Noise Impact Assessment for West Newton A Exploration, Appraisal and Production Development

West Newton, East Riding of Yorkshire

For Rathlin Energy (UK) Limited

www.rpsgroup.com

Quality Management

Prepared by	Christina Ioannidou MSc Eng. Acoustics, MIOA	Senior Acoustic Consultant		20/04/2021
Reviewed & checked by	Lise W. Tjellesen, MSc Eng. Acoustics, MIOA	Technical Director		20/04/2021
Authorised by	Simon Stephenson CEng, BSc (Hons), MIOA, ASA	Technical Director	pp. LWT 	20/04/2021
Date of Issue	20/04/2021	**Report Number**	JAT2106–REPT–03–R5-Rathlin-WNA	

Revision History

Rev	Date	Status	Reason for revision	Comments
0	20/04/2021	Draft	-	Draft for comment
1	19/05/2021	Draft	Update according to comments.	
2	25/05/2021		Update according to comments.	
3	28/05/2021		Update according to comments.	
4	15/06/2021		Update according to comments.	
5	17/06/2021		Update according to comments.	

Contents

1 Introduction 1
2 Acoustic Terminology and Concepts 3
3 Description of Proposed Development 6
Phase 1:Appraisal Testing and Workover of Existing Wells 6
Phase 2: Wellsite Extension Construction 6
Stage 2a: Wellsite Extension and Cellar Construction 6
Stage 2b: Conductor Installation 6
Phase 3:Drilling 7
Phase 4: Well Treatment and Clean Up 7
Phase 5: Well Testing 7
Phase 6: Process Facility 8
Phase 7: Well Workovers, Routine Maintenance and Repairs 8
Phase 8: Well and Production Facility Decommissioning 8
Phase 9 Restoration and Aftercare 9
4 Summary of Relevant Policy, Guidance and Standards 12
Noise Policy Statement for England 12
National Planning Policy Framework 13
Planning Practice Guidance - Noise 14
Planning Practice Guidance on Minerals (PPG-M) 17
British Standard 4142 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound' 19
British Standard 5228: 2009+A1:2014 "Code of practice for noise and vibration control on construction and open sites" 21
British Standard 8233:2014 Guidance on sound insulation and noise reduction for buildings. 23
World Health Organisation (WHO) Guidelines 23
Local Development Plans 25
Joint Minerals Plan 2016 - 2033 26
5 Baseline Noise Description 27
Noise Sensitive Receptors 27
Meteorological Conditions 30
Results and Discussion 30
6 Calculations and Noise Modelling 40

Overview 40
Wellsite Extension Construction, Restoration and Aftercare 40
Traffic 40
Wellsite Extension Construction - Conductor Drilling....42
Drilling 42
Testing of Existing/Additional Wells 46
Noise Model Methodology....47
7 Results and Assessment 48
Traffic Noise Assessment 48
Wellsite Construction and Restoration Noise Assessment 49
Conductor Drilling Noise Assessment....51
Drilling Noise Assessment 54
Appraisal Testing Assessment....58
8 Operational Noise BS 4142 Assessment 61
Overview 61
Noise Emission Limits 61
Assessment....62
Discussion of Context....64
9 Discussion.... 65
10 Uncertainty 67
11 Potential In-Design Mitigation 68
Approach 68
Drilling Phase 68
Drilling Phase 75
Operational Phase....75
Noise Monitoring 76
12 Summary and Conclusions 77

Tables

Table 3.1: Phase Programme 9
Table 3.2: WNA HGV Delivery Schedule and Timings per Phase 10
Table 3.3: HGV Delivery Schedule per Year 11

Table 4.1: Noise Exposure Hierarchy based on the Likely Average Response ... 15
Table 4.2: PPGM Noise Limits ... 19
Table 4.3: Construction Noise Threshold of Potentially Significant Effect at Dwellings ... 22
Table 4.4: Summary of Observed Health Effects in the Population (WHO NNG) ... 24
Table 5.1: Measured Baseline Noise Level Ranges ... 31
Table 5.2: Summary of Attended Noise Measurement Results ... 38
Table 5.3: Baseline Noise Levels Used in Assessment ... 39
Table 6.1: Construction Noise Data Used for Modelling ... 40
Table 6.2: Traffic Data Used for Modelling – Burton Constable Road North of Junction with Pipers Lane ... 41
Table 6.3: Traffic Data Used for Modelling – Lambwath Lane ... 41
Table 6.4: Traffic Data Used for Modelling – Mulberry Lane ... 41
Table 6.5: Traffic Data Used for Modelling – Burton Constable Road South of Junction with Pipers Lane ... 42
Table 6.6: Octave Band Sound Power Level Data for Marriott HH-220 Drilling Rig ... 44
Table 6.7: T-208 Source Sound Power Levels Used in Assessment ... 46
Table 6.8: Source Sound Power Level for Incinerators used in Assessment ... 46
Table 7.1: Construction Traffic Noise Assessment - Burton Constable Road North of Junction with Piper Lane ... 48
Table 7.2: Construction Traffic Noise Assessment - Lambwath Lane ... 48
Table 7.3: Construction Traffic Noise Assessment - Mulberry Lane ... 49
Table 7.4: Construction Traffic Noise Assessment - Burton Constable Road South of Junction with Piper Lane ... 49
Table 7.5: Wellsite Construction and Restoration Noise Assessment ... 50
Table 7.6: PPG-M Noise Assessment for Conductor Drilling ... 52
Table 7.7: Temporary Ambient Noise Level Change Assessment – Conductor Drilling ... 53
Table 7.8: PPG-M Noise Assessment for Drilling ... 55
Table 7.9: Temporary Ambient Noise Level Change Assessment – Drilling ... 57
Table 7.10: PPG-M Noise Assessment for Appraisal Testing ... 58
Table 7.11: Temporary Ambient Noise Level Change Assessment – Appraisal Well Testing ... 59
Table 8.1: Source Sound Power Level Limits Used in Assessment, dB re 1 pW ... 61
Table 8.2: BS4142 Noise Assessment for Operational Noise ... 62
Table 8.3: Ambient Noise Level Change Assessment During Operational Phase ... 63

Figures

Figure 2.1: **Refraction of Sound Waves due to Wind Gradients (Increasing Wind Speed with Height)**

Figure 5.1: **Noise Measurement Locations**

Figure 5.2: **Box and whisker plots of noise monitoring data**

Figure 6.1: **Photo of Marriott HH-220 drilling rig**

Figure 6.2: **Photo of Bentec T-208 drilling rig**

Figure 11.1: **Temporary acoustic enclosure for HPU**

Figure 11.2: **Mud Pump Engine Enclosure (note Exhaust Silencers)**

Figure 11.3: **Example Mud Pump Housing**

Figure 11.4: **Example Generator Enclosure with High Specification Exhaust Silencers**

Figure 11.5: **Example Centrifuge Enclosure**

Figure 11.6: **Example Demountable Acoustic Barrier**

Figure 11.7: **Example Barrier Constructed From Containers**

Figure 11.8: **Example Top Drive Enclosure (HH-220)**

Figure 11.9: **Example Enclosed Incinerator**

Figure A1: **Noise Monitoring Time History Location LT1**

Figure A2: **Noise Monitoring Time History Location LT2**

Figure A3: **Noise Monitoring Time History Location LT3**

Figure A4: **Noise Monitoring Time History Location LT4**

Figure A5: **Noise Monitoring Time History Location LT5**

Figure A6: **Noise Monitoring Time History Location LT6**

Figure A7: **Noise Monitoring Time History Location LT7**

1 Introduction

1.1 Rathlin Energy (UK) Limited intends to extend the existing West Newton A (WNA) wellsite, drill, test, appraise and produce from the two existing wells and drill, test, appraise and produce from up to six new wells.

1.2 The WNA wellsite is located to the north of West Newton and east of Marton, within the Parish of Aldbrough. The wellsite is currently authorised for hydrocarbon exploration use. West Newton village is 1,130 m to the south west and Marton is 800 m to the west.

1.3 The nearest residential properties are Caley Cottage which lies 480 m to the east of the WNA wellsite, Wood End House which lies 640 m to the west of the WNA wellsite, Church House which lies 540 m to the southwest of the WNA wellsite and Marton Farm which lies approximately 730 m to the west of the WNA.

1.4 There is one statutory designated site approximately 1 km to the north east, which is the Lambwath Meadows Site of Special Scientific Interest (SSSI). Four Local Wildlife Sites (LWS) have been identified within 1 km of the wellsite. The closest LWS is the Lambwath Stream, 400 m to the north. The area is predominantly arable fields with interspersed woodland and hedgerows.

1.5 The proposal includes amended access arrangements to the wellsite to allow for HGV's routing from both the North and the South.

1.6 RPS Group has been commissioned by Rathlin Energy (UK) Limited to undertake a noise assessment and this report presents the findings and recommendations from the study. It further details the mitigation methods to be adopted.

1.7 At this time, the exact drilling rig type to be used is unknown (this will depend upon drilling rig availability at the time drilling is due to commence). Therefore, the assessment is based on two example drilling rigs which exhibit different noise levels and characteristics that are considered to provide a range of typical/maximum adverse noise impacts, representative of that which may arise from any drilling rig that is eventually selected. Although the drilling rigs assessed within this report may not be available at the time of drilling, they represent a typical range of drilling rig noise characteristics and RPS' experience in undertaking drilling rig noise assessments has been applied to specification of mitigation. It is therefore anticipated that a similar degree of noise control can be applied to whichever drilling rig is eventually deployed.

1.8 There are no anticipated impacts that would arise due to groundborne vibration resulting directly from the operations. The drills are rotary bored only and therefore impart relatively small amounts of energy into the ground, for example when compared to percussive pilling techniques. Data available for continuous flight augers (i.e. drilling into the ground) suggests that groundborne vibration would be imperceptible at distances of around 20 m from source. Vibration levels from the drilling operations are not expected to be significantly different in magnitude. Consequently, at the nearest human/property receptors ground borne vibration would be considerably lower and, is highly unlikely to be perceptible. Furthermore, no perceptible vibration has been noted during drilling at West Newton A and B (WNA and WNB) wellsites. Vibration has therefore been scoped out of this study.

2 Acoustic Terminology and Concepts

2.1 This section provides an overview of the fundamentals of how sound propagates away from a source.

2.2 Increasing the distance from a noise source normally results in the level of noise getting quieter, due primarily to the spreading of the sound with distance, analogous to the way in which the ripples in a pond spread after a stone has been thrown in. Another important factor relates to the type of ground over which the sound is travelling. Acoustically "soft" ground, (such as grassland, ploughed fields etc.) will result in lower levels of noise with increasing distance from the noise source as compared to acoustically "hard" surfaces (e.g. concrete, water, paved areas). The reduction in noise level depends, however, on the frequency of the sound.

2.3 Wind also affects the way in which sound propagates, with noise levels downwind of a source being louder than upwind. This is partly due to the sound 'rays' being bent either upwards or downwards by the wind in a similar way that light is bent by a lens, as shown in Figure 2.1. Varying temperatures in the atmosphere can also cause sound 'rays' to be bent, adding to the complexity of sound propagation.

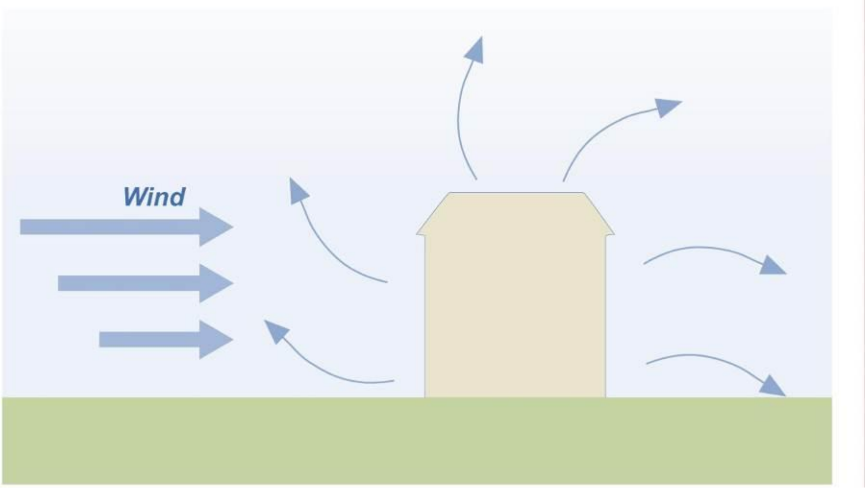


Figure 2.1: Refraction of Sound Waves due to Wind Gradients (Increasing Wind Speed with Height)

2.4 Another attenuation mechanism is absorption of sound by the molecules of the atmosphere. Higher pitched (higher frequency) sounds are more readily absorbed than lower pitched (lower frequency) sounds. The factors affecting the extent to which the sound is absorbed are the temperature and the water content of the atmosphere (relative humidity).

2.5 The effect of varying temperature and humidity is usually minimal when compared to other factors, such as wind and ground effects. However, where high frequency sounds are encountered, there may well be a significant variation between measured sound levels on different days due to variations in temperature and humidity.

2.6 When hearing noise which occurs out in the open (e.g. from road traffic, aircraft, birds, wind in the trees etc.), it is common experience that the noise level is not constant in loudness but is changing in amplitude all of the time. Therefore, it is beneficial to use statistical parameters to numerically describe the noise levels. It has become practice to use indices which describe the noise level which has been exceeded for a certain percentage of the measurement period, and also an index which gives a form of average of the sound energy over a particular time interval. The former are termed percentile noise levels and are notated L_{A90}, L_{A50}, L_{A10} etc. and the latter is termed the equivalent continuous noise level and is notated by L_{Aeq}. It is worth noting that if the noise level does not vary with time, then all the parameters, in theory, normalise to a single value.

2.7 With regards to the percentile levels, the L_{A90} is the sound pressure level which is exceeded for 90% of the measurement time. It is generally used as the measure of background noise (i.e. the underlying noise) in environmental noise standards.

2.8 The L_{Aeq} (sometimes denoted $L_{Aeq,T}$) is the A-weighted equivalent continuous noise level and is an energy averaged value of the actual time varying sound pressure level over the time interval, T. It is used in the UK as a measure of the noise level of a specific industrial noise source when assessing the level of the specific source against the background noise. It is also used as a measure of ambient noise (i.e. the "all-encompassing" sound field).

2.9 Other useful parameters for describing noise include the maximum and minimum sound pressure level encountered over the time period, denote L_{Amax} and L_{Amin} respectively.

2.10 The term 'A' weighting implies a measurement made using a filter with a standardised frequency response which approximates the frequency response of the human ear at relatively low levels of noise. The resulting level, expressed in 'A' weighted decibels, or dBA, is widely used in noise standards, regulations and criteria throughout the world.

2.11 For a more detailed analysis of the frequency characteristics of a noise source, then noise measurements can be made in bands of frequencies, usually one octave wide. The resulting levels are termed octave band sound pressure levels. The standard octave band centre frequencies range from 31.5 Hz (about three octaves below middle 'C' on the piano) to 8 kHz (about five octaves above middle 'C'). This covers most of the audible range of frequencies (usually taken to be around 20 Hz to 20 kHz). Octave band noise levels are usually quoted as linear data – i.e. without an 'A' weighting filter being applied. For more detailed analysis narrowband filters are useful for analysing tones.

2.12 The term decibel is a relative quantity and should always be referenced to an absolute level. In this report, all sound pressure levels (denoted L_P) are expressed in dB re 20 µPa. Hence, a sound pressure level of 0 dBA refers to a pressure level of 20 µPa, which is generally taken as the lowest level of sound that the human ear can detect. A negative dBA value usually implies that the sound is below the threshold of human hearing.

2.13 Subjectively, and for steady noise levels, a change in noise level of 3 dB is normally just discernible to the human ear. However, a noise change of less than 3 dB could be discernible if it has particular frequency characteristics or if it varies in loudness over time. A difference of 10 dB represents a doubling or halving of subjective loudness.

2.14 Sound power (denoted L_W) is the acoustical power radiated from a sound source. The advantage of using the sound power level, rather than the sound pressure level, in reporting noise from a source is that the sound power is independent of the location of the source, distance from the measurement point and environmental conditions. If the sound power of a source is known, then it is possible to calculate the sound pressure level at a distance away from the source, accounting for the attenuation due to propagation, as discussed above. Sound power levels are referenced to power rather than pressure; hence sound power levels are expressed in dB re 1 pW.

3 Description of Proposed Development

Phase 1:Appraisal Testing and Workover of Existing Wells

3.1 The existing hydrocarbon exploration wells (WNA-1 and WNA-2) may be appraised for a short time and both wells may be subject to a workover programme and/or lateral drilling. The operation will take about four weeks to complete and will include a workover rig and/or coiled tubing unit, wireline HGV's, nitrogen conversion equipment, well testing equipment, incinerator unit(s), and necessary metering equipment and tankage. The operation will be conducted 24 hours per day and 7 days per week.

3.2 To facilitate the flowing of hydrocarbons to surface Rathlin will initially install some temporary equipment which will include but will not be limited to incinerator units and potential beam pumps.

3.3 In case further wellbore treatments are required a workover rig and/or coil tubing (CT) unit and cranes may be used.

3.4 The total estimated duration of Phase 1 is up to 12 months. The Phase 1 programme is likely to be as shown in Table 3.1. Details of HGV movements are provided in Table 3.2.

Phase 2: Wellsite Extension Construction

3.5 Positive well appraisal results will initiate the next phase of development, i.e., the expansion of the existing well pad.

3.6 During this phase the equipment that will be used will include a conductor rig, a 360 excavator and a temporary mobile crane. A 4 m high security fencing will be installed around the wellsite perimeter.

Stage 2a: Wellsite Extension and Cellar Construction

3.7 During this phase the pad will be designed in accordance with land permeability and stability investigations performed as part of a geotechnical design process managed by suitably qualified engineers.

3.8 The total estimated duration of Phase 2a is up to 12 weeks. The likely Phase 2a Programme is shown in Table 3.1. Details of HGV movements are provided in Table 3.2.

Stage 2b: Conductor Installation

3.9 During this stage, an initial large-diameter hole will be drilled for each well using a smaller drilling rig (conductor setting rig with a mast height of up to 15 m). A conductor casing (i.e. the outer casing) will be installed and cemented back to surface to provide a stable and watertight structural foundation for the subsequent drilling and setting of smaller diameter and deeper casing strings.

3.10 The total estimated duration of Phase 2b is up to 12 weeks. The Phase 2b programme is likely to be as shown in Table 3.1. Details of HGV movements are provided in Table 3.2.

Phase 3:Drilling

3.11 Six additional wells are planned to be drilled at the WNA wellsite during this phase. The drilling will be split into multiple campaigns. The main noise sources during the drilling campaign will comprise the mobilisation of the main drilling rig (mast height up to 55m) and ancillary equipment to the wellsite and the drilling of main wellbores and side-tracks – if required.

3.12 The Phase 3 programme is likely to be as shown in Table 3.1. Details of HGV movements are provided in Table 3.2.

Phase 4: Well Treatment and Clean Up

3.13 To establish communication between the target formations and the wellbore, the casing must first be perforated. Small perforating charges are used to introduce a pathway between the formation and the wellbore.

3.14 The surface equipment utilised during this phase of operation includes a workover rig or coil tubing unit with a crane. Similar temporary well testing equipment, outlined in Phase 1, will be used during this phase of operation.

3.15 The Phase 4 programme is likely to be as shown in Table 3.1. Details of HGV movements are provided in Table 3.2.

Phase 5: Well Testing

3.16 The wells will require initial well testing. The objective of the well testing is to assess and acquire hydrocarbon data informing the commercial viability of the appraisal wells. The well testing will establish detailed gas and oil composition, flow rates, and pressures before going to the production, Phase 6.

3.17 During Phase 5 the natural gas will be incinerated, and crude oil transported off-site. This surface equipment used during this phase will utilise the same surface production equipment outlined in Phase 6. If Phase 5 identifies that the appraisal wells are not commercial and cannot transition into production wells, the wells will be subject to Phase 8 decommissioning.

3.18 The Phase 5 programme is likely to be as shown in Table 3.1. Details of HGV movements are provided in Table 3.2.

Phase 6: Process Facility

3.19 After the well testing is completed the process facility will be scaled to accommodate new flow rates and pressures from additional wells. During this phase further wells may be drilled alongside production operations.

3.20 During this stage an incinerator unit and/or vent stack for emergency shut down and tank pressure/vacuum will be installed. The maximum height of the incinerator and vent stack is subject to detail design, but it is likely to be less than 15 m.

3.21 A list of equipment expected to emit significant noise levels for the process facility includes the following plant items:

1. Incinerator(s)/ Vent stack
2. Transfer pumps
3. Generators.

3.22 The Phase 6 programme is likely to be as shown in Table 3.1. Details of HGV movements are provided in Table 3.10.

Phase 7: Well Workovers, Routine Maintenance and Repairs

3.23 Throughout the producing lifecycle of a well, maintenance workovers are likely to be required on multiple occasions. This will involve the lowering of tools into a well on a wire or within coiled tubing suspended from a mobile crane or with a small workover rig and may include changing downhole pumps (if installed), changing production tubing, re-perforating, re-treating the formation (acid treatment) or cleaning the formation. It cannot be anticipated how many times or how frequently a well will need maintenance. It is likely that a crane would be mobilised but, in some circumstances, there may be the need to mobilise a workover rig (up to 35 m in height) or in a side-track scenario described in Phase 3, a drilling rig. Working hours will be 24 hours.

3.24 Each maintenance campaign will be designed to comply with the prevailing planning conditions at the time of operation.

3.25 The Phase 7 programme is likely to be as shown in Table 3.1. Details of HGV movements are provided in Table 3.2.

Phase 8: Well and Production Facility Decommissioning

3.26 A workover rig (up to 35 m high) will be mobilised to the wellsite with generators, pumps and tanks. Upon completion, the workover rig and all other surface machinery will be dismantled, cleaned and removed from the wellsite.

3.27 The Phase 8 programme is likely to be as shown in Table 3.1. Details of HGV movements are provided in Table 3.2.

Phase 9 Restoration and Aftercare

3.28 In the event of wellsite restoration, the concrete chambers (drilling cellars) will be dismantled leaving the lowest pre-cast concrete ring in situ. Surface aggregates will be inspected prior to removal. Areas where contamination is identified will be removed for subsequent off-site treatment and reuse. The remaining surface aggregate will be removed for reuse.

3.29 Phase 9 programme is likely to be as shown in Table 3.1. Details of HGV movements are provided in Table 3.2.

Table 3.1: Phase Programme

Phase	Sub-phase	Hours of Wellsite Operations			Estimated Duration
		Mon - Fri	Sat	Sun/Bank Hols	
Phase 1: Appraisal Testing and Workover of Existing Wells	Mobilisation/ Demobilisation	07:00 - 19:00	07:00 - 19:00	None	1 week
	Appraisal Testing of Existing Wells	24/7	24/7	24/7	Up to 12 months
Phase 2: Wellsite Extension Construction	Mobilisation/ Demobilisation	07:00 - 19:00	07:00 - 19:00	None	2 weeks
	Wellsite Extension Construction	07:00 - 19:00	07:00 - 19:00	None	12 weeks
Phase 2b: Conductor Setting	Conductor Mobilisation/ Demobilisation	07:00 - 19:00	07:00 - 19:00	None	4 days (per mobilisation and demobilisation)
	Conductor Drilling	24hrs	24hrs	24hrs	28 days (per well)
Phase 3: Drilling	Mobilisation/ Demobilisation	07:00 - 19:00	07:00 - 19:00	None	2 weeks (per mobilisation and demobilisation)
	Drilling and Completion	24hrs	24hrs	24hrs	15 weeks (per well)
Phase 4: Well Treatment & Clean Up	Mobilisation/ Demobilisation	07:00 - 19:00	07:00 - 19:00	None	2 weeks (per mobilisation and demobilisation)
	Treatment	24hrs	24hrs	24hrs	2 weeks (per well)
	Well Clean Up	24hrs	24hrs	24hrs	2 weeks (per well)
Phase 5: WellTesting of Additional Wells	Mobilisation/ Demobilisation	07:00 - 19:00	07:00 - 19:00	None	2 weeks (per mobilisation and demobilisation)
	Well Testing	24hrs	24hrs	24hrs	330mmscf wellsite budget Indicative 1 – 2 year
Phase 6: Production	Delivery of equipment	07:00 - 19:00	07:00 - 19:00	None	6 weeks
	Production Facility Operation	24hrs	24hrs	24hrs	15 – 20 years
Phase 7: Well Workovers, Routine Maintenance and Repairs	Mobilisation/ Demobilisation	07:00 - 19:00	07:00 - 19:00	None	1 week (per mobilisation and demobilisation)
	Workover Operation	24hrs	24hrs	24hrs	Depends on maintenance requirement

Phase	Sub-phase	Hours of Wellsite Operations			Estimated Duration
		Mon - Fri	Sat	Sun/Bank Hols	
Phase 8: Well and Production Facility Decommissioning	Mobilisation/ Demobilisation	07:00 - 19:00	07:00 - 19:00	None	2 weeks (per mobilisation and demobilisation)
	Plugging and Abandonment	24hrs	24hrs	24hrs	3 weeks per well
	Removal of Surface Production Facility Equipment	07:00 - 19:00	07:00 - 19:00	None	8 weeks per site
Phase 9: Restoration and Aftercare	Mobilisation/ Demobilisation	07:00 - 19:00	07:00 - 19:00	None	1 week (per mobilisation and demobilisation)
	Earthworks Restoration	07:00 - 19:00	07:00 - 19:00	None	8 weeks
	Aftercare	None			5 years

Table 3.2: WNA HGV Delivery Schedule and Timings per Phase

Phase	Sub-Phase	Hours of HGV Operation			Estimated Duration	Estimated 2-way HGV Movements (In and Out)
		Mon - Fri	Sat	Sun/Bank Hols		
Phase 1: Appraisal Testing and Workover of Existing Wells	Mobilisation/ Demobilisation	07:00 - 19:00	None	None	1 week	20 per day
	Appraisal Testing of Existing Wells	07:00 - 19:00	07:00 - 19:00	24/7	4 weeks	5 per day
Phase 2: Wellsite Extension Construction Phase 2b: Conductor Setting	Mobilisation/ Demobilisation	07:00 - 19:00	None	None	2 weeks	10 per day
	Pad construction	07:00 - 19:00	None	None	12 weeks	30 per day
	Conductor Mobilisation and Demobilisation	07:00 - 19:00	None	None	4 days	5 per day
	Conductor Installation	07:00 - 19:00	07:00 - 19:00	24/7	14 days per well	3 per day
Phase 3: Drilling	Mobilisation/ Demobilisation	07:00 - 19:00	None	None	2 weeks	25 per day
	Drilling and Completion	07:00 - 19:00	07:00 - 19:00	24/7	15 weeks per well	15 per day
Phase 4: Well Treatment & Clean Up	Mobilisation/ Demobilisation	07:00 - 19:00	None	None	2 weeks	20 per day
	Clean up & Treatment	07:00 - 19:00	07:00 - 19:00	24/7	2 weeks per well	5 per day
Phase 5: Well Testing of Additional Wells	Mobilisation/ Demobilisation	07:00 - 19:00	None	None	2 weeks	20 per day
	Well Testing	07:00 - 19:00	07:00 - 19:00	24/7	90 days per well	5 per day
Phase 6: Production	Mobilisation/ Demobilisation	07:00 - 19:00	None	None	6 weeks	20 per day
	Facility operations	07:00 - 19:00	07:00 - 19:00	24/7	15-20 years	20-25 per day

Phase	Sub-Phase	Hours of HGV Operation			Estimated Duration	Estimated 2-way HGV Movements (In and Out)
		Mon - Fri	Sat	Sun/Bank Hols		
	Maintenance (includes mobilisation and demobilisation)	07:00 - 19:00	None	None	4-8 weeks	10 per day
Phase 7: Well Workovers, Routine Maintenance and Repairs	Mobilisation/ Demobilisation	07:00 - 19:00	None	None	1 week (per mobilisation and demobilisation)	10 per day
	Workover Operations	24 hours	24 hours	24 hours	Dependent upon maintenance required	Dependent upon maintenance required
Phase 8: Well and Production Facility Decommissioning	Mobilisation/ Demobilisation	07:00 - 19:00	None	None	2 weeks	20 per day
	Removal of Surface Facility Equipment	07:00 - 19:00	None	None	4 weeks	10 per day
	Plugging and Decommissioning Well(s)	07:00 - 19:00	None	24/7	3 weeks per well	5 per day
Phase 9: Restoration and Aftercare	Mobilisation/ Demobilisation	07:00 - 19:00	None	None	2 weeks	10 per day
	Earthworks Restoration	07:00 - 19:00	None	None	8 weeks	30 per day
	Aftercare	07:00 - 19:00	None	24/7	3 weeks per well	0 per day

3.30 The average daily delivery schedule of the HGVs is given in Table 3.3 for the indicated years.

Table 3.3: HGV Delivery Schedule per Year

Year	Maximum 2 way HGV loads per day	Maximum HGV Trips per day
1	25	50
2	30	60
3	25	50
4	25	50
5-20	25	50
21	30	60
21-25	0	0

4 Summary of Relevant Policy, Guidance and Standards

Noise Policy Statement for England

4.1 The Noise Policy Statement for England (NPSE) [1] sets out the long term overarching vision of Government noise policy, which is to promote good health and a good quality of life through the management of noise within the context of Government policy on sustainable development. Whilst the NPSE does not seek to change pre-existing policy, the document is intended to aid decision makers by making explicit the implicit underlying principles and aims regarding noise management and control that are to be found in existing policy documents, legislation and guidance.

4.2 The NPSE describes a Noise Policy Vision and three Noise Policy Aims and states that the vision and aims provide:

> *"the necessary clarity and direction to enable decisions to be made regarding what is an acceptable noise burden to place on society."*

4.3 In other words, the purpose of the document is to provide guidance for the decision maker on whether the noise impact is an acceptable burden to bear in order to receive the economic and other benefits of the proposal.

4.4 Where existing policy and guidance does not provide adequate guidance then decision makers can go back to the aims of the policy statement to provide overriding guidance. The "Noise Policy Vision" is to "promote good health and good quality of life through the effective management of noise within the context of Government policy on sustainable development". This long-term vision is supported by the following aims, through effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

i. avoid significant adverse impacts of health and quality of life;

ii. mitigate and minimise adverse impacts on health and quality of life; and

iii. where possible, contribute to the improvement of health and quality of life.

4.5 The aims of the policy differentiate between noise impacts on health (e.g. sleep disturbance, hypertension, stress etc.) and noise impacts on quality of life (e.g. amenity, enjoyment of property etc.). The aims also differentiate between "significant adverse impacts" and "adverse impacts". The explanatory note to the NPSE clarifies that a significant adverse impact is deemed to have occurred if the "Significant Observed Adverse Effect Level" (SOAEL) is exceeded. An adverse effect, on the other hand, lies between the "Lowest Observed Adverse Effect Level" (LOAEL) and the SOAEL.

4.6 In assessing whether a development should be permitted, there are therefore four questions that should be answered, with reference to the principles of sustainable development, i.e. will the development result in:

a. a significant adverse impact to health;

b. a significant adverse impact to quality of life;

c. an adverse impact to health; or

d. an adverse impact to quality of life?

4.7 If the answer to question a) or b) is yes, then the NPSE provides a clear guidance that the development should be viewed as being unacceptable (item i. above – i.e. avoid significant adverse impacts of health and quality of life). If the answer to question c) or d) is yes, then the NPSE provides a clear steer that the impact should be mitigated and minimised (item ii. above).

National Planning Policy Framework

4.8 The National Planning Policy Framework (NPPF) [2] sets out the Government's planning policies for England and how these are expected to be applied. The emphasis of the Framework is to allow development to proceed where it can be demonstrated to be sustainable. In relation to noise, Paragraph 180 of the Framework states:

> *"Planning policies and decisions should ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*
>
> *a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from the development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
>
> *b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and*
>
> *c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation."*

4.9 Point 'a)' refers to 'significant adverse impacts' which relates to the 'significant observed adverse effect level' (SOAEL) in the Noise Policy Statement for England (NPSE), though the term 'effect' is used instead of 'impact' these are interchangeable in this context.

4.10 Paragraph 203 of the Framework notes that *"It is essential that there is a sufficient supply of minerals to provide the infrastructure, buildings, energy and goods that the country needs. Since minerals are a finite natural resource, and can only be worked where they are found, best use needs to be made of them to secure their long-term conservation."* Paragraph 204 goes on to state that *"Planning policies should:… g) when developing noise limits, recognise that some noisy short-term activities, which may otherwise be regarded as unacceptable, are unavoidable to facilitate minerals extraction…"*

4.11 The NPPF therefore explicitly recognises that it may be necessary to allow noise levels due to minerals extraction to give rise to higher short-term impacts than would otherwise be acceptable for other types of industry.

Planning Practice Guidance - Noise

4.12 Planning Practice Guidance on Noise (PPG-N) [3] provides guidance to local planning authorities to ensure effective implementation of the planning policy set out in the National Planning Policy Framework. The PPG suggests that planning authorities should ensure that unavoidable noise emissions are controlled, mitigated or removed at source and establish appropriate noise limits for extraction in proximity to noise sensitive properties.

4.13 The PPG-N reiterates general guidance on noise policy and assessment methods provided in the NPPF, NPSE and British Standards and contains examples of acoustic environments commensurate with various effect levels. Paragraph 006 of the PPG-N explains that:

> *"The subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any particular situation."*

4.14 According to the PPG-N, factors that can influence whether noise could be of concern include:

- the source and absolute level of the noise together with the time of day it occurs;
- for non-continuous sources of noise, the number of noise events, and the frequency and pattern of occurrence of the noise;
- the spectral content and the general character of the noise;
- the local topology and topography along with the existing and, where appropriate, the planned character of the area;
- where applicable, the cumulative impacts of more than one source should be taken into account along with the extent to which the source of noise is intermittent and of limited duration;

- whether adverse internal effects can be completely removed by closing windows and, in the case of new residential development, if the proposed mitigation relies on windows being kept closed most of the time;
- in cases where existing noise sensitive locations already experience high noise levels, a development that is expected to cause even a small increase in the overall noise level may result in a significant adverse effect occurring even though little to no change in behaviour would be likely to occur;
- where relevant, Noise Action Plans, and, in particular the Important Areas identified through the process associated with the Environmental Noise Directive and corresponding regulations;
- the effect of noise on wildlife;
- if external amenity spaces are an intrinsic part of the overall design, the acoustic environment of those spaces; and
- the potential effect of a new residential development being located close to an existing business that gives rise to noise should be carefully considered. This is because existing noise levels from the business even if intermittent (for example, a live music venue) may be regarded as unacceptable by the new residents and subject to enforcement action. To help avoid such instances, appropriate mitigation should be considered, including optimising the sound insulation provided by the new development's building envelope. In the case of an established business, the policy set out in paragraph 182 of the NPPF should be followed.

4.15 The PPG-N provides a relationship between various perceptions of noise, effect level and required action in accordance with the NPPF. This is reproduced in Table 4.1, below.

Table 4.1: Noise Exposure Hierarchy based on the Likely Average Response

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
		Lowest Observed Adverse Effect Level	
Noticeable and intrusive	Noise can be heard and causes 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.	Observed Adverse Effect	Mitigate and reduce to a minimum

Perception	Examples of Outcomes	Increasing Effect Level	Action
		Significant Observed Adverse Effect Level	
Noticeable and disruptive	The 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.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

4.16 The PPG-N describes sound that is not noticeable to be at levels below the No Observed Effect Level (NOEL). It describes exposures that are noticeable but not to the extent there is a perceived change in quality of life as below the LOAEL and need no mitigation. The audibility of sound from a development is not, in itself, a criterion to judge noise effects that is commensurate with national planning policy.

4.17 The PPG-N suggests that noise exposures above the LOAEL cause small changes in behaviour. Examples of noise exposures above the LOAEL provided in the PPG-N include:

- having to turn up the volume on the television;
- needing to speak more loudly to be heard;
- where there is no alternative ventilation, closing windows for some of the time because of the noise; or
- a potential for some reported sleep disturbance.

4.18 In line with the NPPF and NPSE, the PPG-N states that consideration needs to be given to mitigating and minimising effects above the LOAEL but taking account of the economic and social benefits being derived from the activity causing the noise.

4.19 The PPG-N suggests that noise exposures above the SOAEL cause material changes in behaviour. Examples of noise exposures above the SOAEL provided in the PPG-N are:

- where there is no alternative ventilation, keeping windows closed for most of the time or avoiding certain activities during periods when the noise is present; and/or
- there is a potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep.

4.20 In line with the NPPF and NPSE, the PPG-N states that effects above the SOAEL should be avoided and that, whilst the economic and social benefits being derived from the activity causing the noise must be taken into account, such exposures are undesirable.

4.21 The PPG-N suggests that a noise impact may be partially offset if the residents of affected dwellings have access to a relatively quiet part of their dwelling, private external amenity area and/or external public or private amenity space nearby.

Planning Practice Guidance on Minerals (PPG-M)

4.22 The PPG-M [4] provides guidance to mineral planning authorities to ensure effective implementation of the planning policy set out in the NPPF. The PPG-M adopted the criteria from the Technical Guidance which initially accompanied the NPPF (and was withdrawn on 7th March 2014) and this adopted the criteria previously set out in the replaced Minerals Policy Statement (MPS) 2, Annex 2 and the earlier Minerals Planning Guidance (MPG) 11.

4.23 The PPG-M suggests that minerals planning authorities should ensure that unavoidable noise emissions are controlled, mitigated or removed at source and appropriate noise limits established for extraction in proximity to noise sensitive properties.

4.24 The PPG-M also suggests that development proposals should include a noise emissions assessment, to include identification of all sources of noise and, for each source, consider the proposed operating locations, procedures, schedules and duration of work for the life of the operation. The proposals for the control or mitigation of noise emissions should consider:

- the main characteristics of the production process and its environs, including the location of noise-sensitive properties;
- proposals to minimise, mitigate or remove noise emissions at source;
- assessing the existing noise climate around the site of the proposed operations, including background noise levels at nearby noise-sensitive properties;
- estimating the likely future noise from the development and its impact on the neighbourhood of the proposed operations;
- monitoring noise emissions to ensure compliance with appropriate environmental standards.

4.25 The guidance goes on to state that planning authorities will need to consider whether the overall effect of the noise exposure would be above or below the SOAEL and LOAEL, and whether a good standard of amenity can be achieved taking account of the prevailing acoustic environment.

4.26 The PPG-M sets out noise level criteria to be achieved by mineral extraction operations:

> *"Mineral planning authorities should aim to establish a noise limit, through a planning condition, at the noise-sensitive property that does not exceed the background noise level ($L_{A90,1h}$) by more than 10 dBA during normal working hours (0700 – 1900). Where it will be difficult not to exceed the background level by more than 10 dBA without imposing unreasonable burdens on the mineral operator, the limit set should be as near that level as practicable. In any event, the total noise from the operations should not exceed 55 dB $L_{Aeq,1h}$ (free field). For operations during the evening (1900-2200) the noise limits should not exceed the background noise level ($L_{A90,1h}$) by more than 10 dBA and should not exceed 55 dBA $L_{Aeq,1h}$ (free field). For any operations during the period 22.00 – 07.00 noise limits should be set to reduce to a minimum any adverse impacts, without imposing unreasonable burdens on the mineral operator. In any event the noise limit should not exceed 42 dBA $L_{Aeq,1h}$ (free field) at a noise sensitive property.*
>
> *Where the site noise has a significant tonal element, it may be appropriate to set specific limits to control this aspect. Peak or impulsive noise, which may include some reversing bleepers, may also require separate limits that are independent of background noise (e.g. L_{max} in specific octave or third-octave frequency bands – and that should not be allowed to occur regularly at night.)*
>
> *Care should be taken, however, to avoid any of these suggested values being implemented as fixed thresholds as specific circumstances may justify some small variation being allowed."*

4.27 All mineral operations will have some particularly noisy short-term activities that cannot meet the limits set for normal operations. Examples include soil-stripping, the construction and removal of baffle mounds, soil storage mounds and spoil heaps, construction of new permanent landforms and aspects of site road construction and maintenance. However, these activities can bring longer-term environmental benefits. In relation to this, the PPG-M states:

> *"Increased temporary daytime noise limits of up to 70 dBA $L_{Aeq,1h}$ (free field) for periods of up to eight weeks in a year at specified noise-sensitive properties should be considered to facilitate essential site preparation and restoration work and construction of baffle mounds where it is clear that this will bring longer-term environmental benefits to the site or its environs.*
>
> *Where work is likely to take longer than eight weeks, a lower limit over a longer period should be considered. In some wholly exceptional cases, where there is no viable alternative, a higher limit for a very limited period may be appropriate in order to attain the environmental benefits. Within this framework, the 70 dBA $L_{Aeq,1h}$ (free field) limit referred to above should be regarded as the normal maximum."*

4.28 The noise limits contained within the PPG-M have been reproduced in Table 4.2 below. The limits contained in the table apply to emissions from the minerals activities evaluated outside a residential noise sensitive receptor (NSR). Whilst not explicitly stated in the PPG-M, noise levels in excess of the limits are likely to be indications of exposures above the SOAEL, depending on the context as described in the NPSE, NPPF and PPG-N.

Table 4.2: PPGM Noise Limits

Activity	Period	Noise Limit, dB $L_{Aeq,1h}$
Normal Operations (long term extraction)	07:00 – 19:00 hours	10 dB above the background sound level and ≤ 55
	19:00 – 22:00 hours	10 dB above the background sound level and ≤ 55
	22:00 – 07:00 hours	42
Short-term Activities (limited to 8 weeks in any year – soil stripping/bund construction/restoration etc.)	Daytime activities	70

4.29 The noise limits in the guidance for minerals extraction sites is higher than would normally be tolerated for permanent industrial development of the same scale for two reasons, namely:

- the options for the location of minerals extraction sites is limited by the location of the natural resource; and
- minerals extraction activities are usually limited in duration due to the resources eventually running out.

4.30 Both of the above factors also apply to this development.

British Standard 4142 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound'

4.31 BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound' [5] describes a method for rating and assessing sound of an industrial and/or commercial nature. The standard is applicable to the determination of the rating level of industrial or commercial sound as well as the ambient, background and residual noise levels for the purposes of investigating complaints, assessing sound from proposed new, modified or additional sources or assessing sound at proposed new dwellings. The determination of whether a noise amounts to a nuisance is beyond the scope of the standard, as is rating and assessment of indoor noise levels.

4.32 The standard compares the "rating level" of the noise (i.e. the specific noise level from the site under investigation adjusted using penalties for acoustic character such as tonality or impulsiveness) with the pre-existing background noise level.

4.33 The standard specifies that:

- typically, the greater the difference between rating level and background noise, the greater the magnitude of impact;
- a difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- a difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context; 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 a 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.

4.34 The standard notes that where background sound levels and rating levels are both “low”, absolute noise levels might be as, or more, relevant than the margin by which the rating level exceeds the background, especially at night.

4.35 With regards to the rating correction, paragraph 9.2 of BS 4142 states:

“Consider the subjective prominence of the character of the specific sound at the noise-sensitive locations and the extent to which such acoustically distinguishing characteristics will attract attention.”

4.36 The commentary to paragraph 9.2 of BS 4142 suggests the following subjective methods for the determination of the rating penalty for tonal, impulsive and/or intermittent specific sounds:

“Tonality - For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a rating penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible.

Impulsivity – A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible.

Other sound characteristics - Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

Intermittency - When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. … If the intermittency is *readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied."*

British Standard 5228: 2009+A1:2014 "Code of practice for noise and vibration control on construction and open sites"

4.37 British Standard 5228: 2009+A1:2014 "Code of practice for noise and vibration control on construction and open sites" [6] is the most relevant standard relating to construction noise. The standard is split into two parts: Part 1 dealing with noise and Part 2 dealing with vibration.

4.38 The standard notes that for some large infrastructure projects that require an EIA, construction noise is sometimes assessed by comparing the predicted construction noise (plus pre-construction ambient noise) with the pre-construction ambient noise. However, it notes that a greater difference might be tolerated than for a permanent industrial source.

4.39 For dwellings, times of site activity outside of normal working hours will need special consideration. It suggests that evening noise limits might have to be as much as 10 dBA below the daytime limit and that very strict noise control targets might need to be applied for night-time working.

4.40 Annex E (informative) of the standard provides examples of criteria that can be used for the assessment of the significance of effects due to construction noise. It notes three main reasons for undertaking such an assessment:

- For Environmental Impact Assessments (EIA);
- Assessments for developments that do not require EIA; and
- Control of Pollution Act Section 61 applications.

4.41 Annex E describes two main approaches for assessing the significance of effects, as follows:

- Significance based upon fixed (absolute) limits and eligibility for noise insulation and temporary re-housing. This is primarily based on guidance given in Advisory Leaflet 72 and is described below; and
- Significance based upon noise change. The standard notes that this assessment method reflects more conventional EIA methodologies for noise.

4.42 With respect to noise change, the standard gives two examples of assessment techniques: the first being the "ABC" method and the latter being the 5 dB change method. The ABC method has been used in this assessment.

4.43 The ABC method criteria are based on a comparison of the predicted L_{Aeq} level due to construction works with the pre-existing L_{Aeq} before the construction works, rounded to the nearest 5 dB. If the rounded pre-existing L_{Aeq} level is less than the values listed in Category A, then the noise levels listed in the Category A column should be used as the threshold level for significance of construction noise. If the pre-existing L_{Aeq} level is equal to the values listed in Category A, then the noise levels listed in the Category B column should be used as the threshold level for significance. Finally, if the pre-existing L_{Aeq} level is greater than the values listed in Category A, then the noise levels listed in the Category C column should be used.

Table 4.3: Construction Noise Threshold of Potentially Significant Effect at Dwellings

Assessment Category	Threshold Value (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 potentially 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 potentially 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: Applies to residential receptors only.

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

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

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

19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays, 07:00 – 23:00 Sundays.

4.44 The 5 dB change method is based upon a significant effect being deemed to occur where noise from construction activities exceeds pre-construction ambient levels by 5 dBA or more, subject to lower cut-off values of 65, 55 and 45 dB $L_{Aeq,period}$ for the daytime, evening and night-time periods respectively.

4.45 Annex E also includes guidance on setting noise limits for construction activities which will involve long-term earth moving activities (as is the case for the borrow pit and some construction aspects of the Project). It states that this type of activity is more akin to surface mineral extraction sites and suggests that a limit of 55 dB $L_{Aeq,1h}$ is adopted for these types of activities but only where the works are likely to occur for a period in excess of six months.

4.46 The standard also includes criteria for assessing the requirement for provision of sound insulation or temporary re-housing where, in spite of the mitigation measures applied and any Section 61 consents under the Control of Pollution Act, noise levels at some properties exceed particular trigger levels.

4.47 According to the scope of the standard, it is intended to give “recommendations for basic methods of noise control relating to construction sites, including sites where demolition, remediation, ground treatment or related civil engineering works are being carried out, and open sites, where work activities/operations generate significant noise levels”. The proposed activities at the wellsite (e.g. use of a drilling rig and flaring) do not fall within the definition of an “open site” provided for in paragraph 3.11 of the standard, but the standard is applicable to construction of the wellsite and access track.

British Standard 8233:2014 Guidance on sound insulation and noise reduction for buildings.

4.48 British Standard 8233:2014 [7] has been used for many years for general guidance on acceptable noise levels in and around buildings. The latest revision to the standard, BS 8233:2014, provides guidance on design criteria for internal ambient noise levels in new (or refurbished) buildings. The scope of the standard states that it should not be used to assess the effects of changes in the external noise level to occupants of an existing building.

4.49 In relation to external noise levels, the second paragraph of 7.7.3.2 states that:

> *"For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$ with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments..."*

World Health Organisation (WHO) Guidelines

4.50 In 2009 a report was published presenting the conclusions of a World Health Organisation (WHO) working group responsible for preparing guidelines for exposure to noise during sleep entitled “Night Noise Guidelines for Europe” [8] (NNG). The document can be seen as an extension to the original 1999 WHO Guidelines for Community Noise. Various effects are described including biological effects, sleep quality, and well-being. The document gives threshold levels for observed effects expressed as $L_{max, inside}$ and $L_{night, outside}$. The L_{night} is a *year-long average* night-time noise level, not taking into account the façade effect of a building. In an exposed population a noise exposure of 40 dB $L_{night, outside}$ is stated as equivalent to the “lowest observed adverse effect level” for night noise. Above this level adverse health effects observed are self-reported sleep disturbance, environmental insomnia and increased use of somnifacient drugs and sedatives. Above 55 dB $L_{night, outside}$ cardiovascular effects become the major public health concern. Threshold levels for waking in the night, and/or too early in the morning are given as 42 dB $L_{Amax, inside}$. Lower thresholds are given that may change sleep structure.

4.51 The effects of different levels of night noise on the population's health in the NNGs are summarised in Table 4.4.

Table 4.4: Summary of Observed Health Effects in the Population (WHO NNG)

Noise Level, $L_{night, outside}$	Observed Effect
up to 30 dBA	No substantial biological effects are observed.
30 to 40 dBA	A number of effects are observed to increase: body movements, awakening, self-reported sleep disturbance, arousals. The intensity of the effect depends on the nature of the source and on the number of events, even in the worst cases the effects seem modest.
40 to 55 dBA	Adverse health effects are observed along the exposed population. Many people have to adapt their lives to cope with the noise at night. Vulnerable groups are now severely affected.
Above 55 dBA	The situation is considered increasingly dangerous for public health. Adverse health effects occur frequently, a high percentage of the population is highly annoyed and there is limited evidence that the cardiovascular system is coming under stress.

4.52 It is relevant to note that taking into account typical night to night variation in noise levels that will often occur due to meteorological effects and the effects of a façade, the night noise guidelines are similar to those previously given in the 1999 WHO report [9] (an external façade noise level of 45 dB L_{Aeq}), although defined in a different way.

4.53 The WHO guideline values give the lowest threshold noise levels below which the occurrence rates of particular effects can be assumed to be negligible. Exceedances of the WHO guideline values do not necessarily imply significant noise impact and, indeed, it may be that significant impacts do not occur until much higher degrees of noise exposure are reached.

4.54 Guidance on desirable levels of environmental noise is also given in the 1999 report. Section 4.3.1 of the document states that *"to protect the majority of people from being seriously annoyed during the daytime, the sound pressure level on balconies, terraces and outdoor living areas should not exceed 55 dB L_{Aeq} for a steady continuous noise. To protect the majority of people from being moderately annoyed during the daytime, the sound pressure level should not exceed 50 dB L_{Aeq}. These values are based on annoyance studies but most countries in Europe have adopted 40 dB L_{Aeq} as the maximum allowable level for new developments."*

4.55 The daytime value of 40 dB L_{Aeq} for new developments is very low and is not considered to be consistent with the criteria adopted for new developments (be it new noise sensitive development or new noise sources) in the UK. The values for moderate and serious annoyance are, however, consistent with UK planning policy.

4.56 The WHO guidelines have not been formally adopted into UK legislation or guidance, hence it remains a source of information reflecting a high level of health care with respect to noise, rather than a standard to be rigidly applied. The guideline values give the lowest threshold noise levels below which the occurrence rates of particular effects can be assumed to be negligible. Exceedances of the WHO guideline values do not necessarily imply significant noise impact and indeed, it may be that significant impacts do not occur until much higher degrees of noise exposure are reached.

4.57 The major concern in Europe is with respect to noise from transportation systems, and most of the studies on which these guidelines are based relate to this type of noise source. There can be no certainty that the same effects will be observed from noise of an industrial nature, but in the absence of any more detailed information some weight should be attached to the WHO guidance when assessing industrial noise as well.

4.58 In 2001 the Defra-funded National Noise Incidence Survey [10] measured external noise levels outside 1,160 dwellings throughout the UK over 24-hour periods spread over the course of the year. The study concluded that an estimated 55% of the population of the United Kingdom live in dwellings exceeding the recommended WHO daytime noise level threshold of 55 dB L_{Aeq} and that 67% live in dwellings exceeding the night-time threshold for sleep disturbance of 45 dB L_{Aeq}.

Local Development Plans

East Riding Local Plan

4.59 The East Riding Local Plan Strategy Document [11] states that:

> *"7.10 The use of a site for employment purposes may give rise to justifiable complaint from neighbouring uses. This could relate to complaints about excessive noise or odour levels, or high levels of HGV movements in predominantly residential areas. Where an applicant can demonstrate that measures could not reasonably be taken to mitigate the complaint or nuisance, and alternative less pervasive forms of employment uses are not possible, then alternative uses will be supported provided all other relevant policies in the Local Plan are satisfied."*

4.60 Policy EC5 (Supporting the energy sector) states that:

> *"A. Proposals for the development of the energy sector, excluding wind energy but including the other types of development listed in Table 7, will be supported where any significant adverse impacts are addressed satisfactorily and the residual harm is outweighed by the wider benefits of the proposal. Developments and their associated infrastructure should be acceptable in terms of:*
>
> *… 3. The effects of development on:*
>
> *i. local amenity, including noise, air and water quality, traffic, vibration, dust and visual impact…"*

Joint Minerals Plan 2016 - 2033

4.61 The East Riding of Yorkshire and Kingston upon Hull Joint Minerals Plan [12], Policy DM1 (Impacts of Mineral Development) states that:

A. Mineral development will be supported where it can be demonstrated that:…

2. The development would avoid harm to the environment or communities. Where harm is outweighed by the need for the development, the impacts on communities and the environment can be mitigated to within acceptable levels, both individually and cumulatively (including the impact of the factors in part B below) with other existing and proposed mineral and other forms of development;…

…B. In determining applications for minerals development, including the proposed order and method of working, the overall programme of extraction and the proposed restoration and aftercare of the site, the following must be addressed where relevant:

…2. Noise, dust, fumes, illumination and visual intrusion…"

4.62 Guidance on monitoring and enforcement states that:

"7.17 The effective monitoring of operational sites is important. Requirements for the monitoring of impacts such as dust and noise, may be controlled through planning conditions. However, it is important that the two MPAs act as an independent regulator to increase confidence amongst local communities. Efficient and effective monitoring and enforcement can often identify potential problems at an early stage. This can ensure these are resolved quickly and satisfactorily."

5 Baseline Noise Description

Noise Sensitive Receptors

5.1 Baseline sound level monitoring was undertaken at eight locations representative of the nearest and potentially most affected NSRs to the proposed wellsite. The NSRs include those in the vicinity of the WNA wellsite. The long-term monitoring locations are as follows and as shown in Figure 5.1, overleaf.

- **LT1 – Caley Cottage:** This location is approximately 670 m to the east of the existing WNA wellsite and approximately 480 m from the wellsite extension. Baseline data from this location would also be representative of the public footpath that runs from Fosham Road to West Newton, located between the WNA wellsite and Caley Cottage.
- **LT2 – West Newton Grange:** This location is approximately 2.5 km to the south-east of the WNA wellsite, approximately 700 m to the north-east of WNC wellsite
- **LT3 – Smithy Briggs / Smithy Briggs Cottage:** These locations are approximately 2.3 km to the south of the WNA wellsite, approximately 630 m west of WNC wellsite;
- **LT4 – Low Fosham:** This location is approximately 1.6 km to the east of the WNA wellsite, approximately 530 m north-east of WND wellsite;
- **LT5 – Withernick (Straits Farm / South End):** This location is approximately 950 m north-east of the existing WNA wellsite;
- **LT6 – Model Farm / Old Farm:** These locations are approximately 1.7 km to the south-east of the WNA wellsite, approximately 960 m to the south of WND wellsite;
- **LT7 – Flinton:** This location is approximately 3.8 km to the south-east of the WNA wellsite, approximately 970 m south-east of WNC wellsite; and
- **LT8 – West Carlton:** This location is approximately 2.5 km to the east of the WNA wellsite, approximately 1.4 km east of WND wellsite.

5.2 In addition to the eight long term monitoring locations outlined above, additional short-term attended monitoring was undertaken at three locations to further quantify and characterise the baseline acoustic environment. These locations are as follows:

- **ST1 – Wood End House / Marton Old School:** This location is approximately 620 m from the WNA wellsite and it is also representative of the nearest NSRs to the WNA wellsite including Marton Farm, Church House (The Catholic Church of the Most Holy Sacrament) and Old School House.

- **ST2 – Brickyard Cottage:** This residential location is approximately 3 km south of the WNA wellsite.
- **ST3 – Sproatley Village:** Sproatley Village is approximately 4.2 km south of the WNA wellsite. The B1238 passes through the village, which would be a designated traffic route to the proposed wellsite.

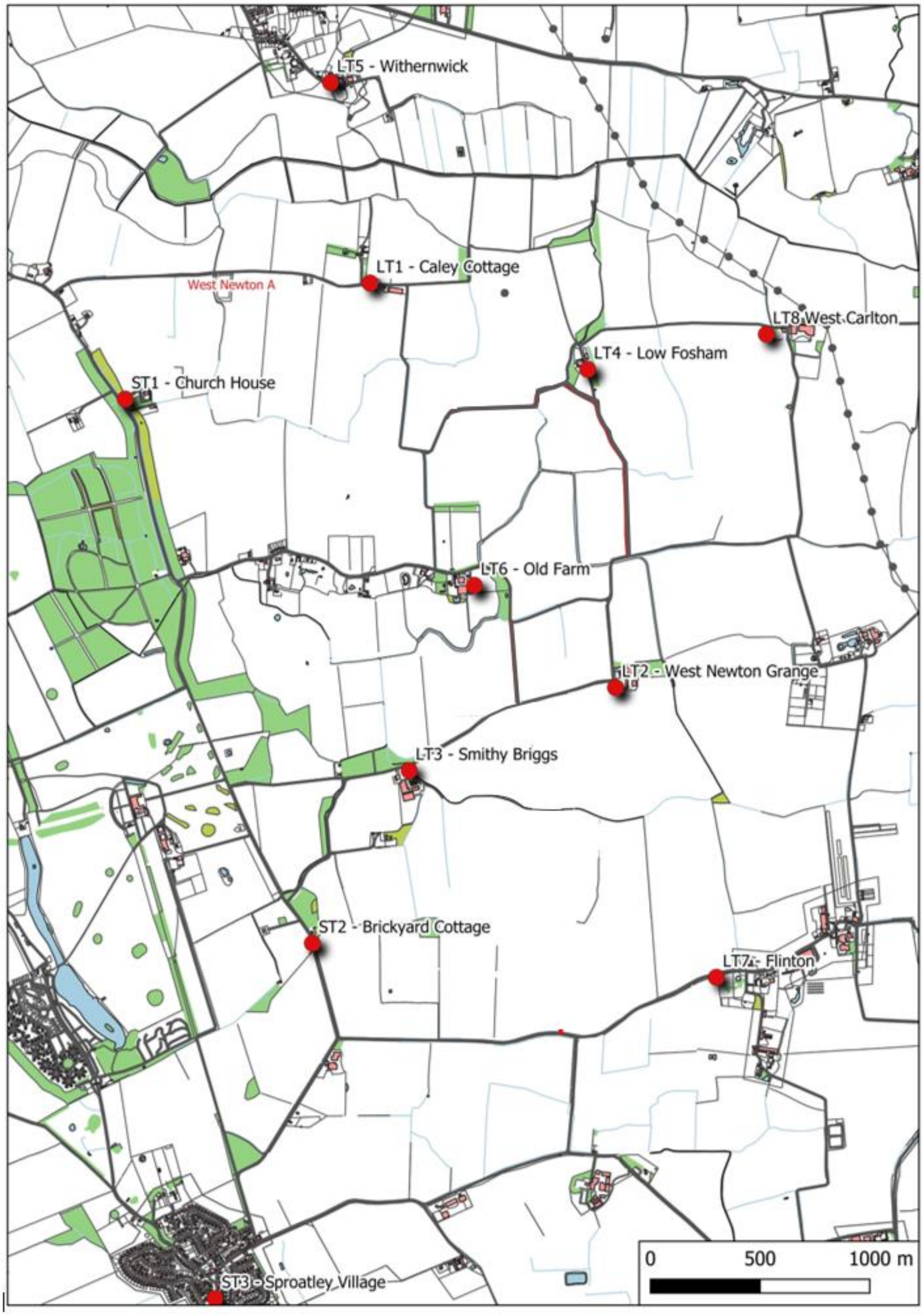


Figure 5.1: Noise Measurement Locations

5.3 Unattended long-term noise monitoring was undertaken from 11th August to 27th August 2020. The noise surveys were undertaken using Rion type NL-52 sound level meters. The sound level meters were programmed to measure various parameters including the L_{Aeq}, L_{AFmax} and L_{A90} values, logging at contiguous 15-minute intervals throughout the monitoring period[1]. Microphone positions were 1.5 m above the ground and at least 3.5 m from any vertical reflecting surface. The equipment calibration level was checked prior to, and after, the monitoring periods – no significant changes (< ±0.2 dB) were noted.

5.4 Attended measurements were also conducted in additional locations. Overall A-weighted and octave band sound pressure levels were recorded, and a description was made by the surveyor of the sources of noise contributing to the baseline noise environment for each measurement (including any events contributing to the recorded levels). In addition, measurements and observations were made of meteorological conditions including wind speed and direction, cloud cover (in octants), relative humidity and temperature.

5.5 The measurements conformed to the requirements of BS 7445:2003 [13].

Meteorological Conditions

5.6 Weather conditions were monitored throughout the survey period using a metrological data logger. Winds varied in speed and direction throughout the monitoring period with some higher wind speeds resulting in elevated noise levels. Periods where wind speeds exceeded 5 m/s have therefore been excluded from the analysis. No significant periods of rain were recorded during the survey period.

Results and Discussion

5.7 The time history noise plots for the long-term monitoring are provided in Figures A1 to A8 at the back of this report. Noise levels in the locality are influenced by distant traffic, aircraft and rural activities. A summary of the measured baseline noise levels is given in Table 5.1. In the tables the average value is a logarithmic average for the L_{Aeq} and arithmetic average for L_{A90} and L_{AFmax}.

[1] Although the PPG-M guidelines are based on a 1 hour assessment period a 15 minute period was chosen for the baseline noise monitoring in order to include a greater number of data points in the survey and to provide a greater understand of variations in noise throughout each period. This approach also reduces the number of periods in which a single loud event causes a greater influence over the period L_{Aeq}, thus providing a more robust and precautionary baseline assessment.

Table 5.1: Measured Baseline Noise Level Ranges

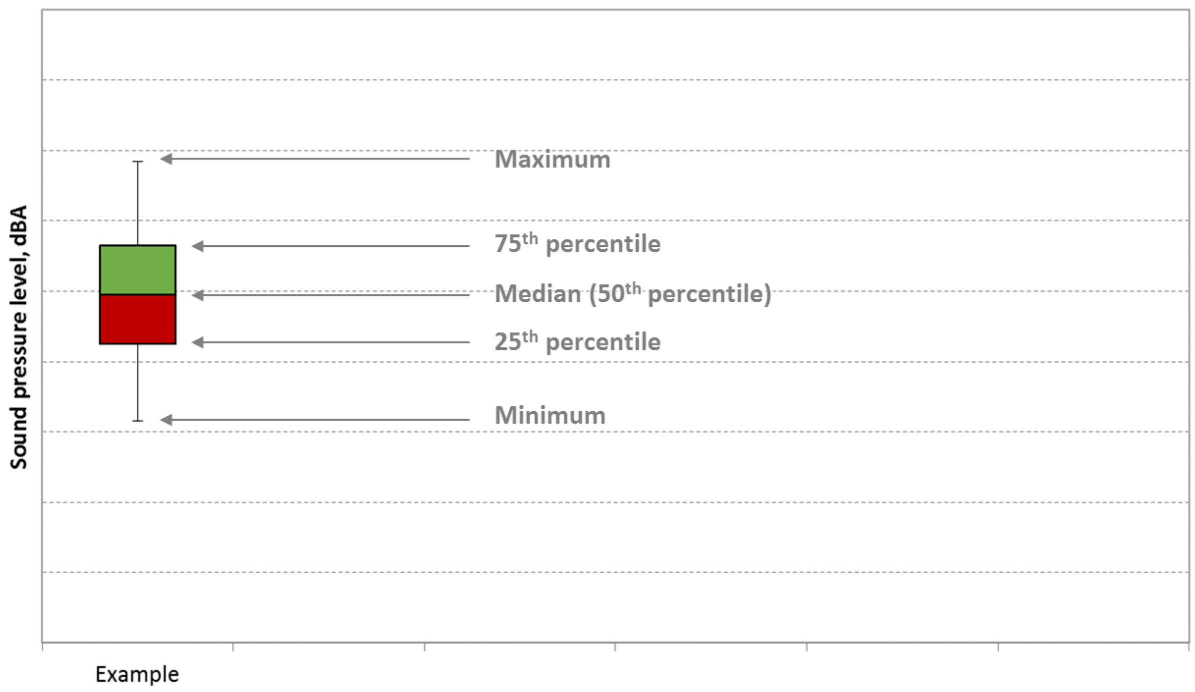
	Ambient noise, dB L_{Aeq}			Background noise, dB L_{A90}			Maximum noise, dB L_{Amax}		
	Day	Eve	Night	Day	Eve	Night	Day	Eve	Night
LT1 – Caley Cottage									
Range	28-82	21-63	19-58	25-59	18-56	17-53	39-104	32-90	31-84
25th percentile	42	35	32	34	27	26	56	51	44
Median	47	43	39	38	32	33	63	61	50
75th percentile	52	49	45	44	40	40	74	75	56
Average	58	51	46	39	34	33	65	62	50
St dev	7.3	9.9	9.3	6.3	9.0	8.8	11.2	14.5	9.4
LT2 – West Newton Grange									
Range	29-63	21-61	19-58	25-58	18-55	18-53	39-94	30-80	26-76
25th percentile	37	31	30	32	27	27	51	44	41
Median	42	36	37	36	32	31	55	50	47
75th percentile	48	42	43	41	35	38	61	57	56
Average	49	48	45	37	33	33	56	51	48
St dev	7.1	9.3	8.4	6.4	8.1	7.8	7.6	9.6	9.1
LT3 – Smithy Briggs / Smithy Briggs Cottage									
Range	34-84	26-64	25-60	27-56	23-53	23-54	46-105	34-88	30-86
25th percentile	42	33	32	34	28	28	59	46	43
Median	46	37	38	37	31	32	64	54	49
75th percentile	52	42	45	41	37	37	75	60	58
Average	58	48	46	38	33	33	67	54	51
St dev	6.9	8.2	8.2	5.1	6.7	6.7	10.6	10.7	10.8
LT4 – Low Fosham									
Range	34-70	19-55	19-59	26-58	18-46	17-53	48-92	31-81	29-75
25th percentile	42	30	29	33	25	24	58	43	46
Median	44	37	37	36	30	31	62	51	50
75th percentile	48	42	43	39	35	36	67	59	57
Average	49	35	39	36	30	31	63	51	51
St dev	5.8	7.9	8.7	4.7	5.8	7.4	8.5	10.2	8.5
LT5 – Straits Farm / South End									
Range	36-73	26-62	21-59	29-55	21-56	18-52	48-98	35-79	30-91
25th percentile	44	33	30	35	28	25	61	48	46
Median	47	39	38	37	32	31	66	56	52
75th percentile	50	44	47	40	37	37	71	63	61
Average	51	48	46	38	33	32	66	56	54
St dev	5.1	8.7	9.8	4.3	7.6	7.7	6.9	9.6	11.0
LT6 – Model Farm / Old Farm									
Range	36-75	28-59	27-74	30-57	27-53	26-52	48-104	37-81	34-111
25th percentile	44	33	34	36	30	30	61	45	43

	Ambient noise, dB L_{Aeq}			Background noise, dB L_{A90}			Maximum noise, dB L_{Amax}		
	Day	Eve	Night	Day	Eve	Night	Day	Eve	Night
Median	48	39	39	40	34	35	65	51	49
75th percentile	51	46	44	44	42	40	70	58	54
Average	55	46	49	40	36	35	65	52	50
St dev	5.8	7.5	6.9	4.8	6.7	5.9	7.5	9.1	8.9
LT7 – Flinton									
Range	49-69	20-66	24-62	25-52	19-49	21-47	70-100	34-87	31-91
25th percentile	57	51	40	34	30	28	75	74	51
Median	58	54	46	37	32	31	77	76	71
75th percentile	59	56	50	41	38	36	80	78	75
Average	58	54	49	38	34	32	78	76	64
St dev	2.0	4.4	7.8	5.5	6.6	5.5	4.1	4.5	14.1
LT8 – West Carlton									
Range	29-65	21-63	20-57	23-59	19-57	18-51	42-82	33-73	28-73
25th percentile	38	32	31	33	26	25	52	48	42
Median	43	36	37	37	31	31	56	53	50
75th percentile	49	44	45	43	39	40	59	58	57
Average	49	49	45	38	33	32	56	53	50
St dev	6.8	9.5	8.9	6.8	9.2	8.5	5.9	8.7	9.1

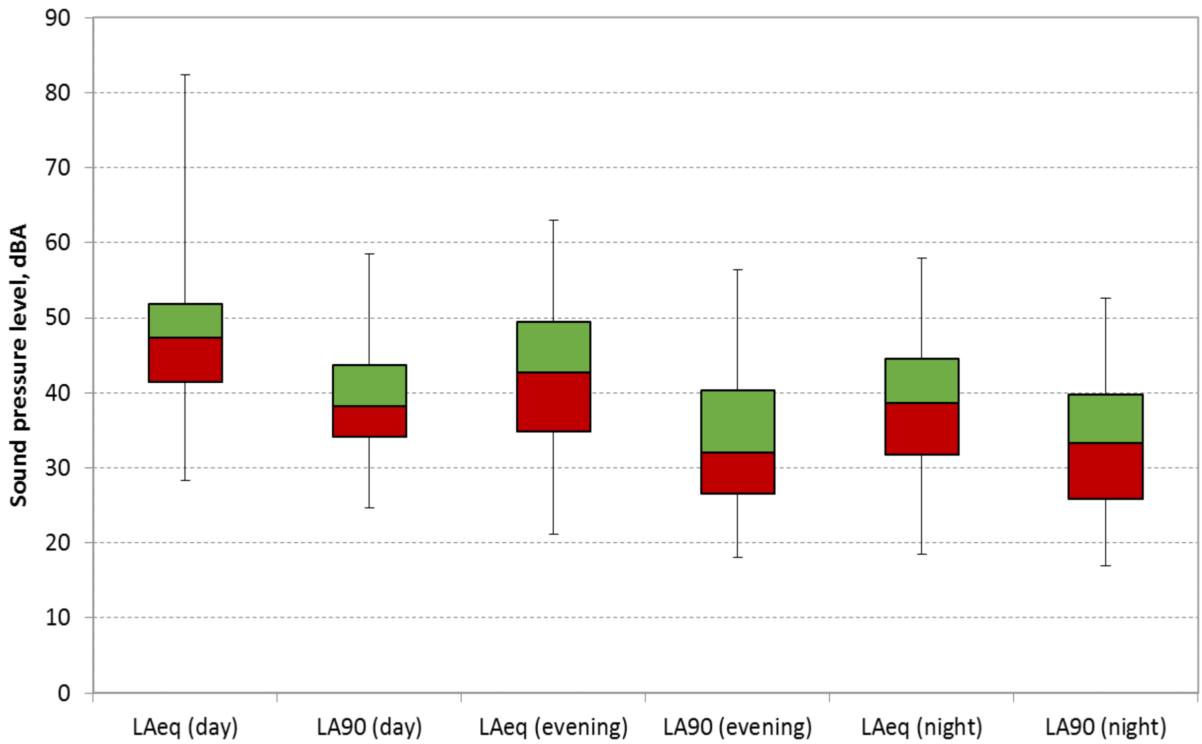
5.8 The monitor installed at LT4 (Low Fosham) stopped recording on the morning of 21st August 2020 meaning that only 10 days data was recorded at this location. However, given that the earlier part of the monitoring period was generally calmer than the latter part it is not considered that this significantly affects the findings which still include a significant quantity of datapoints. The failure was caused by a battery failure and no drift in calibration was noted on the unit (or any other unit) meaning that there is a high degree of confidence in the data.

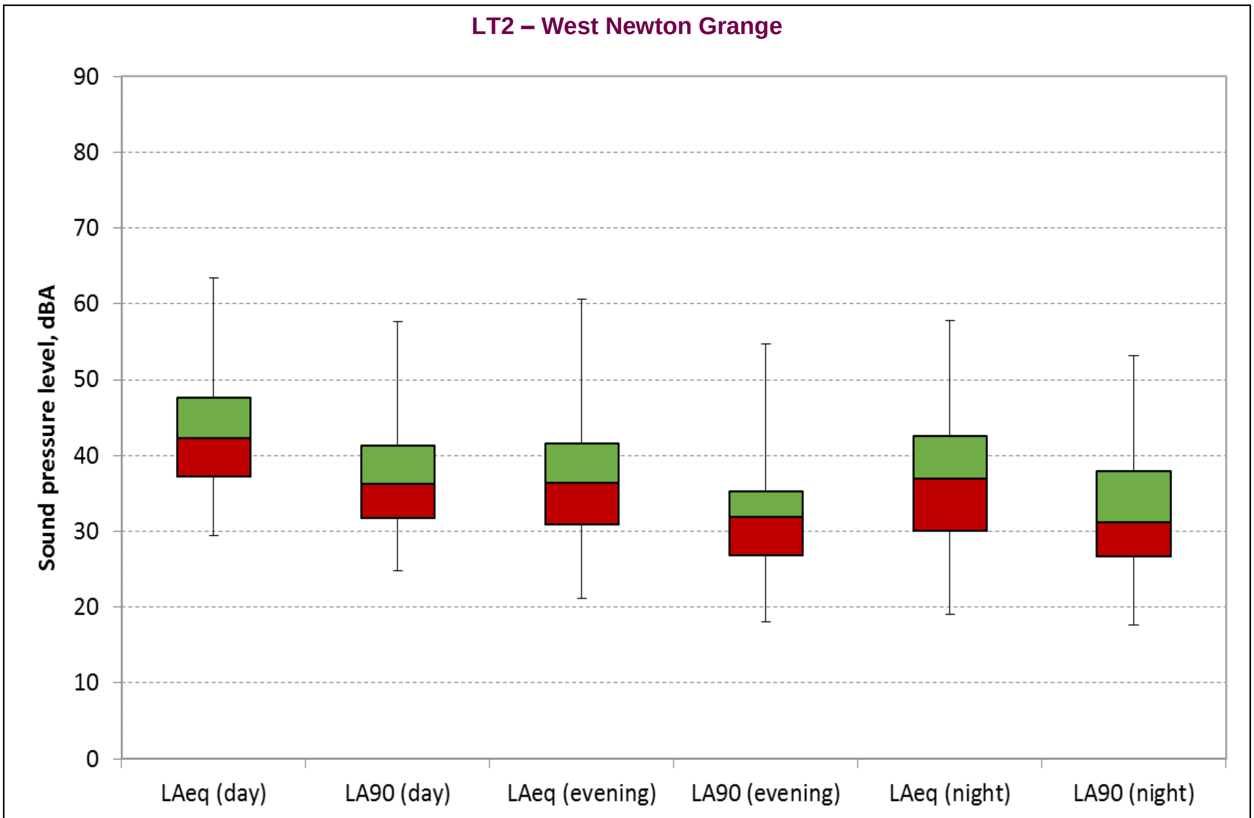
5.9 The spread of the measured noise data is also shown in the box and whisker plots in Figure 5.2.

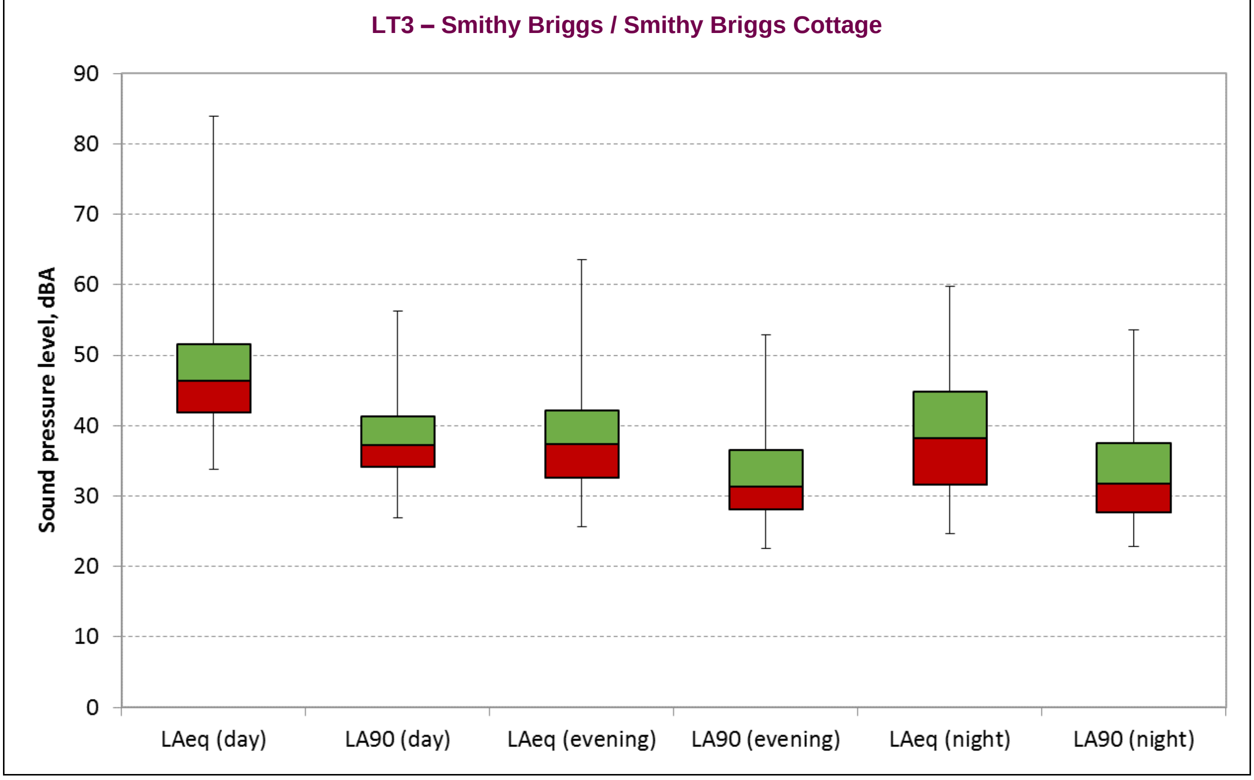
Key

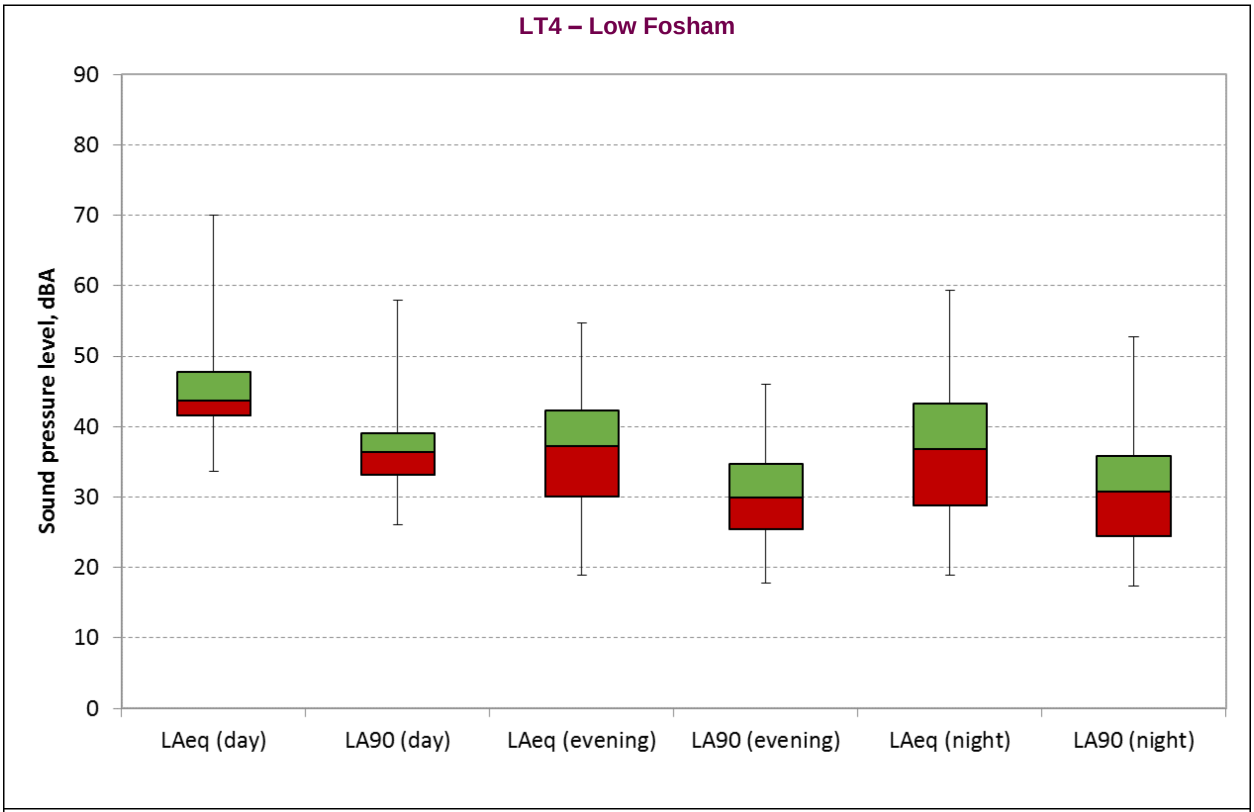


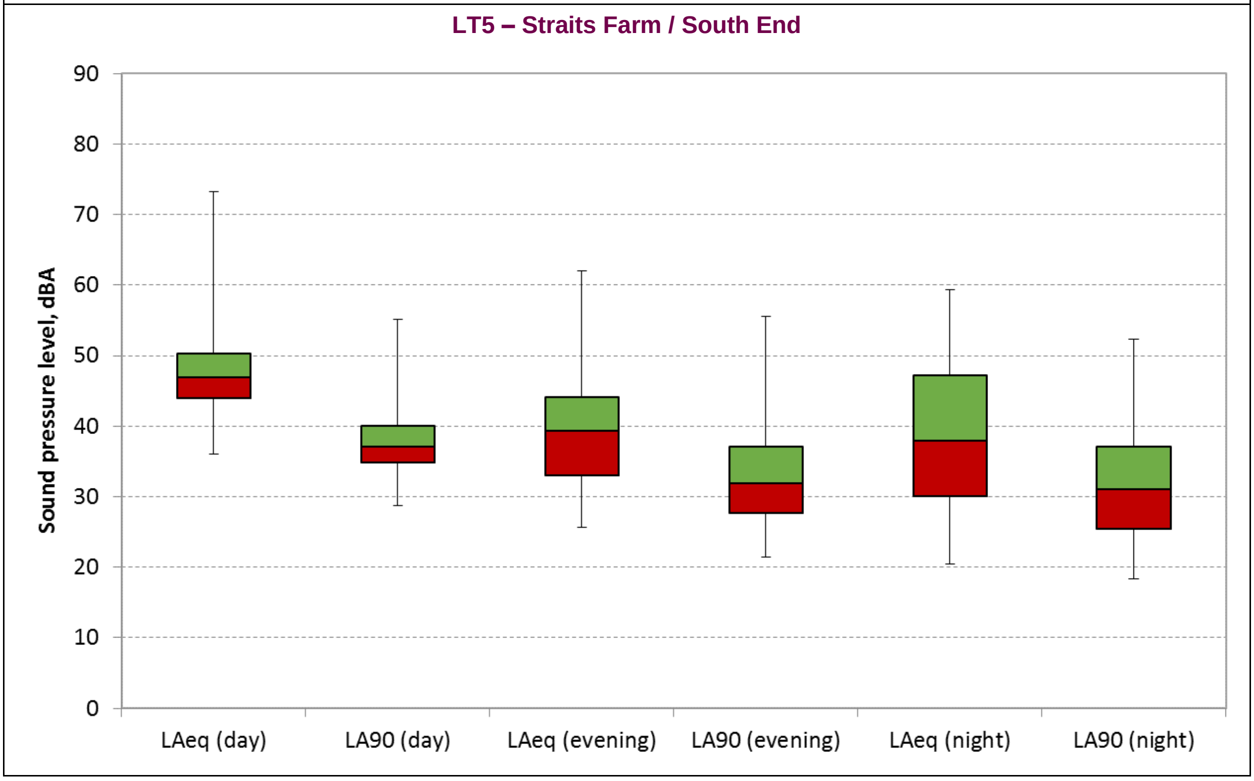
LT1 – Caley Cottage



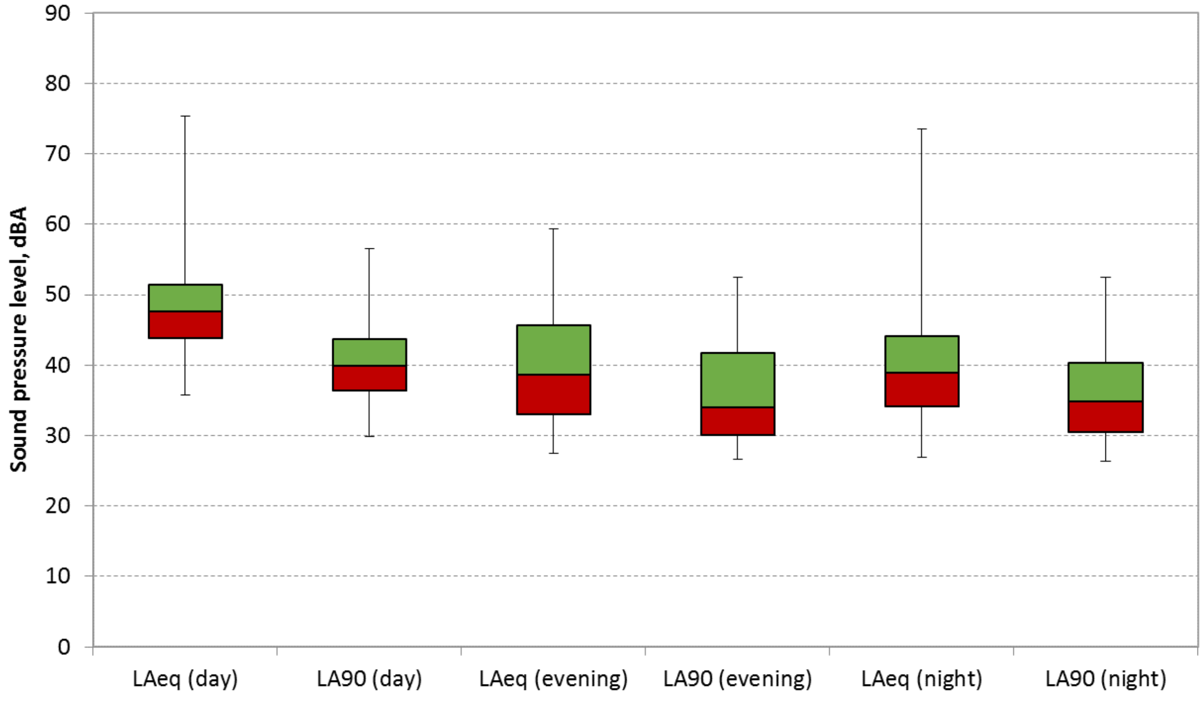

LT2 – West Newton Grange
Sound pressure level, dBA
90
80
70
60
50
40
30
20
10
0
LAeq (day)
LA90 (day)
LAeq (evening)
LA90 (evening)
LAeq (night)
LA90 (night)


LT3 – Smithy Briggs / Smithy Briggs Cottage
Sound pressure level, dBA
90
80
70
60
50
40
30
20
10
0
LAeq (day)
LA90 (day)
LAeq (evening)
LA90 (evening)
LAeq (night)
LA90 (night)

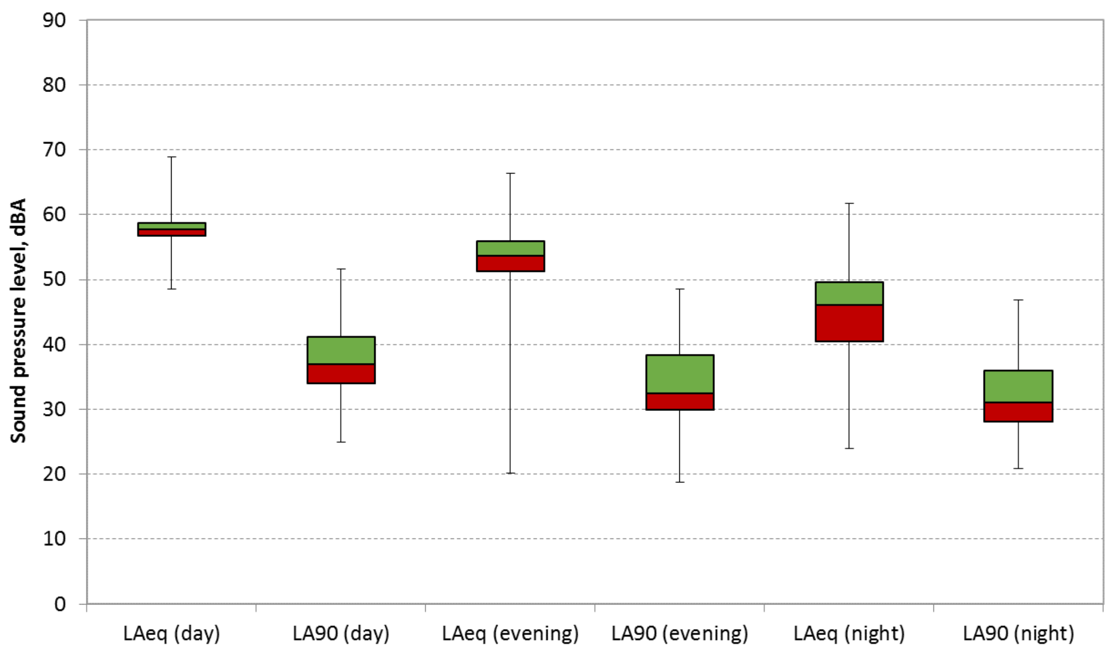

LT4 – Low Fosham
Sound pressure level, dBA
0
10
20
30
40
50
60
70
80
90
LAeq (day)
LA90 (day)
LAeq (evening)
LA90 (evening)
LAeq (night)
LA90 (night)


LT5 – Straits Farm / South End
Sound pressure level, dBA
0
10
20
30
40
50
60
70
80
90
LAeq (day)
LA90 (day)
LAeq (evening)
LA90 (evening)
LAeq (night)
LA90 (night)

LT6 – Model Farm / Old Farm



LT7 – Flinton



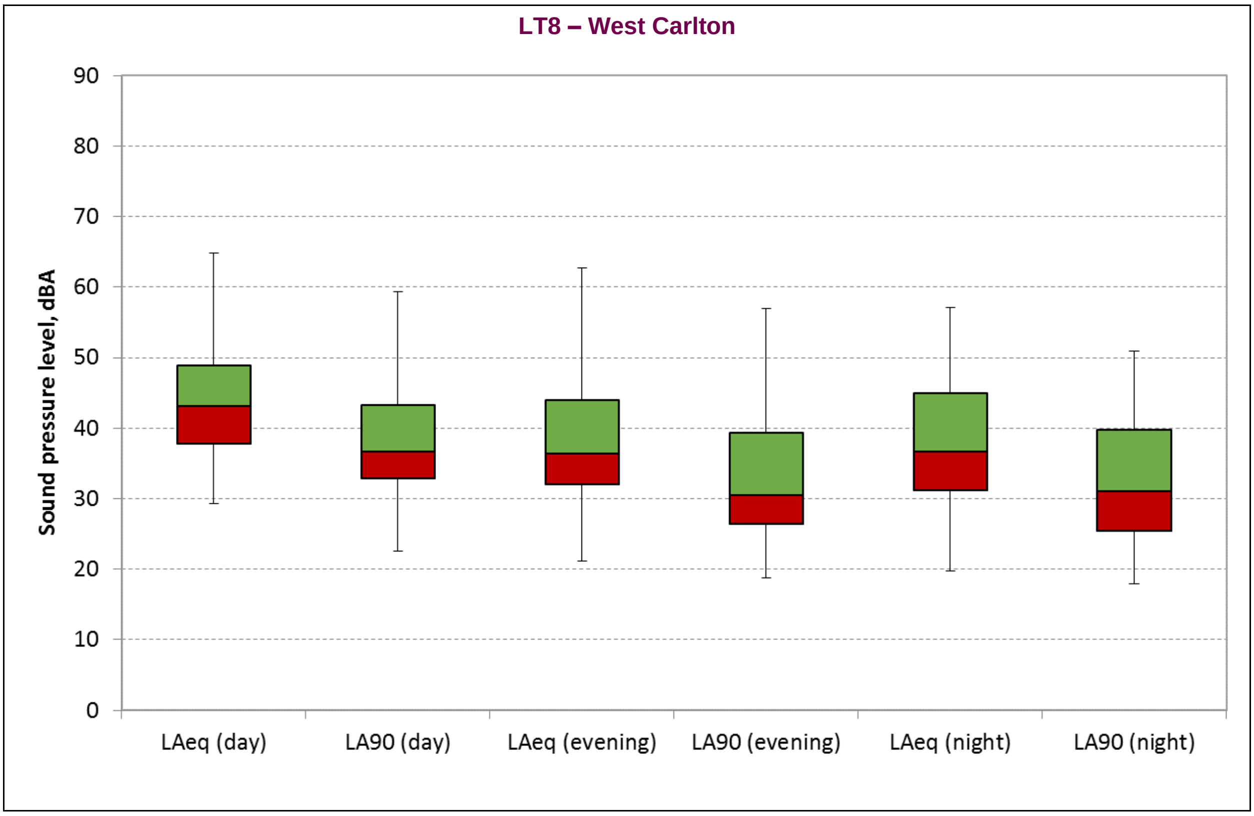


Figure 5.2: Box and whisker plots of noise monitoring data

5.10 The results of the attended noise monitoring are summarised in Table 5.2.

Table 5.2: Summary of Attended Noise Measurement Results

Location	Start time	Sound pressure level, dBA			
		L_{Aeq}	L_{AFmax}	L_{A10}	L_{A90}
ST1 – Wood End House / Marton Old School	11/08/2020 15:53	62	85	54	34
	11/08/2020 16:08	64	88	63	33
	11/08/2020 16:23	61	79	51	33
	11/08/2020 19:19	59	83	48	32
	11/08/2020 19:34	36	47	39	32
	26/08/2020 23:16	28	44	32	20
	26/08/2020 23:21	25	36	25	20
	26/08/2020 23:48	31	49	24	20
	26/08/2020 23:53	22	29	23	20
ST2 – Brickyard Cottage	11/08/2020 15:17	59	82	50	35
	11/08/2020 15:32	58	78	54	35
	11/08/2020 15:47	61	79	54	37
	11/08/2020 18:59	61	87	49	34
	11/08/2020 19:14	35	43	37	33
ST3 – Sproatley Village by B1238	11/08/2020 14:40	62	74	67	43
	11/08/2020 14:55	62	78	67	42
	11/08/2020 15:10	63	73	68	50

5.11 It is important that the background sound levels adopted for the assessment are representative of the period being assessed. However, there is no 'single' background sound level that can be derived from such measurements. It is particularly difficult to determine what is 'representative' of the night-time period because it can be subject to a wide variation in background sound level between the shoulder night periods.

5.12 The 25th percentile value from the unattended monitoring has been used as a starting point in order to characterise the baseline noise environment. This value is not the lowest sound level encountered but is lower than obtained using the average. It therefore represents somewhere in the range of lower sound levels that are likely to be encountered and therefore represents a precautionary assessment. Use of the 25th percentile also ensures that any periods during which higher wind speeds could have affected the measured baseline noise levels do not unduly affect the analysis. In addition, filtering out data with wind speeds in excess of 5 m/s provides an additional precautionary exclusion of elevated sound levels.

5.13 Baseline noise levels at other locations have been derived based on the typical difference in ambient and background noise between the short-term and supplementary long-term locations. The baseline noise levels used in the assessment for the nearest residential receptors are summarised in Table 5.3.

Table 5.3: Baseline Noise Levels Used in Assessment

Receptor	Ambient noise level, dB L_{Aeq}			Background noise level, dB L_{A90}		
	Day	Evening	Night	Day	Evening	Night
Brickyard Cottage	59	35	32	35	33	32
Burton Constable	42	33	32	34	28	28
Caley Cottage	42	35	32	34	27	26
Church House	62	36	32	33	32	26
Flinton	57	51	40	34	30	28
Gardener's Cottage	42	33	32	34	28	28
Lambwath Hill / Low Fosham	42	30	29	33	25	24
Lambwath Meadows SSSI	42	30	29	33	25	24
Marton Farm	62	36	32	33	32	26
Moat Farm / Tansterne House	37	31	30	32	27	27
Model Farm	44	33	34	36	30	30
Old Farm	44	33	34	36	30	30
Marton Old School	62	36	32	33	32	26
Smithy Briggs	42	33	32	34	28	28
Smithy Briggs Cottage	42	33	32	34	28	28
South End	44	33	30	35	28	25
Sproatley Village	62	-	-	45	-	-
Straits Farm	44	33	30	35	28	25
West Carlton	38	32	31	33	26	25
West Newton Grange	37	31	30	32	27	27
Wood End House	62	36	32	33	32	26
Note: no data recorded at Sproatley Village during the evening or night-time periods due to the assessment of traffic being undertaken for daytime activities only.						

6 Calculations and Noise Modelling

Overview

6.1 This section presents the noise modelling scenarios that were considered in this assessment, based on the phases description of the proposed wellsite in Section 3, and the noise modelling methodology.

Wellsite Extension Construction, Restoration and Aftercare

6.2 For the purposes of construction noise modelling, it has been assumed that, as a worst case, all of the equipment shown in Table 6.1 will be utilised on the wellsite at the same time for the shown assumed on-times. In reality, it is likely that construction will take place in stages with only some of the equipment operating at any one time. It has been assumed that similar equipment will be utilised for the wellsite restoration and aftercare.

Table 6.1: Construction Noise Data Used for Modelling

Plant item	Number on the wellsite at any time	Assumed % on time	BS 5228 ref	Sound power level, L_W dBA
Excavator	3	100	C4.66	**97**
Dumper	3	100	C4.4	**104**
Dozer	1	100	C2.11	**107**
Roller	2	100	C5.19	**108**
Generator	1	100	C4.76	**89**
Large Smoothing vibrating roller	1	100	C 5.28	**106**
Concrete Pump	1	30	C 3.26	**81**
Concrete mixer truck	1	30	C.4.20	**79**

Traffic

6.3 Traffic noise calculations have been carried out based on daily figures with and without construction traffic, as shown in Table 6.2. The HGV trips given in Table 6.2 are showing an average daily number of HGV trip for the indicated year.

6.4 It is understood that the wellsite access route will be via T junction with Fosham Road, onto Piper's Lane, then Burton Constable Road, then on Lambwath Lane, then turning west on to Mulberry Lane. There will also be a wellsite access route to the south via Fosham Road, Pipers Lane, Burton Constable Road and Pasture Lane.

6.5 The baseline traffic flows shown in Table 6.2 to Table 6.5 are based on the provided traffic counts from Nationwide Data Collection (NDC) for the wellsite access routes mentioned above.

6.6 It should be noted that the baseline traffic counts presented in Table 6.2 to Table 6.5 are 18-hour traffic flows averaged over a weekly period of traffic counts and therefore include both weekday and weekend traffic counts. It is considered reasonable to also include the weekends to derive the 18-hour traffic flow as, according to Table 3.2, HGV deliveries are expected to occur in some phases also over the weekends.

Table 6.2: Traffic Data Used for Modelling – Burton Constable Road North of Junction with Pipers Lane

Year	Maximum 2 way HGV loads	Maximum HGV Trips	18-hour traffic flow	18h HGVs	%HGVs
Baseline	-	-	777	16	2.1
1	25	50	827	66	7.9
2	30	60	837	76	9.1
3	25	50	827	66	7.9
4	25	50	827	66	7.9
5-20	25	50	827	66	7.9
21	30	60	837	76	9.1
21-25	0	0	777	16	2.1

Table 6.3: Traffic Data Used for Modelling – Lambwath Lane

Year	Maximum 2 way HGV loads	Maximum HGV Trips	18-hour traffic flow	18h HGVs	%HGVs
Baseline	-	-	1205	14	1.2
1	25	50	1255	64	5.1
2	30	60	1265	74	5.8
3	25	50	1255	64	5.1
4	25	50	1255	64	5.1
5-20	25	50	1255	64	5.1
21	30	60	1265	74	5.8
21-25	0	0	1205	14	1.2

Table 6.4: Traffic Data Used for Modelling – Mulberry Lane

Year	Maximum 2 way HGV loads	Maximum HGV Trips	18-hour traffic flow	18h HGVs	%HGVs
Baseline	-	-	2864	27	0.9
1	25	50	2914	77	2.6
2	30	60	2924	87	3.0
3	25	50	2914	77	2.6
4	25	50	2914	77	2.6
5-20	25	50	2914	77	2.6
21	30	60	2924	87	3.0
21-25	0	0	2864	27	0.9

Table 6.5: Traffic Data Used for Modelling – Burton Constable Road South of Junction with Pipers Lane

Year	Maximum 2 way HGV loads	Maximum HGV Trips	18-hour traffic flow	18h HGVs	%HGVs
Baseline	-	-	724	29	4.0
1	25	50	774	79	10.2
2	30	60	784	89	11.4
3	25	50	774	79	10.2
4	25	50	774	79	10.2
5-20	25	50	774	79	10.2
21	30	60	784	89	11.4
21-25	0	0	724	29	4.0

Wellsite Extension Construction - Conductor Drilling

6.7 Conductor drilling operations will occur on a 24-hour basis and, as such, it is the night-time situation rather than the daytime which will be more critical. At the present time, no decision on the exact conductor drilling rig to be utilised on the wellsite has been made. The choice of the conductor drilling rig will depend on several factors, including rig availability at the time the wells are to be drilled, if planning permission is granted. Consequently, the noise characteristics from a typical type of conductor drilling rig (Marriott's Rig G28) was assessed to determine the suitability of the wellsite with regards to potential noise impacts and the types of mitigation required. This represents a typical worst-case scenario in terms of the likely noise impacts from conductor drilling.

Drilling

6.8 Drilling operations will occur on a 24-hour basis and, as such, it is the night-time rather than the daytime which will be more sensitive to sound. At the present time, no decision on the exact drilling rig to be utilised on the wellsite has been made. The choice of drilling rig will depend on several factors, including drilling rig availability at the time the wells are to be drilled, if planning permission is granted. Consequently, the noise characteristics from two typical types of drilling rigs were assessed to determine the suitability of the wellsite with regards to potential noise impacts and the types of mitigation required. This represents a typical worst-case scenario in terms of the likely noise impacts from drilling. The two drilling rig types assessed were the Drillmec HH-220 and the Bentec T-208. The Drillmec HH-220 drilled at West Newton B wellsite in 2020.

6.9 It should be noted that these two drilling rigs are typical of the type of drilling rig that might be used. Different drilling rigs produce different noise levels and noise characteristics and the drilling rigs selected for the assessment were considered to give a representative range of the noise levels and characters that could occur from any selected drilling rig. This would also enable different noise mitigation measures to be assessed as part of the Noise Impact Assessment. The drilling rigs assessed are typical and form part of the range of drilling rigs in terms of power, capability, height and top drive that could be selected to drill the wells at West Newton A depending on availability. It is expected that other rigs of a comparable type will have a similar noise footprint.

6.10 A workover rig may be utilised for the Appraisal Testing and Workover of Existing Wells phase, the Well Treatment and Clean Up phase and the Well Workovers, Routine Maintenance and Repairs phase. Typically, a workover rig would be smaller with a lower noise footprint than a full rotary equipped drilling rig. Consequently, the noise levels predicted for the two workover rigs assessed would be lower during these phases than during the drilling phase. As such, the workover rig has been scoped out from this assessment.

Marriott Drillmec HH-220

6.11 The Drillmec HH-220 drilling rig is operated by Marriott Drilling. The HH-220 drilling rig is hydraulically operated and is erected using its own hydraulic pistons. Pipe handling is automated and computer controlled, and consequently there is significantly reduced manual handling of drill pipes, virtually eliminating the impact noise associated with more traditional pipe handling methods. The top drive is hydraulically powered. There is no brake drum as on a conventional drilling rig, and hence there is no characteristic brake drum "squeal".

6.12 A photo of the Marriott HH-220 drilling rig is shown in Figure 6.1.

Figure 6.1: Photo of Marriott HH-220 drilling rig

6.13 In addition to the drilling rig trailer there are three packaged generators (of which two units are normally in operation) as well as other equipment including: mud pumps, shale shakers, centrifuges, a mud mixing units and a hydraulic power pack (HPU).

6.14 Mitigation measures installed on the HH-220 drilling rig include:

- Hydraulic operated drilling rig with automated pipe handling to reduce pipe handling noise;
- Enclosed shale shakers;
- Acoustically enclosed top drive;
- Acoustically enclosed generators with high specification exhaust silencers; and
- Acoustically enclosed HPU.

6.15 Sound power level data for the drilling rig was obtained from a range of sources including noise surveys during drilling campaigns at Tinker Lane and Springs Road in Nottinghamshire. Measurements were carried out using the sound intensity scanning methodology. The sound power levels were determined by measuring sound intensity levels (by scanning a microphone probe over each element) and integrating over the radiating area. In general, measuring sound intensity to determine sound power provides more accurate predictions than measuring sound pressure due to the ability to minimise/reject off axis/extraneous noise. Furthermore, the ability to measure more accurately in the near-field (compared to sound pressure level measurements) means that there is no requirement to include empirical near-field corrections in the sound power calculations.

6.16 The source noise data have been refined over several years and compared against a significant quantity of environmental noise monitoring data at various sites such that there is a high level of confidence in the data.

6.17 A summary of the Marriott HH-220 drilling rig noise data utilised to build the noise model is shown in Table 6.6 as overall A-weighted and linear octave band sound power levels.

Table 6.6: Octave Band Sound Power Level Data for Marriott HH-220 Drilling Rig

Name	Overall, dBA	Linear octave band sound power level, dB re 1 pW							
		63	125	250	500	1k	2k	4k	8k
Top Drive (unenclosed, 60 rpm)	**91**	81	77	84	89	88	81	75	66
Mud pump motor (unenclosed)	**103**	102	104	102	99	96	95	94	88
Mud pump (unenclosed)	**97**	99	98	98	93	91	89	88	83
Generator	**99**	106	113	99	92	88	85	84	77
Generator Exhaust	**100**	107	114	99	90	87	86	85	78
HPU	**97**	93	98	103	99	92	87	80	73
Rig Trailer Hydraulics	**91**	74	79	99	86	74	69	65	59
Shale Shakers	**84**	90	82	82	81	80	76	71	68
Sand Shakers	**82**	88	81	78	78	77	73	69	67
Centrifuge (enclosed)	**80**	87	91	83	76	72	66	58	57

Bentec T-208

6.18 Another potential candidate drilling rig at the West Newton A wellsite is the Bentec T-208, shown in Figure 6.2, which is a 53.3 m high drilling rig with an electric top drive.

6.19 Although RPS has not undertaken noise measurements on this drilling rig, detailed noise measurements have been undertaken on the drilling rig by German consultancy Kötter Consulting Engineers GmbH & Co (report no. 212363-02.01). Measurements were conducted on the drilling rig with two different top drive speeds of 65 and 130 rpm in order to determine the potential sound power level under a range of drilling conditions.

Figure 6.2: Photo of Bentec T-208 drilling rig

Table 6.7: T-208 Source Sound Power Levels Used in Assessment

Item	Overall, dBA	Linear octave band sound power level, dB re 1 pW								
		31.5	63	125	250	500	1k	2k	4k	8k
Wirth TPK 1600 mud pump motor	**103**	98	101	101	97	94	92	101	93	81
Wirth TPK 1600 mud pump (remaining components without motor)	**95**	97	103	100	98	93	87	83	79	73
Shale shaker with enclosure	**94**	114	96	92	88	90	89	86	85	83
Pumps, agitators and tanks	**93**	93	92	91	90	89	89	86	82	75
Centrifuge unit	**97**	96	99	94	96	95	90	89	89	79
Power control unit (incl. coolers)	**94**	94	89	93	96	90	89	85	81	77
Top drive (65 rpm)	**100**	94	95	94	99	98	95	90	86	87
Top drive (130 rpm)	**103**	94	94	95	100	101	97	96	88	86

6.20 No measurement results were presented for the generators (it is assumed that the drilling rig was operating using power from the electric grid). Consequently, sound power level data for the HH-220 drilling rig generators was used in the assessment on the basis that a similar degree of noise control can be fitted to the T-208 drilling rig generators if required (i.e. high specification enclosure upgrades, upgraded exhaust silencers, AV mounts, resilient exhaust mount inserts, high specification acoustic louvers and cooling air silencers). Full details of the proposed mitigation are presented in Section 10.

Testing of Existing/Additional Wells

6.21 The primary sources of noise during appraisal testing will be the use of two enclosed incinerator units. For this assessment two enclosed incinerators at 10 m height above ground were considered with a maximum flow rate of 2.24 MMscfd.

6.22 The source noise data used in this assessment has been based on manufacturer's data for similar types of incinerator corrected using the methodology presented in VDI 3732 [[14]] to account for variation in flow rate. Frequency spectrum data was not available and this was therefore based on measurements on other similar incinerators. The assumed source sound power level for the incinerators is as presented in Table 6.8.

Table 6.8: Source Sound Power Level for Incinerators used in Assessment

Item	Overall, dBA	Linear octave band sound power level, dB re 1 pW							
		63	125	250	500	1k	2k	4k	8k
Enclosed incinerator (10 m height) per incinerator	**104**	115	102	102	101	97	96	95	87

6.23 In addition, a workover drilling rig will be used during this the extended well testing phase. Typically, a workover rig would be smaller with a lower noise footprint than a full rotary equipped drilling rig. Consequently, the noise levels predicted for the two rigs assessed would be lower during these phases than during the drilling phase.

Noise Model Methodology

6.24 The noise emissions from the proposed activities have been modelled using the CadnaA environmental noise prediction software. This model calculates the contribution from each noise source input as a specified source type (e.g. point, line, area) octave band sound power levels at selected locations. It predicts noise levels under light down-wind conditions based on hemispherical propagation, atmospheric absorption, ground effects, screening and directivity based on the procedure detailed in ISO 9613.

6.25 The ground between the wellsite and the receiver locations has been assumed to be soft although the wellsite itself has been modelled as hard ground. Terrain contour data has also been entered in the model based on OS land contours, although the land is fairly flat. Buildings have been included and these provide some degree of screening as well as reflecting surfaces.

6.26 The model has been run using a receiver height of 4 m above ground in order to investigate the noise impact from night-time operations, i.e. at first floor bedroom window level.

6.27 The same noise modelling techniques have been used by RPS on several drilling rigs in the UK and worldwide and there is a high degree of confidence in the model. The main area of uncertainty relates to source noise level data for the drilling rig that RPS has not undertaken the measurements on. However, once the final drilling rig has been chosen, RPS will be able to provide detailed noise control advice to ensure that the drilling rig meets or outperforms the noise emission levels specified in this report.

7 Results and Assessment

Traffic Noise Assessment

7.1 Based on worst-case changes in traffic flows, noise levels along Burton Constable Road, Lambwath Lane and Mulberry Lane have been calculated using the methodology described in Calculation of Road Traffic Noise (CRTN). The traffic noise assessment is presented in Table 7.1 to Table 7.4, including a comparison against the Design Manual for Roads and Bridges (DMRB) classification of magnitude of noise impacts in the short term.

7.2 It should be noted that the noise change presented in Table 7.1 to Table 7.4 indicates an average noise change over the indicated year as the noise change is based on average daily HGV trips.

7.3 The resulting changes in road traffic noise levels indicate that for receptors along Mulberry Lane, the resulting noise impacts are likely to be imperceptible, and as a worst case are considered to be negligible and temporary in nature.

7.4 The resulting changes in road traffic noise levels indicate that for receptors along Burton Constable Road, north/south of the junction with Piper Lane and receptors along Lambwath Lane, most of the resulting noise impacts are considered to be negligible to minor and temporary in nature. The average noise change between years 5 to 20 cannot be considered temporary and will have a minor noise impact.

Table 7.1: Construction Traffic Noise Assessment - Burton Constable Road North of Junction with Piper Lane

Year	Average Noise Change, dB	Assessment
1	**+2.1**	Minor/ temporary
2	**+2.4**	Minor/ temporary
3	**+2.1**	Minor/ temporary
4	**+2.1**	Minor/ temporary
5-20	**+2.1**	Minor
21	**+2.4**	Minor/ temporary
21-25	**0.0**	Negligible

Table 7.2: Construction Traffic Noise Assessment - Lambwath Lane

Year	Average Noise Change, dB	Assessment
1	**+1.5**	Minor/ temporary
2	**+1.8**	Minor/ temporary
3	**+1.5**	Minor/ temporary
4	**+1.5**	Minor/ temporary

Year	Average Noise Change, dB	Assessment
5-20	**+1.5**	Minor
21	**+1.8**	Minor/ temporary
21-25	**0.0**	Negligible

Table 7.3: Construction Traffic Noise Assessment - Mulberry Lane

Year	Noise Change, dB	Assessment
1	**+0.7**	Negligible / temporary
2	**+0.9**	Negligible / temporary
3	**+0.7**	Negligible / temporary
4	**+0.7**	Negligible / temporary
5-20	**+0.7**	Negligible
21	**+0.9**	Negligible / temporary
21-25	**0.0**	Negligible

Table 7.4: Construction Traffic Noise Assessment - Burton Constable Road South of Junction with Piper Lane

Year	Noise Change, dB	Assessment
1	**+1.9**	Minor/ temporary
2	**+2.2**	Minor/ temporary
3	**+1.9**	Minor/ temporary
4	**+1.9**	Minor/ temporary
5-20	**+1.9**	Minor
21	**+2.2**	Minor/ temporary
21-25	**0.0**	Negligible

7.5 Site traffic on the access tracks has been assessed, where relevant, as part of the on-site noise level predictions for each phase.

7.6 The grid noise map for the construction traffic noise at a 4 m height above local ground can be seen in Figure A9 in the Figures section at the end of this report.

Wellsite Construction and Restoration Noise Assessment

7.7 The results of the construction noise assessment are summarised in Table 7.5. The table includes the baseline ambient noise level for each location, the BS 5228 ABC method significance criteria, the specific noise due to construction and an assessment of whether the BS 5228 criteria are exceeded. Construction hours will be Monday to Saturday 07:00 hrs to 19:00 hrs. No works will take place on Sundays and Bank Holidays or at night. In order to produce a worst-case precautionary assessment, the lower BS 5228 criteria has been used even where baseline noise levels would otherwise place it within a higher band. The predicted noise levels include the contribution from construction on wellsite as well as HGV movements on the access track.

Table 7.5: Wellsite Construction and Restoration Noise Assessment

Location	Baseline Ambient Sound Level, dB L_{Aeq}		BS 5228 Criteria		Site Construction Sound Level, dBA	Assessment	
	Day	Evening	Day	Evening / weekends		Day	Evening / weekends
Brickyard Cottage	59	35	65	55	0	OK	OK
Burton Constable	42	33	65	55	0	OK	OK
Caley Cottage	42	35	65	55	44	OK	OK
Church House	62	36	65	55	39	OK	OK
Flinton	57	51	65	55	0	OK	OK
Gardener's Cottage	42	33	65	55	0	OK	OK
Lambwath Hill / Low Fosham	42	30	65	55	32	OK	OK
Lambwath Meadows	42	30	65	55	0	OK	OK
Marton Farm	62	36	65	55	45	OK	OK
Moat Farm / Tansterne House	37	31	65	55	0	OK	OK
Model Farm	44	33	65	55	27	OK	OK
Old Farm	44	33	65	55	27	OK	OK
Marton Old School	62	36	65	55	43	OK	OK
Smithy Briggs	42	33	65	55	0	OK	OK
Smithy Briggs Cottage	42	33	65	55	0	OK	OK
South End	44	33	65	55	40	OK	OK
Straits Farm	44	33	65	55	39	OK	OK
West Carlton	38	32	65	55	0	OK	OK
West Newton Grange	37	31	65	55	0	OK	OK
Wood End House	62	36	65	55	42	OK	OK

7.8 It should be noted that the construction noise predictions are based on all plant items working as stated in Table 6.1 for the entire construction phase. In reality, this is an unrealistic scenario. Nevertheless, the assessment shows that even if all plant was to operate at one time, noise due to construction will be well below the BS 5228 criteria for significance. It should also be noted that the wellsite construction and restoration will be temporary operations. Consequently, it can be concluded that temporary construction noise will not result in a significant impact.

7.9 The grid noise map for the wellsite construction and restoration noise at a 4 m height above local ground can be seen in Figure A10 in the Figures section at the end of this report.

Conductor Drilling Noise Assessment

7.10 The PPG-M requires that "for any operations during the period 22.00 – 07.00 noise limits should be set to reduce to a minimum any adverse impacts, without imposing unreasonable burdens on the mineral operator. In any event the noise limit should not exceed 42 dBA $L_{Aeq,1h}$ (free field) at a noise sensitive property." The approach taken for this assessment has been to utilise best available techniques to reduce noise from the drilling rigs to as low as practicable without placing overly restrictive burdens on the operator. Consequently, the mitigation measures developed as part of this assessment take into account various factors including practicability, safety and technical constraints.

7.11 The conductor drilling noise assessment is shown in Table 7.6 in comparison to the PPG-M noise limits. The PPG-M noise limits are shown for day and evening periods for both the target value (background + 10 dB) and the upper limit value.

7.12 Noise modelling shows that noise levels will be below the daytime, evening and night-time PPG-M limits (free-field) at all receptors.

Table 7.6: PPG-M Noise Assessment for Conductor Drilling

Location	Background sound level, dB L_{A90}			PPG-M limit, dBA			Specific sound level, dBA	Assessment		
	Day	Eve	Night	Day	Eve	Night	G-28	Day	Eve	Night
Brickyard Cottage	35	33	32	45-55	43-55	42	0	OK	OK	OK
Burton Constable	34	28	28	44-55	38-55	42	0	OK	OK	OK
Caley Cottage	34	27	26	44-55	37-55	42	35	OK	OK	OK
Church House	33	32	26	43-55	42-55	42	26	OK	OK	OK
Flinton	34	30	28	44-55	40-55	42	0	OK	OK	OK
Gardener's Cottage	34	28	28	44-55	38-55	42	0	OK	OK	OK
Lambwath Hill / Low Fosham	33	25	24	43-55	35-55	42	19	OK	OK	OK
Lambwath Meadows	33	25	24	43-55	35-55	42	0	OK	OK	OK
Marton Farm	33	32	26	43-55	42-55	42	30	OK	OK	OK
Moat Farm / Tansterne House	32	27	27	42-55	37-55	42	0	OK	OK	OK
Model Farm	36	30	30	46-55	40-55	42	17	OK	OK	OK
Old Farm	36	30	30	46-55	40-55	42	16	OK	OK	OK
Marton Old School	33	32	26	43-55	42-55	42	31	OK	OK	OK
Smithy Briggs	34	28	28	44-55	38-55	42	0	OK	OK	OK
Smithy Briggs Cottage	34	28	28	44-55	38-55	42	0	OK	OK	OK
South End	35	28	25	45-55	38-55	42	27	OK	OK	OK
Straits Farm	35	28	25	45-55	38-55	42	27	OK	OK	OK
West Carlton	33	26	25	43-55	36-55	42	0	OK	OK	OK
West Newton Grange	32	27	27	42-55	37-55	42	0	OK	OK	OK
Wood End House	33	32	26	43-55	42-55	42	27	OK	OK	OK

7.13 Table 7.7 shows the baseline ambient noise levels and predicted conductor drilling noise levels. With standard mitigation measures in place, it is expected that noise levels will be below the WHO guideline limit for the onset of sleep disturbance at all the residential receptors. The assessment is based upon the maximum noise level produced by the example conductor rig at any receptor and is therefore representing a worst-case scenario.

7.14 Conductor drilling activities will last for approximately 28 days per well. Consequently, the noise impacts presented in the table will be a temporary impact.

Table 7.7: Temporary Ambient Noise Level Change Assessment – Conductor Drilling

Location	Ambient sound level, dB L_{Aeq}			Specific sound level, dBA	Max new ambient sound level, dBA			Change, dB		
	Day	Eve	Night	G-28	Day	Eve	Night	Day	Eve	Night
Brickyard Cottage	59	35	32	0	59	35	32	**0**	**0**	**0**
Burton Constable	42	33	32	0	42	33	32	**0**	**0**	**0**
Caley Cottage	42	35	32	35	43	38	37	**+1**	**+3**	**+5**
Church House	62	36	32	26	62	36	33	**0**	**0**	**+1**
Flinton	57	51	40	0	57	51	40	**0**	**0**	**0**
Gardener's Cottage	42	33	32	0	42	33	32	**0**	**0**	**0**
Lambwath Hill / Low Fosham	42	30	29	19	42	31	30	**0**	**0**	**0**
Lambwath Meadows SSSI	42	30	29	0	42	30	29	**0**	**0**	**0**
Marton Farm	62	36	32	30	62	37	34	**0**	**+1**	**+2**
Moat Farm / Tansterne House	37	31	30	0	37	31	30	**0**	**0**	**0**
Model Farm	44	33	34	17	44	33	34	**0**	**0**	**0**
Old Farm	44	33	34	16	44	33	34	**0**	**0**	**0**
Marton Old School	62	36	32	31	62	37	35	**0**	**+1**	**+3**
Smithy Briggs	42	33	32	0	42	33	32	**0**	**0**	**0**
Smithy Briggs Cottage	42	33	32	0	42	33	32	**0**	**0**	**0**
South End	44	33	30	27	44	34	32	**0**	**+1**	**+2**
Straits Farm	44	33	30	27	44	34	32	**0**	**+1**	**+2**
West Carlton	38	32	31	0	38	32	31	**0**	**0**	**0**
West Newton Grange	37	31	30	0	37	31	30	**0**	**0**	**0**
Wood End House	62	36	32	27	62	37	34	**0**	**+1**	**+1**

7.15 It is noted that there is potential for a temporary change in ambient noise levels whilst conductor drilling is taking place. Consequently, it is likely that noise from conductor drilling will be audible at the nearest residential premises to the wellsite especially during the evening and night-time. However, it is not considered feasible to conduct drilling operations in such a quiet area without introducing a temporary change in ambient noise. In this respect, it is important to note that the conductor rig will be fitted with high-specification mitigation measures in order to reduce noise levels to as low as reasonably practicable. Furthermore, the PPG-M noise limits are specifically formulated to take into account the quiet characteristics of rural areas where minerals and oil and gas extraction often occurs.

7.16 The grid noise map for the conductor drilling noise at a 4 m height above local ground can be seen in Figure A11 in the Figures section at the end of this report.

Drilling Noise Assessment

7.17 The PPG-M requires that "for any operations during the period 22.00 – 07.00 noise limits should be set to reduce to a minimum any adverse impacts, without imposing unreasonable burdens on the mineral operator. In any event the noise limit should not exceed 42 dBA $L_{Aeq,1h}$ (free field) at a noise sensitive property." The approach taken for this assessment has been to utilise best available techniques to reduce noise from the drilling rigs to as low as practicable without placing overly restrictive burdens on the operator. Consequently, the mitigation measures developed as part of this assessment take into account various factors including practicability, safety and technical constraints.

7.18 The drilling noise assessment is shown in Table 7.8 in comparison to the PPG-M noise limits. The PPG-M noise limits are shown for day and evening periods for both the target value (background + 10 dB) and the upper limit value of 55 dB $L_{Aeq,1h}$ (free field). The night-time noise limit is 42 dB L_{Aeq} (free-field).

7.19 Noise modelling for the two example drilling rigs shows that noise levels will be below the night-time 42 dB L_{Aeq} (free-field) noise limit from the PPG-M for all drilling rigs considered. It should be noted that the noise levels for both example rigs during night-t time fall below the 40 dBA level which WHO NNG identifies as the level above which adverse health effects are observed along the exposed population (LOAEL).

7.20 As stated in paragraph 4.26, for operations during the evening (19:00-22:00 hours) the noise limits should not exceed the background noise level ($L_{A90,1h}$) by more than 10 dBA and should not exceed 55 dBA $L_{Aeq,1h}$ (free field). Specific noise levels at the Caley Cottage receptor exceed the lower PPG-M noise limit only during the evening period (19:00-22:00 hours) for the two example drilling rigs and only by 1 dB. The noise levels at Caley Cottage do not exceed the upper noise limit of 55 dBA $L_{Aeq,1h}$ during daytime and evening time or the criterion of 42 dB during night-time. Noise levels are below the PPG-M noise limits at all other receptors for the daytime and evening periods for both example drilling rigs.

7.21 If needed, Caley Cottage could be protected by a bund or a hoarding to the west boundary of the wellsite.

Table 7.8: PPG-M Noise Assessment for Drilling

Location	Background sound level, dB L_{A90}			PPG-M limit, dBA			Specific sound level, dBA		Assessment		
	Day	Eve	Night	Day	Eve	Night	HH-220	T-208	Day	Eve	Night
Brickyard Cottage	35	33	32	45-55	43-55	42	0	0	**OK**	**OK**	**OK**
Burton Constable	34	28	28	44-55	38-55	42	0	0	**OK**	**OK**	**OK**
Caley Cottage	34	27	26	44-55	37-55	42	38	38	**OK**	**Exceedance of lower limit only (see paragraph 7.20)**	**OK**
Church House	33	32	26	43-55	42-55	42	35	32	**OK**	**OK**	**OK**
Flinton	34	30	28	44-55	40-55	42	0	0	**OK**	**OK**	**OK**
Gardener's Cottage	34	28	28	44-55	38-55	42	0	0	**OK**	**OK**	**OK**
Lambwath Hill / Low Fosham	33	25	24	43-55	35-55	42	28	26	**OK**	**OK**	**OK**
Lambwath Meadows	33	25	24	43-55	35-55	42	0	0	**OK**	**OK**	**OK**
Marton Farm	33	32	26	43-55	42-55	42	36	37	**OK**	**OK**	**OK**
Moat Farm / Tansterne House	32	27	27	42-55	37-55	42	0	0	**OK**	**OK**	**OK**
Model Farm	36	30	30	46-55	40-55	42	25	22	**OK**	**OK**	**OK**
Old Farm	36	30	30	46-55	40-55	42	25	21	**OK**	**OK**	**OK**
Marton Old School	33	32	26	43-55	42-55	42	37	36	**OK**	**OK**	**OK**
Smithy Briggs	34	28	28	44-55	38-55	42	0	0	**OK**	**OK**	**OK**
Smithy Briggs Cottage	34	28	28	44-55	38-55	42	0	0	**OK**	**OK**	**OK**
South End	35	28	25	45-55	38-55	42	32	32	**OK**	**OK**	**OK**

Location	Background sound level, dB L_{A90}			PPG-M limit, dBA			Specific sound level, dBA		Assessment		
	Day	Eve	Night	Day	Eve	Night	HH-220	T-208	Day	Eve	Night
Straits Farm	35	28	25	45-55	38-55	42	32	31	**OK**	**OK**	**OK**
West Carlton	33	26	25	43-55	36-55	42	0	0	**OK**	**OK**	**OK**
West Newton Grange	32	27	27	42-55	37-55	42	0	0	**OK**	**OK**	**OK**
Wood End House	33	32	26	43-55	42-55	42	39	36	**OK**	**OK**	**OK**

7.22 Table 7.9 shows the baseline ambient noise levels and predicted drilling noise levels for the drilling rigs. With standard mitigation measures in place, it is expected that noise levels will be below the WHO guideline limit for the onset of sleep disturbance at all the residential receptors. The assessment is based upon the maximum noise level produced by any of the two example rigs at any receptor and therefore represents a worst-case scenario.

7.23 Drilling activities will last for approximately 15 weeks per well. Consequently, the noise impacts presented in the table will be a temporary impact.

Table 7.9: Temporary Ambient Noise Level Change Assessment – Drilling

Location	Ambient sound level, dB L_{Aeq}			Specific sound level, dBA		Max new ambient sound level, dBA			Change, dB		
	Day	Eve	Night	HH-220	T-208	Day	Eve	Night	Day	Eve	Night
Brickyard Cottage	59	35	32	0	0	59	35	32	**0**	**0**	**0**
Burton Constable	42	33	32	0	0	42	34	33	**0**	**0**	**0**
Caley Cottage	42	35	32	38	38	44	41	41	**+1**	**+5**	**+7**
Church House	62	36	32	35	32	62	39	37	**0**	**+3**	**+5**
Flinton	57	51	40	0	0	57	51	40	**0**	**0**	**0**
Gardener's Cottage	42	33	32	0	0	42	33	32	**0**	**0**	**0**
Lambwath Hill / Low Fosham	42	30	29	28	26	42	32	32	**0**	**+2**	**+3**
Lambwath Meadows SSSI	42	30	29	0	0	42	31	30	**0**	**0**	**0**
Marton Farm	62	36	32	36	37	62	41	41	**0**	**+4**	**+6**
Moat Farm / Tansterne House	37	31	30	0	0	37	31	31	**0**	**0**	**0**
Model Farm	44	33	34	25	22	44	34	35	**0**	**+1**	**+1**
Old Farm	44	33	34	25	21	44	34	35	**0**	**+1**	**+1**
Marton Old School	62	36	32	37	36	62	40	39	**0**	**+4**	**+6**
Smithy Briggs	42	33	32	0	0	42	34	33	**0**	**0**	**0**
Smithy Briggs Cottage	42	33	32	0	0	42	33	32	**0**	**0**	**0**
South End	44	33	30	32	32	44	37	35	**0**	**+3**	**+4**
Straits Farm	44	33	30	32	31	44	37	35	**0**	**+3**	**+4**
West Carlton	38	32	31	0	0	38	33	32	**0**	**0**	**0**
West Newton Grange	37	31	30	0	0	37	32	31	**0**	**0**	**0**
Wood End House	62	36	32	39	36	62	41	41	**0**	**+5**	**+8**

7.24 It is noted that there is potential for a temporary change in ambient noise levels whilst drilling is taking place. Consequently, it is likely that noise from drilling will be audible at the nearest residential premises to the wellsite especially during the evening and night-time. However, it is not considered feasible to conduct drilling operations in such a quiet area without introducing a temporary change in ambient noise. In this respect, it is important to note that the drilling rigs will be fitted with high-specification mitigation measures in order to reduce noise levels to as low as reasonably practicable. Furthermore, the PPG-M noise limits are specifically formulated to take into account the quiet characteristics of rural areas where minerals and oil and gas extraction often occurs.

7.25 The grid noise map for the appraisal drilling noise at a 4 m height above local ground can be seen in Figures A12 and A13 in the Figures section at the end of this report for the HH220 and T208 drilling rig, respectively.

Appraisal Testing Assessment

7.26 Table 7.10 presents an assessment of noise due to appraisal testing in accordance with the PPG-M. From Table 7.10 it can be seen that the predicted noise levels during appraisal testing at all receptors do not exceed the PPG-M criteria.

7.27 With standard mitigation measures in place, it is expected that noise levels will be below the WHO guideline limit for the onset of sleep disturbance at all the residential receptors.

7.28 Appraisal testing of the existing wells will last up to 12 months and the well testing will most likely last 1 to 2 years. Consequently, the noise impacts presented in the table will be a temporary impact.

Table 7.10: PPG-M Noise Assessment for Appraisal Testing

Location	Background sound level, dB L_{A90}			PPG-M limit, dBA			Specific sound level, dBA	Assessment		
	Day	Eve	Night	Day	Eve	Night		Day	Eve	Night
Brickyard Cottage	35	33	32	45	43	42	0	OK	OK	OK
Burton Constable	34	28	28	44	38	42	0	OK	OK	OK
Caley Cottage	34	27	26	44	37	42	37	OK	OK	OK
Church House	33	32	26	43	42	42	33	OK	OK	OK
Flinton	34	30	28	44	40	42	0	OK	OK	OK
Gardener's Cottage	34	28	28	44	38	42	0	OK	OK	OK
Lambwath Hill / Low Fosham	33	25	24	43	35	42	22	OK	OK	OK
Lambwath Meadows SSSI	33	25	24	43	35	42	0	OK	OK	OK
Marton Farm	33	32	26	43	42	42	35	OK	OK	OK
Moat Farm / Tansterne House	32	27	27	42	37	42	0	OK	OK	OK
Model Farm	36	30	30	46	40	42	22	OK	OK	OK
Old Farm	36	30	30	46	40	42	21	OK	OK	OK
Marton Old School	33	32	26	43	42	42	37	OK	OK	OK
Smithy Briggs	34	28	28	44	38	42	0	OK	OK	OK
Smithy Briggs Cottage	34	28	28	44	38	42	0	OK	OK	OK
South End	35	28	25	45	38	42	30	OK	OK	OK

Location	Background sound level, dB L_{A90}			PPG-M limit, dBA			Specific sound level, dBA	Assessment		
	Day	Eve	Night	Day	Eve	Night		Day	Eve	Night
Straits Farm	35	28	25	45	38	42	30	OK	OK	OK
West Carlton	33	26	25	43	36	42	0	OK	OK	OK
West Newton Grange	32	27	27	42	37	42	0	OK	OK	OK
Wood End House	33	32	26	43	42	42	34	OK	OK	OK

7.29 An assessment of the temporary change in ambient noise levels during well testing is shown in Table 7.11.

Table 7.11: Temporary Ambient Noise Level Change Assessment – Appraisal Well Testing

Location	Ambient sound level, dB L_{Aeq}			Specific sound level, dBA	Max new ambient sound level (Initial Flow Testing), dBA			Appraisal Well Testing Noise Change, dB		
	Day	Eve	Night		Day	Eve	Night	Day	Eve	Night
Brickyard Cottage	59	35	32	0	59	35	32	**0**	**0**	**0**
Burton Constable	42	33	32	0	42	33	33	**0**	**0**	**0**
Caley Cottage	42	35	32	37	44	40	40	**+1**	**+4**	**+6**
Church House	62	36	32	33	62	38	36	**0**	**+2**	**+4**
Flinton	57	51	40	0	57	51	40	**0**	**0**	**0**
Gardener's Cottage	42	33	32	0	42	33	32	**0**	**0**	**0**
Lambwath Hill / Low Fosham	42	30	29	22	42	32	32	**0**	**+1**	**+1**
Lambwath Meadows SSSI	42	30	29	0	42	31	30	**0**	**0**	**0**
Marton Farm	62	36	32	35	62	39	37	**0**	**+3**	**+5**
Moat Farm / Tansterne House	37	31	30	0	37	31	30	**0**	**0**	**0**
Model Farm	44	33	34	22	44	33	34	**0**	**0**	**0**
Old Farm	44	33	34	21	44	33	34	**0**	**0**	**0**
Marton Old School	62	36	32	37	62	40	39	**0**	**+4**	**+6**
Smithy Briggs	42	33	32	0	42	33	33	**0**	**0**	**0**
Smithy Briggs Cottage	42	33	32	0	42	33	32	**0**	**0**	**0**
South End	44	33	30	30	44	36	34	**0**	**+2**	**+3**
Straits Farm	44	33	30	30	44	36	34	**0**	**+2**	**+3**
West Carlton	38	32	31	0	38	33	32	**0**	**0**	**0**
West Newton Grange	37	31	30	0	37	32	31	**0**	**0**	**0**
Wood End House	62	36	32	34	62	39	37	**0**	**+2**	**+4**

7.30 The assessment shows that sound due to appraisal well testing (i.e. using two incinerators) could result in a noticeable short-term change in ambient noise during the daytime, evening and night-time at the closest receptors to wellsite. However, although the change in ambient noise would be perceptible, ambient noise levels will still be below the PPG-M guidelines and WHO criteria for onset of sleep disturbance of 42 dB L_{Aeq} (free-field).

7.31 The grid noise map for the conductor drilling noise at a 4 m height above local ground can be seen in Figure A14 in the Figures section at the end of this report.

8 Operational Noise BS 4142 Assessment

Overview

8.1 A BS 4142 assessment was undertaken to assess the operational noise from the wellsite.

8.2 The primary noise sources during the production phase are expected to include an enclosed incinerator, a crude oil heater, beam pumps (max. 8 items), a transfer pump and a generator.

8.3 At this stage there is no information available on the exact type of plant types and thus on the frequency spectrum data of the plant expecting to be operating during the production phase.

8.4 Therefore, the assessment provides noise emission levels for each plant item to ensure that the specific noise levels from the wellsite production do not exceed the background noise levels at the nearest noise sensitive receptor, i.e., Caley Cottage, during daytime, evening and night-time periods. These noise emission levels can be used during the detailed design of the site to ensure that the predicted noise levels at the NSRs are not exceeded.

Noise Emission Limits

8.5 The assumed sound power levels for each plant item are presented in Table 8.1. These sound power levels are based on measured sound power levels from similar plant on other sites and are therefore considered achievable. It should be noted that the provided noise limits take into account any potential rating penalties.

8.6 It should be noted that a worst-case approach has been adopted where all plant items below are operating simultaneously and at 100% of the time. For clarity the incinerator unit is only utilised for safety purposes and infrequent.

Table 8.1: Source Sound Power Level Limits Used in Assessment, dB re 1 pW

Item	Overall sound power level, dB re 1 pW
8 x Beam pumps	80 dBA per beam pump
Incinerator unit	72 dBA
Transfer pump	90 dBA
Crude oil heater	87 dBA
Generator	86 dBA

Assessment

8.7 Table 8.2 presents the BS 4142 assessment of the operational (production) noise of the wellsite during daytime, evening and night-time hours. The grid noise map for the operational noise at a 4 m height above local ground can be seen in Figure A15 in the Figures section at the end of this report.

8.8 As a worst-case approach a 3 dB penalty has been applied to the nearest noise sensitive receptors to the wellsite to account for any distinct character of the specific sound. It is not considered necessary to apply any additional rating penalties related to tonality or impulsivity as the specific noise is not expected to present such characteristics. Consequently, it is considered that the assessment is worst case and pessimistic.

Table 8.2: BS4142 Noise Assessment for Operational Noise

Location	Background sound level, dB L_{A90}			Residual sound level, dB $L_{Aeq,T}$			Specific sound level, dBA	Rating Penalty, dB	Rating Level, dB	Rating - Background Level Difference, dB		
	Day	Eve	Night	Day	Eve	Night				Day	Eve	Night
Brickyard Cottage	35	33	32	59	35	32	0	0	0	**-35**	**-33**	**-32**
Burton Constable	34	28	28	42	33	32	0	0	5	**-34**	**-28**	**-28**
Caley Cottage	34	27	26	42	35	32	23	3	26	**-8**	**-1**	**0**
Church House	33	32	26	62	36	32	18	3	19	**-12**	**-11**	**-5**
Flinton	34	30	28	57	51	40	0	0	0	**-34**	**-30**	**-28**
Gardener's Cottage	34	28	28	42	33	32	0	0	3	**-34**	**-28**	**-28**
Lambwath Hill / Low Fosham	33	25	24	42	30	29	12	0	10	**-21**	**-13**	**-12**
Lambwath Meadows SSSI	33	25	24	42	30	29	0	0	7	**-33**	**-25**	**-24**
Marton Farm	33	32	26	62	36	32	21	3	24	**-9**	**-8**	**-2**
Moat Farm / Tansterne House	32	27	27	37	31	30	0	0	4	**-32**	**-27**	**-27**
Model Farm	36	30	30	44	33	34	10	0	8	**-26**	**-20**	**-20**
Old Farm	36	30	30	44	33	34	9	0	7	**-27**	**-21**	**-21**
Marton Old School	33	32	26	62	36	32	23	3	24	**-7**	**-6**	**0**
Smithy Briggs	34	28	28	42	33	32	0	0	5	**-34**	**-28**	**-28**
Smithy Briggs Cottage	34	28	28	42	33	32	0	0	3	**-34**	**-28**	**-28**
South End	35	28	25	44	33	30	18	0	17	**-17**	**-10**	**-7**
Straits Farm	35	28	25	44	33	30	18	0	17	**-17**	**-10**	**-7**
West Carlton	33	26	25	38	32	31	0	0	7	**-33**	**-26**	**-25**
West Newton Grange	32	27	27	37	31	30	0	0	7	**-32**	**-27**	**-27**
Wood End House	33	32	26	62	36	32	22	3	24	**-8**	**-7**	**-1**

8.9 The results in Table 8.2 for the daytime, evening and night-time period indicate that, for all receptors the rating levels are below background sound levels which is indicative of a negligible adverse impact, depending on the context.

8.10 An assessment of the change in ambient noise levels during the wellsite operation is shown in Table 7.11. The results show that the operational noise from the wellsite is predicted to result in a 1 dB increase in the ambient sound level only at the Caley Cottage and Marton Old School receptors and only during night-time.

8.11 At all other receptors no increase is predicted in the noise levels for all the assessed time periods.

Table 8.3: Ambient Noise Level Change Assessment During Operational Phase

Location	Ambient Sound Level, dB L_{Aeq}			Specific Sound Level, dBA	Max New Ambient Sound Level (incl. Operational Noise), dBA			Ambient Noise Level Change, dB		
	Day	Eve	Night		Day	Eve	Night	Day	Eve	Night
Brickyard Cottage	59	35	32	0	59	35	32	**0**	**0**	**0**
Burton Constable	42	33	32	0	42	33	32	**0**	**0**	**0**
Caley Cottage	42	35	32	23	42	35	33	**0**	**0**	**+1**
Church House	62	36	32	18	62	36	32	**0**	**0**	**0**
Flinton	57	51	40	0	57	51	40	**0**	**0**	**0**
Gardener's Cottage	42	33	32	0	42	33	32	**0**	**0**	**0**
Lambwath Hill / Low Fosham	42	30	29	12	42	30	29	**0**	**0**	**0**
Lambwath Meadows SSSI	42	30	29	0	42	30	29	**0**	**0**	**0**
Marton Farm	62	36	32	21	62	36	32	**0**	**0**	**0**
Moat Farm / Tansterne House	37	31	30	0	37	31	30	**0**	**0**	**0**
Model Farm	44	33	34	10	44	33	34	**0**	**0**	**0**
Old Farm	44	33	34	9	44	33	34	**0**	**0**	**0**
Marton Old School	62	36	32	23	62	36	33	**0**	**0**	**+1**
Smithy Briggs	42	33	32	0	42	33	32	**0**	**0**	**0**
Smithy Briggs Cottage	42	33	32	0	42	33	32	**0**	**0**	**0**
South End	44	33	30	18	44	33	30	**0**	**0**	**0**
Straits Farm	44	33	30	18	44	33	30	**0**	**0**	**0**
West Carlton	38	32	31	0	38	32	31	**0**	**0**	**0**
West Newton Grange	37	31	30	0	37	31	30	**0**	**0**	**0**
Wood End House	62	36	32	22	62	36	32	**0**	**0**	**0**

Discussion of Context

8.12 The wellsite will be operating 24/7 but at this stage the exact on-time for each plant item is unknown. This assessment has adopted a worst-case approach where all plant has been assumed to be operating simultaneously at 100% on-time which is a worst-case approach.

8.13 Thus, taking into account the worst-case approach for this assessment and the unchanged ambient noise levels once the proposed wellsite is operational, sound from the proposed wellsite is not expected to result in an adverse impact on quality of life and the predicted sound levels from the operational wellsite are considered to be below the LOAEL.

8.14 The BS 4142:2014+A1:2019 initial estimate of impact indicates that sound from the facility may result in negligible adverse impacts which is also confirmed by the context of the scenario discussed above.

8.15 On the basis of the above, it is concluded that levels of sound arising from the operation of the wellsite will not result in any adverse impacts, significant or otherwise, at any of the nearby NSRs. Sound arising from the operation of the facility is therefore acceptable in accordance with the relevant British Standards, national and local planning policy.

9 Discussion

9.1 As discussed in Section 4, there are four key questions which need to be answered to determine whether the Government's noise policy aims have been met for a new development, these are.:

a) is there a significant adverse impact to health;

b) is there a significant adverse impact to quality of life;

c) is there an adverse impact to health; or

d) is there an adverse impact to quality of life?

9.2 If the answer to question a. or b. is yes, then the NPSE provides a clear steer that the development should be viewed as being unacceptable. If the answer to question c. or d. is yes, then the NPSE provides a clear steer that the impact should be mitigated and minimised. It follows that if the answer to all four questions is "no" then the development should normally be viewed as acceptable on noise grounds.

9.3 With respect to the impacts of noise on health, it is the effect on sleep that is likely to be the primary concern. The absolute noise level assessment shows that noise from the development can be mitigated in all phases so that it does not exceed the WHO guideline levels for onset of sleep disturbance effects and the PPG-M absolute noise limit of 42 dBA. Also, the outcome of the BS 4142 assessment of operational noise from the wellsite has shown that negligible impacts are predicted at all noise sensitive receptors. **It can therefore be concluded that there will be no adverse impact on health.**

9.4 Some residents living in close proximity to the wellsite could experience higher noise levels, especially during the evening and at night during the drilling and well testing phases, compared to what they are used to. However, it is the daytime and evening periods that are of greatest concern with respect to the impact on quality of life (amenity, enjoyment of property etc.). This is because people will tend to be indoors or asleep during the night, whereas during the day and evening they are more likely to be using outdoor spaces for amenity purposes.

9.5 It has been established that the development will result in a small increase in ambient noise during the daytime, although ambient noise levels could temporarily increase during the evening during drilling and well testing phases. While this change in noise level is likely to be perceptible at times, absolute noise levels will be significantly below the absolute noise limit criteria set out in the PPG-M for the daytime and evening. Thus, taking into account the relatively low absolute level of noise due to the proposed activities, it is unlikely that this would seriously affect the quality of life, even of those living in close proximity to the wellsite, especially when the short-term nature of the impact is taken into consideration. Also, the outcome of the BS 4142 assessment of operational noise from the wellsite has shown that negligible impacts are predicted at all noise sensitive receptors. **It can**

therefore be concluded that the proposed wellsite will not result in a significant adverse impact on the quality of life.

9.6 It is an important consideration that any noise impact from the development during the wellsite extension construction, appraisal testing and appraisal drilling will be temporary in nature. In particular, appraisal well testing, which produces the highest night-time and evening levels for the development, will be short-term in nature. Furthermore, the impacts due to noise, modelled as part of this assessment, have been based on worst case assumptions, such as the receiver location always being down-wind from the wellsite and the wellsite equipment operating at its maximum capacity throughout the programme. In reality, this will not be the case all the time and there will be significant periods within the development programme when noise levels will be less than predicted and assessed in this report.

10 Uncertainty

10.1 In all assessments, it is good practice to consider uncertainty which can arise from several different aspects. There are degrees of uncertainty associated with: instrumentation used for surveying; measurement technique and the variables influencing the measurement results such as transmission path and weather conditions; source terms used for modelling; calculation uncertainty; assessment uncertainty; and the subjective response of residents to noise sources.

10.2 Uncertainty due to instrumentation has been significantly reduced with the introduction of more modern instrumentation and is reduced further by undertaking field calibration checks on sound level meters before and after each measurement period and that all instrumentation is within accepted laboratory calibration intervals.

10.3 Every effort has been made to reduce the uncertainty of the baseline sound level measurements. The duration of the baseline survey is considered to significantly reduce the uncertainty associated with the baseline sound levels. Based on professional judgement including substantial experience of acquiring and analysing baseline data for numerous sites in various locations, and a desk based review of the wellsite and surrounding area, it is considered that the baseline data acquired during the survey is typical of the area.

10.4 Calculation uncertainty and assessment uncertainty have been reduced by peer review of all baseline data, model input data, model results and assessment calculations, and by using the appropriate level of precision at each stage of the assessment calculations.

10.5 A quantitative assessment has been undertaken based on likely source levels measured by RPS personnel, provided by the project team for the proposed equipment or based on recognised and accepted empirical calculation methodologies. Where assumptions have been made, they have favoured a worst-case scenario.

10.6 With regards to subjective response, the noise standards adopted for the assessment will have been based upon the subjective response of most of the population or will be based upon the most likely response of most of the population. This is considered to be the best that can be achieved in a population of varying subjective response which will vary dependent upon a wide range of factors.

10.7 All areas and potential consequences of uncertainty have been minimised at every stage of the assessment process. On the basis of the above, and in the context of subjective response, the effects of uncertainty on the assessment are considered minimal.

11 Potential In-Design Mitigation

Approach

11.1 The approach taken for this development has been to utilise best available technology to reduce noise levels from drilling, appraisal testing and production phase to as low as reasonably practicable.

11.2 Notwithstanding this, it is not known which exact plant items will be utilised (e.g. drilling rigs, incinerators, operational plant items). Consequently, it is difficult to specify the exact noise mitigation measures that will be installed. Nevertheless, it is possible to provide recommendations for best practice.

11.3 This chapter provides details of possible engineering noise control measures for the drilling rigs based on specific noise measurements on the example rigs combined with experience of carrying out noise control on other drilling rigs. These mitigation measures represent the range of typical techniques that could be applied. Mitigation measures will be finalised once the equipment has been chosen and a noise management plan will be prepared detailing the specific mitigation measures to be installed and their effect on ambient noise levels in the vicinity.

11.4 This chapter also includes mitigation measures for the incinerator units and also plant items that are expected to operate during the production phase of the wellsite.

Drilling Phase

Hydraulic Power Unit

11.5 The hydraulic power unit (HPU) is a potentially significant source of noise for hydraulic drilling rigs. Most of the acoustic energy from the HPU is typically emitted via the HPU enclosure roof, caused by a combination of structure-borne and airborne transmission paths. A secondary acoustic enclosure can be utilised to reduce its contribution to noise levels. It is also possible to install acoustic lagging to hydraulic pipework if this proves to be a significant source. Based on experience on other drilling rigs, it is anticipated that these mitigation measures should reduce the contribution from the HPU by 5 to 10 dB. An example isometric drawing of an enclosure for a HPU is shown in Figure 11.1.

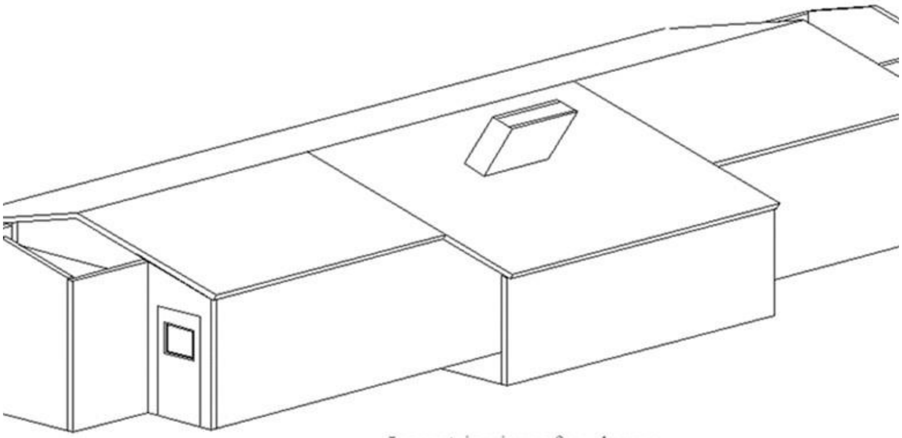


Figure 11.1: Temporary acoustic enclosure for HPU

Mud Pumps

11.6 Mud pumps can be either electrically powered or diesel driven and can vary significantly in the degree of noise control fitted as standard.

11.7 Whichever drilling rig is chosen, it is possible that, if technically feasible, the mud pumps could be installed in acoustic enclosures (e.g. similar to those shown in Figure 11.2) or screened and fitted with exhaust silencers if diesel driven. An alternative design to individual (packaged) enclosures around each mud pump is to install a larger housing in which all mud pumps can be installed (see Figure 11.3). Based on experience of other drilling rigs, it is expected that reductions of 10 dB can be achieved through properly designed enclosures and silencers.

Figure 11.2: Mud Pump Engine Enclosure (note Exhaust Silencers)

Figure 11.3: Example Mud Pump Housing

Generators

11.8 Power generators are usually installed in acoustic enclosures. Typically, these incorporate an acoustically absorptive internal lining and possibly an acoustic skirt (if there are significant emissions from the sub-skid). If necessary, depending on the design of generator enclosures on the drilling rig chosen, the acoustic performance of existing enclosures can be improved by installation of an additional mass layer between the mineral wool lining and steel outer cladding (mass loaded vinyl has been used with success in the past). The requirement for exhaust silencing will be dependent on the generators and what is already fitted, but generally a double (piggy-backed) silencer arrangement is preferable. Exhaust pipe hangers and supports often utilise resilient inserts to minimise the potential for structure-borne noise. Likewise, the engine itself can be mounted on AV mounts if it is feasible to do so. The air intakes and outlets typically utilise splitter silencers or acoustic louvers, depending on air flow and pressure drop requirements. Using a high specification enclosure, it should be possible to reduce the sound power level of most generators to less than 100 dBA. An example of an enclosure is shown in Figure 11.4

Figure 11.4: Example Generator Enclosure with High Specification Exhaust Silencers

Shale Shakers

11.9 Mitigation for the shale shakers could be in the form of either a full enclosure or by using local screening around the shakers. It is expected that up to 10 dB reduction in noise from the shale shakers could be achieved for a full enclosure (based on measurements on other drilling rigs) and 3 to 5 dB reduction for localised screening. The choice of screening or enclosure will depend upon the location and elevation of the shale shakers on the drilling rig chosen as well as their noise level (for example, on some rigs the shale shakers may already be screened by the drilling rig structure).

Centrifuge

11.10 Centrifuges can be a significant noise source if they are not enclosed. It is recommended that the centrifuge is installed in an acoustic enclosure with an internal acoustically absorptive lining and suitable AV mounts to prevent structure-borne noise. An example enclosure is shown in Figure 11.5.

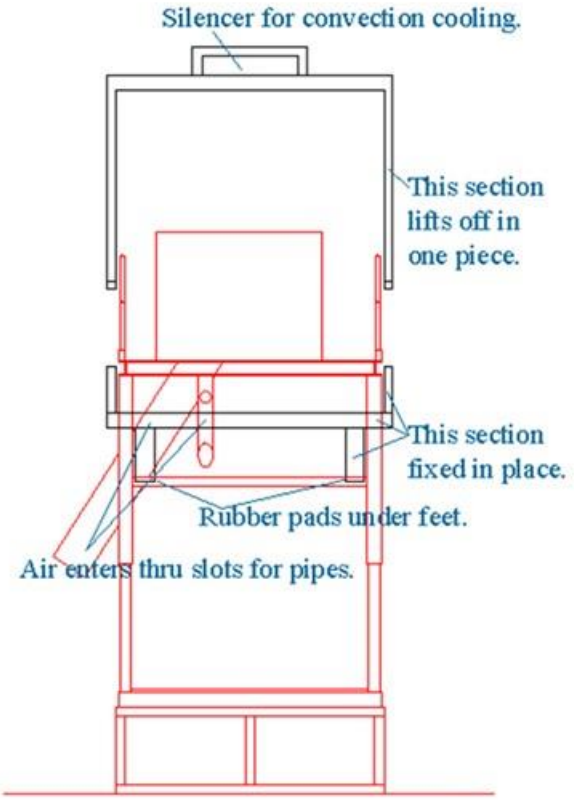


Figure 11.5: Example Centrifuge Enclosure

Acoustic Screening

11.11 Depending on the drilling rig chosen, it may be possible to erect an acoustic screen around some parts of the drilling rig should this be required in order to meet agreed noise levels. This could be in the form of a bespoke acoustic screen (e.g. Figure 11.6), close-boarded wooden fencing or stacked containers (e.g. Figure 11.7, showing triple stacked containers). Some in-wellsite screening could be provided, for example, by erecting wellsite stores and offices so that they are between the drilling rig equipment and the residential receptors.

Figure 11.6: Example Demountable Acoustic Barrier

Figure 11.7: Example Barrier Constructed From Containers

Draw-Works

11.12 Although not a continuous noise source, the draw-works is used for hoisting new sections of drill pipe via the travelling block once each section has been drilled, depending on the drilling rig design. It is also used for tripping. During operation of the draw-works, the top drive is not normally operational (instead the rotary table is used). Although the draw-works are usually located on the drill floor (which can sometimes be acoustically screened), the sound power level can be relatively high on some drilling rigs which can mean that this source of noise could intermittently be significant. It is therefore recommended that, depending on the characteristics of the chosen drilling rig and technical / safety constraints, an acoustic enclosure is fitted around the draw-works. This would typically include an acoustically lined "sleeve" for the draw-works cables to penetrate.

Top Drive

11.13 Many drilling rig top drives can be fitted with an acoustic enclosure. For example, the two example drilling rigs used in this assessment all have acoustically enclosed top drives. It may be possible to fit a silencer to the cooling fan on electric top drives which would reduce noise levels from this source further. An example top drive enclosure is shown in Figure 11.8.

Figure 11.8: Example Top Drive Enclosure (HH-220)

Drilling Phase

Flaring

11.14 Combustion noise in incinerators is a combination of two main mechanisms. Firstly, there is the jet noise due to the gas flowing through the orifice(s) and then noise produced from the combustion process. It is usually the former of these that dominates. The level of noise and frequency content is also affected by the incinerator nozzle – for example, the frequency content is a direct function of the dimensions of the orifices. Large reductions in sound emission can be attained by utilising a low noise incinerator tip but this needs to be balanced against other factors such as incinerator emissions, efficiency and flow handling capability.

11.15 Another important factor is the height of the incinerator. Ground incinerators will be less able to propagate than incinerators at a height. Furthermore, it may be possible to utilise screening around an incinerator in order to reduce noise. It is therefore recommended that an incinerator is utilised combined with an acoustic screen (i.e. a shrouded incinerator). An example enclosed incinerator is shown in Figure 11.9.

Figure 11.9: Example Enclosed Incinerator

11.16 Alternatively, it may be possible to utilise an enclosed combustor rather than an incinerator, although there may be technical difficulties due to gas emission compliance requirements meaning that this might not be feasible.

Operational Phase

Generators

11.17 With regards to the generators, the same advice as per paragraph 11.8 applies. The acoustic enclosure of the selected generator of the operational phase should be designed in such a way to achieve the sound power noise limits given in Table 8.1.

Incinerator Unit

11.18 With regards to the incinerator unit, the same advice as per paragraphs 11.14 to 11.16 applies. The selected incinerator unit should achieve the sound power noise limits given in Table 8.1.

Beam Pumps

11.19 Depending on the beam pump type, enclosures or acoustic barriers can be considered to mitigate their noise emission levels.

Transfer Pump

11.20 Transfer pumps noise emission levels can be mitigated using appropriately designed acoustic enclosures.

Crude oil heater

11.21 The main noise sources of a crude oil heater are its exhaust and its burner. The crude oil heater exhaust can be mitigated by an appropriate silencer arrangement. The burner noise emissions can be mitigated using appropriately designed acoustic screens.

Noise Monitoring

11.22 In addition to the above engineering noise control measures, it is proposed to ensure that noise levels do not exceed the recommended PPG-M limits by undertaking noise monitoring at the nearest residential property to the wellsite. The noise monitoring would be undertaken during the early stages of the drilling, testing and appraisal phase or by utilising a remote noise monitoring system.

12 Summary and Conclusions

12.1 The results of the noise assessment carried out for the proposed wellsite can be summarised as follows:

- Noise from wellsite traffic in Mulberry Lane, Lambwath Road, and Burton Constable Road will lead to a negligible to minor increase in traffic noise and is therefore not considered a significant impact.
- The design of the drilling rig and other plant will incorporate mitigation measures to minimise noise levels to the lowest reasonably practicable level.
- Noise from the proposed wellsite will meet the noise standards contained in the PPG-M (which includes oil and gas extraction in its definition of minerals extraction sites) once mitigation measures have been applied.
- The predicted noise levels do not exceed the WHO guideline limits for the onset of sleep disturbance effects at night.
- Noise levels will be well below the 55 dB L_{Aeq} absolute noise limit in the PPG-M for the daytime. It is unlikely that this would seriously affect the quality of life of even those living in close proximity to the wellsite, especially when the short-term nature of the impact is taken into consideration.

12.2 On the basis of the above and in conclusion, noise from the proposed exploration, appraisal and production development will be mitigated such that it does not cause a significant adverse impact, as defined by the NPSE, NPPF and PPG-M. Therefore, sound arising from the proposed development is acceptable in accordance with the relevant British Standards, national and local planning policy. The potential for noise having an adverse impact on human health, the natural environment or general amenity has therefore been minimised.

Figures

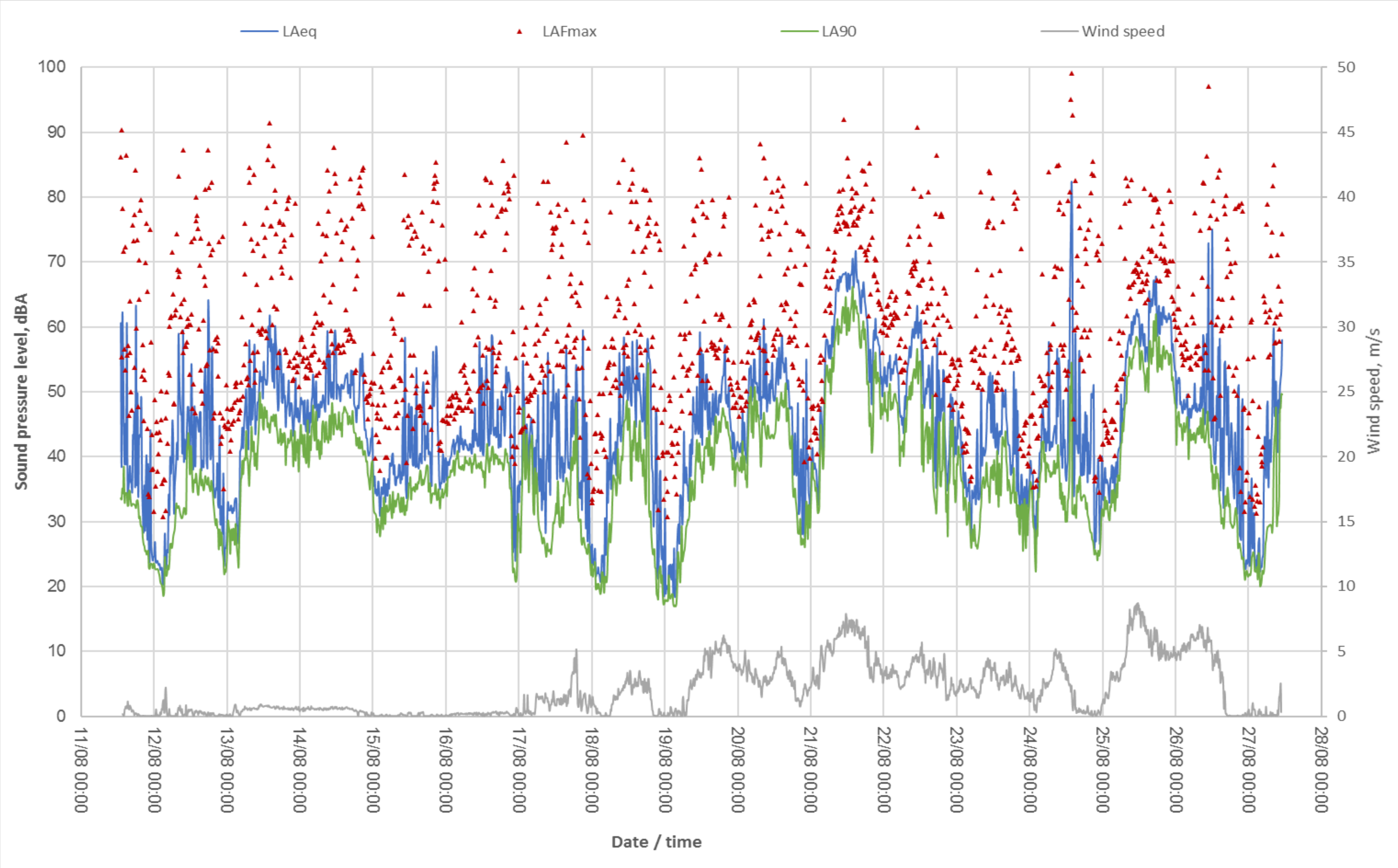


Figure A1: Noise Monitoring Time History Location LT1

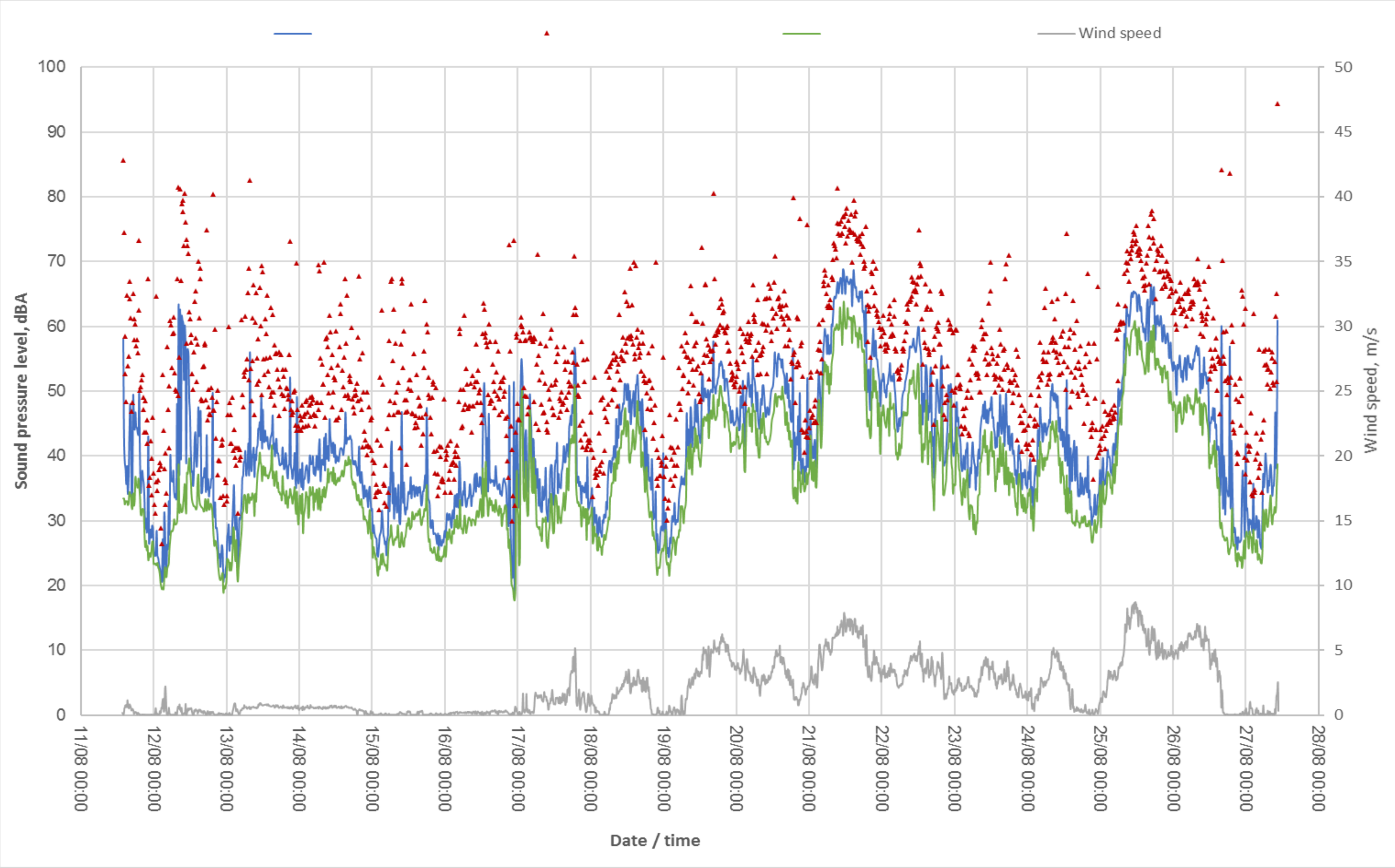


Figure A2: Noise Monitoring Time History Location LT2

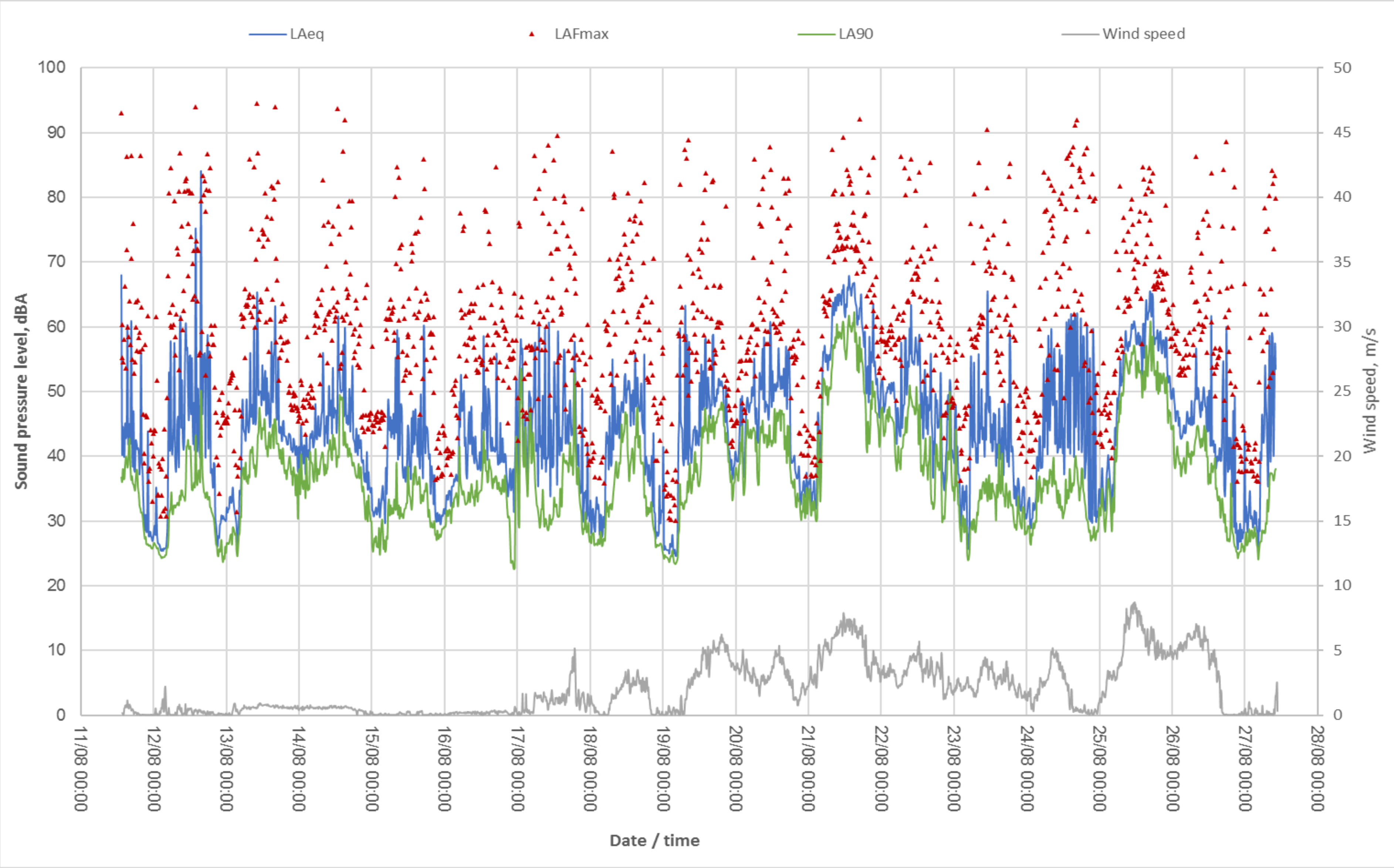


Figure A3: Noise Monitoring Time History Location LT3

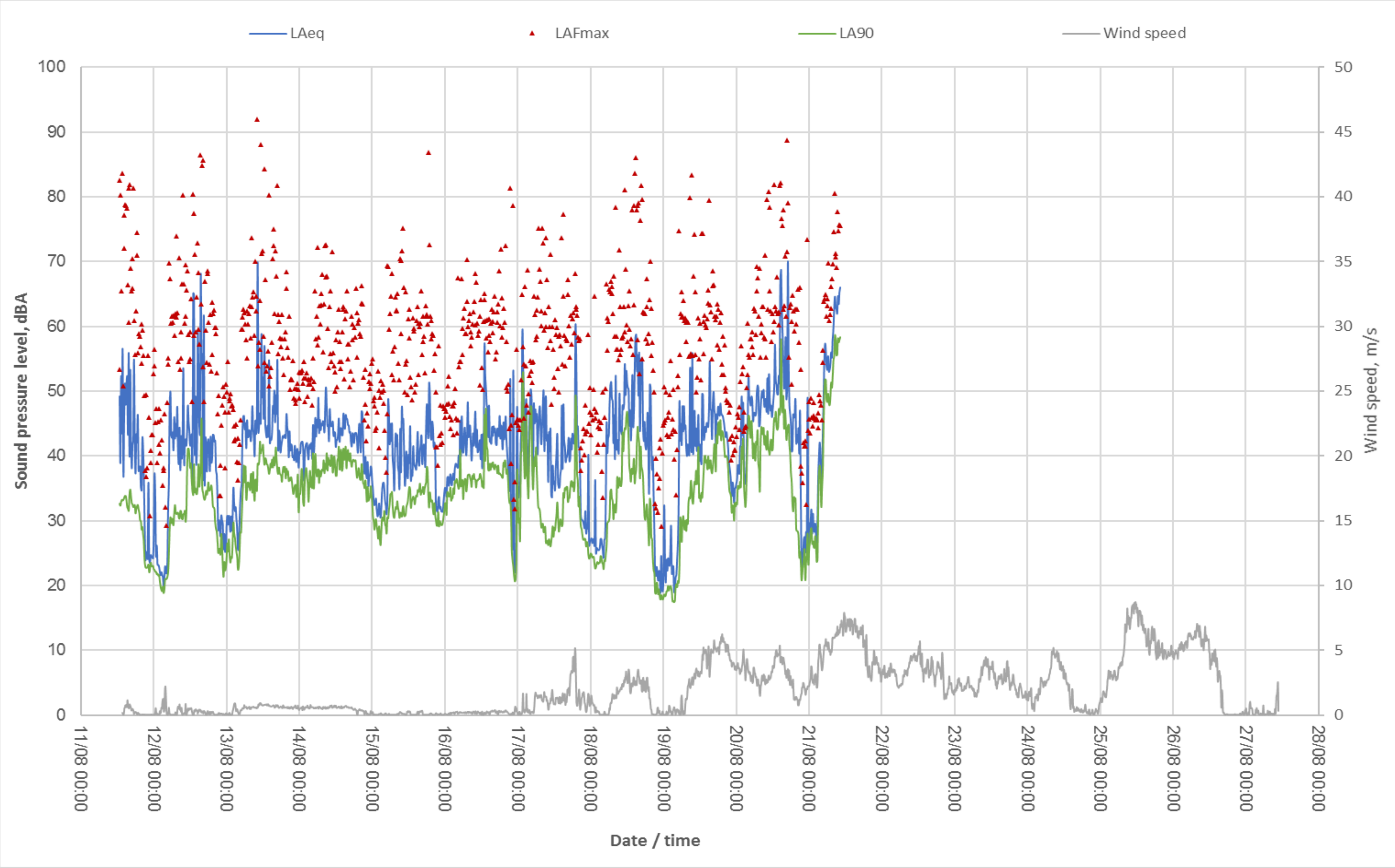


Figure A4: Noise Monitoring Time History Location LT4

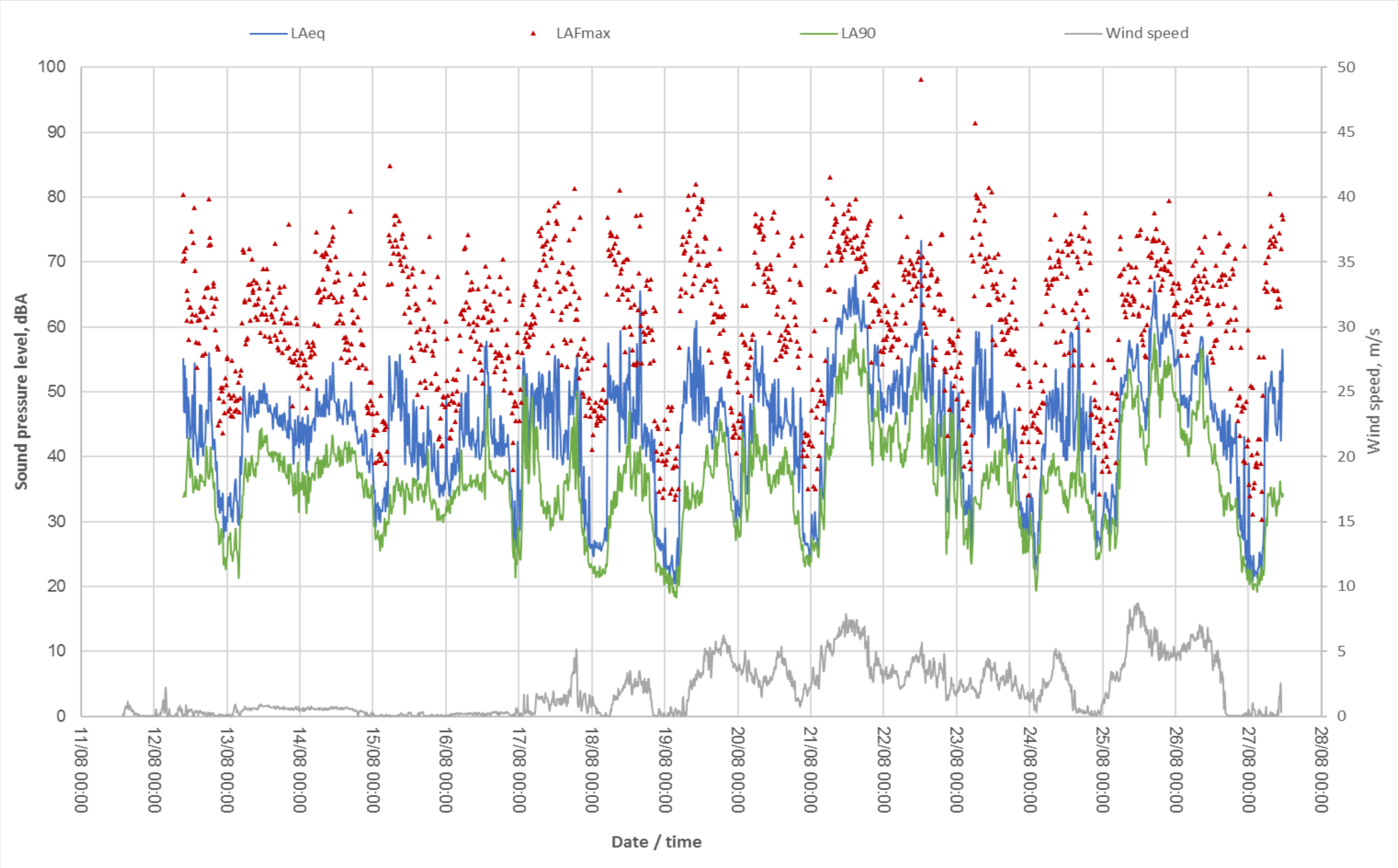


Figure A5: Noise Monitoring Time History Location LT5

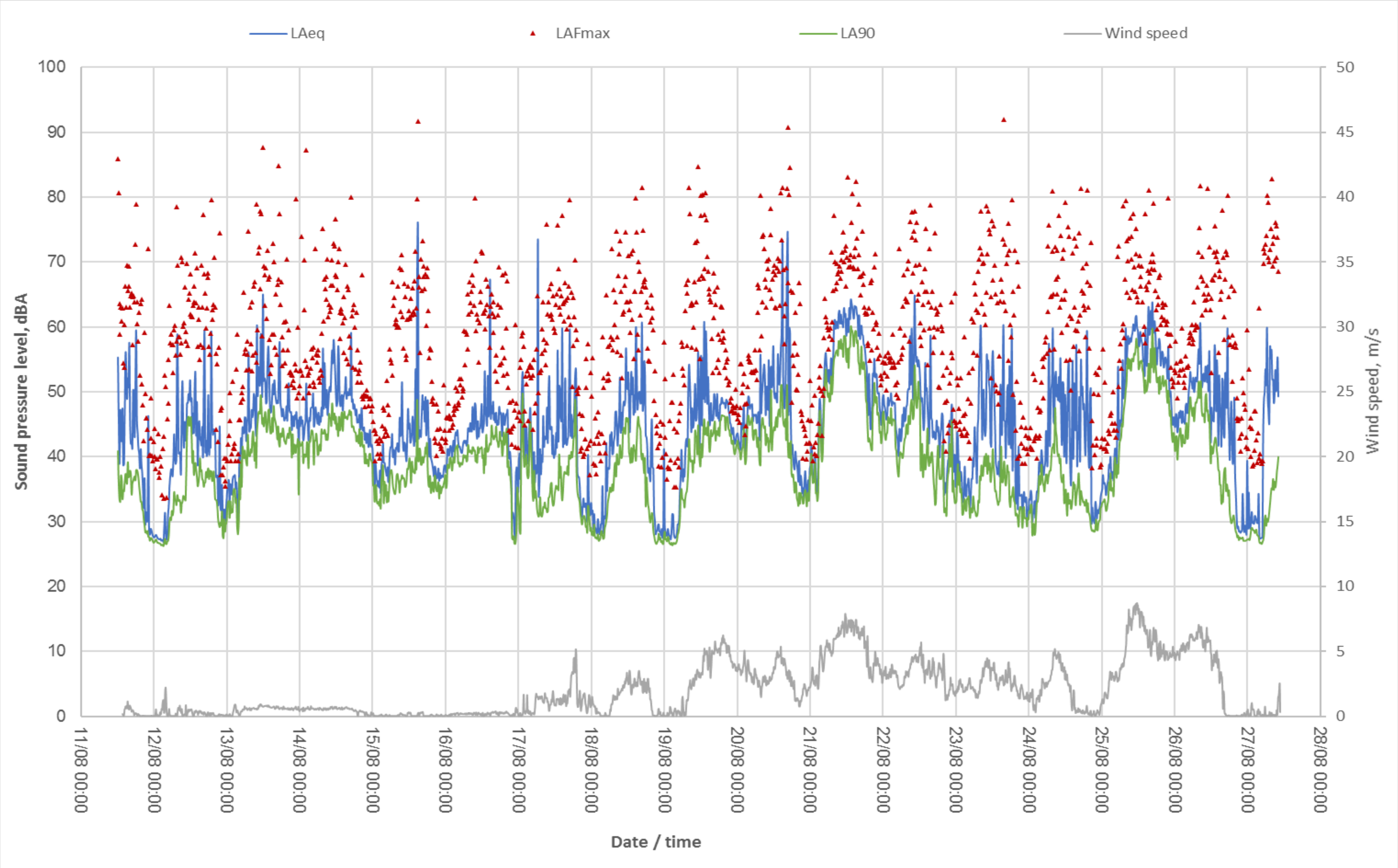


Figure A6: Noise Monitoring Time History Location LT6

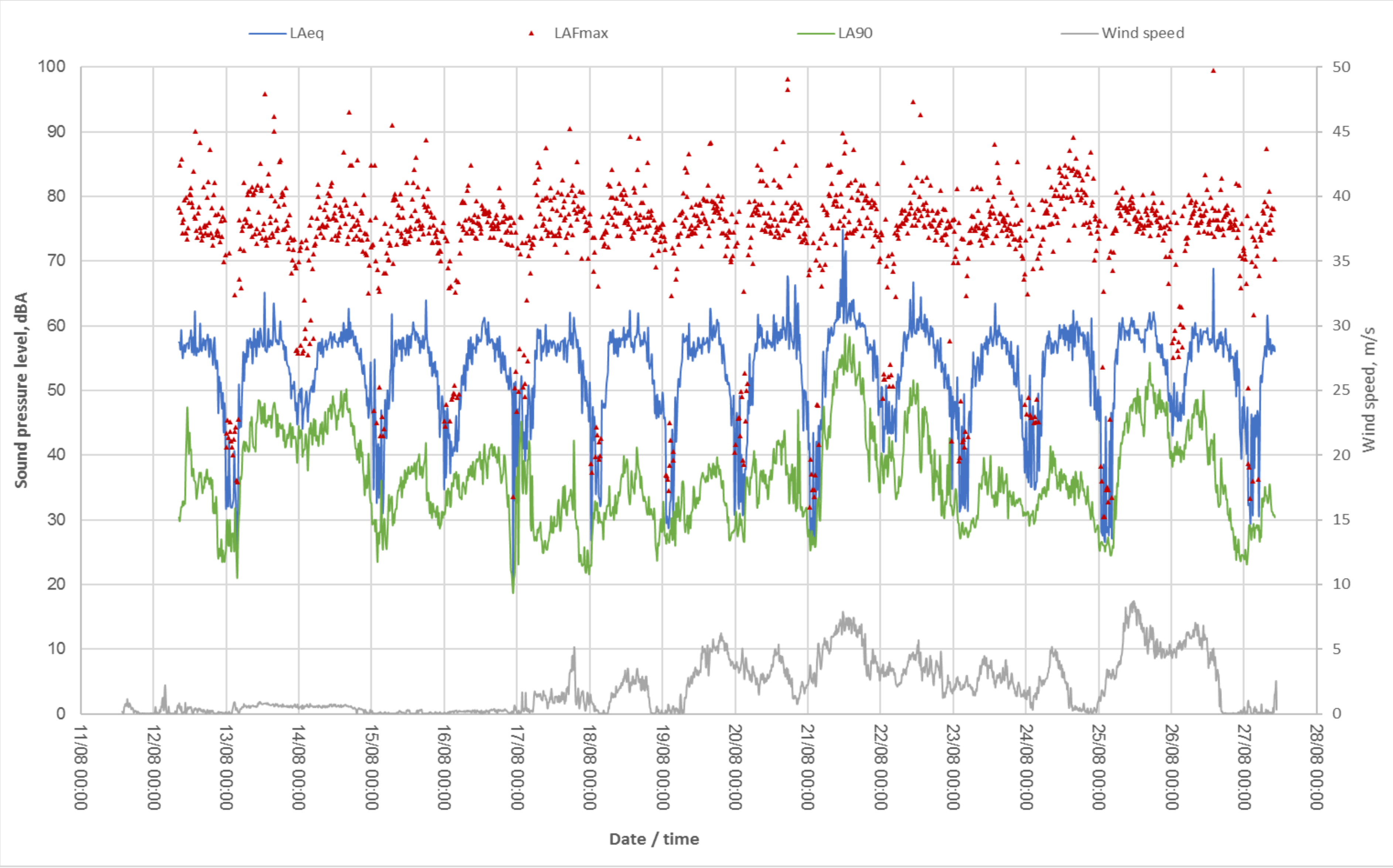


Figure A7: Noise Monitoring Time History Location LT7

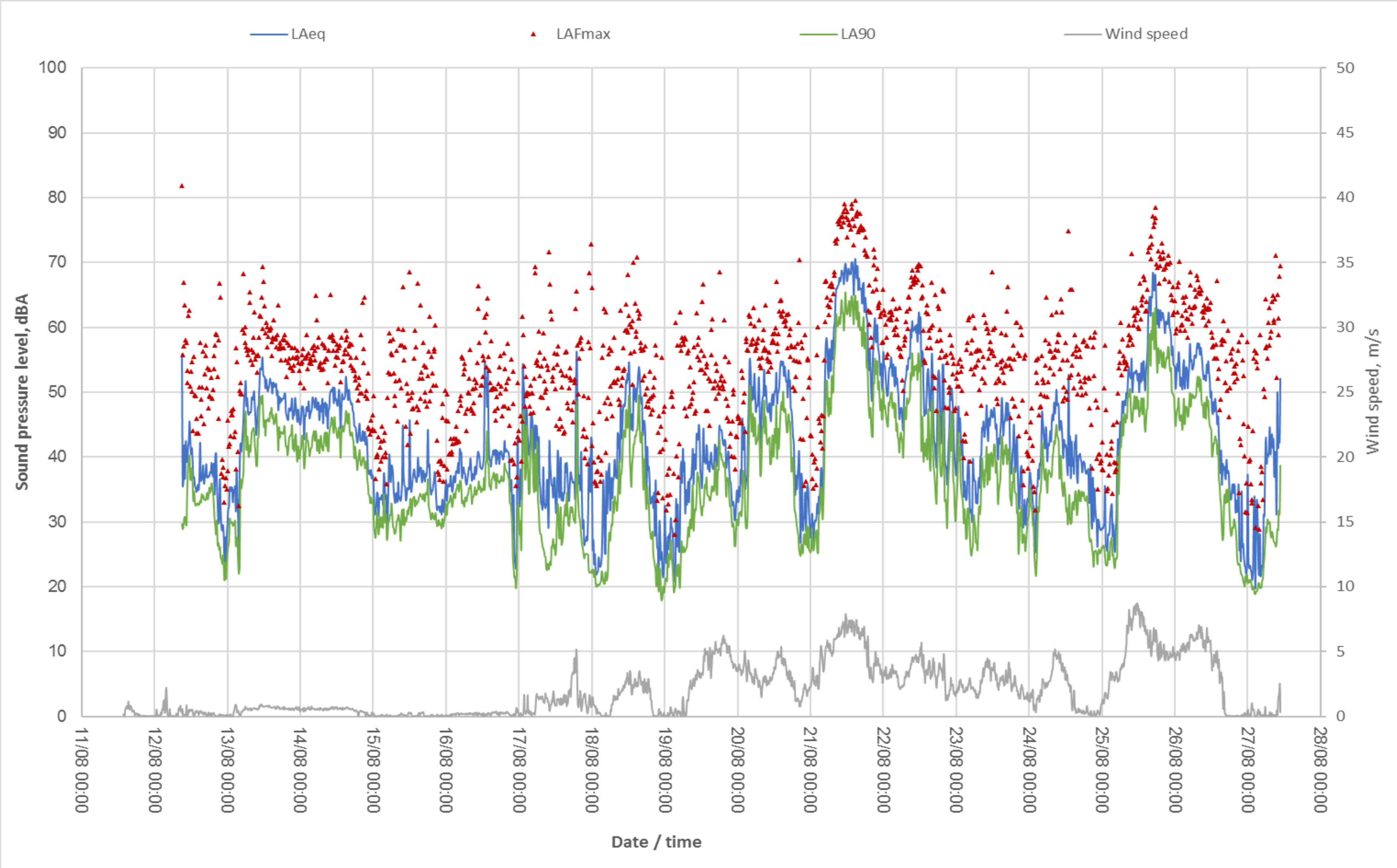
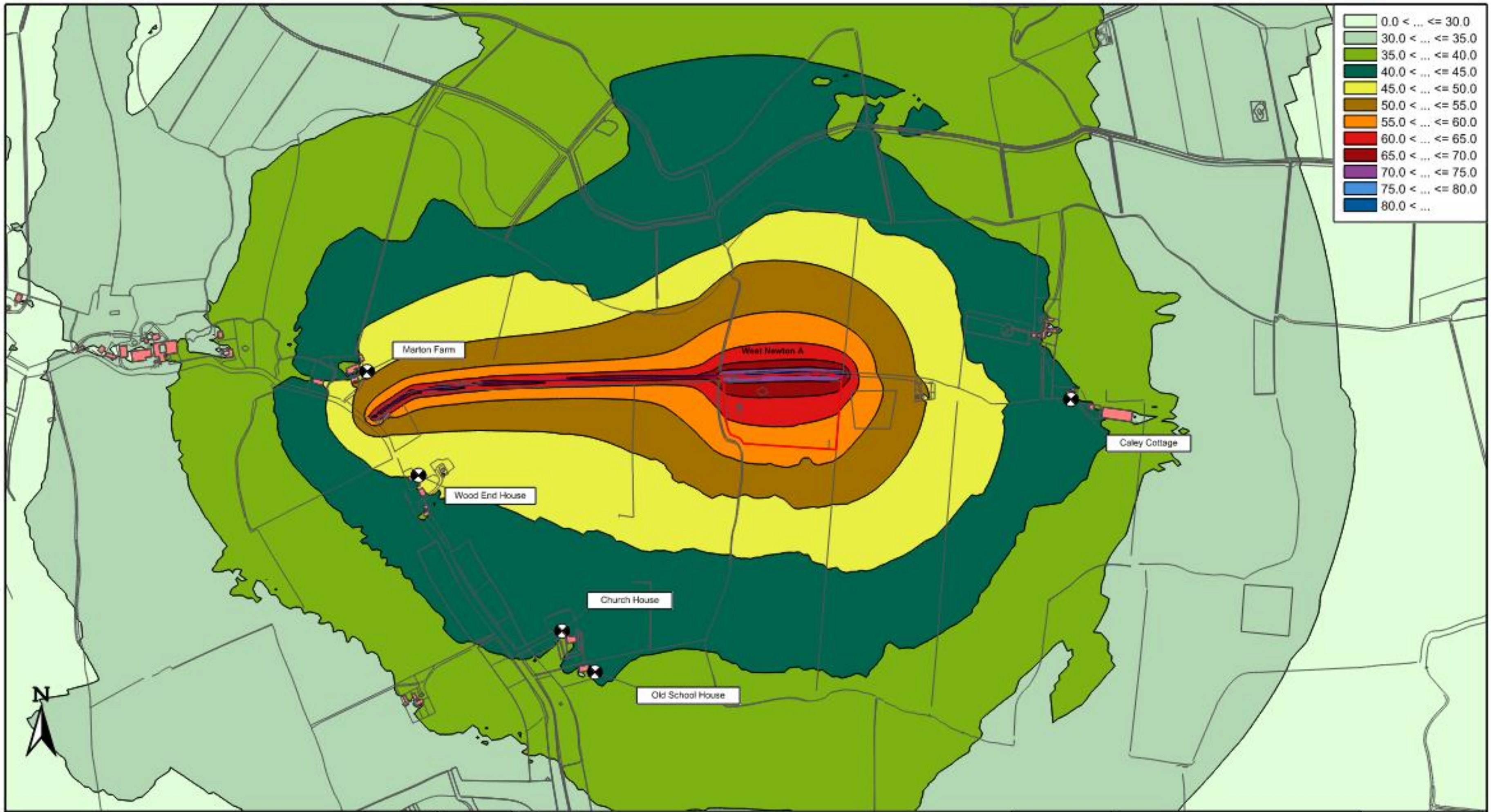
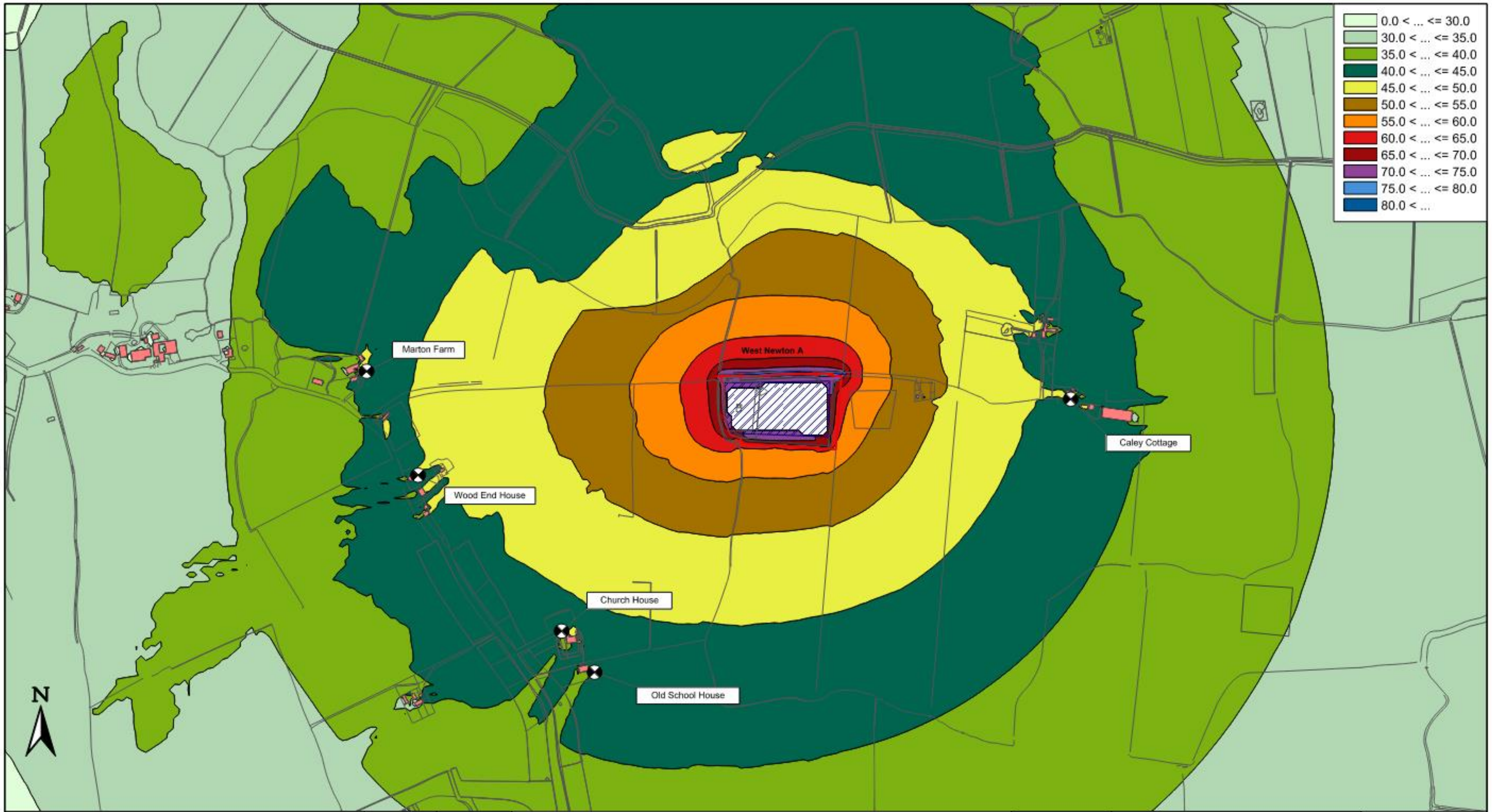


Figure A8: Noise Monitoring Time History Location LT8

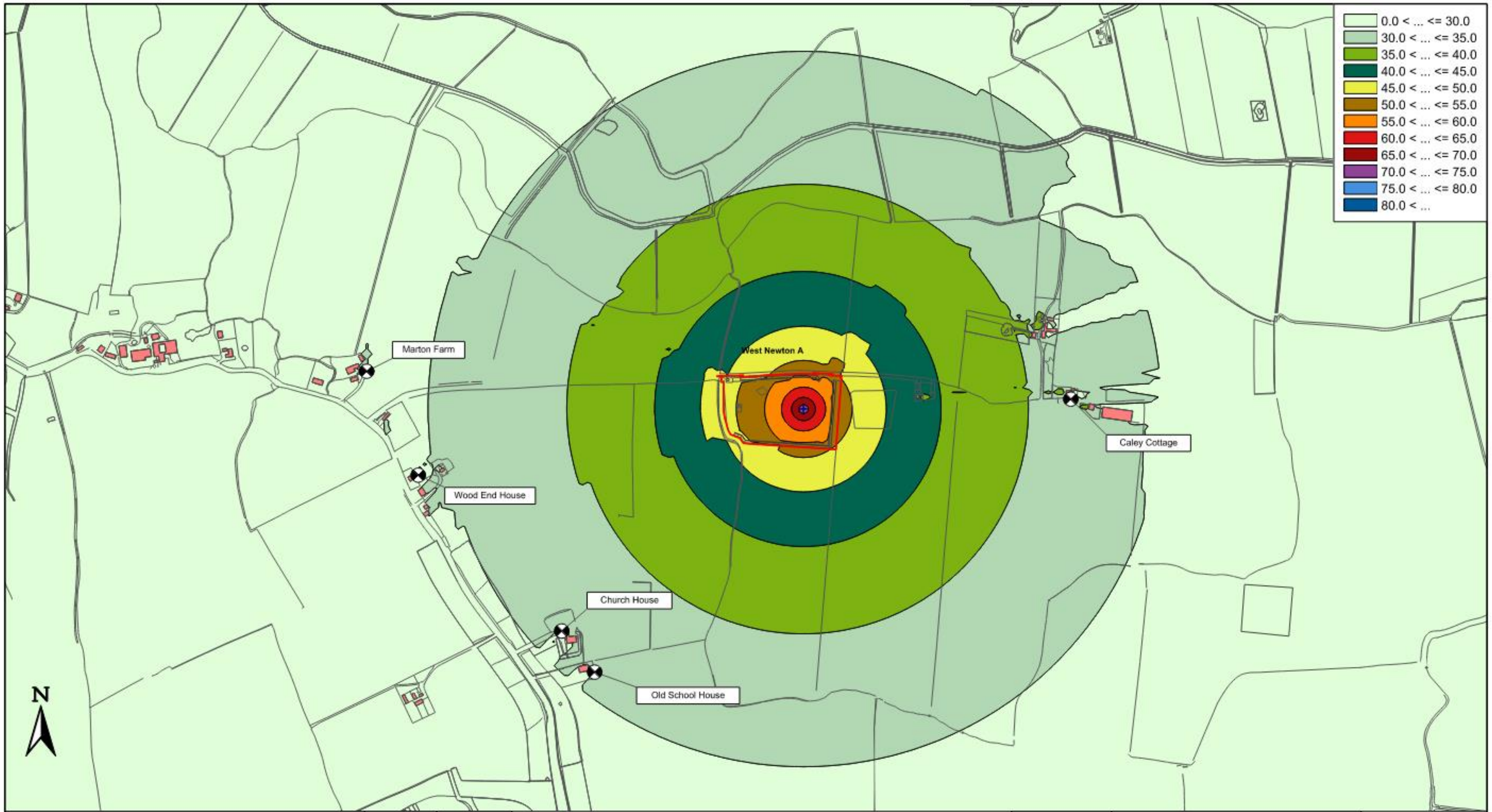


Rathlin Energy

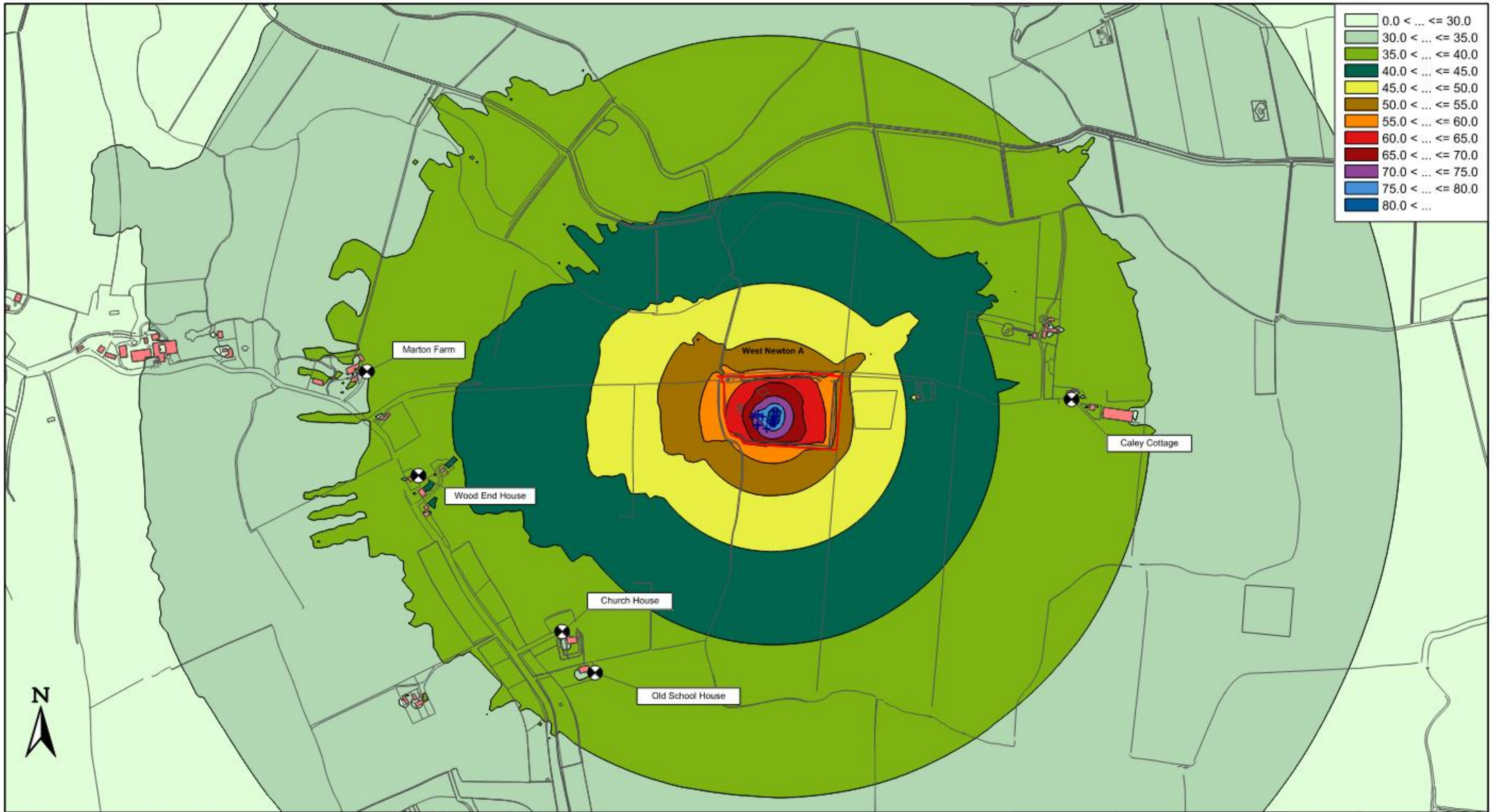
Author	CI	**West Newton A Wellsite** **Site Construction Access**	Project No.	JAT2106
			Project Title	West Newton A
Scale	1:7500@A3	**Rathlin Energy (UK) Limited**	Drawing No.	Figure A9
		Sheet 1 of 1	Date	16.04.21



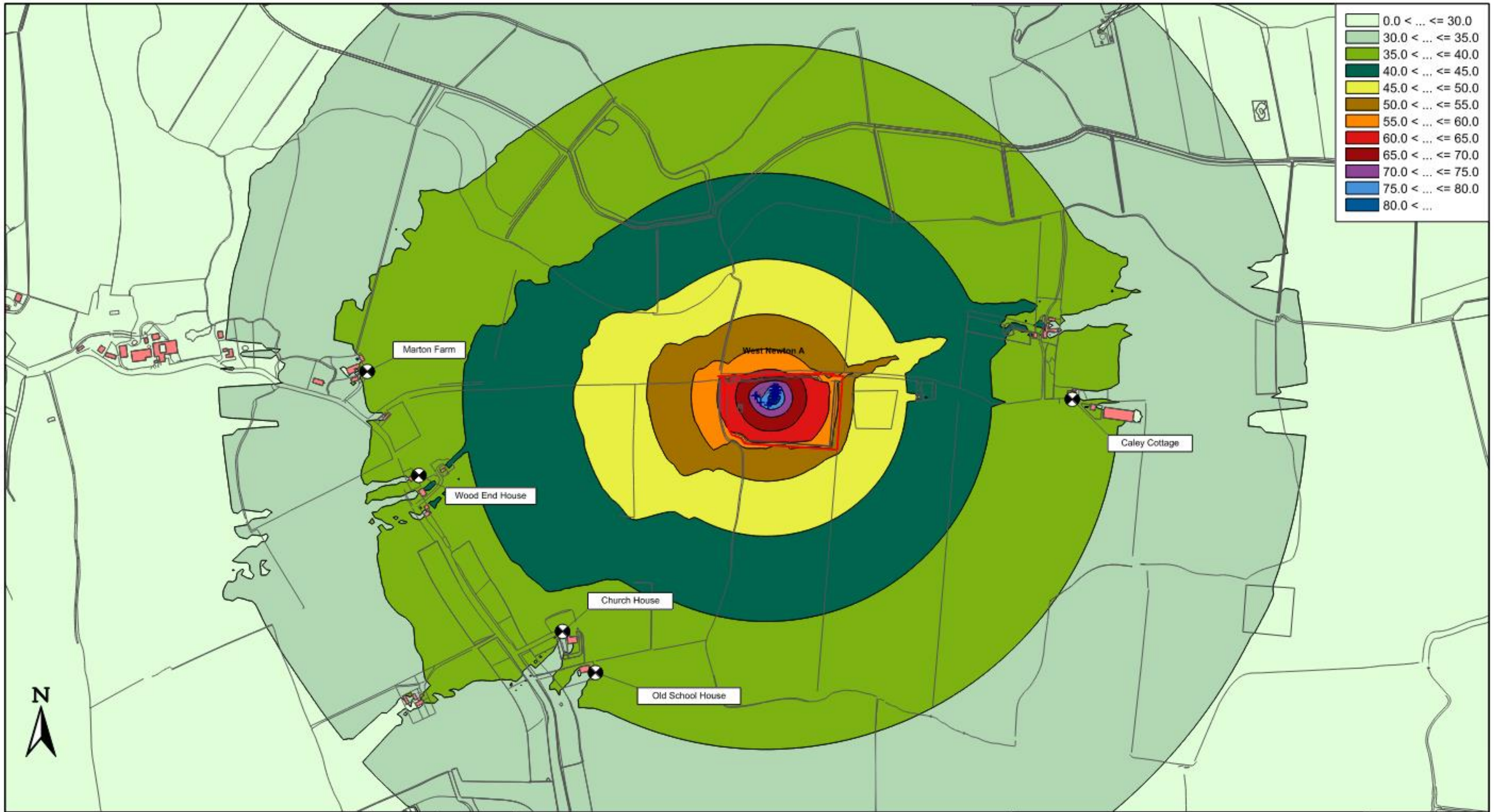
Rathlin Energy	Author	CI	West Newton A Wellsite Site Construction and Restoration	Project No.	JAT2106
				Project Title	West Newton A
	Scale	1:7500@A3	Rathlin Energy (UK) Limited	Drawing No.	Figure A2
			Sheet 1 of 1	Date	16.04.21



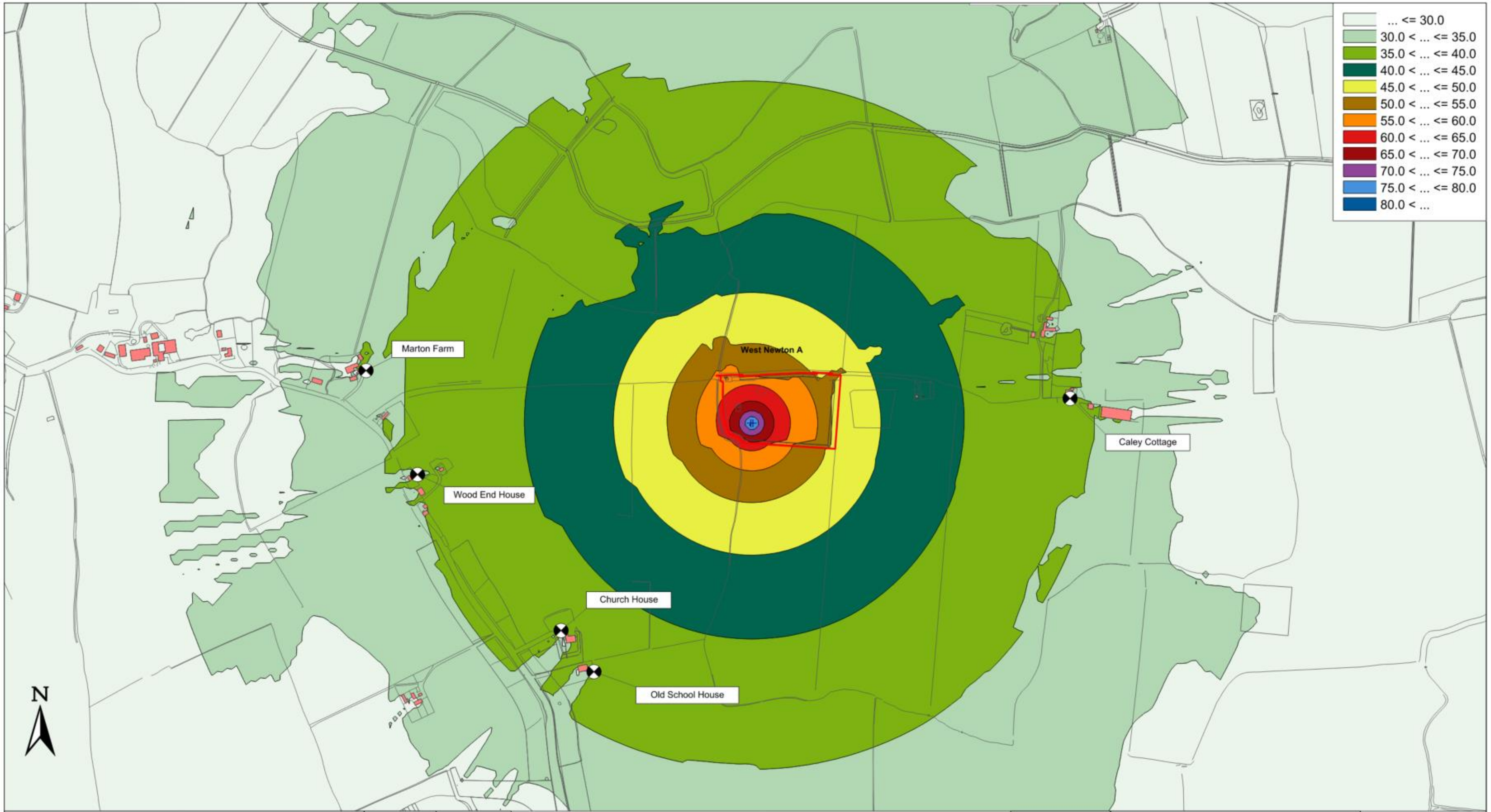
Rathlin Energy	Author	CI	**West Newton A Wellsite Conductor Drilling**	Project No.	JAT2106
				Project Title	West Newton A
	Scale	1:7500@A3	**Rathlin Energy (UK) Limited**	Drawing No.	Figure A11
			Sheet 1 of 1	Date	16.04.21



Rathlin Energy					
	Author	CI	West Newton A Wellsite Drilling HH220	Project No.	JAT2106
				Project Title	West Newton A
	Scale	1:7500@A3	Rathlin Energy (UK) Limited	Drawing No.	Figure A1
			Sheet 1 of 1	Date	16.04.21



Rathlin Energy	Author	CI	West Newton A Wellsite Drilling T208	Project No.	JAT2106
				Project Title	West Newton A
	Scale	1:7500@A3	Rathlin Energy (UK) Limited	Drawing No.	Figure A13
			Sheet 1 of 1	Date	16.04.21



Rathlin Energy	Author	CI	West Newton A Wellsite Well Testing Rathlin Energy (UK) Limited Sheet 1 of 1	Project No.	JAT2106	rps
	Scale	1:7500@A3		Project Title	West Newton A	
				Drawing No.	Figure A14	
				Date	17.05.21	

Rathlin Energy	Author	CI	**West Newton A Wellsite Production**	Project No.	JAT2106
				Project Title	West Newton A
	Scale	1:7500@A3	**Rathlin Energy (UK) Limited**	Drawing No.	Figure A15
			Sheet 1 of 1	Date	19.04.21

References

1 Department for Environment, Food and Rural Affairs. Noise Policy Statement for England. Defra. 2010.

2 Ministry of Housing, Communities & Local Government. National Planning Policy Framework: HSMO. July 2018.

3 Department for Communities and Local Government. National Planning Practice Guidance

4 Department for Communities & Local Government. Planning Practice Guidance: Minerals. HMSO. 2014. http://planningguidance.planningportal.gov.uk/

5 British Standards Institution. British Standard 4142:2014+A1:2019. Methods for rating and assessing industrial and commercial sound.

6 British Standards Institution. British Standard 5228-1:2009+A1:2014. Code of practice for noise and vibration control on construction and open sites - Part 1: Noise.

7 British Standards Institution. British Standard 8233:2014 Guidance on sound insulation and noise reduction for buildings.

8 European Centre for Environment and Health. Night Noise Guidelines (NNGL) for Europe. World Health Organisation. 2009.

9 Berglund, B. et al. Guidelines for Community Noise. World Health Organisation. 2000.

10 Skinner C and Grimwood C. (2002). The National Noise Incidence Study 2000/2001 (United Kingdom): Volume 1 – Noise Levels. BRE report 206344f.

11 East Riding Local Plan 2012 – 2029 Strategy Document (Adopted April 2016)

12 East Riding of Yorkshire and Kingston upon Hull Joint Minerals Plan 2016 – 2033 (Adopted November 2019)

13 British Standards Institution. British Standard 7445-1:2003. Description and measurement of environmental noise - Part 1: Guide to environmental quantities and procedures.

14 Verein Deutscher Ingenieure (VDI) 3732:1990. Characteristic noise emission values of technical sound sources – flares.