Environmental Noise Survey, Noise Break-in Assessment & Sound Insulation Scheme

Client:	AAA Property Group Ltd.
Client Address:	4 Greenfield Road, Holmfirth, HD9 2JT
Site Address:	Land to the Rear of 149 Upper Hoyland Road, Barnsley, S74 PNL
Date:	22/09/2021

WEB www.novaacoustics.co.uk **EMAIL:** info@novaacoustics.co.uk **TELEPHONE** 0113 322 7977

Authorisation and Version Control	
Report Prepared by	Mr. M Caley, MSc, MIOA
Report Checked by	Mr. J Barratt-Gibson, MSc, MIOA, MIET
Report Approved by	Mr. A T Martin, MSc, MIOA, MCIEH, MIET, MInstSCE
Date	22/09/2021
Project Number	6504AC
Version Reference	001

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Executive Summary

An environmental noise survey and noise impact assessment have been undertaken to assess the suitability of the site on land to the rear of 149 Upper Hoyland Road, Barnsley, S74 PNL for residential development. The measured ambient sound levels have allowed a BS8233:2014 noise assessment to be carried out. A summary of the results of the assessment can be found below.

A sound insulation scheme has been provided in Section 5.0, including glazing and an alternative ventilation strategy. These recommendations should be sufficient to achieve appropriate internal noise levels for the proposed development according to the BS8233:2014 criteria.

In order to reduce noise from the A6195 road as much as possible, it is recommended that earth bunding and fencing are installed at the north-western perimeter of the site. The earth bunding should be a minimum of 2m high, with a 2m tall close-board timber fence erected on top. It is also recommended that 2m tall close-board timber fences are installed around all garden areas. All fencing should contain no holes or gaps and must have a minimum surface mass of 10 kg/m^2. An example product that achieves the criteria is Jacksons '12k Envirofence'. Further information can be found in Section 5.0.

An overview of all recommendations can be found in the table below:

Recommendations and Mitigation Overview
- The recommended sound reduction that must be provided by the glazing can be found in Table 5.0. - Appropriate glazing specifications can be found in Table 7.0. - Appropriate alternative ventilation can be found in Table 8.0.

The findings of this report will require written approval from the Local Authority prior to work commencing.

1. Introduction

Overview

NOVA Acoustics Ltd has been commissioned to prepare a noise assessment for a residential development ('the Proposed Development') on land to the rear of 149 Upper Hoyland Road, Barnsley, S74 PNL ('the Site').

The applicant is preparing a planning application ('the Application') to be submitted to Barnsley Metropolitan Borough Council.

The following technical noise assessment has been prepared to support the planning application to Barnsley Metropolitan Borough Council. The report details the ambient sound climate at the proposed development site and provides a sound insulation scheme to protect the amenity of the occupants of the proposed residential dwellings.

This noise assessment is necessarily technical in nature; therefore, a glossary of terms is included in Appendix A to assist the reader.

Scope & Objectives

The scope of the noise assessment can be summarised as follows:

- Ambient sound monitoring survey to evaluate the prevailing ambient and maximum sound levels incident on the proposed development;
- A detailed assessment of the suitability of the Site, in accordance with relevant standards in respect of sound from the surrounding noise sources; and
- Recommendation of mitigation measures, where necessary, to comply with the requirements of the National Planning Policy Framework (2021), Noise Policy Statement for England (2010), and British Standard BS8233:2014 'Guidance on Sound Insulation and Noise Reduction for Buildings'. Further information on the legislation and the latest Entertainment Noise Legislation can be found in Appendix B.

2. Environmental Noise Survey

Measurement Methodology

In order to characterise the sound profile of the area at the proposed development, an environmental sound survey was carried out from 26/08/21 to 31/08/21. For the long-term monitoring, a sound level meter was attached to a tree approximately 3.5m from the ground at the northern perimeter of the site (MP1). For the short-term monitoring, a sound level meter was placed at various locations around the site approximately 1.5m from the ground (MP2, MP3 and MP4). The monitoring positions were chosen in order to collect representative sound levels at the proposed development during the day time and night time periods. The monitoring locations are shown in Figure 1.0 below.

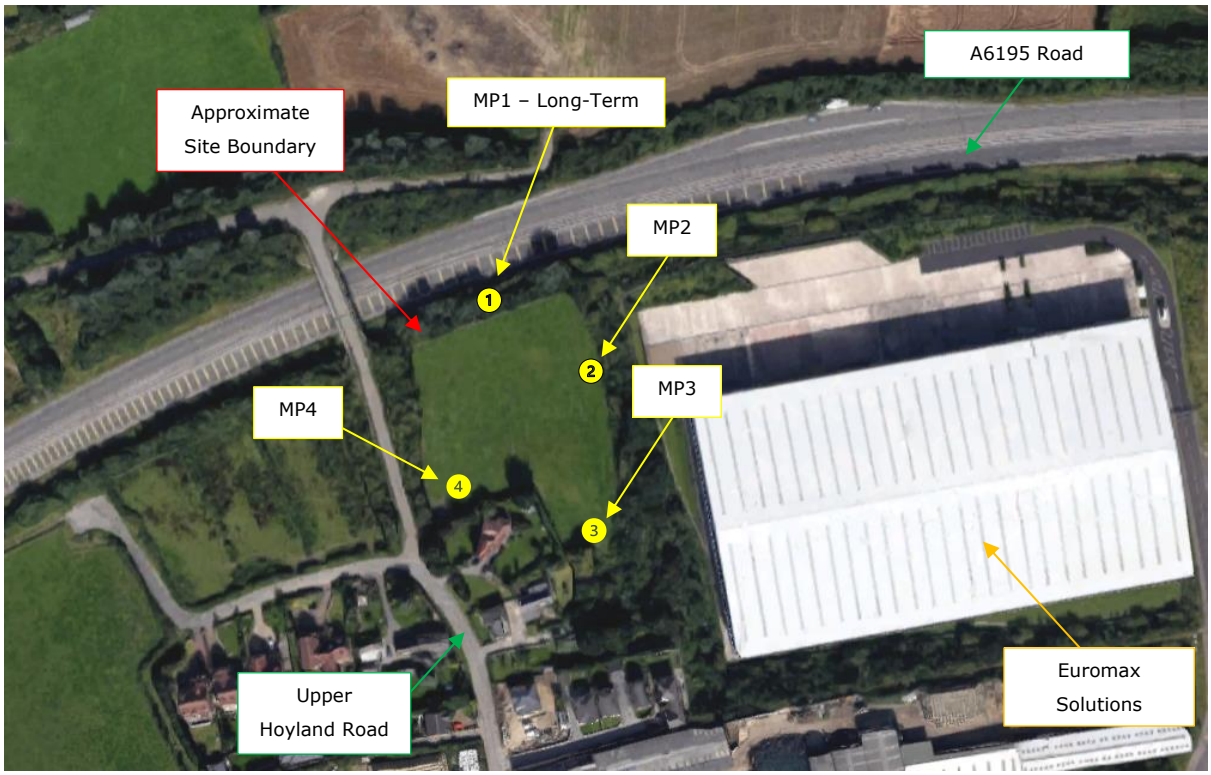


Figure 1.0 – Indicative Site Layout

Context & Subjective Impression

The proposal is for the erection of 18no. dwellings on land adjacent to Upper Hoyland Road.

The area surrounding the site contains a mixture of residential dwellings and commercial/industrial properties. The acoustic environment is of a moderate to high level and is dominated by road traffic noise emissions from the A6195 Road.

During the manned monitoring periods it was found that noise emissions from the Euroxmax facility to the east of the site were occasionally audible, but rarely dominant in the environment. The noise emissions included high-pitched tonal and impulsive noises, thought to be from the loading/unloading of stock. The noise emissions were very infrequent, and noise breaking out from the structure was inaudible. No sources of continuous fixed plant were audible above the road noise emissions. Further to this, the noise from the adjacent factory could not be isolated from the measurements on-site due to the magnitude of the road traffic noise and thus no specific BS4142

assessment can be undertaken. As such, it is thought that provided future occupants can be protected from road noise emissions, they will also be protected from noise emissions from the Euromax Facility.

Environmental Noise Survey Results

The following table outlines the highest 16-hour and 8-hour sound levels measured during the day time and night time periods that will be used in the noise break-in and external noise level assessments. A full summary of all results can be found in Appendix D.

Measurement Position MP1				
Measurement Period ('t')	**$L_{Aeq,t}$**	**$L_{Amax,t}$**	**$L_{A90,t}$**	**$L_{A10,t}$**
Highest 16-hour (Day)	74.0	101.0	70.0	75.0
Highest 8-hour (Night)	68.0	88.0	59.0	73.0

Table 1.0 – Long-Term Monitoring Results – MP1

Short-Term Measurement Positions					
Measurement Position	**Measurement Period ('t')**	**$L_{Aeq,t}$**	**$L_{Amax,t}$**	**$L_{A90,t}$**	**$L_{A10,t}$**
MP2	26/08/21: 09:05 – 09:35	65.0	73.0	57.0	68.0
MP3	26/08/21: 09:40 – 10:10	62.0	76.0	56.0	65.0
MP4	26/08/21: 10:15 – 10:50	64.0	74.0	58.0	67.0

Table 2.0 – Short-Term Measurement Results – MP2 to MP4

In the following section, the maximum noise level events are assessed. ProPG states:

"…in noise sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB $L_{Amax,F}$ more than 10 times a night."

The following table shows a summary of the maximum sound level results.

Measurement Position MP1			
Measurement Period ('t')	**$L_{AFMax,15min}$**	***SMR $L_{AFMax,15min}$**	**No. of Exceedances of 82 dB $L_{AFMax,15min}$**
Night 1	86.0	79.0	3
Night 2	87.0	80.0	4
Night 3	83.0	79.0	1
Night 4	85.0	80.0	3
Night 5	88.0	82.0	2

Table 3.0 – Maximum Sound Level Summary Results – MP1

**Statistically Most Repeated*

3. Internal Noise Design Criteria

This section highlights the guidance outlined in BS8233:2014 and the criteria used in order to achieve appropriate internal noise levels.

BS8233:2014 'Guidance on Sound insulation and noise reduction for buildings'

BS8233 provides guidance on noise levels from sources without specific character in the built environment, based on the recommendations of the World Health Organization; specifically, 'WHO Guidelines on Community Noise, 1999'. The Guidelines on Community Noise (1999) document defines community noise to include noise from "industries" and "construction". The desirable criteria levels of steady state, "anonymous" noise in unoccupied spaces within dwellings, from sources such as road traffic, mechanical services and other continuously running plant, are tabulated below:

Activity	Location	07:00 – 23:00	23:00 – 07:00
Resting	Living Room	35 dB $L_{Aeq,16hour}$	--
Dining	Dining Room/Area	40 dB $L_{Aeq,16hour}$	--
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

Table 4.0 – BS8233:2014 Internal Noise Level Criteria

It should be noted that the WHO Guidelines should be considered as aspirational. Furthermore, BS8233:2014 states that where development is considered necessary or desirable, despite external noise levels that are above WHO guidelines, the target levels may be relaxed by up to 5 dB.

It is stated that the desirable internal and external noise criteria outlined in Table 4.0 of BS8233, are based on anonymous steady state sources and where there are normal diurnal fluctuations in external noise. Where the external noise climate comprises of dominant non-anonymous sources or does not follow normal diurnal fluctuations an alternative assessment period may be appropriate.

Earth Bunding and Acoustic Fencing

In order to reduce noise from the A6195 road as much as possible, it is recommended that earth bunding and fencing are installed at the north-western perimeter of the site. The earth bunding should be a minimum of 2m high, with a 2m tall close-board timber fence erected on top. It is also recommended that 2m tall close-board timber fences are installed around the perimeter of all garden areas. All fencing should contain no holes or gaps and must have a minimum surface mass of 10 kg/m^2. An example product that achieves the criteria is Jacksons '12k Envirofence'. If the earth bunding and fencing is not installed, the noise levels in the gardens of the most affected properties are predicted to be approximately 68 dB, which is significantly above the BS8233:2014 criteria. The proposed location for the bunding and fencing can be found in Appendix C.

4. Sound Modelling

Based on the measured noise levels sound maps have been generated using SoundPlan 8.2, which undertakes its calculations in accordance with the guidance given in IS09613 – 1:1993 and ISO9613 – 2:1996.

The following assumptions have been made within the calculation software:

- To accurately model the land surrounding the development the topographical data has been taken from Google Maps, it is assumed this has an accuracy within the last 3 years.
- The ground between the source and receiver is modelled as mostly acoustically 'soft'.
- The sound maps are shown at a height of 1.5m.
- The highest $L_{Aeq,16hr}$ and $L_{Aeq,8hr}$ values from the day time and night time periods measured at MP1 and the short-term measurements from positions MP2 to MP4 have been used to calibrate the sound map.
- The 10th highest $L_{AFmax,15min}$ value from MP1 has been used to calibrate the noise map.

The noise maps showing the day time and night time L_{Aeq} sound levels incident on the Proposed Development can be seen below in Figures 2.0 and 3.0.

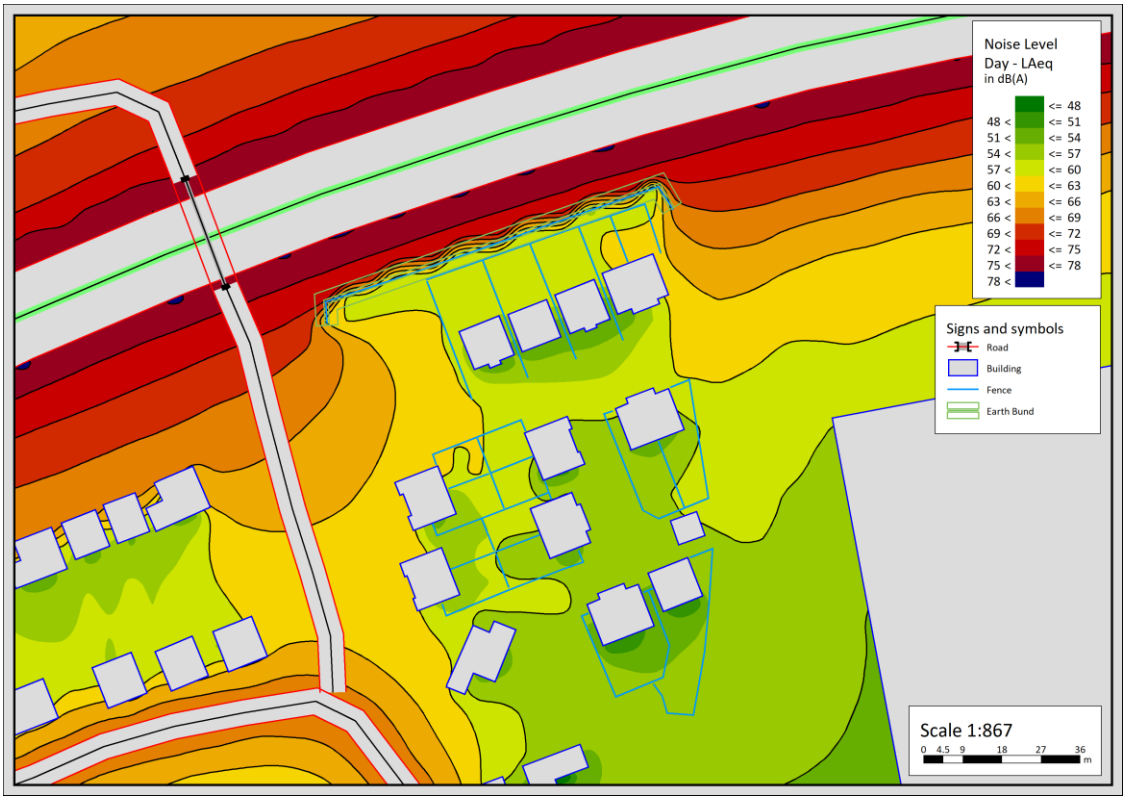


Figure 2.0 – Specific Sound Level Map – Day Time L_{Aeq} – 1.5m Grid Height

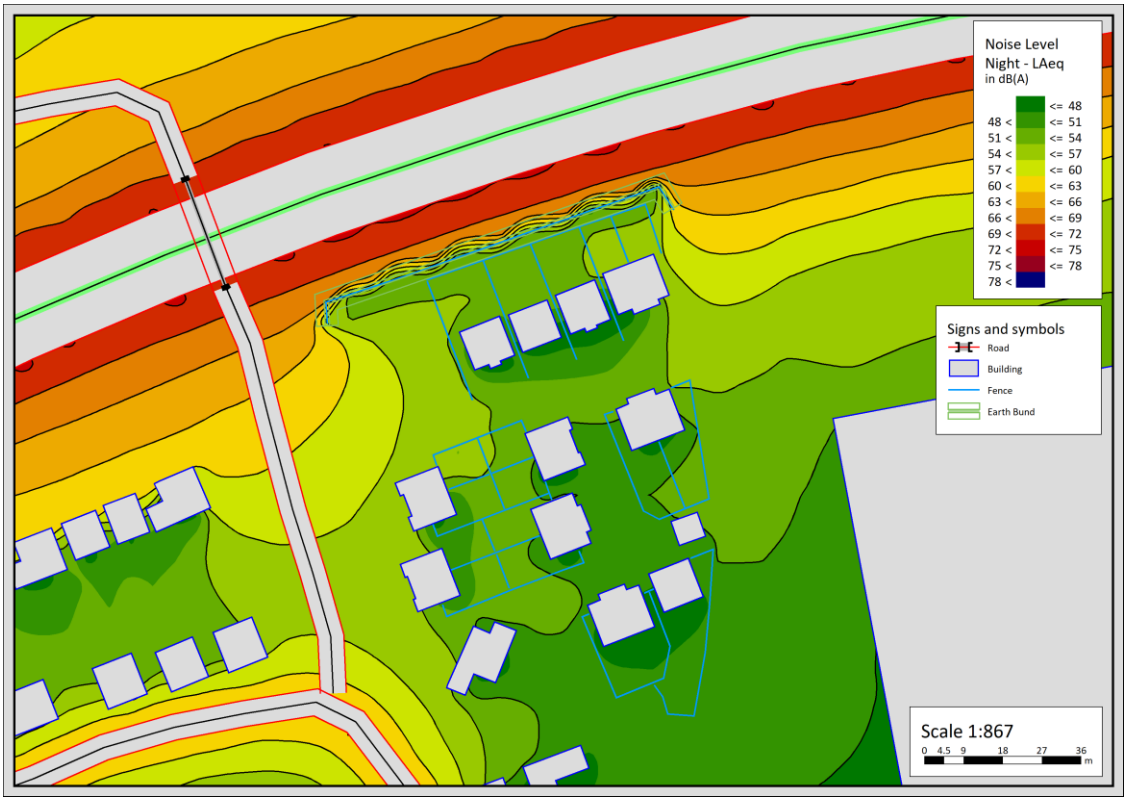


Figure 3.0 – Specific Sound Level Map – Night Time L_{Aeq} – 1.5m Grid Height

The noise map showing the maximum noise emissions incident on the Proposed Development can be seen in Figure 4.0 below.

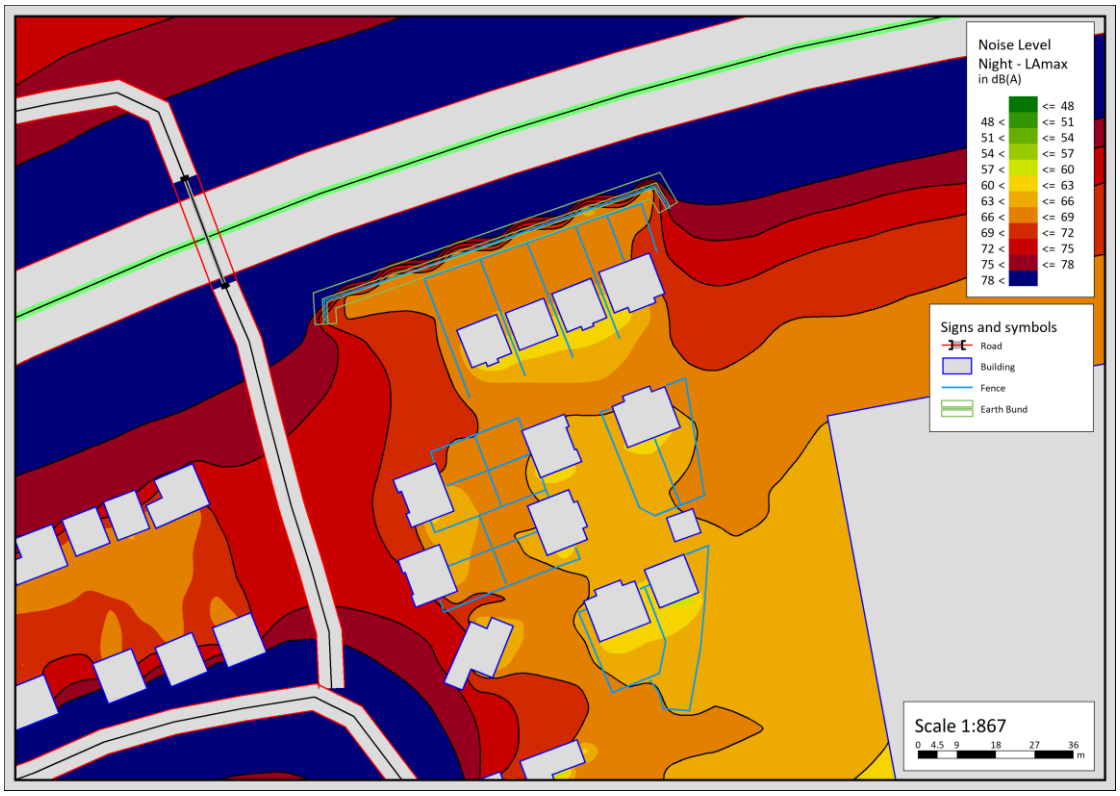


Figure 4.0 – Specific Sound Level Map – Night Time L_{Amax} – 1.5m Grid Height

5. Noise Break-In & External Noise Level Assessment

Façade Layout

The noise levels vary significantly across the development site. For this reason, the site has been separated and grouped into three colour zones (red, amber and green) as shown in the figure below.

Figure 5.0 – Zone Allocation

Noise Break-In Assessment

The following section analyses the ambient sound levels incident on the development compared with the internal noise level criteria presented within BS8233:2014.

To ensure a robust analysis the following considerations have been taken:

- The $L_{AFmax,15min}$ exceeded fewer than ten times during the night time period predicted using the SoundPlan Model.
- The highest L_{Aeq} sound levels for each colour zone predicted using the SoundPlan model.

The following table outlines the minimum sound reduction required in order to achieve appropriate internal noise levels.

Zone Colour	Location	Time Period	Façade Noise Level (dB)	BS8233:2014 Criteria	Min. SRI Required (dB)
Red	Bedroom / Living Room	Day time	66.0	35.0 dB $L_{Aeq,16hour}$	31.0 R_w + C_{tr}
	Bedroom	Night time	60.0	30.0 dB $L_{Aeq,8hour}$	30.0 R_w + C_{tr}
	Bedroom	Night time	75.0	45.0 dB $L_{Amax,8hour}$	30.0 R_w
Amber	Bedroom / Living Room	Day time	63.0	35.0 dB $L_{Aeq,16hour}$	28.0 R_w + C_{tr}
	Bedroom	Night time	58.0	30.0 dB $L_{Aeq,8hour}$	28.0 R_w + C_{tr}
	Bedroom	Night time	72.0	45.0 dB $L_{Amax,8hour}$	27.0 R_w
Green	Bedroom / Living Room	Day time	60.0	35.0 dB $L_{Aeq,16hour}$	25.0 R_w + C_{tr}
	Bedroom	Night time	55.0	30.0 dB $L_{Aeq,8hour}$	25.0 R_w + C_{tr}
	Bedroom	Night time	69.0	45.0 dB $L_{Amax,8hour}$	24.0 R_w

Table 5.0 – Internal Noise Level Analysis

External Noise Level Assessment

The predicted noise levels in the centre of the external amenity areas (gardens) are compared with the BS8233:2014 criteria in the table below.

Zone Colour	External Amenity Area Noise Level (dB)	BS8233:2014 Criteria (dB)	Exceedance of Criteria (dB)
Red	59.0 – 60.0	50.0 – 55.0 $L_{Aeq,16hour}$	4.0 – 5.0
Amber	55.0 – 60.0	50.0 – 55.0 $L_{Aeq,16hour}$	0.0 – 5.0
Green	53.0 – 57.0	50.0 – 55.0 $L_{Aeq,16hour}$	0.0 – 2.0

Table 6.0 – External Noise Level Analysis

As can be seen in the table above, the external noise levels are predicted to be up to approximately 5 dB above the criteria. However, the following is stated in BS8233:2014 regarding external amenity noise levels:

"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. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of

living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited."

It has been recommended that earth bunding and fencing is installed at the site, which evidences good acoustic design. It is thought that this is the maximum amount of shielding that can be provided from road traffic noise emissions and as such, garden noise levels cannot be further reduced with the current site design. For this reason, it is thought that a relaxation of the criteria should be applied in this location. Further to this, planning was approved for a similar development located on adjacent land to the west of the site (planning ref: 2016/0041). Not only is the layout of the site very similar to the proposed development, but comparable mitigation was also recommended in the acoustic assessment, which was predicted to provide adequate levels of acoustic shielding.

6. Sound Insulation Scheme

The following section outlines the required sound insulation scheme that should be installed at the proposed development to protect the amenity of the future residents. The sound insulation scheme should be installed prior to occupation and be retained thereafter.

Building Envelope

The noise levels within the proposed dwellings will be dictated by the configuration, materials, and elements of the façade. The non-glazed elements of the facade will contribute significantly to the reduction of ambient noise levels. The façade construction for lightweight or heavyweight constructions will provide ample levels of sound insulation, for the purposes of this report it is assumed the façade provides a minimum sound reduction of 50.0 dB R_w. The following section provides a sound insulation scheme based on the weakest elements of the façade, including the glazing, ventilation and roof construction.

a) Roof Specification

If the development has rooms within the roof space the roof system will require additional sound insulation to achieve appropriate internal noise levels. Where the roof, is being utilized as a voided loft space with thermal insulation the following detailing is not required. Where rooms are within the roof, the ceilings should consist of standard roofing slates, 100mm 45kg/m^3 insulation fitted tightly between the 200mm roof joists and 1no. 15mm SoundBloc plasterboard fixed to British Gypsum RB1 resilient bars to achieve a minimum sound reduction of 50dB R_w. Any other configuration of roof that would achieve at least 50dB R_w will be suitable for the development.

b) Glazing Specification

Windows can be considered the weakest point of a façade in terms of noise reduction from external noise. The glazed elements installed in all the living rooms and bedrooms require the minimum sound reduction as shown in Section 5.0. The glazing options shown in the following table provide a suitable sound reduction, however, any other windows capable of providing this attenuation will be suitable. The performance is specified for the whole window unit, including frames and other design features. The glazing specifications have been taken from the Pilkington Optiphon Range.

Zone Colour	Location	Glazing Configuration	Attenuation (dB)
Red	Living Rooms & Bedrooms	*Double Glazing* 6mm Glass / 16mm Argon Cavity / 6.6mm Optiphon Glass	34.0 $R_W + C_{tr}$ 40.0 R_W
Amber	Living Rooms & Bedrooms	*Double Glazing* 6mm Glass / 16mm Air Cavity / 4mm Glass	28.0 $R_W + C_{tr}$ 32.0 R_W
Green	Living Rooms & Bedrooms	*Double Glazing* 4mm Glass / 16mm Air Cavity / 4mm Glass	25.0 $R_W + C_{tr}$ 29.0 R_W

Table 7.0 – Glazing Specifications

The glazing suppliers are required to demonstrate the acoustic performance of their proposed system either by providing an acoustic test report in accordance with BS EN ISO 10140-2:2010 or an evidence-based calculation.

c) Ventilation Specification

BS8233 States:

"If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level."

and

"The Building Regulations' supporting documents on ventilation [48, 49, 50] recommend that habitable rooms in dwellings have background ventilation. Where openable windows cannot be relied upon for this ventilation, trickle ventilators can be used and sound attenuating types are available. However, windows may remain openable for rapid or purge ventilation, or at the occupant's choice. Alternatively, acoustic ventilation units are available for insertion in external walls. These can provide sound reduction comparable with double glazed windows. However, ducted systems with intakes on the quiet side of the building might be required in very noisy situations, or where appearance rules out through-the-wall fans."

An alternative ventilation system should be installed within habitable rooms to fully protect the amenity of future residents. As stated in BS8233:2014 section 5.4.4, having complete enclosure of the noise source or receiver is the most effective barrier of sound. An alternative ventilation strategy allows for maximum sound insulation from the noise source whilst still maintaining a sufficient level of ventilation. It is recommended that the alternative ventilation should provide the same resistance to sound as the glazed elements. The following table provides ventilation systems that meets the above recommendations.

Background Ventilation		
Zone Colour	**Model**	**Attenuation (dB)**
All Zones – Bedrooms and Living Rooms	Titon Standard Vent + C75 (trickle)	34.0 Open / 50.0 Closed $D_{n,e,w} + C_{tr}$
Through Wall Ventilation (not purge)		
Zone Colour	**Model**	**Attenuation (dB)**
All Zones – Bedrooms and Living Rooms	Titon 9x3 Acoustic Airliner set with hit and miss ventilator	38.0 $D_{n,e,w} + C_{tr}$ (Open)

Table 8.0 – Ventilation Specification

The through wall ventilation specified within the table above is also capable of providing background ventilation. If the mechanical ventilation option is opted for the background trickle ventilation option is not required to be installed.

The following table outlines recommended noise levels from mechanical ventilation in dwellings.

Ventilation Condition	Possible System	Desirable Internal Ambient Noise Levels from Mechanical Services, L_{Aeq} (dB)		
		Bedrooms	Living Rooms	Bathrooms / Kitchens
Whole dwelling ventilation	Continuous MEV[1] at low ventilation rates Continuous MVHR[2] at minimum ventilation rates	≤ 26.0	≤ 30.0	--
Extract ventilation	Intermittent Extract Fans Continuous MEV at high ventilation rates	≤ 26.0	≤ 35.0	≤ 45.0

Table 9.0 – Recommended Internal Noise Levels from Mechanical Ventilation

The ventilation suppliers are required to demonstrate the acoustic performance of their proposed system either by providing an acoustic test report in accordance with BS EN ISO 10140-2:2010 or an evidence-based calculation.

Appendix A – Acoustic Terminology

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level (Sound Level)	The sound level is the sound pressure relative to a standard reference pressure of 20μPa (20x10-6 Pascals) on a decibel scale.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20μPa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
$L_{eq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{90,T}$	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Facade	At a distance of 1m in front of a large sound reflecting object such as a building façade.
Fast Time Weighting	An averaging time used in sound level meters. Defined in BS 5969.

In order to assist the understanding of acoustic terminology and the relative change in noise, the following background information is provided. The human ear can detect a very wide range of pressure fluctuations, which are perceived as sound. In order to express these fluctuations in a manageable way, a logarithmic scale called the decibel, or dB scale is used. The decibel scale typically ranges from 0 dB (the threshold of hearing) to over 120 dB. An indication of the range of sound levels commonly found in the environment is given in the following table.

Sound Level	Location
0dB(A)	Threshold of hearing
20 to 30dB(A)	Quiet bedroom at night
30 to 40dB(A)	Living room during the day
40 to 50dB(A)	Typical office
50 to 60dB(A)	Inside a car
60 to 70dB(A)	Typical high street
70 to 90dB(A)	Inside factory
100 to 110dB(A)	Burglar alarm at 1m away
110 to 130dB(A)	Jet aircraft on take off
140dB(A)	Threshold of Pain

The ear is less sensitive to some frequencies than to others. The A-weighting scale is used to approximate the frequency response of the ear. Levels weighted using this scale are commonly identified by the notation dB(A).

In accordance with logarithmic addition, combining two sources with equal noise levels would result in an increase of 3 dB(A) in the noise level from a single source. A change of 3 dB(A) is generally regarded as the smallest change in broadband continuous noise which the human ear can detect (although in certain controlled circumstances a change of 1 dB(A) is just perceptible). Therefore, a 2 dB(A) increase would not be normally be perceptible. A 10 dB(A) increase in noise represents a subjective doubling of loudness.

A noise impact on a community is deemed to occur when a new noise is introduced that is out of character with the area, or when a significant increase above the pre-existing ambient noise level occurs.

For levels of noise that vary with time, it is necessary to employ a statistical index that allows for this variation. These statistical indices are expressed as the sound level that is exceeded for a percentage of the time period of interest. In the UK, traffic noise is measured as the L_{A10}, the noise level exceeded for 10% of the measurement period. The L_{A90} is the level exceeded for 90% of the

time and has been adopted to represent the background noise level in the absence of discrete events. An alternative way of assessing the time varying noise levels is to use the equivalent continuous sound level, L_{Aeq}.

This is a notional steady level that would, over a given period of time, deliver the same sound energy as the actual fluctuating sound. To put these quantities into context, where a receiver is predominantly affected by continuous flows of road traffic, a doubling or halving of the flows would result in a just perceptible change of 3 dB, while an increase of more than 25%, or a decrease of more than 20%, in traffic flows represent changes of 1 dB in traffic noise levels (assuming no alteration in the mix of traffic or flow speeds).

Note that the time constant and the period of the noise measurement should be specified. For example, BS4142:2014 specifies background noise measurement periods of 1 hour during the day and 15 minutes during the night. The noise levels are commonly symbolised as $L_{A90,1hour}$ dB and $L_{A90,15mins}$ dB. The noise measurement should be recorded using a 'FAST' time response equivalent to 0.125ms.

Appendix B – Legislation, Policy and Guidance

This report is to be primarily based on the following legislation, policy and guidance.

B.1 – National Planning Policy Framework (2021)

Government policy on noise is set out in the National Planning Policy Framework (NPPF), published in 2021. This replaced all earlier guidance on noise and places an emphasis on sustainability. In section 15, Conserving and enhancing the natural and local environment, paragraph 174e, it states:

Preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans;

Paragraph 185 states:

Planning policies and decisions should also 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 impact resulting from noise from new 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.*

B.2 – Noise Policy Statement for England (2010)

Paragraph 185 of the NPPF also refers to advice on adverse effects of noise given in the Noise Policy Statement for England (NPSE). This document sets out a policy vision to:

Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.

To achieve this vision the Statement identifies the following three aims:

Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- *Avoid significant adverse impacts on health and quality of life;*
- *Mitigate and minimise adverse impacts on health and quality of life;*
- *Where possible, contribute to the improvement of health and quality of life.*

In achieving these aims the document introduces significance criteria as follows:

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur. It is stated that "significant adverse effects on health and quality of life should be avoided while also considering the guiding principles of sustainable development".

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected. It is stated that the second aim above lies somewhere between LOAEL and SOAEL and requires that: "all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also considering the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur."

NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise. This can be related to the third aim above, which seeks: "where possible, positively to improve health and quality of life through the pro-active management of noise while also considering the guiding principles of sustainable development, recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society. The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim."

The NPSE recognises that it is not possible to have a single objective noise-based measure that is mandatory and applicable to all sources of noise in all situations and provides no guidance as to how these criteria should be interpreted. It is clear, however, that there is no requirement to achieve noise levels where there are no observable adverse impacts but that reasonable and practicable steps to reduce adverse noise impacts should be taken in the context of sustainable development and ensure a balance between noise sensitive and the need for noise generating developments.

Any scheme of noise mitigation outlined in this report will, therefore, aim to abide by the above principles of the NPPF and NPSE whilst recognizing the constraints of the site.

B.3 – BS8233:2014 'Guidance on sound insulation and noise reduction for buildings'

The British Standard BS 8233: 2014, Guidance on Sound insulation and noise reduction for buildings provides additional guidance on noise levels from sources without specific character in the built environment, based on the recommendations of the World Health Organization; specifically, WHO Guidelines on Community Noise, 1999. The criteria desirable levels of steady state, "anonymous" noise in unoccupied spaces within dwellings, from sources such as road traffic, mechanical services and other continuously running plant, are tabulated below:

Activity	Location	07:00 – 23:00	23:00 – 07:00
Resting	Living Room	35 dB $L_{Aeq,16hour}$	--
Dining	Dining Room/Area	40 dB $L_{Aeq,16hour}$	--
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

Table 10.0 – BS8233:2014 Internal Noise Level Criteria

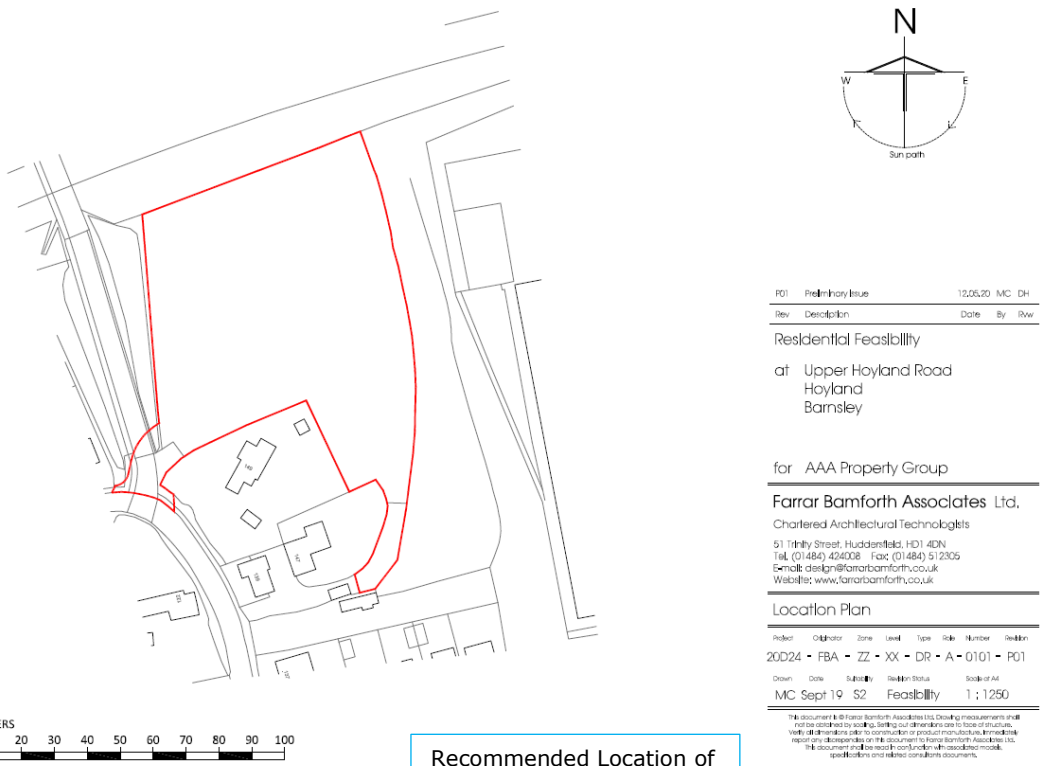
It is noted, however that where development is considered necessary or desirable, despite external noise level above WHO guidelines, the above target levels may be relaxed by up to 5 dB.

The standard also recommends that for traditional external amenity areas, such as gardens, it is desirable that external noise levels do not exceed 50 dB $L_{Aeq,T}$, and that 55 dB $L_{Aeq,T}$ would be acceptable in noisier environments. However, it is recognised that these values may not be achievable in all areas where development is desirable and in such locations, development should be designed to achieve the lowest practicable levels.

General recommendations for mitigation to enable these targets to be achieved are provided, including the use of bunds and barriers to reduce external noise and space planning and sound insulation for the control of internal noise levels.

For this assessment, the above criteria are considered to be the LOAEL as defined in the NPSE above.

Appendix C – Location and Site Plans



Appendix D – Environmental Survey

D.1 – Tabulated Summary Noise Data

Measurement Position MP1								
Measurement Period ('t')	**Octave Band $L_{eq,t}$ (Hz, dB)**						**$L_{Aeq,t}$ (dB)**	**$L_{Amax,t}$ (dB)**
	125	**250**	**500**	**1k**	**2k**	**4k**		
Day 1 – 26/08/21: 11:10 – 23:00	64.0	67.0	69.0	73.0	63.0	52.0	74.0	101.0
Night 1 – 26/08/21: 23:00 – 07:00	58.0	60.0	63.0	67.0	57.0	45.0	68.0	86.0
Day 2 – 27/08/21: 07:00 – 23:00	64.0	67.0	69.0	73.0	63.0	52.0	74.0	94.0
Night 2 – 27/08/21: 23:00 – 07:00	56.0	59.0	61.0	65.0	55.0	44.0	66.0	87.0
Day 3 – 28/08/21: 07:00 – 23:00	63.0	66.0	67.0	71.0	61.0	50.0	73.0	100.0
Night 3 – 28/08/21: 23:00 – 07:00	55.0	57.0	60.0	64.0	54.0	43.0	65.0	83.0
Day 4 – 29/08/21: 07:00 – 23:00	64.0	66.0	67.0	71.0	61.0	50.0	72.0	94.0
Night 4 – 29/08/21: 23:00 – 07:00	54.0	58.0	60.0	64.0	54.0	44.0	65.0	85.0
Day 5 – 30/08/21: 07:00 – 23:00	64.0	66.0	67.0	72.0	62.0	50.0	73.0	94.0
Night 5 – 30/08/21: 23:00 – 07:00	58.0	60.0	63.0	67.0	57.0	46.0	68.0	88.0

Table 11.0 – Sound Survey Summary Results – MP1

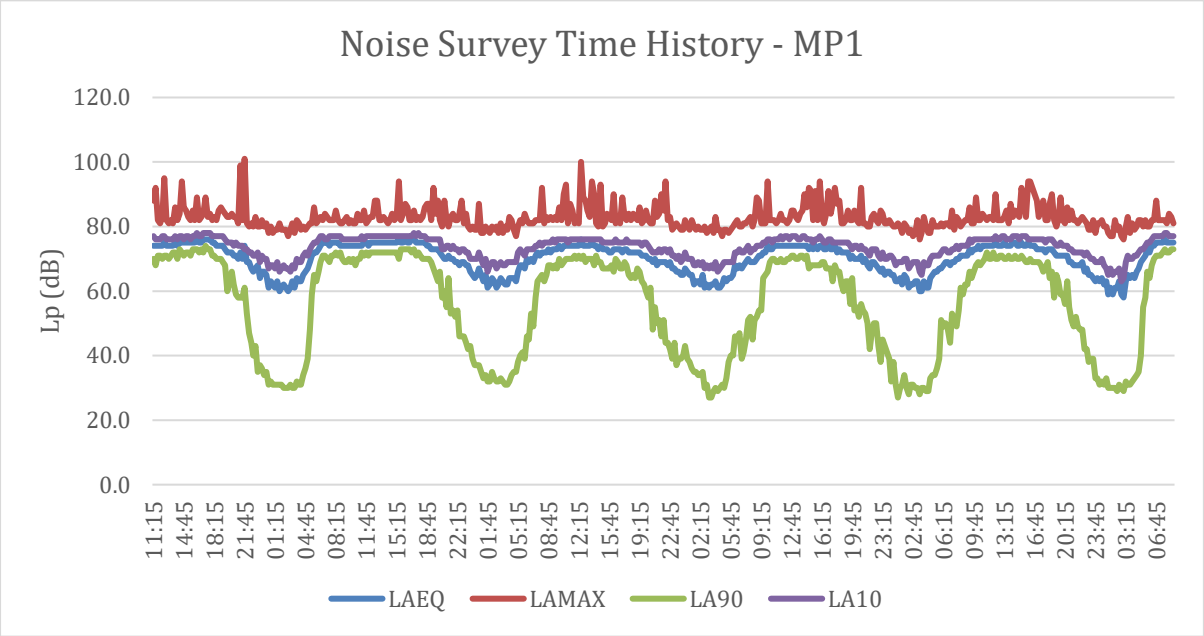


Table 12.0 – Noise Survey Time History – MP1

D.2 – Surveying Equipment

Piece of Equipment	Serial No.	Calibration Deviation
CESVA SC420 Class 1 Sound Level Meter	T246471	≤0.5
CESVA CB006 Class 1 Calibrator	901955	

Table 13.0 – Measurement Equipment

All equipment used during the survey was field calibrated at the start and end of the measurement period with a negligible deviation of ≤0.5 dB. All sound level meters are calibrated every 24 months and all calibrators are calibrated every 12 months, by a third-party calibration laboratory. All microphones were fitted with a protective windshield for the entire measurements period. Calibration certificates can be provided upon request.

D.3 – Meteorological Conditions

As the environmental noise survey was carried out over a long un-manned period no localised records of weather conditions were taken. However, all measurements have been compared with met office weather data of the area, specifically the closest weather station, and the data from the weather station is outlined in the table below. When reviewing the time history of the noise measurements, any scenarios that were considered potentially to be affected by the local weather conditions have been omitted. The analysis of the noise data includes statistical and percentile analysis and review of minimum and maximum values, which aids in the preclusion of any periods of undesirable weather conditions. The weather conditions were deemed suitable for the measurement of environmental noise in accordance with BS7445 Description and Measurement of Environmental Noise. The table below presents the average temperature, wind speed and rainfall range for each 24-hour period during the entire measurement.

Weather Conditions – Worsbrough (Approx. 2km North of Site)				
Time Period	**Air Temp (^{0}C)**	**Rainfall (mm/h)**	**Prevailing Wind Direction**	**Wind Speed (m/s)**
26/08/21: 00:00 – 23:59	12.9 – 18.4	0.0	SW	1.3 – 7.4
27/08/21: 00:00 – 23:59	12.0 – 16.7	0.0	SW	0.5 – 4.8
28/08/21: 00:00 – 23:59	9.6 – 21.3	0.0	SSE	0.0 – 3.5
29/08/21: 00:00 – 23:59	11.0 – 17.4	0.0	SE	0.0 – 5.2
30/08/21: 00:00 – 23:59	12.3 – 17.3	0.0	SE	2.2 – 7.0
31/08/21: 00:00 – 23:59	11.3 – 16.7	0.0 – 0.5	SSE	1.3 – 7.5

Table 14.0 – Weather Summary