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Proposed Mixed-Use Development Barnsley West - Land to the South of Barugh Green Road, Barnsley

Noise Impact Assessment

For:
Strata Sterling Barnsley West Limited

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1 Introduction

1.1 Overview

Environmental Noise Solutions Ltd (ENS) has been commissioned by Strata Sterling Barnsley West Limited to undertake a noise impact assessment for a proposed mixed-use development (known as 'Barnsley West') on land to the south of Barugh Green Road in Barnsley (hereafter referred to as 'the site').

This report details:

- The methodology and results of a baseline noise survey conducted at the site and at locations representative of nearest noise sensitive receptors (NSRs) to the site
- The assessment of potential impact with regard to existing and future local noise sources that may affect the proposed development
- Recommendations for building envelope design (fenestration and ventilation) at key locations within the proposed development
- The assessment of potential noise impact, associated with the proposals, upon nearby NSRs

The report has been prepared for Strata Sterling Barnsley West Limited for the sole purpose described above and no extended duty of care to any third party is implied or offered. Third parties referring to the report should consult Strata Sterling Barnsley West Limited and ENS as to the extent to which the findings may be appropriate for their use.

A glossary of acoustic terms used in the main body of the text is contained in Appendix A.

1.2 Site Description

The site is located to the south of Barugh Green Road (A635) in the Higham / Barugh Green area, approximately 2 km to the north-west of Barnsley town centre, as shown in Appendix B.

The site is bound by:

- Barugh Green Road (A635) to the north with Claycliffe Business Park further beyond
- Higham village (residential area) to the west
- Gawber village (residential area) to the east
- M1 motorway to the south

2 Policy Context and Assessment Guidance

2.1 National Planning Policy Framework

The National Planning Policy Framework (NPPF)¹ was updated September 2023 and sets out the Government's planning policies for England and how these are expected to be applied.

Where issues of noise impact are concerned the NPPF provides brief guidance in paragraph 170 where it states that planning policies and decisions should contribute to and enhance the natural and local environment by:

'preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of.....noise pollution'.

Paragraph 180 advises that:

'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.....mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life'.

The NPPF also refers to the 2010 DEFRA publication, the Noise Policy Statement for England (NPSE) which reinforces and supplements the NPPF.

Paragraph 182 states that:

'Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.'

2.2 Noise Policy Statement for England

The Noise Policy Statement for England² (NPSE) sets out the long-term vision of promoting good health and a 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:

- 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

The NPSE describes the following levels at which noise impacts may be identified:

¹ National Planning Policy Framework. Ministry of Housing, Communities and Local Government (20)

² Noise Policy Statement for England. Government Department for Environment, Food and Rural Affairs (2010)

- 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
- LOAEL – Lowest Observed Adverse Effect Level. This is the level above which adverse effects on health and quality of life can be detected
- SOAEL – Significant Observed Adverse Effect Level. This is the level above which significant adverse effects on health and quality of life occur

According to the explanatory notes in the statement, where a noise level falls between the lowest observable adverse effect level (LOAEL) and a level which represents a significant observable adverse effect level (SOAEL):

‘...all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life whilst also taking into consideration the guiding principles of sustainable development. This does not mean that such effects cannot occur.’

2.3 Planning Practice Guidance on Noise

In December 2014, Planning Practice Guidance³ (PPG) was updated online to provide additional guidance and elaboration on the NPPF. It advises that the Local Planning Authority should consider the acoustic environment in relation to:

- Whether or not a significant adverse effect is occurring or likely to occur
- Whether or not an adverse effect is occurring or likely to occur
- Whether or not a good standard of amenity can be achieved

In line with the Explanatory Note of the NPSE, the PPG references the LOAEL and SOAEL in relation to noise impact. It also provides examples of outcomes that could be expected for a given perception level of noise, plus actions that may be required to bring about a desired outcome. However, in line with the NPSE, no objective noise levels are provided for LOAEL or SOAEL although the PPG acknowledges 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’.

Table 2.1 summarises the PPG noise exposure hierarchy.

³ Planning Practice Guidance on Noise, 2014: <http://planningguidance.planningportal.gov.uk/blog/guidance/noise/>

Table 2.1: PPG Noise Exposure Hierarchy

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
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

The PPG also provides general advice on the typical options available for mitigating noise, suggesting that Local Plans may include noise standards applicable to proposed developments within the Local Authority's administrative boundary, although it states that:

'Care should be taken, however, to avoid these being implemented as fixed thresholds as specific circumstances may justify some variation being allowed'.

With regard to the mitigation of extant environmental noise at a proposed residential development, the guidance states that:

'... consideration should also be given to 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 both cases a suitable alternative means of ventilation is likely to be necessary. Further information on ventilation can be found in the Building Regulations'.

2.4 Assessment Guidance

British Standard 4142:2014

BS 4142:2014⁴ presents methods for rating and assessing the potential impact of commercial and industrial sound upon noise sensitive receptors.

The scope of BS 4142 specifically includes sound from industrial and manufacturing processes, sound from fixed plant, sound from loading and unloading of goods at industrial and commercial sites and mobile plant forming an intrinsic part of the overall sound from a premises or process.

A rating penalty can be applied to account for the character of the noise, namely tonality, impulsivity and intermittency. All of these corrections can be added together in linear fashion where appropriate.

⁴ British Standard 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound, BSI (2019)

Tonality can be determined objectively (using adjacent third octave band analysis / the Joint Nordic method) or subjectively as listed below:

- +2 dB penalty: Just perceptible
- +4 dB penalty: Clearly perceptible
- +6 dB penalty: Highly perceptible

Impulsivity (the rapidity of the change in sound level) can be determined objectively (using Fast Fourier Transform analysis) or subjectively as listed below:

- +3 dB penalty: Just perceptible
- +6 dB penalty: Clearly perceptible
- +9 dB penalty: Highly perceptible

Where intermittency is present (i.e. when the specific noise has identifiable on/off conditions) a +3 dB penalty can be applied.

Where the specific sound feature characteristics are neither tonal nor impulsive, but are distinguishable against the residual noise, a +3 dB penalty can be applied.

In order to assess the impact, the 'Rating level' of the new noise source is compared with the existing 'Background level' and the following analysis made:

- Typically, the greater this difference, the greater the magnitude of the impact
- A difference of +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context
- A difference of +5 dB is likely to be an indication of an adverse impact, depending on the context
- 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

BS 4142 requires separate analysis for day and night time periods, evaluating the Rating level over an appropriate reference time interval (T_r) of:

- 1 hr during the day (between 07:00 - 23:00 hrs)
- 15 min during the night (between 23:00 - 07:00 hrs)

3 Noise Survey and Results

3.1 Overview

In order to quantify the level of external noise affecting the site and local vicinity, noise monitoring was carried out between Monday 7th October 2019 and Wednesday 9th October 2019.

The adopted noise monitoring positions (shown in Appendix B) were as follows:

- 1 – Northern boundary of the site, at a position representative of the nearest proposed dwellings to the Barugh Green Road (at a distance of approximately 18 metres from nearside kerb)
- 2 – South-eastern boundary of the site, at a position representative of the southern-most proposed dwellings (i.e. closest to the M1 motorway); this position is also representative of the nearest existing noise sensitive receptors (NSRs) to the proposed commercial use at the south-east area of the development
- 3 – North-western boundary of the site, at a position representative of the proposed school (i.e. similar distance from Barugh Green Road); this position is also representative of the nearest existing NSRs to the north-west area (including proposed school and commercial use) of the development
- 4 – Western boundary of the site, representative of the nearest existing NSRs to the western area of the development (construction phase)
- 5 – South-western boundary, representative of the nearest existing NSRs to the proposed commercial use at the south-west area of the development
- 6 – Central part of the site, representative of proposed dwellings adjacent to Hermit Lane
- 7 – North-eastern boundary of the site, representative of the nearest existing NSRs to the eastern area of the development (construction phase)

3.2 Equipment

Noise measurements were undertaken using a Bruel & Kjaer 2250 Type 1 integrating sound level meter. The meter was connected to a windshield covered microphone positioned at a height of 1.5 metres above ground in free-field conditions at the locations detailed in Section 3.1.

The measurement system calibration was verified immediately before and after each survey period using a Bruel & Kjaer Type 4231 calibrator. No drift in calibration levels greater than 0.5 dB was noted.

Measurements consisted of A-weighted broadband parameters including L_{Aeq} , L_{A10} , L_{A90} and L_{AFmax} together with linear octave and third octave band data.

3.3 Weather

The noted weather conditions during the survey were generally dry / slightly damp, mild and calm (with average wind speeds ≤ 5 m/s). Weather conditions were therefore considered appropriate for noise monitoring.

3.4 Summary of Results

Table 3.1 presents a summary of the noise data for each measurement session, at each measurement position, rounded to the nearest decibel.

Table 3.1: Summary of Noise Measurement Data

Position	Date	Time (hh:mm)	L _{Aeq} (dB)	L _{AFmax} (dB)	L _{A10} (dB)	L _{A90,15min} Range (dB)	Comment
1	07/10/2019	10:02 – 11:02	60	79	63	52 – 53	Road traffic on Barugh Green Road (A635)
		11:02 – 12:02	59	74	62	51	
		12:02 – 13:02	59	73	62	51 – 53	
		23:01 – 23:16	55	79	58	47	
	08/10/2019	00:04 – 00:19	50	64	53	45	
		23:00 – 23:15	56	74	59	50	
09/10/2019	00:00 – 00:16	51	64	54	45		
2	07/10/2019	13:16 – 14:16	50	70	52	48 – 49	Distant road traffic on M1 Motorway
		14:16 – 15:16	51	69	52	48 – 49	
		15:16 – 16:16	52	62	54	47 – 51	
		23:42 – 23:57	48	55	49	46	
	08/10/2019	23:20 – 23:35	49	67	51	46	
09/10/2019	00:22 – 00:37	48	64	50	45		
3	08/10/2019	01:20 – 01:35	46	59	48	43	Distant road traffic on M1 Motorway
		01:35 – 01:50	45	53	48	42	
		11:17 – 11:32	53	65	54	50	
		11:32 – 11:47	53	73	56	49	
	09/10/2019	01:39 – 01:54	48	58	50	45	
		01:54 – 02:09	48	61	50	43	
		11:23 – 11:38	49	61	52	45	
11:38 – 11:53	47	55	49	46			
4	08/10/2019	12:01 – 12:16	53	62	54	51	Distant road traffic on M1 Motorway
		12:16 – 12:31	53	62	55	51	
	09/10/2019	11:56 – 12:11	51	57	52	49	
		12:11 – 12:26	50	61	52	48	
5	08/10/2019	00:43 – 00:58	52	63	54	49	Distant road traffic on M1 Motorway
		00:58 – 01:13	52	69	54	48	Distant road traffic on M1 Motorway and road traffic on Higham Road
		12:38 – 12:53	59	66	61	57	Distant road traffic on M1 Motorway and road traffic on Higham Road
		12:53 – 13:08	59	67	61	57	Distant road traffic on M1 Motorway and road traffic on Higham Road
	09/10/2019	01:01 – 01:16	51	59	53	47	Distant road traffic on M1 Motorway
		01:16 – 01:31	52	62	55	49	Distant road traffic on M1 Motorway
		12:31 – 12:46	57	70	59	52	Distant road traffic on M1 Motorway and road traffic on Higham Road
12:46 – 13:01	56	70	59	51	Distant road traffic on M1 Motorway and road traffic on Higham Road		
6	07/10/2019	23:22 – 23:37	51	73	50	43	Distant road traffic on M1 Motorway
	08/10/2019	00:25 – 00:40	47	68	47	43	Distant road traffic on M1 Motorway
		13:12 – 13:27	57	75	59	47	Distant road traffic on M1 Motorway and occasional vehicles on Hermit Lane
		13:27 – 13:42	60	82	63	47	
		23:40 – 23:55	48	69	48	42	Distant road traffic on M1 Motorway
	09/10/2019	00:42 – 00:57	49	71	51	44	Distant road traffic on M1 Motorway
		13:08 – 13:23	57	77	57	43	Distant road traffic on M1 Motorway and occasional vehicles on Hermit Lane
13:23 – 13:38		59	82	61	43		
7	08/10/2019	13:55 – 14:10	54	66	57	50	Road traffic on A635 (Barugh Green Road and Wilthorpe Road)
		14:10 – 14:25	51	67	53	49	
	09/10/2019	13:44 – 13:59	52	65	54	50	
		13:59 – 14:14	52	66	54	50	

3.5 Analysis

Northern Boundary

At Position 1, the dominant noise source was observed to be due to road traffic on Barugh Green Road (A635). No contributions from the existing nearby commercial premises (to the north) were observed at any time during the noise survey.

For the prediction of daytime road traffic noise, the Department of Transport's Memorandum on the Calculation of Road Traffic Noise (CRTN) explains that the following shortened measurement procedure may be used. Measurements of L_{A10} are made over any three consecutive hours between 10:00 - 17:00 hrs.

Using $L_{A10, 3hr}$ as the arithmetic mean of the three consecutive values of hourly L_{A10} , the $L_{A10, 18hr}$ can be calculated from the equation:

$$(i) \quad L_{A10, 18hr} = L_{A10, 3hr} - 1 \text{ dB}$$

$$(ii) \quad L_{Aeq, 16hr} \approx L_{A10, 18hr} - 2 \text{ dB}$$

Substituting (ii) into (i) gives the following approximation:

$$(iii) \quad L_{Aeq, 16hr} \approx L_{A10, 3hr} - 3 \text{ dB}$$

Based on the above formula, the 16-hr daytime ambient noise level is calculated to be 59 dB $L_{Aeq, 16hr}$.

A study prepared by TRL Limited on behalf of the Department for Environment, Food and Rural Affairs (DEFRA) entitled 'Converting the UK Traffic Noise Index L_{A10} (18 hour) to EU Noise Indices for Noise Mapping' presents a methodology for calculating night-time road traffic noise levels, based on daytime road traffic noise levels, using the following formulae:

$$(iv) \quad L_{Aeq, 8hr} \approx 0.9 \times L_{A10, 18hr} - 3.77 \text{ (for non-motorway roads)}$$

$$(v) \quad L_{Aeq, 8hr} \approx 0.87 \times L_{A10, 18hr} + 4.24 \text{ (for motorways)}$$

Based on the above formula (iv) for non-motorway roads, the 8-hr night-time ambient noise level is calculated to be 51 dB $L_{Aeq, 8hr}$.

Maximum noise levels were due to passing vehicle movements and were ≤ 79 dB L_{AFmax} at night.

South-Eastern Boundary

At Position 2, the dominant noise source was observed to be due to distant road traffic on the M1 Motorway.

Using the CRTN formula (iii) presented in the foregoing subsection, the 16-hr daytime ambient noise level is calculated to be 50 dB $L_{Aeq, 16hr}$.

Based on the TRL formula (v) for motorways, the 8-hr night-time ambient noise level is calculated to be 49 dB $L_{Aeq, 8hr}$.

Maximum noise levels were ≤ 67 dB L_{AFmax} at night.

Background noise levels ranged from 47 – 51 dB $L_{A90, 15min}$ during the day and 45 – 46 dB $L_{A90, 15min}$ at night. Typical background noise levels were around:

- 49 dB $L_{A90,15min}$ during the day
- 46 dB $L_{A90,15min}$ at night

North-Western Boundary

At Position 3, the dominant noise source was observed to be due to distant road traffic on the M1 Motorway. Daytime ambient noise levels were around 47 – 53 dB $L_{Aeq,T}$ and night-time ambient noise levels were around 45 – 48 dB $L_{Aeq,T}$. Maximum noise levels were \leq 61 dB L_{AFmax} at night.

Background noise levels ranged from 45 – 50 dB $L_{A90,15min}$ during the day and 42 – 45 dB $L_{A90,15min}$ at night. Typical background noise levels were around:

- 48 dB $L_{A90,15min}$ during the day
- 43 dB $L_{A90,15min}$ at night

Western Boundary

At Position 4, the dominant noise source was observed to be due to distant road traffic on the M1 Motorway with daytime ambient noise levels of around 50 – 53 dB $L_{Aeq,T}$.

South-Western Boundary

At Position 5, the dominant noise source was observed to be due to distant road traffic on the M1 Motorway, particularly at night. During the daytime, additional contributions were also noted from Higham Road.

Daytime ambient noise levels were around 56 – 59 dB $L_{Aeq,T}$ and night-time ambient noise levels were around 51 – 52 dB $L_{Aeq,T}$. Maximum noise levels were \leq 69 dB L_{AFmax} at night.

Background noise levels ranged from 51 – 57 dB $L_{A90,15min}$ during the day and 47 – 49 dB $L_{A90,15min}$ at night. Typical background noise levels were around:

- 57 dB $L_{A90,15min}$ during the day
- 49 dB $L_{A90,15min}$ at night

Central Area

At Position 6, the dominant noise source was observed to be due to distant road traffic on the M1 Motorway and occasional vehicle movements on Hermit Lane. Daytime ambient noise levels were around 57 – 60 dB $L_{Aeq,T}$ and night-time ambient noise levels were around 47 – 51 dB $L_{Aeq,T}$. Maximum noise levels were \leq 73 dB L_{AFmax} at night.

Background noise levels ranged from 43 – 47 dB $L_{A90,15min}$ during the day and 42 – 44 dB $L_{A90,15min}$ at night. Typical background noise levels were around:

- 47 dB $L_{A90,15min}$ during the day
- 43 dB $L_{A90,15min}$ at night

North-Eastern Boundary

At Position 7, the dominant noise source was observed to be due to road traffic on the A635 (Barugh Green Road and Wilthorpe Road) with daytime ambient noise levels of around 51 – 54 dB $L_{Aeq,T}$.

4 Noise Criteria for Mixed-Use Development

4.1 Plant Noise Limits for Industrial / Commercial Use

Detailed information regarding the proposed nature of operation of industrial / commercial use and any item(s) of external plant associated with the proposals was not available at the time of writing. However, this section has been included to aid in the specification of any external plant and/or the control of noise impact from the proposed industrial / commercial units.

Proposed industrial / commercial units and any associated external plant / operations should be designed so that rating levels (as determined using the guidance of BS 4142:2014) do not exceed the existing background noise level at the nearest existing NSRs in order to avoid an adverse impact.

Table 4.1 provides the highest permissible free-field rating noise levels from proposals when measured at the nearest existing or proposed receptors. These are based on the measured background noise levels presented in Section 3.

Table 4.1: Limiting Rating Noise Levels from Proposed Industrial / Commercial Units and Plant

Receptor	Limiting Rating Noise Level [$L_{A,T,r}$ (dB)] at NSR	
	Day	Night
Dwellings (existing or proposed) near to south-eastern boundary of site	49	46
Dwellings (existing or proposed) near to north-western boundary of site	48	43
Dwellings (existing or proposed) near to south-western boundary of site	57	49
Dwellings (existing or proposed) near to the centre of site	47	43

It should be noted that the limits presented in Table 4.1 are rating levels i.e. industrial / commercial noise levels when appropriate acoustic feature corrections have been applied, in accordance with the penalties described in Section 2 of this report. It should also be noted that the noise limits are the highest allowable noise levels from all proposed units / plant. Care should be taken to see that these limits are met with all units / plant in operation simultaneously and with appropriate acoustic feature correction penalties applied.

The following assessment is based on the employment layout set out in the latest site masterplan reference: BWM-BBA-ZZ-DR-A-1052-S2-P03.

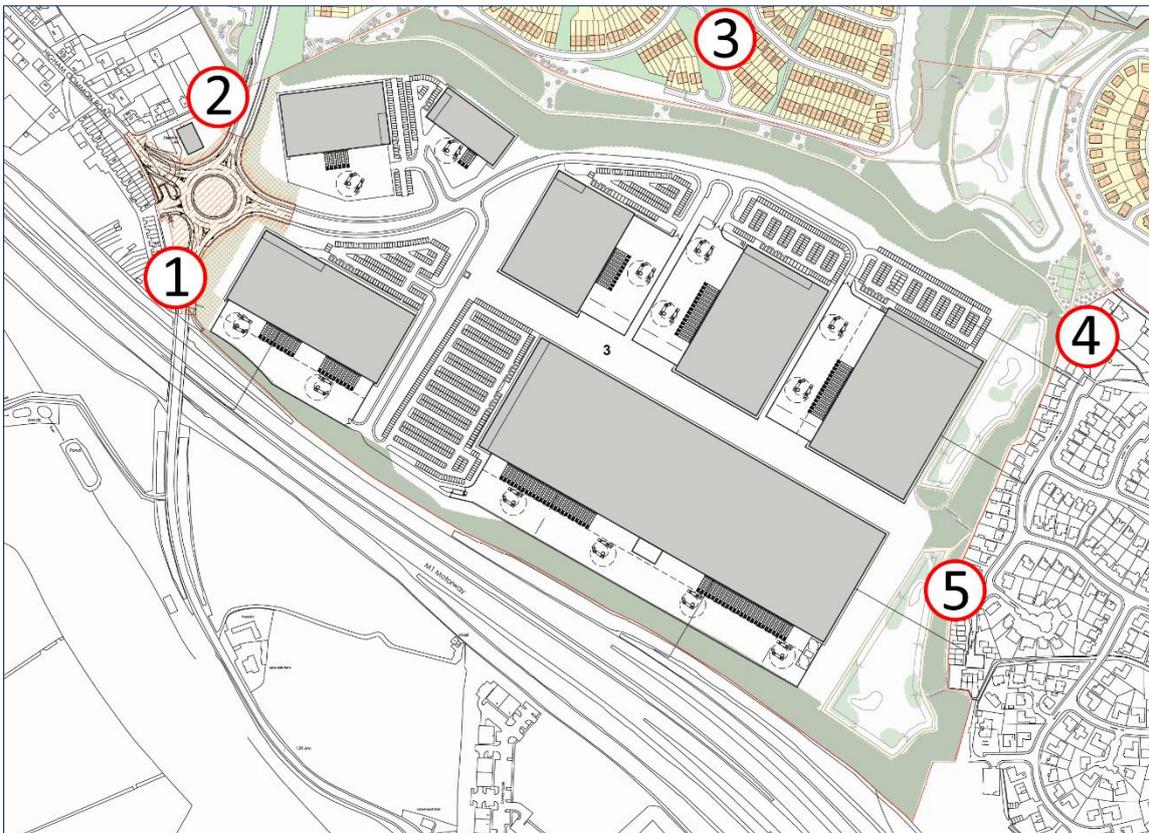
5 Employment Area – Noise Impact

5.1 Receptors

Based on the current masterplan, the nearest noise sensitive receptors (NSRs) to the units are identified on Figure 5.1, and described below:

- NSR1 – Existing dwelling on Higham Common Road
- NSR2 – Existing dwelling on Hermit Lane
- NSR3 – Location of nearest proposed dwellings to the north of the employment area
- NSR4 – Existing dwelling on Harden Close
- NSR5 – Existing dwelling on Drury Farm Court

Figure 5.1: Noise Sensitive Receptors



5.2 Internal Noise Break-Out

Overview

Table 5.1 presents the distances between each NSR and the façade of the nearest unit.

Table 5.1: Distances between NSRs and Nearest Façade of Each Unit

Receptor	Approximate distance to nearest unit (m)
NSR1	65
NSR2	55
NSR3	135
NSR4	77
NSR5	94

Source Noise Levels

At the time of writing, the final occupants of the proposed units are to be determined; therefore, it is not possible to predict a precise internal noise levels for the proposed units. However, for assessment purposes, a relatively high internal reverberant noise level of 80 dB $L_{Aeq,T}$ has been robustly adopted, for use in noise break-out calculations, based on the following:

- Reverberant internal noise levels of up to 80 dB $L_{Aeq,T}$ have been measured previously by ENS inside a fabricators unit (B2)
- Reverberant internal noise levels of 68 – 72 dB $L_{Aeq,T}$ have been measured previously by ENS inside a busy distribution unit (B8)

Propagation

A three-dimensional Cadna-A noise model has been developed to predict noise emission from the proposed units. Noise model geometry is based on Ordnance Survey mapping data and drawings supplied by the client.

Propagation of noise has been calculated in broadband terms according to ISO 9613: 1996, at a height of 4m above ground level, representative of first-floor bedrooms in the surrounding NSRs. All buildings within the model are assumed to be acoustically reflective, and second order reflections have been considered. The noise model assumes mixed hard/soft ground for propagation corrections. All buildings outside the site boundary have an assumed height of 8m.

For the purpose of the calculations, the sound reduction performance of the building envelope is assumed to be ≥ 25 dB R_w based on the sound reduction performance of standard single-skin insulated cladding.

Calculations assume that the sound insulation of the façade will not be compromised by weaker elements (e.g. rooflights) or penetrations such as louvres or doors. Where any louvres, roof lights or doors are proposed for any of the units, they should therefore be designed with a sound insulation performance of ≥ 25 dB R_w .

Noise break-out levels, associated with internal operations within the units, have been determined at the nearest NSRs, assuming that all units are operating concurrently. For a robust assessment, it is assumed that each unit will operate with an internal noise level of 80 dB $L_{Aeq,T}$ continuously throughout the assessment period.

The calculated site noise levels are presented in Table 5.2.

Table 5.2: Calculated Unit Break-Out Levels at NSRs

Receptor	Predicted cumulative noise level (dB $L_{Aeq,1hr}$)
NSR1	40
NSR2	41
NSR3	37
NSR4	39
NSR5	40

Impact Assessment

The calculated unit noise break-out levels have been assessed in accordance with BS 4142. At this stage, the exact nature of commercial / industrial operation within the proposed units is not known; therefore, it is not possible to determine whether or not the site noise will be tonal or impulsive in nature. For the purpose of assessment, a 3 dB acoustic feature correction has been applied on the assumption that the noise emission from the units may be distinguishable against the residual acoustic environment.

The results of the BS 4142 assessment are presented in Tables 5.3 and 5.4 for day and night periods respectively.

Table 5.3: BS 4142 Assessment of Unit Noise Break Out – Daytime

Parameter	NSR1	NSR2	NSR3	NSR4	NSR5
Typical daytime background sound level ($L_{A90,15min}$)	57 dB	57 dB	47 dB	49 dB	49 dB
Specific noise level ($L_{Aeq,1hr}$)	40 dB	41 dB	37 dB	39 dB	40 dB
Acoustic feature correction	+ 3 dB				
Rating level ($L_{Ar,1hr}$)	43 dB	44 dB	40 dB	39 dB	44 dB
Excess of rating level over background sound level	- 14 dB	- 13 dB	- 7 dB	- 10 dB	- 5 dB
Assessment (depending on context)	Low impact				

Table 5.4: BS 4142 Assessment of Unit Noise Break Out – Night

Parameter	NSR1	NSR2	NSR3	NSR4	NSR5
Typical night background sound level ($L_{A90,15min}$)	49 dB	49 dB	43 dB	46 dB	46 dB
Specific noise level ($L_{Aeq,15min}$)	40 dB	41 dB	37 dB	39 dB	40 dB
Acoustic feature correction	+ 3 dB				
Rating level ($L_{Ar,15min}$)	43 dB	44 dB	40 dB	39 dB	44 dB
Excess of rating level over background sound level	- 6 dB	- 5 dB	- 3 dB	- 7 dB	- 2 dB
Assessment (depending on context)	Low impact				

The BS 4142 assessment of noise break-out from the units indicates a low impact at all assessed receptors during day and night periods.

5.3 Service Area Operations

Overview

The proposed site layout drawing shows that each unit includes associated service areas immediately adjacent to the building.

Table 5.5 presents the distances between each NSR and a position roughly central to the loading area of each service area.

Table 5.5: Distances between NSRs and Proposed Service Areas

Receptor	Approximate minimum distance (m)
NSR1	70
NSR2	96
NSR3	125
NSR4	190
NSR5	140

It is assumed that activity within the service yards will consist of intermittent Heavy Goods Vehicle (HGV) movements and Forklift Truck (FLT) movements associated with loading/unloading operations.

Source Noise Levels

In order to assess the impact of HGV and FLT movements within the service areas, the Single Event Level / Sound Exposure Level (SEL) has been used. The SEL of a single discrete noise event is the level which if maintained constant for a period of one second would contain as much A-weighted sound energy as is contained in the actual noise event.

The SEL of HGV movements at low speed has previously been measured by ENS at circa 78 dB(A) at 10 metres. The SEL of a FLT loading operation has previously been measured at approximately 67 dB(A) at 10 metres. Associated maxima were around 75 dB L_{AFmax} and 79 dB L_{AFmax} (at 10 metres distance) respectively.

At this stage, the exact hours of operation of the proposed units are to be determined. For the purpose of assessment, it is assumed that HGV and FLT activity in the external service areas could potentially occur during the day or night.

In lieu of detailed delivery / collection schedule information, it is assumed that each service area could accommodate 4 no. HGV deliveries / collections per hour (i.e. 1 no. every 15-minutes). This equates to 8 no. HGV movements and 4 no. events of FLT loading / unloading activity per hour in each service yard during the day.

The following formula may be used for calculating the $L_{Aeq,T}$ level from the SEL:

$$L_{Aeq,T} = 10 \times \log_{10} [(n \times 10^{SEL/10}) / T]$$

where:

SEL = the Single Event Level / Sound Exposure Level

n = number of event occurrences

T = reference time period, in seconds

Processing the above, the calculated source noise levels ($L_{Aeq,T}$), at a reference distance of 10 metres, are presented in Table 5.6 and 5.7 for day and night periods respectively.

Table 5.6: Calculated HGV and FLT Noise Levels at 10 metre distance - Day

Source	SEL at 10m	No. of Events per ref. Period (Hour)	Reference Time (s)	Source Noise Level $L_{Aeq,1hr}$ at 10m
HGV	78 dB(A)	8	3600	52 dB
FLT	67 dB(A)	4	3600	38 dB

Table 5.7: Calculated HGV and FLT Noise Levels at 10 metre distance - Night

Source	SEL at 10m	No. of Events per ref. Period (15 min)	Reference Time (s)	Source Noise Level $L_{Aeq,15min}$ at 10m
HGV	78 dB(A)	2	900	52 dB
FLT	67 dB(A)	1	900	38 dB

Noise Propagation

Noise levels associated with HGV and FLT movements have been determined at the nearest NSRs using the Cadna-A noise model. The noise model assumes point source propagation from the edge of the service yards closest to each receptor, which is considered representative of the most onerous noise impact. The calculations assume that all of the service yards are operating continuously and concurrently throughout the assessment period.

The calculated cumulative service area noise levels are presented in Table 5.8.

Table 5.8: Calculated Service Area Noise Levels at NSRs

Receptor	Predicted cumulative noise level (dB $L_{Aeq,1hr}$)
NSR1	31
NSR2	28
NSR3	26
NSR4	16
NSR5	22

Impact Assessment

For the purpose of assessment, a 6 dB penalty has been applied on the robust assumption that the noise emission from the service areas could be perceived as clearly impulsive.

The results of the BS 4142 assessment are presented for daytime and night periods in Tables 5.9 and 5.10, respectively.

Table 5.9: BS 4142 Assessment of Service Yard Operations – Daytime

Parameter	NSR1	NSR2	NSR3	NSR4	NSR5
Typical daytime background sound level ($L_{A90,15min}$)	57 dB	57 dB	47 dB	49 dB	49 dB
Specific noise level ($L_{Aeq,1hr}$)	31 dB	28 dB	26 dB	16 dB	22 dB
Acoustic feature correction	+ 6 dB				
Rating level ($L_{Ar,1hr}$)	37 dB	34 dB	32 dB	22 dB	28 dB
Excess of rating level over background sound level	- 20 dB	- 23 dB	- 24 dB	- 27 dB	- 21 dB
Assessment (depending on context)	Low impact				

Table 5.10: BS 4142 Assessment of Service Yard Operations – Night

Parameter	NSR1	NSR2	NSR3	NSR4	NSR5
Typical night background sound level ($L_{A90,15min}$)	49 dB	49 dB	43 dB	46 dB	46 dB
Specific noise level ($L_{Aeq,15min}$)	31 dB	28 dB	26 dB	16 dB	22 dB
Acoustic feature correction	+ 6 dB				
Rating level ($L_{Ar,15min}$)	37 dB	34 dB	32 dB	22 dB	28 dB
Excess of rating level over background sound level	- 12 dB	- 15 dB	- 11 dB	- 24 dB	- 18 dB
Assessment (depending on context)	Low impact				

The BS 4142 assessment of service yard operations indicate a low impact at all assessed receptors during day and night periods.

With regard to service yard maxima at night, noise levels are calculated at or below the following at the NSRs, based on the source locations set out above:

- 57 dB L_{AFmax} at NSR1
- 54 dB L_{AFmax} at NSR2
- 50 dB L_{AFmax} at NSR3
- 42 dB L_{AFmax} at NSR4
- 49 dB L_{AFmax} at NSR5

The above levels are all below the World Health Organisation upper limit of 60 dB L_{AFmax} to avoid sleep disturbance due to noise ingress through a partly open window and would not be expected to result in adverse impacts.

6 Summary and Conclusions

A noise survey and assessment has been performed for a proposed mixed-use development on land to the south of Barugh Green Road in Barnsley.

Noise monitoring was carried out between Monday 7th October 2019 and Wednesday 9th October 2019 to quantify the level of external noise affecting the site and local vicinity. The results of the baseline noise survey are presented in Section 3.

Section 4 presents recommendations for a noise mitigation strategy to protect potential future residential development at the site from the existing noise climate using relevant criteria. In order to avoid adverse impacts (as defined by BS 4142:2014), maximum permissible free-field rating noise levels, from proposed industrial/commercial units and plant, are recommended at existing and proposed NSRs. These are based on the measured background noise levels presented in Section 3.

Section 5 considers the potential noise impact of the proposed industrial / commercial units and plant upon noise sensitive receptors (NSRs) proximate to the development. The results of the assessment indicate that the proposed employment uses would not result in adverse impacts at the closest noise sensitive receptors.

Appendix A - Abbreviations and Definitions

Sound Pressure Level (L_p)

The basic unit of sound measurement is the sound pressure level. As the pressures to which the human ear responds can range from 20 μPa to 200 Pa, a linear measurement of sound levels would involve many orders of magnitude. Consequently, the pressures are converted to a logarithmic scale and expressed in decibels (dB) as follows:

$$L_p = 20 \log_{10}(p/p_0)$$

Where L_p = sound pressure level in dB; p = rms sound pressure in Pa; and p_0 = reference sound pressure (20 μPa).

A-weighting

A frequency filtering system in a sound level meter, which approximates under defined conditions the frequency response of the human ear. The A-weighted sound pressure level, expressed in dB(A), has been shown to correlate well with subjective response to noise.

Equivalent continuous A-weighted sound pressure level, $L_{Aeq, T}$

The value of the A-weighted sound pressure level in decibels of continuous steady sound that within a specified time interval, T, has the same mean-square sound pressure as a sound that varies with time. $L_{Aeq, 16h}$ (07:00 to 23:00 hours) and $L_{Aeq, 8h}$ (23:00 to 07:00 hours) are used to qualify daytime and night time noise levels.

$L_{A10, T}$

The A-weighted sound pressure level in decibels exceeded for 10% of the measurement period, T. $L_{A10, 18h}$ is the arithmetic mean of the 18 hourly values from 06:00 to 24:00 hours.

$L_{A90, T}$

The A-weighted sound pressure level of the residual noise in decibels exceeded 90% of a given time interval, T. L_{A90} is typically taken as representative of background noise.

L_{AFmax}

The maximum A-weighted noise level recorded during the measurement period. The subscript 'F' denotes fast time weighting, slow time weighting 'S' is also used.

Single Event Level / Sound Exposure Level (SEL or L_{AE})

The energy produced by a discrete noise event averaged over one second, regardless of the event duration. This allows for comparison between different noise events which occur over different lengths of time.

Weighted Sound Reduction Index (R_w)

Single number quantity which characterises the airborne sound insulation properties of a material or building element over a defined range of frequencies (R_w is used to characterise the insulation of a material or product that has been measured in a laboratory).

Appendix B – Noise Measurement Positions

