but both properties have similar distance to the adjacent Breakspear Road which is the main noise source influencing the ambient and background noise levels.
- The monitoring location MP04 was positioned at a location judged representative of both 160 and 178 Hoylake Crescent, and Oak Farm this is considered representative due to the similar noise environment close to rural areas and shielded from residential roads.
- Limited data sets were available for unattended monitors MP01, MP02, MP3 and MP04 where site logs indicated inactivity, as such the background levels adopted may not be as robust as extended period data sets.
- There is c. 7 weeks data for the unattended monitor MP05 in the absence of significant site activity. This data set length is considered robust for the derivation of noise sensitive receptor background sound levels.

- Calibration drift - Each of the unattended monitors has been calibrated on a regular basis using Class 1 field calibrators with no significant drift noted.
- For all unattended monitors, it was necessary to exclude periods of site activity to reduce noise from the adjacent site influencing the background data used. As such the periods removed were more biased towards weekdays leaving the potentially quieter weekend periods. This too may have led to lower background noise levels being adopted for the assessment.
- Equipment measurement range - The noise floor of the Class 1 sound level meter used on this project is specified to be 17 dB(A) or less. At the monitoring location, the specified noise floor of the equipment is sufficiently below the measured noise levels and is unlikely to have affected the measured background sound levels.
- Weather affected data – Weather conditions throughout the monitoring period have been deemed suitable, and are considered to have not changed the $L_{A90,T}$ levels used in this assessment.
- Covid-19 related changes – It was noted that the $L_{A90,T}$ levels during the unattended survey periods, may have been lower than the normal expected level, due to reduced activity and movements of local businesses and the general public during the government-imposed lockdown. This potentially leads to lower-than-expected background levels for the area, and therefore, increased levels between the $L_{A90,T}$ and calculated construction sound levels. It is not possible to provide a robust estimate of how much the background noise levels could potentially have been reduced by lower environmental activity.

6.7 Context

6.7.1 When considering the significance of an impact, BS 4142 advises that the context of the impact should be taken into account. The context of the impact should consider factors such as: the absolute level of sound; the character and level of the residual sound compared to the character and level of the specific sound; the sensitivity of the receptor; and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions.

6.7.2 Background noise levels for MP01 and MP05 were obtained during a period of national lockdown and may therefore be lower than periods of normal national activity. The assessment levels presented within this report may therefore overestimate the potential impacts.

6.7.3 The assumed plant operating times are high and represent a worse case assessment. Several items of plant are assumed to have 100% operation and so actual usage levels may be less and result in lower receptor specific sound levels.

6.7.4 The mean ambient noise level at MP01, which represents the closest receptor R1, in the absence of site activity is 58 dB $L_{Aeq,16hour}$ for daytime, as presented in Table 7. In comparison, the calculated construction levels at the closest receptor (R1) are 53 dB and 51 dB $L_{Aeq,T}$ for day and evening periods and so are 5 dB or more lower than the pre-existing ambient noise levels. It is noted therefore that daytime noise impacts at R1 are likely to be mitigated by higher pre-existing ambient noise levels. The calculated R1 night-time site noise level of c. 51 dB $L_{Aeq,T}$ is c. 1 dB below the pre-existing ambient level of 52 dB $L_{Aeq,T}$.

6.7.5 The mean ambient noise level at MP02, which represents the receptor R2, in the absence of site activity is 64 dB $L_{Aeq,16hour}$ for daytime, as presented in Table 7. In comparison, the calculated construction levels for day and evening periods are 51 dB and 46 dB $L_{Aeq,T}$ and therefore are 13 dB or more lower than pre-existing ambient noise levels. Construction noise impacts at R2 are therefore likely to be mitigated by higher pre-existing ambient noise levels.

6.7.6 The mean ambient noise level at MP03, which represents R3, R4 and R5, in the absence of site activity is 54 dB $L_{Aeq,16hour}$ for daytime, as presented in Table 7. In comparison the calculated day or evening construction levels at receptors R3, R4 and R5 are up to 48 dB $L_{Aeq,T.}$ Calculated specific noise levels are therefore 6 dB or more lower than the pre-existing ambient noise levels.

6.7.7 The mean ambient noise level at MP04, which represents R6, R7 and R9, in the absence of site activity is 56 dB $L_{Aeq,16hour}$ for daytime, as presented in Table 7. In comparison, the highest day or evening calculated construction level at these receptors is 40 dB $L_{Aeq,T}$ which is 16 dB lower than the pre-existing ambient noise level.

6.7.8 The mean ambient noise level at MP05, which represents the closest receptor R8, in the absence of site activity is 61 dB $L_{Aeq,16hour}$ for daytime, as presented in Table 7. In comparison, the highest calculated day or evening construction level is 36 dB $L_{Aeq,12hour}$ and so is 25 dB or more lower than pre-existing ambient noise levels. It is noted therefore that construction noise impacts at R8 are likely to be mitigated by higher pre-existing ambient noise levels.

6.7.9 The proposed operations are not permanent and are proposed to be in operation until April 2024. Other aspects of the HS2 construction project noise levels have been assessed against criteria presented in BS 5228 part 1. For context purposes a BS 5228 construction noise assessment is presented in Appendix D for reference.

6.7.10 The BS 5288 assessment results in Appendix D shows that the calculated construction levels at all receptors fall below significant effect threshold levels by 1 dB or more during all day, evening, and night-time periods.

6.7.11 Differences between rating and background levels for receptors locations R1 to R5 indicate a significant adverse impact in either daytime or night-time assessment periods. However, the pre-existing ambient noise levels are greater than calculated specific levels. Furthermore, it is noted that a BS 5228 assessment indicates that significance thresholds are not exceeded at any receptor during any period. Considering this context, it is judged that impacts at receptors R1 to R5 would be reduced to the adverse impact level.

6.7.12 At R6 the worse assessment period is night-time, which has a rating level of just 1 dB above the background level. This is 4 dB below the level of adverse impact, depending on the context.

6.7.13 At receptors R7, R8 and R9 rating levels are all calculated to be equal or below background levels during day, evening and night-time periods. This is an indication that the specific source having a low noise impact depending on the context.

7 Conclusions

7.1.1 Construction sound levels associated with the operation of a Storage & Treatment Area have been calculated at 9 no. sensitive receptors (R1 – R9) adjacent to a site off Harvil Road. Sound levels have been assessed using the principles of BS 4142:2014+A1:2019 in accordance with Environment Agency guidance.

7.1.2 Sensitive receptor background levels have been obtained by analysing data from 5 no. unattended noise monitors in the absence of logged significant construction activities at nearby construction sites.

7.1.3 Initial assessments indicated differences between background and rating levels of up to +21 dB and +26 dB for day and night periods respectively. Subsequently additional discussions were undertaken with site to increase the scope and height of noise barriers where practicable, refine plant requirements and restrict some operations to daytime periods only.

7.1.4 The subsequent assessment considered 3 no. time periods for assessment, 07:00 to 19:00 hrs, 19:00 to 23:00 hrs and 23:00 to 07:00. With the noise management measures agreed with site, differences between rating and background levels were reduced to +11 dB, +9 dB and +13 dB respectively for the assessment periods considered at the worse affected receptors.

7.1.5 A requirement for spoil deliveries to be completed via road, has been identified as a project requirement as an alternative to use of the conveyor. A BS 4142 assessment has been completed and it is noted that in comparison to the assessment including the conveyor, impacts are generally reduced with day evening and night assessment levels of up to +2 dB, +9 dB and below +0 dB respectively at the worse affected receptors.

7.1.6 In accordance with the assessment methodology of BS 4142 the context of the differences between rating and background levels was examined. During daytime periods calculated specific noise levels were below pre-existing ambient noise levels by 5 dB or more. At all receptors, day and night construction noise levels are calculated to fall below pre-existing ambient noise levels.

7.1.7 For additional context the site noise levels were assessed in accordance with BS 5228 which provides significance threshold levels for construction activities based on pre-existing ambient noise levels. It was noted that in each case for day, evening and night periods the threshold criteria were not exceeded.

7.1.8 When the assessment levels of the BS 4142 study are considered in the context of both the pre-existing ambient noise levels and the conventional construction noise assessment for these limited time activities, it is considered that receptor

locations R1 to R5 would have impacts reduced to the adverse level. There would be low impacts at receptor groups R8 and R9.

7.1.9 Discussions with the construction manager have confirmed that the extent of noise barriers cannot be practicably increased beyond that presented in figure 8 without impacting on the logistical operation of site. Additionally for engineering reasons it has been confirmed that barrier heights cannot be increased. The 3 no. Pugmill noise sources are elevated to c. 4m high and site has confirmed that it would not be practicable to install barriers around these noise sources.

7.1.10 It should be noted that the goal of this assessment is to determine the noise impact associated with the proposed works and act as a means of supporting the associated permit application. Eligibility of properties surrounding areas of SCSjv works for noise insulation is constantly reviewed periodically in line with the HS2 technical standard as the works progress in the area, and a number of properties exposed to noise from material transfers and other construction activities (including properties on Hoylake Crescent, the Greenway and Breakspear Road South) are currently being considered for provision of noise insulation in line with the criteria of determination outlined in the technical standard.

8 References

Title	Reference
BS 4142:2014+A1:2019.	Methods for rating and assessing industrial and commercial sound. BSI Standards Publication.
BS 5228-1:2009+A1:2014	Code of practice for noise and vibration control on construction and open sites. Part 1: Noise. BSI Standards Publication.
ISO:9613-2:1996	Acoustics – Attenuation of sound during propagation outdoors. Part 2: General method of calculation

Appendix A

Figure A1: STATISTICAL ANALYSIS OF BACKGROUND LEVELS AT MP01 – NO CONSTRUCTION

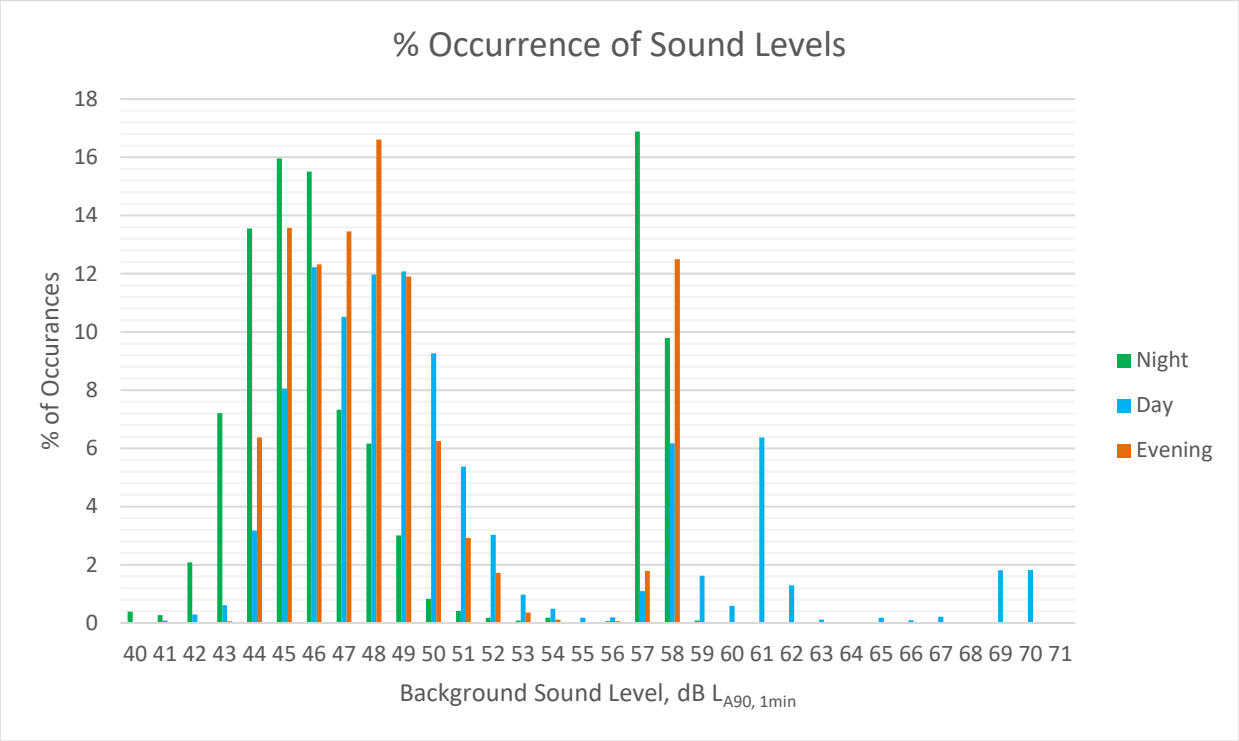


Figure A2: STATISTICAL ANALYSIS OF BACKGROUND LEVELS AT MP02 – NO CONSTRUCTION

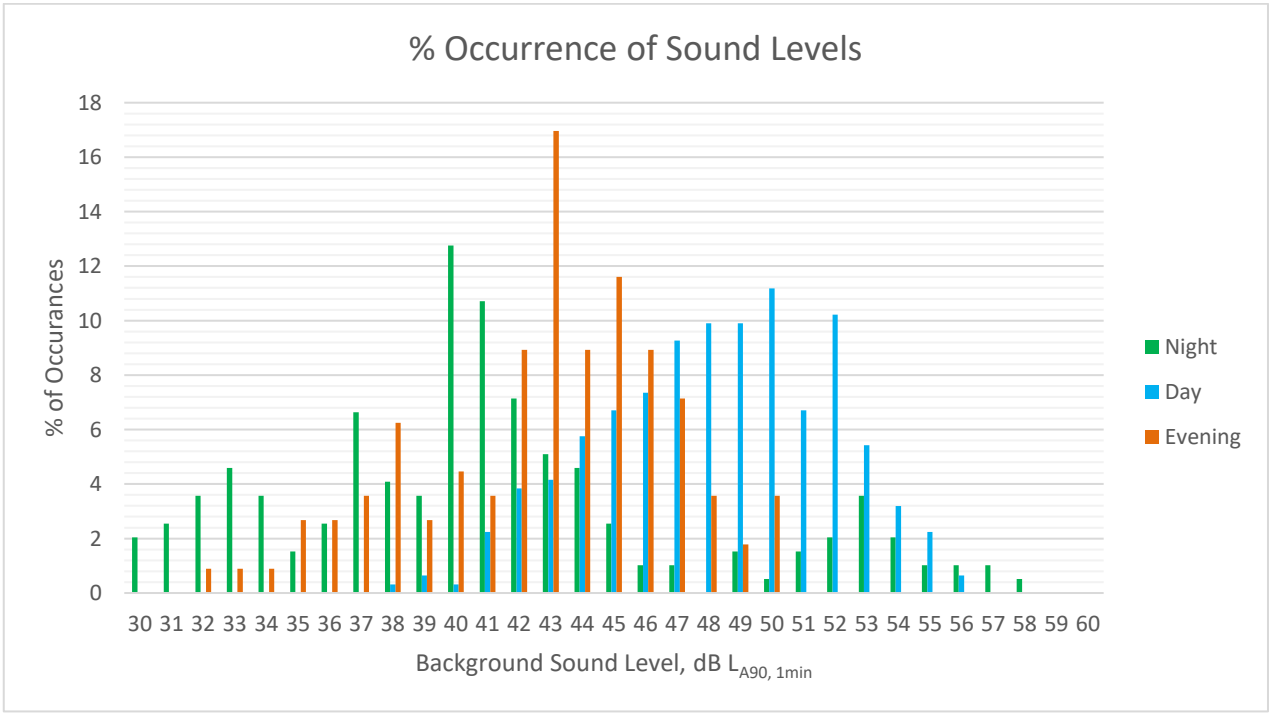


Figure A3: STATISTICAL ANALYSIS OF BACKGROUND LEVELS AT MP03 - NO SIGNIFICANT CONSTRUCTION

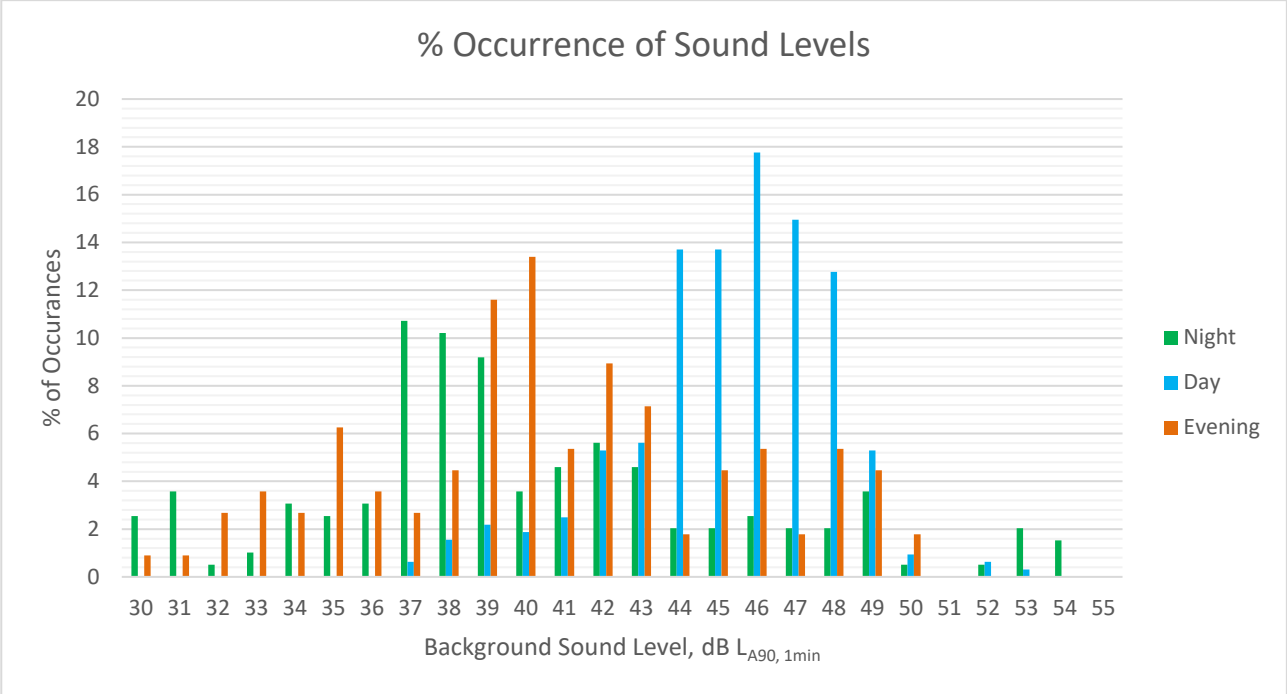


Figure A4: STATISTICAL ANALYSIS OF BACKGROUND LEVELS AT MP04 - NO SIGNIFICANT CONSTRUCTION

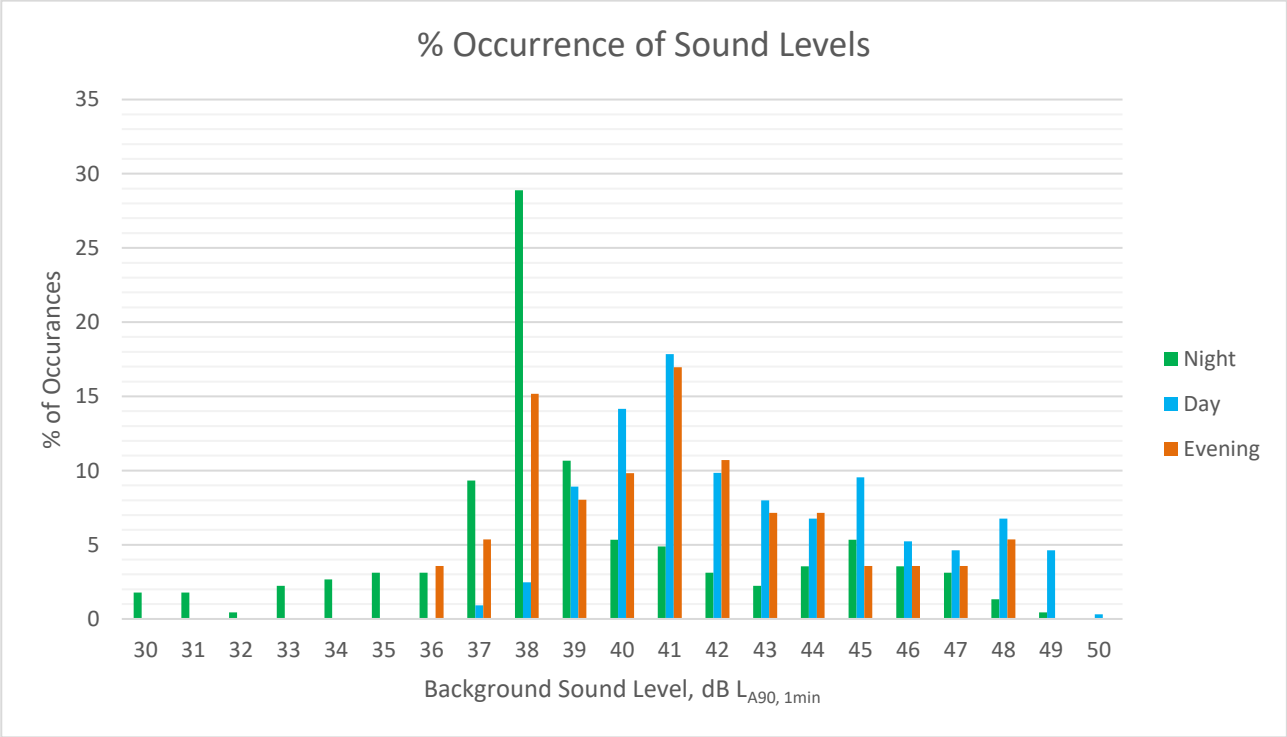
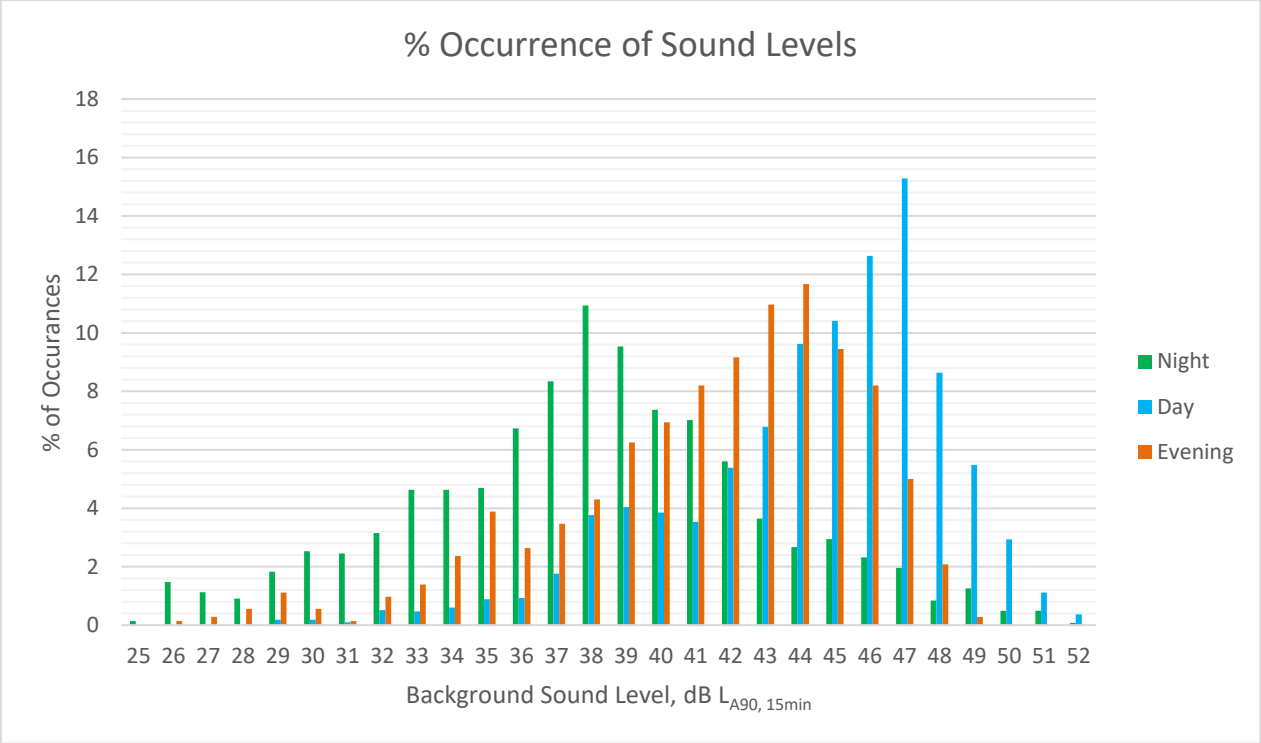


Figure A5: STATISTICAL ANALYSIS OF BACKGROUND LEVELS AT MP05 - NO SIGNIFICANT CONSTRUCTION



Appendix B

Table b1: WEATHER RECORD OBTAINED FOR UNATTENDED MONITOR PERIODS

Data type Unit	Wind Speed, m/s		Rain intensity, mm/h		Temperature, °C		Humidity rate, %	
Period start (dd/mm/yyyy)	Mean	Max	Mean	Max	Mean	Max	Mean	Max
01/11/2020	1.6	9.3	0	0.3	14.4	17.4	81	91
02/11/2020	2.1	13.3	0	6.6	13.2	17	71	87
03/11/2020	1.1	11.4	0.2	22.6	7.1	10.4	78	91
04/11/2020	0.5	3.9	0	0	4.3	12.6	83	94
05/11/2020	0.9	3.2	0	0	3.4	10.7	90	94
06/11/2020	0.8	4.7	0	0	5.7	11.8	79	95
07/11/2020	0.5	2.9	0	1.3	9.9	16	82	93
08/11/2020	0.4	2.3	0	1.6	12.1	14.3	89	93
09/11/2020	0.5	3.8	0.1	8	12.8	16.2	90	95
10/11/2020	0.5	3.2	0.1	3.7	11.3	15.9	88	94
11/11/2020	1.3	8	0.1	4.5	11.2	13.1	86	94
12/11/2020	1.2	7.8	0	1.4	10.6	13.4	77	86
13/11/2020	0.9	6.7	0	3.6	10.5	12.6	77	88
14/11/2020	1.3	7.9	0.2	10.5	12.1	13.7	87	93
15/11/2020	1.4	8	0.2	11.3	10.4	13.1	80	92
16/11/2020	1.3	7	0	1.8	10.6	12.9	78	92
17/11/2020	1.2	7.5	0	0	12.8	14.2	81	89
18/11/2020	1.5	10.5	0	4.1	11.6	15.2	77	89
19/11/2020	1.5	8.5	0	2.4	7.5	10.5	75	89
20/11/2020	0.8	5	0	1.7	5.5	10.7	89	94
21/11/2020	1.4	8.5	0	0	11	12.6	75	83
22/11/2020	0.6	4.5	0	0	7.7	11.4	84	94
23/11/2020	0.6	3.8	0	0	5	10.1	88	94
24/11/2020	1	5.8	0	0	10	12.3	81	90
25/11/2020	0.7	5.2	0	3.6	9.1	12.8	87	93
26/11/2020	0.4	2.5	0	0	4.6	9	87	94
27/11/2020	0.5	3	0	0.3	2.4	5.4	91	95
28/11/2020	0.7	3.8	0	0	8.5	10.3	88	92
29/11/2020	0.7	2.8	0	0	7.2	8.8	91	93
30/11/2020	1.3	7.9	0	1.1	6.7	10.3	87	94
01/12/2020	0.9	4.2	0	0	4	8.3	80	91
02/12/2020	0.5	2.8	0	0	4.3	6.4	86	93
03/12/2020	0.8	4.6	0.4	8.2	4.9	6.8	90	93
04/12/2020	1.4	6.6	0.1	2.8	4.1	5.4	81	93
05/12/2020	1.2	6.4	0	0	5.1	8.5	76	86
06/12/2020	0.8	3.9	0	0.5	2.2	5.9	88	93

Data type Unit	Wind Speed, m/s		Rain intensity, mm/h		Temperature, °C		Humidity rate, %	
Period start (dd/mm/yyyy)	Mean	Max	Mean	Max	Mean	Max	Mean	Max
07/12/2020	0.6	2.5	0	0.7	0.9	2	93	94
08/12/2020	0.5	2.9	0	3.8	0.7	3.7	92	94
09/12/2020	0.8	4.1	0	2.4	5	6.5	85	93
10/12/2020	1.1	5	0	5.1	6.8	7.4	83	93
11/12/2020	0.5	4.6	0.2	8	8.1	10.7	92	94
12/12/2020	1.2	6.6	0	0	6.8	9.4	84	94
13/12/2020	1.1	6.7	0.1	4.1	6.6	11.4	91	94
14/12/2020	1.2	7.7	0.1	8.5	10.2	13.1	84	91
15/12/2020	0.8	6	0	5.4	8.5	11.5	85	93
16/12/2020	1.3	8.3	0.1	11.2	8.7	10.5	84	91
17/12/2020	0.8	5.2	0	0.9	8.4	11.5	85	94
18/12/2020	1.7	8.3	0	0	11.1	11.9	86	91
19/12/2020	1.4	8.2	0.1	37.2	9.8	12	81	91
20/12/2020	1	7	0	7.9	7.6	10.5	81	88
21/12/2020	1.2	7.5	0.1	6.9	10.9	13.6	89	93
22/12/2020	1	7.8	0	0.8	10.6	13.6	87	93
23/12/2020	0.8	9.6	0.1	22.8	10.2	13.1	85	93
24/12/2020	2.2	9.5	0	4	4.4	6.5	76	88
25/12/2020	1.2	4.8	0	0	1.6	4.1	74	84
26/12/2020	1.4	9.7	0	1.1	6.3	10.6	83	90
27/12/2020	1.4	11.8	0.3	9.8	5.6	9.7	80	93
28/12/2020	0.8	4.7	0	0.1	0.8	2.9	90	94
29/12/2020	1.2	5.1	0	0.2	2.4	4.1	84	89
30/12/2020	0.5	4	0	0	0.6	5.1	88	94
31/12/2020	0.8	3.6	0	0	-0.3	1	89	94
06/02/2021	0.9	6.1	0.2	8.8	5.9	9.1	87	93
07/02/2021	2.4	9.3	0	4.8	1.6	3.7	76	90
08/02/2021	2	9.7	0	0.1	-1.2	-0.6	76	85
09/02/2021	1.3	6.3	0	2.8	-0.5	0.4	77	85
13/02/2021	1.9	7.6	0	0	-0.8	1.8	53	66
14/02/2021	1.7	8.6	0	4.9	2.6	4.3	61	85
20/02/2021	1.5	8.6	0	0	12.7	14.3	65	76
21/02/2021	0.7	4.9	0	0.5	11	13.6	78	90
22/02/2021	0.4	2.6	0	0.7	8.3	9.8	88	91
25/03/2022	0.5	1.3	0	0	10.2	20.9	60	89
26/03/2022	0.6	1.3	0	0	11.5	21.3	59	88
27/03/2022	0.5	1	0	0	8.9	16.7	78	90
28/03/2022	0.5	1.2	0	0	10	18.8	68	92
29/03/2022	0.6	1.4	0	0.3	9.2	12.9	75	86
30/03/2022	1	2.4	0	0.3	7.1	11	77	88

Data type Unit	Wind Speed, m/s		Rain intensity, mm/h		Temperature, °C		Humidity rate, %	
Period start (dd/mm/yyyy)	Mean	Max	Mean	Max	Mean	Max	Mean	Max
03/04/2022	0.8	1.7	0	0	4.2	10.7	62	93
04/04/2022	1.5	2.7	0.1	5.2	9.7	14.7	76	88
05/04/2022	1.4	2.6	0	0	12	14.7	67	80
15/04/2022	0.5	1.4	0	0	15	25.6	63	92
16/04/2022	0.6	1.5	0	0	14.7	24.5	61	92
17/04/2022	0.8	1.9	0	0	13.2	21.6	54	92
18/04/2022	0.6	1.7	0	0	12.2	18.1	56	87
19/04/2022	0.7	1.9	0	4.9	11	18.6	65	89

Appendix C

Unattended Survey Results

Daytime $L_{Aeq,16hr}$ and night-time $L_{Aeq,8hr}$ ambient sound levels at MP01 to MP05 are presented in Tables C1**Error! Reference source not found.** to C5 below. The ambient sound levels h ave been calculated using logarithmic averaging of measurements, whilst mean $L_{Amax,F}$ and $L_{A90,T}$ sound levels have been calculated using arithmetic averaging of measurements. The range of measured levels from which each logarithmic or mean value has been calculated is shown in parenthesis.

Table C1: Summary of unattended sound monitoring result at MP01

Day of Meas.	Date	Measured Sound Levels, dB re. 2 x 10^{-5} Pa.					
		Daytime (07:00 hrs - 23:00 hrs)			Night-time (23:00 hrs - 07:00 hrs)		
		$L_{Amax,F}$	$L_{Aeq,16hr}$	$L_{A90,16hr}$	$L_{Amax,F}$	$L_{Aeq,8hr}$	$L_{A90,8hr}$
Sat	06-Feb-21	64 (45-83)	63 (44-76)	50 (43-73)	55 (47-81)	50 (44-62)	46 (43-50)
Sun	07-Feb-21	61 (46-83)	57 (44-69)	51 (44-63)	57 (46-83)	52 (45-66)	47 (44-56)
Tue	09-Feb-21	65 (46-84)	61 (44-72)	52 (44-70)	57 (42-75)	52 (40-60)	44 (39-52)
Sat	13-Feb-21	60 (47-84)	53 (45-66)	48 (44-58)	51 (46-71)	48 (44-58)	46 (42-50)
Sun	14-Feb-21	60 (48-86)	56 (45-67)	51 (44-60)	60 (58-72)	59 (57-62)	58 (57-60)
Sat	20-Feb-21	64 (49-98)	58 (47-73)	52 (46-60)	56 (47-77)	50 (45-62)	46 (43-51)
Sun	21-Feb-21	62 (48-96)	55 (45-71)	48 (41-54)	57 (49-78)	53 (47-65)	49 (46-58)
Overall Mean Values		**62 (60-65)**	**58 (53-63)**	**50 (48-52)**	**56 (51-60)**	**52 (48-59)**	**48 (44-58)**

Table C2: Summary of unattended sound monitoring result at MP02

Day of Meas.	Date	Measured Sound Levels, dB re. 2 x 10^{-5} Pa.					
		Daytime (07:00 hrs - 23:00 hrs)			Night-time (23:00 hrs - 07:00 hrs)		
		$L_{Amax,F}$	$L_{Aeq,16hr}$	$L_{A90,16hr}$	$L_{Amax,F}$	$L_{Aeq,8hr}$	$L_{A90,8hr}$
Fri	25-Mar-22	78 (73-88)	64 (58-68)	49 (43-55)	73 (69-80)	58 (51-65)	44 (40-53)
Sat	26-Mar-22	77 (71-90)	63 (58-65)	48 (42-53)	73 (69-78)	56 (51-61)	42 (38-46)
Sun	27-Mar-22	75 (71-85)	62 (55-64)	45 (39-49)	74 (53-83)	61 (40-67)	44 (36-58)
Mon	28-Mar-22	77 (71-85)	64 (54-67)	47 (38-55)	73 (65-91)	60 (42-67)	40 (31-54)
Tue	29-Mar-22	77 (69-90)	64 (50-66)	47 (32-55)	73 (42-86)	61 (31-67)	36 (28-55)
Wed	30-Mar-22	77 (71-94)	66 (54-79)	48 (34-56)	74 (68-79)	61 (47-67)	37 (31-54)
Sun	03-Apr-22	75 (71-94)	62 (54-66)	45 (38-52)	73 (51-81)	63 (41-69)	45 (38-60)
Overall Mean Values		**77 (75-78)**	**64 (62-66)**	**47 (45-49)**	**73 (73-74)**	**60 (56-61)**	**41 (36-44)**

Table C3: Summary of unattended sound monitoring result at MP03

Day of Meas.	Date	Measured Sound Levels, dB re. 2 x 10^{-5} Pa.					
		Daytime (07:00 hrs - 23:00 hrs)			Night-time (23:00 hrs - 07:00 hrs)		
		$L_{Amax,F}$	$L_{Aeq,16hr}$	$L_{A90,16hr}$	$L_{Amax,F}$	$L_{Aeq,8hr}$	$L_{A90,8hr}$
Fri	25-Mar-22	70 (60-87)	55 (50-59)	46 (41-50)	64 (56-76)	51 (44-58)	42 (38-50)
Sat	26-Mar-22	68 (57-84)	53 (48-58)	45 (39-49)	61 (55-77)	48 (41-56)	39 (36-43)
Sun	27-Mar-22	69 (59-89)	55 (46-61)	44 (37-48)	63 (56-81)	53 (41-59)	43 (36-54)
Mon	28-Mar-22	69 (56-99)	55 (42-66)	44 (34-59)	59 (49-74)	50 (32-57)	36 (27-49)
Tue	29-Mar-22	69 (55-88)	54 (42-59)	43 (28-49)	62 (49-82)	51 (33-60)	31 (23-49)
Wed	30-Mar-22	69 (54-88)	54 (41-61)	44 (32-49)	60 (51-76)	48 (34-54)	34 (27-48)
Sun	03-Apr-22	68 (56-93)	52 (47-60)	44 (38-50)	60 (50-70)	53 (42-60)	46 (40-55)
Overall Mean Values		**69 (68-70)**	**54 (52-55)**	**44 (43-46)**	**62 (59-64)**	**50 (48-53)**	**38 (31-43)**

Table C4: Summary of unattended sound monitoring result at MP04

Day of Meas.	Date	Measured Sound Levels, dB re. 2 x 10^{-5} Pa.					
		Daytime (07:00 hrs - 23:00 hrs)			Night-time (23:00 hrs - 07:00 hrs)		
		$L_{Amax,F}$	$L_{Aeq,16hr}$	$L_{A90,16hr}$	$L_{Amax,F}$	$L_{Aeq,8hr}$	$L_{A90,8hr}$
Tue	04-Jan-22	77 (69-85)	56 (49-61)	45 (41-50)	60 (46-83)	49 (39-57)	40 (37-48)
Wed	05-Jan-22	77 (65-84)	56 (50-60)	46 (41-49)	63 (47-85)	51 (39-58)	40 (37-49)
Fri	15-Apr-22	77 (63-84)	56 (44-61)	41 (37-50)	62 (45-78)	51 (39-58)	39 (37-47)
Sat	16-Apr-22	76 (51-83)	56 (40-60)	40 (37-47)	63 (46-83)	51 (39-58)	40 (37-47)
Sun	17-Apr-22	77 (58-83)	56 (49-60)	43 (40-48)	63 (46-80)	51 (36-58)	38 (33-47)
Mon	18-Apr-22	77 (69-82)	55 (48-59)	40 (36-44)	62 (40-89)	53 (30-62)	35 (28-46)
Tue	19-Apr-22	77 (68-91)	56 (48-63)	41 (36-47)	-	-	-
Overall Mean Values		**77 (76-77)**	**56 (55-56)**	**42 (40-46)**	**62 (60-63)**	**51 (49-53)**	**39 (35-40)**

Table C5: Summary of unattended sound monitoring result at MP05

Day of Meas.	Date	Measured Sound Levels, dB re. 2 x 10^{-5} Pa.					
		Daytime (07:00 hrs - 23:00 hrs)			Night-time (23:00 hrs - 07:00 hrs)		
		$L_{Amax,F}$	$L_{Aeq,16hr}$	$L_{A90,16hr}$	$L_{Amax,F}$	$L_{Aeq,8hr}$	$L_{A90,8hr}$
Overall Mean Values		**83 (77-85)**	**61 (59-64)**	**44 (33-48)**	**61 (47-82)**	**54 (45-58)**	**38 (28-46)**

Table C6: FULL DAILY RESULTS OF UNATTENDED SOUND MONITORING RESULT AT MP05

Day of Meas.	Date	Measured Sound Levels, dB re. 2 x 10^{-5} Pa.					
		Daytime (07:00 hrs - 23:00 hrs)			Night-time (23:00 hrs - 07:00 hrs)		
		$L_{Amax,F}$	$L_{Aeq,16hr}$	$L_{A90,16hr}$	$L_{Amax,F}$	$L_{Aeq,8hr}$	$L_{A90,8hr}$
Sat	01-Nov-20	80 (57-89)	59 (48-64)	46 (43-48)	60 (51-84)	51 (45-60)	41 (38-46)
Sun	02-Nov-20	83 (79-89)	61 (59-64)	48 (42-49)	71 (56-87)	56 (50-63)	46 (41-51)
Mon	03-Nov-20	83 (79-87)	60 (55-63)	46 (43-48)	66 (54-88)	56 (46-64)	42 (39-48)
Tue	04-Nov-20	85 (75-89)	62 (52-66)	44 (39-49)	64 (52-88)	56 (45-65)	40 (37-46)
Wed	05-Nov-20	84 (78-88)	62 (54-65)	41 (37-46)	-[1]	-[1]	-[1]
Thu	06-Nov-20	84 (76-91)	62 (55-66)	44 (38-50)	80 (75-87)	57 (49-60)	38 (38-39)
Fri	07-Nov-20	82 (50-90)	59 (40-65)	41 (38-45)	58 (41-83)	52 (37-61)	38 (36-44)
Sat	08-Nov-20	80 (51-89)	59 (41-64)	38 (34-40)	51 (37-84)	49 (33-59)	34 (32-38)
Sun	09-Nov-20	84 (75-91)	62 (54-66)	43 (38-48)	60 (38-85)	55 (34-61)	36 (32-44)
Mon	10-Nov-20	84 (72-91)	62 (50-67)	43 (39-49)	60 (40-87)	54 (35-63)	37 (32-44)
Tues	11-Nov-20	84 (72-90)	62 (49-66)	46 (43-49)	60 (37-88)	55 (33-63)	39 (31-49)
Wed	12-Nov-20	84 (71-91)	62 (52-65)	45 (42-49)	62 (43-86)	54 (38-61)	39 (37-48)
Thu	13-Nov-20	84 (77-90)	62 (53-68)	46 (41-48)	61 (43-88)	55 (39-65)	41 (37-47)
Fri	14-Nov-20	83 (75-93)	61 (53-70)	46 (42-49)	58 (38-89)	54 (35-66)	39 (34-46)
Sat	15-Nov-20	80 (52-88)	60 (44-65)	44 (41-47)	51 (41-82)	48 (35-59)	38 (34-46)
Sun	16-Nov-20	83 (74-89)	61 (51-65)	45 (39-48)	60 (47-81)	52 (38-59)	38 (36-39)
Mon	17-Nov-20	84 (76-90)	62 (51-65)	44 (40-48)	59 (42-86)	54 (38-63)	39 (35-47)
Tue	18-Nov-20	84 (77-91)	62 (54-66)	47 (42-49)	56 (43-88)	53 (38-64)	39 (36-46)
Wed	19-Nov-20	83 (79-85)	61 (54-63)	40 (36-44)	68 (48-88)	58 (39-64)	38 (35-41)
Thu	20-Nov-20	83 (67-92)	62 (46-69)	48 (41-52)	62 (43-86)	55 (37-62)	40 (34-50)
Fri	21-Nov-20	82 (77-88)	59 (52-62)	43 (41-45)	58 (42-86)	54 (39-64)	39 (37-43)
Sat	22-Nov-20	79 (54-90)	59 (42-66)	39 (37-40)	51 (41-79)	49 (34-58)	35 (31-37)
Sun	23-Nov-20	84 (72-90)	62 (50-66)	46 (43-50)	54 (41-87)	55 (34-64)	38 (32-47)
Mon	24-Nov-20	83 (69-90)	61 (48-65)	45 (43-48)	63 (46-87)	55 (40-64)	40 (37-47)
Tue	25-Nov-20	83 (67-101)	64 (44-75)	43 (34-47)	61 (43-85)	55 (39-64)	41 (37-46)
Wed	26-Nov-20	84 (75-90)	61 (50-65)	42 (40-48)	48 (39-80)	45 (31-57)	31 (29-39)
Thu	27-Nov-20	83 (74-88)	61 (53-66)	45 (40-50)	62 (46-85)	53 (37-59)	39 (34-45)
Fri	28-Nov-20	82 (77-89)	59 (51-62)	38 (33-40)	56 (38-88)	53 (33-63)	34 (31-39)
Sat	29-Nov-20	80 (56-89)	59 (41-63)	33 (29-38)	49 (35-81)	45 (30-58)	30 (28-32)
Sun	30-Nov-20	83 (80-87)	61 (57-63)	44 (41-45)	63 (36-84)	54 (28-59)	28 (26-33)
Mon	01-Dec-20	83 (77-90)	61 (54-65)	41 (35-46)	55 (36-81)	53 (33-60)	34 (32-39)
Tue	02-Dec-20	83 (75-89)	61 (54-65)	43 (37-47)	58 (37-84)	54 (31-62)	37 (29-42)
Wed	03-Dec-20	84 (70-90)	62 (55-66)	48 (34-56)	60 (45-87)	54 (40-63)	42 (36-51)
Thu	04-Dec-20	84 (78-89)	61 (53-65)	47 (44-49)	78 (70-84)	57 (48-60)	45 (44-45)
Fri	05-Dec-20	79 (43-89)	59 (39-64)	41 (38-45)	55 (42-84)	51 (38-61)	40 (36-46)
Sat	06-Dec-20	77 (53-89)	59 (39-64)	34 (29-38)	47 (38-79)	45 (31-57)	32 (30-35)
Sun	07-Dec-20	84 (77-90)	62 (54-66)	38 (32-43)	54 (39-83)	51 (29-59)	29 (26-32)
Mon	08-Dec-20	84 (79-89)	62 (57-65)	46 (42-50)	64 (43-86)	57 (34-63)	37 (32-45)
Tue	09-Dec-20	-[1]	-[1]	-[1]	82 (78-86)	58 (52-60)	43 (43-43)
Wed	10-Dec-20	84 (74-89)	62 (53-66)	44 (40-48)	63 (41-89)	56 (37-64)	39 (36-55)
Thu	11-Dec-20	84 (74-89)	62 (52-67)	44 (38-48)	63 (44-89)	56 (40-65)	43 (36-55)
Fri	12-Dec-20	83 (81-88)	59 (57-62)	40 (39-42)	79 (77-83)	57 (50-61)	32 (32-33)
Sat	13-Dec-20	80 (57-89)	59 (48-65)	46 (43-50)	55 (44-84)	50 (40-59)	41 (37-47)
Sun	14-Dec-20	84 (77-88)	62 (54-66)	47 (43-51)	60 (44-89)	55 (39-63)	42 (37-50)
Mon	15-Dec-20	84 (73-89)	62 (53-66)	48 (45-51)	61 (47-88)	54 (42-63)	43 (39-51)
Tues	16-Dec-20	84 (76-90)	62 (52-66)	47 (44-50)	60 (43-89)	56 (39-67)	41 (38-47)
Wed	17-Dec-20	84 (76-94)	62 (53-66)	48 (43-53)	62 (46-87)	56 (40-65)	43 (38-51)
Thu	18-Dec-20	84 (75-89)	62 (53-67)	47 (43-51)	59 (44-87)	56 (40-65)	41 (38-47)
Overall Mean Values		**83 (77-85)**	**61 (59-64)**	**44 (33-48)**	**61 (47-82)**	**54 (45-58)**	**38 (28-46)**

Note: [1] Data not available for the period.

Appendix D

BS 5228 Assessment

The BS 5228 (ABC) example assessment method 1 allows an assessment of the effects from construction noise using a matrix of established noise threshold levels above which a potential significant effect is concluded. ABC threshold levels are to be applied to residential receptors only.

An extract from BS 5288, Table E1 setting out the example ABC threshold values is provided overleaf on Figure D1.

Figure D1: Table E.1 extracted from BS 5228.

Table E.1 **Example threshold of potential significant effect at dwellings**

Assessment category and threshold value period	Threshold value, in decibels (dB) ($L_{Aeq,T}$)		
	Category A [A]	Category B [B]	Category C [C]
Night-time (23.00–07.00)	45	50	55
Evenings and weekends [D]	55	60	65
Daytime (07.00–19.00) and Saturdays (07.00–13.00)	65	70	75

NOTE 1 A potential significant effect is indicated if the $L_{Aeq,T}$ noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level.

NOTE 2 If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3 dB due to site noise.

NOTE 3 Applied to residential receptors only.

[A] Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.

[B] Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.

[C] Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.

[D] 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.

The baseline noise levels used in the BS 5228 assessment have been taken from the semi-permanent unattended noise monitoring systems during periods where no construction works were taking place, using baseline levels obtained from monitors MP01 to MP05 for the periods described in Section 3.3. The $L_{Aeq,T}$ levels presented in this document for MP01 and MP05 were measured during the Covid-19 pandemic, during a government lockdown. It is considered that this may have led to an unusually low $L_{Aeq,T}$ levels, as road traffic reduced due to restrictions in place at the time.

Sensitive receptor pre-existing ambient noise levels have been calculated for day (07:00 to 19:00 hrs), evening, (19:00 to 23:00 hrs) and night-time (23:00 to 07:00 hrs) periods for BS 5228 assessment purposes.

A summary of the pre-existing ambient noise levels assigned to each receptor is presented in Table D1 below with the BS 5228 assessment category and significant effect level.

Table D1: Receptor BS 5228 Assessment Categories and Significant Effect Levels

Baseline Monitor	Baseline Period	Ambient Level, dB $L_{Aeq,T}$ (no Construction)	Threshold Category / Value, dB $L_{Aeq,T}$
MP01 (R1)	Day	58	A - 65
	Evening	52	A - 55
	Night	52	C - 55
MP02 (R2)	Day	64	B - 70
	Evening	59	C - 65
	Night	58	C - 55
MP03 (R3, R4 and R5)	Day	54	A - 65
	Evening	52	A - 55
	Night	50	C - 55
MP04 (R6, R7 and R9)	Day	56	A - 65
	Evening	55	B - 60
	Night	51	C - 55
MP05 (R8)	Day	61	A - 65
	Evening	60	C - 65
	Night	54	C - 55

A comparison between the predicted receptor day, evening and night construction noise levels with the corresponding significant effect threshold level is presented below in Table D2.

Table D2: Comparison between Calculated Receptor Construction Levels and Significant Effect Levels

Receptor	Assessment Period	Construction Level , dB $L_{Aeq,T}$ (a)	Threshold Level , dB $L_{Aeq,T}$ (b)	Difference (a-b)
R1	Day	53	65	-12
	Evening	51	55	-4
	Night	51	55	-4
R2	Day	51	70	-19
	Evening	46	65	-19
	Night	47	55	-8
R3	Day	48	65	-17
	Evening	46	55	-9
	Night	47	55	-8
R4	Day	47	65	-18
	Evening	45	55	-10
	Night	47	55	-8
R5	Day	45	65	-20
	Evening	41	55	-14
	Night	43	55	-12
R6	Day	40	65	-25
	Evening	38	60	-22
	Night	39	55	-16

Receptor	Assessment Period	Construction Level , dB $L_{Aeq,T}$ (a)	Threshold Level , dB $L_{Aeq,T}$ (b)	Difference (a-b)
R7	Day	40	65	-25
	Evening	38	60	-22
	Night	38	55	-17
R8	Day	36	65	-29
	Evening	33	65	-32
	Night	35	55	-20
R9	Day	33	65	-32
	Evening	28	60	-32
	Night	30	55	-25