A CAF GROUP COMPANY

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Noise Impact Assessment

256309

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January 2026

DOCUMENT ISSUE RECORD

Document Number:	**256309-BWB-ZZ-XX-RP-AC-0001**
BWB Reference:	**256309_001_P01**

Revision	Date of Issue	Status	Author:	Checked:	Approved:
P01	07/01/2026	Issue	Ian Wallbank BSc (Hons) MIOA	Luke Pickering BSc (Hons) MIOA	Sam Ellwood BSc (Hons) MIOA

Notice

EXECUTIVE SUMMARY

This noise impact assessment has been prepared by BWB Consulting (BWB) on behalf of Barrat Homes (the Client) in support of a reserved matters application for a proposed residential development comprising 415 dwellings (The Site).

A baseline noise survey was undertaken to inform the outline application in January 2022 and has been used for the basis of the subsequent assessment. A detailed noise assessment has been undertaken in accordance with current standards and guidance; and a condition enforced by Hinckley and Bosworth Borough Council.

Predictive noise modelling has demonstrated that all private garden areas are expected to achieve the upper guideline level of 55 dB $L_{Aeq,16h}$ in accordance with BS 8233. Therefore, mitigation will not be required to reduce noise levels in outdoor living areas of any dwelling.

The assessment shows that with appropriate noise mitigation measures including the provision of appropriate glazing and ventilation strategies, noise break-in from road and farm noise can be adequately controlled in accordance with BS 8233 guidance.

Noise from the unmitigated MUGA is expected to exceed AGP guidance noise levels at the nearest receptors. Mitigation has been recommended in the form of a suitable glazing and ventilation strategy for affected dwellings.

An assessment of overheating has found that some dwellings are expected to exceed the criteria given in Approved Document O. For these dwellings, the simplified method cannot be applied due to the influence of external noise. Consequently, dynamic thermal modelling, following the procedures of CIBSE TM59, is required to assess the risk of overheating under realistic occupancy and environmental conditions.

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1. INTRODUCTION

Instruction

1.1 BWB Consulting (BWB) was instructed by Barrat Homes (the Client) to undertake a Noise Impact Assessment in support of a reserved matters application for a proposed residential development comprising 415 dwellings (The Site).

1.2 This assessment has been undertaken based on the results of a baseline noise survey on the Site. The results of the survey have been assessed in accordance with current standards and guidance.

1.3 The purpose of this Technical Note is to address the following Planning Condition relating to noise:

"Any forthcoming Reserved Matters application shall include a scheme for protecting the proposed dwellings from noise from the adjacent road network and the adjacent farms has been submitted and approved by the Local Planning Authority. All works which form part of the scheme shall be completed before any of the permitted dwellings are first occupied"

1.4 Where appropriate, consideration has been given to noise mitigation measures to reduce noise levels at noise sensitive receptors.

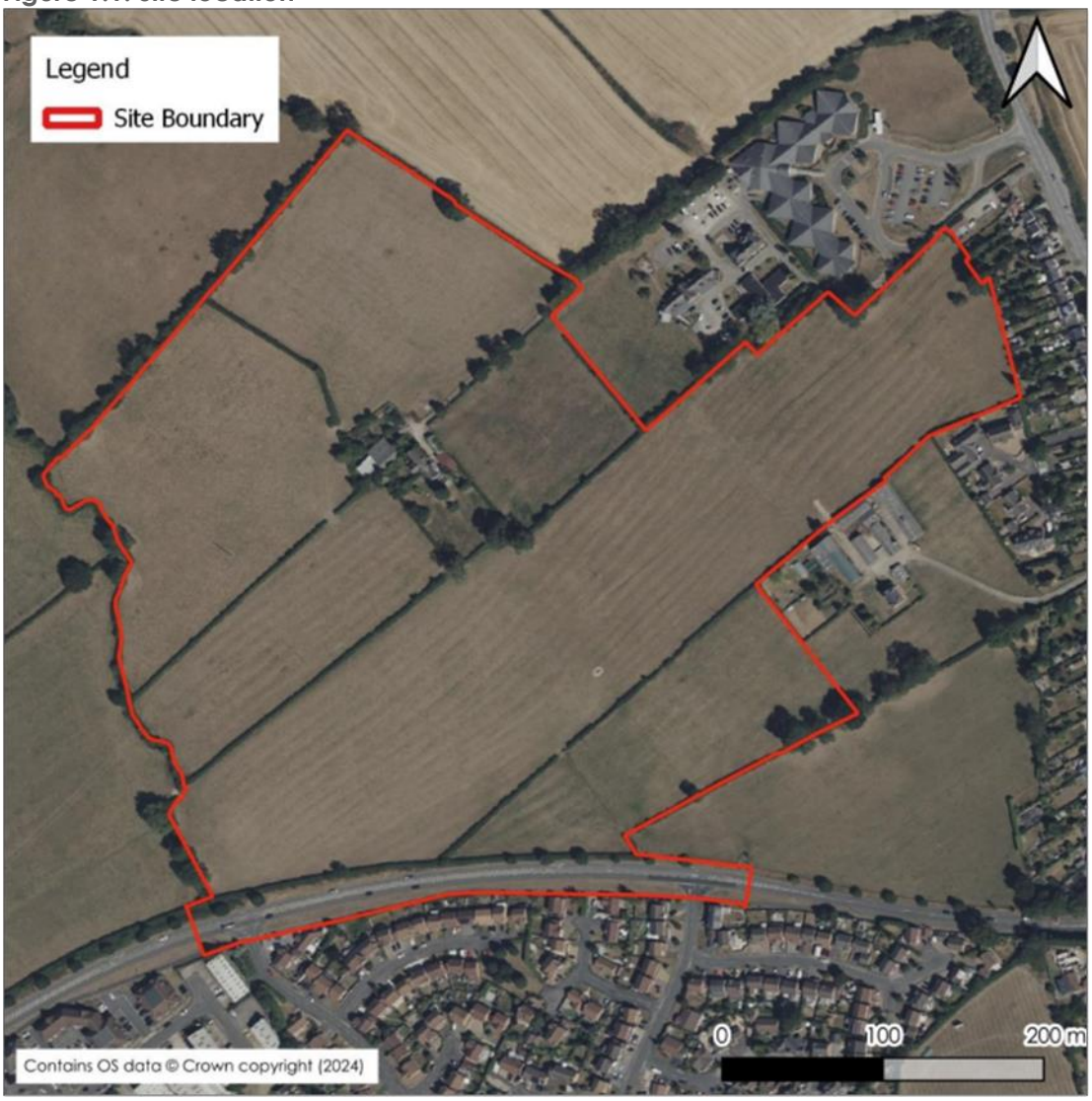
1.5 This report is necessarily technical in nature, so to assist the reader, a glossary of acoustic terminology can be found in **Appendix A**.

Site Setting

1.6 The Site currently comprises several existing structures amongst open farmland. The Site is bound by Normandy Way to the south with existing commercial and residential premises situated beyond. To the west the Site is bordered by Phase 1 of the development with Stoke Road beyond. To the north-west lies an existing farm with an existing residential building. To the north, the Site is bordered by open farmland with Hinckley and Bosworth Community Hospital to the north-east. To the east, the Site is bordered by residential dwellings off Ashby Road.

1.7 The location of the Site is shown in **Figure 1.1**.

Figure 1.1: Site location



Proposed Development

1.8 The proposed development comprises 415 dwellings with a MUGA close to the east boundary of the Site. The proposed site layout is shown below in **Figure 1.2.**

Figure 1.2: Site Layout Plan

2. STANDARDS AND GUIDANCE

National Planning Policy Framework (NPPF)

2.1 Published in December 2024, this document sets out the Government's planning policies for England. It makes the following reference to noise in the section entitled Conserving and enhancing the natural environment:

> "*187. Planning policies and decisions should contribute to and enhance the natural and local environment by:*
>
> *[…]*
>
> *e) 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."

2.2 It also makes the following references to noise in the Section entitled Ground conditions and pollution:

> "*198. 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[72];*
>
> *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.*
>
> *[72] See Explanatory Note to the Noise Policy Statement for England (Department for Environment, Food & Rural Affairs, 2010).*"

BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings

2.3 This standard provides guidance for the control of noise in and around buildings. The guidance provided within the document is applicable to the design of new buildings, or refurbished buildings undergoing a change of use, but does not provide guidance on assessing the effects of changes in the external noise levels to occupants of an existing building.

2.4 The guidance provided includes appropriate internal and external noise level criteria which are applicable to dwellings and office for steady external noise sources. It is stated that it is desirable that the internal ambient noise level does not exceed the following criteria set out in **Table 2.1** below:

Table 2.1: Summary of internal ambient noise levels to be achieved in habitable rooms

Activity	Location	Internal noise level criteria ($L_{Aeq,T}$, dB)	
		Daytime (07:00 - 23:00hrs)	Night-time (23:00 - 07:00hrs)
Resting	Living room	35	-
Dining	Dining room/area	40	-
Sleeping (daytime resting)	Bedroom	35	30

2.5 Whilst BS 8233:2014 recognises that a guideline value may be set in terms of Sound Exposure Level (SEL) or L_{AFmax} for the assessment of regular individual noise events that can cause sleep disturbance during the night-time, a specific criterion is not stipulated. Accordingly, reference has been made in this assessment to the World Health Organisation (WHO) 1999: Guidelines for Community Noise.

2.6 With respect to external amenity space such as gardens and patios it is stated that it is desirable that the 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. It is then confirmed that higher external noise criteria may be appropriate under certain circumstances such as within city centres urban areas, and locations adjoining the strategic transportation network, where it may be necessary to compromise between elevated noise levels and other factors such as convenience of living, and efficient use of land resource.

World Health Organisation (WHO) 1999: Guidelines for Community Noise

2.7 The World Health Organisation (WHO) guidance: 1999: Guidelines for community noise includes guidance for individual maximum noise events during the night-time. This document draws upon guidance from Vallet and Vernay, which states:

> "*For good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{AFmax} more than 10-15 times per night*"

Sport England Design Guidance Note – Artificial Grass Pitch (AGP) Acoustics – Planning Implications, 2015

2.8 The above guidance document expands on the general technical advice already available from Sport England. It provides details of acoustic implications associated with such facilities and follows on from an acoustic research programme involving detailed analysis of relevant noise guidance documents and site testing in a range of locations.

2.9 It proposes appropriate noise criteria and assessment methods and outlines practical measures that can be applied to reduce noise in particularly sensitive areas.

2.10 It refers to the World Health Organisation (WHO) document Guidelines for Community Noise (1999) which provides guidance for outdoor living areas that states that to avoid 'moderate annoyance' during the daytime and evening the noise level should not exceed 50dB $L_{Aeq,T}$. WHO guidelines for residential development are typically calculated over a 16-hour daytime period. For an artificial grass pitch, a 16-hour assessment period may not truly reflect the noise impact as it considers times of use and non-use. It is suggested an appropriate assessment period is for one hour, $L_{Aeq,1h}$ as this is typically the period for a community sports session on an AGP.

2.11 The document identifies that, from measurement data, a typical free-field noise level of 58dB $L_{Aeq,1h}$ at a distance of 10 metres (m) from the side-line halfway marking has been determined as representative for noise from an AGP. The document goes on to state that, when a site is in an open location, noise levels of 50dB $L_{Aeq,1h}$ can be achieved at a distance of 40m at 1.5m above local ground height.

Approved Document O (Overheating Mitigation)

2.12 This document provides guidance on how to comply with Part O of the building regulations. The aim of Part O of the building regulations is to protect the health and welfare of occupants of the building by reducing the occurrence of high indoor temperatures. Approved Document O (ADO) provides guidance on how to comply with Part O of the building regulations and applies to new residential development only.

2.13 Paragraphs 3.2 and 3.3 of ADO refer to noise within bedrooms at night. It is considered that the intention is to manage the impact from sound generated from all non-natural sources. Sources such as road, rail and air traffic, sources of an industrial or commercial nature, and sounds arising from entertainment venues are all within scope.

2.14 Paragraph 2.10 of ADO lists the means for removing excess heat as:

- *"Opening Windows*
- *Ventilation louvres in external walls*
- *A mechanical ventilation system*
- *A mechanical cooling system"*

2.15 Paragraph 3.2 of AD-O states:

"In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take into account of the likelihood that windows will be closed during sleeping hours (11pm to 7am)."

2.16 Paragraph 3.3 of AD-O states:

"Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.

(a) 40 dB $L_{Aeq,T}$ averaged over 8 hours (between 11pm and 7am).

(b) 55 dB L_{AFmax} more than 10 times a night (between 11pm and 7am)."

2.17 The document goes on to state that ventilators and windows should be open as required based on the overheating mitigation strategy. Where there is a natural ventilation strategy using open windows, the extent to which windows will need to be opened will depend on the physical arrangement, environmental conditions, and the number of room occupants, as determined in the CIBSE TM59 dynamic thermal modelling.

2.18 The Association of Noise Consultants (ANC) issued a guide in November 2024 entitled "Approved Document O Noise Guide".

2.19 Table 1 of this guidance document is replicated in **Table 2.4** and defines the noise levels at moderate and high-risk locations when considering the simplified assessment method.

Table 2.4: Noise Levels Using the Simplified Method

Parameter	High Risk Location	Moderate Risk Location
$L_{Aeq, 8h}$ averaged over 8 hours (between 11pm and 7am)	45 dB	50 dB
L_{AFmax} more than 10 times a night (between 11pm and 7am)	60 dB	65 dB

2.20 For clarity, the above table suggests that the sound insulation performance of the external building fabric when a window is open wide enough to comply with the guidance in ADO, is only in the region of 5 dB for high risk locations (where the opening is larger), and 10 dB for moderate risk locations (where the required window opening is smaller).

2.21 Where the simplified method cannot be used, dynamic thermal modelling is required following the procedures of CIBSE TM59. The equivalent area of the open windows required to mitigate overheating determined through thermal modelling can then be used to determine internal noise levels and compare against the ADO acoustic criteria.

Consultation with Hinckley and Bosworth Borough Council

2.22 In January 2022, consultation was undertaken with Mr. Simon Smith, Senior Environmental Health Officer at Hinckley and Bosworth Borough Council via email. A response was received from Mr. Smith on 21st January 2022, agreeing to the methodology.

2.23 Following the baseline noise survey, further consultation was undertaken with Mr Smith, where it was also agreed that noise associated with the existing commercial premises to the south need not to be considered within the assessment as road traffic was dominant during periods of observation.

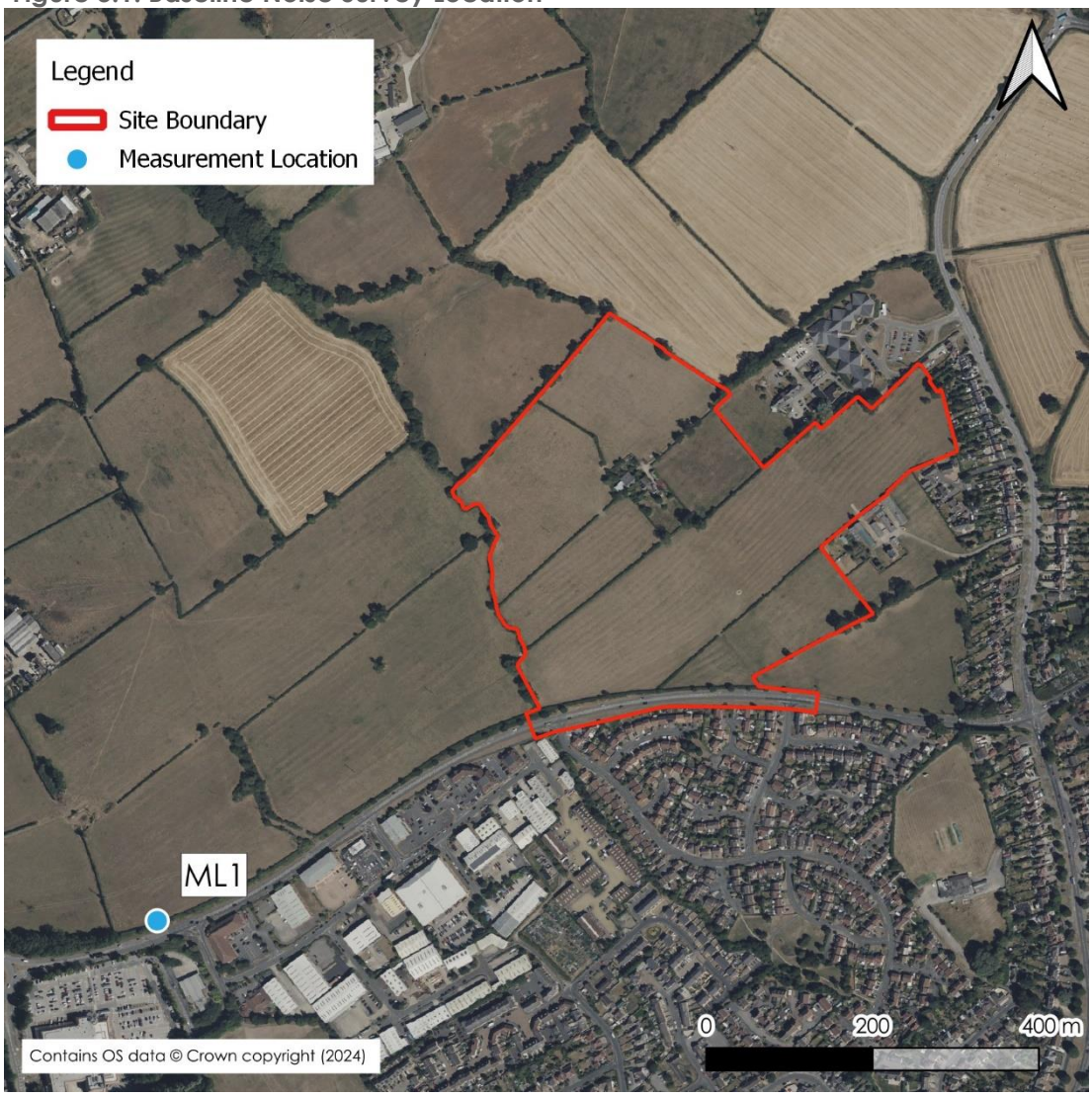
2.24 As part of the consultation, Mr Smith noted that should the existing farm remain as an operating premises, consideration should be given to the impact of noise associated with farm operations within the assessment.

2.25 Mr Smith provided further correspondence on 18th October 2023 in which he advised that he had been out to the Site to investigate whether plant noise from Hinckley and Bosworth Community Hospital to the north-east would pose a noise constraint. Mr Smith confirmed that having visited the Site, he was satisfied that noise from plant associated with the hospital need not be considered.

3. BASELINE NOISE SURVEY

3.1 A baseline noise survey was undertaken to inform the outline application in January 2022. The results of which have been utilised to determine noise levels incident on the Site due to road traffic on Normandy Way to the south. The measurement location adopted during the survey is identified in **Figure 3.1**.

Figure 3.1: Baseline Noise Survey Location



Survey Methodology

Noise Measurement Location 1 (ML1)

3.2 Noise measurements were undertaken at ML1 over a 24-hour period commencing at 15:00 on Thursday 27th January 2022. The microphone at ML1 was established at 1.8 m above local ground level and at 15 m from nearside kerb edge of Normandy Way to the south. The noise climate at ML1 was dominated by road traffic on Normandy Way.

Measurement Equipment

3.3 The baseline noise survey was undertaken using the Class 1 specification noise measurement equipment detailed in **Table 3.1**. Equipment was calibrated using a portable calibrator immediately before and after the measurements with no significant drift in calibration observed. The sound level meter, pre-amplifier and microphone were calibrated to UKAS standards at an accredited laboratory within the 24 months prior to the measurements. The portable calibrator was calibrated within the 12 months preceding the date of the survey.

Table 3.1: Noise Measurement Equipment

Position	Equipment	Make & Model	Serial Number
ML1	Sound Level Meter	SVAN 971	60745
	Microphone	ACO 7052E	64535
	Preamp	SV18	66815
	Calibrator	B&K DB0311	449050

Meteorological Conditions

The weather throughout the survey remained conducive to environmental noise measurement, it being dry with winds <5ms^{-1}.

Measurement Results

3.4 A summary of measured sound pressure levels at ML1 is presented in **Table 3.2 and**

3.5 **Table** 3.**3** below. Further details of the survey data are presented in **Appendix B.**

Table 3.2: Summary of Measured Sound Pressure Level at ML1

Period	Start Time	Period (T)	dB $L_{Aeq,T}$	dB $L_{A90,T}$[2]	dB L_{AFmax}[3]
Daytime	27/01/2022 15:00	16-hours	62[1]	56	-
Night-Time	27/01/2022 23:00	8-hours	56	37	74

[1] logarithmic average $L_{Aeq,15mins}$ noise level between 15:00 – 23:00 on 27/01/22 and between 07:00 – 15:00 on 28/01/22
[2] arithmetic average $L_{A90,15mins}$ during measurement period
[3] 10th highest L_{AFmax} noise levels during measurement period

Table 3.3: Summary of Octave Band Measured Sound Pressure Levels at ML1

Period	Sound Pressure Level (dB) per Octave Band (Hz)							
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Daytime	70	64	60	53	59	56	46	39
Night-Time	63	57	53	45	52	50	40	30

4. ASSESSMENT

4.1 This assessment considers noise from roads, farm and the proposed MUGA on proposed sensitive receptors.

Noise Model

4.2 A detailed noise model has been generated in order to calculate the impact of road traffic noise from Normandy Way and the roundabout on the proposed residential dwellings, based on the following methodology:

- The noise model was set up to apply the noise prediction methodology set out in the 1988 Department of Transport and the Welsh Office document Calculation of Road Traffic Noise for road traffic noise sources;
- Mapping of the Site and the surrounding area was calibrated into the noise model based on known Ordinance Survey grid reference points;
- Ground topography was approximated using publicly available Lidar Data from DEFRA;
- Off-site buildings which would provide screening to the Site have been incorporated as reflective façades;
- To reflect the local ground cover, ground absorption was set to G = 0.5 (50% acoustically absorptive ground);
- The model was set to include second order reflected noise from solid structures;
- The noise model has been calibrated using original on-site measured noise levels. Corrections have been applied at the roundabout to the south of The Site, where a lower speed has been assumed.

4.3 **Figures 4.1** and **4.2** present the predicted noise contours across the site from road traffic on Normandy Way.

Figure 4.1: Daytime Road Noise Contours at 1.5 m Height, dB $L_{Aeq,16h}$

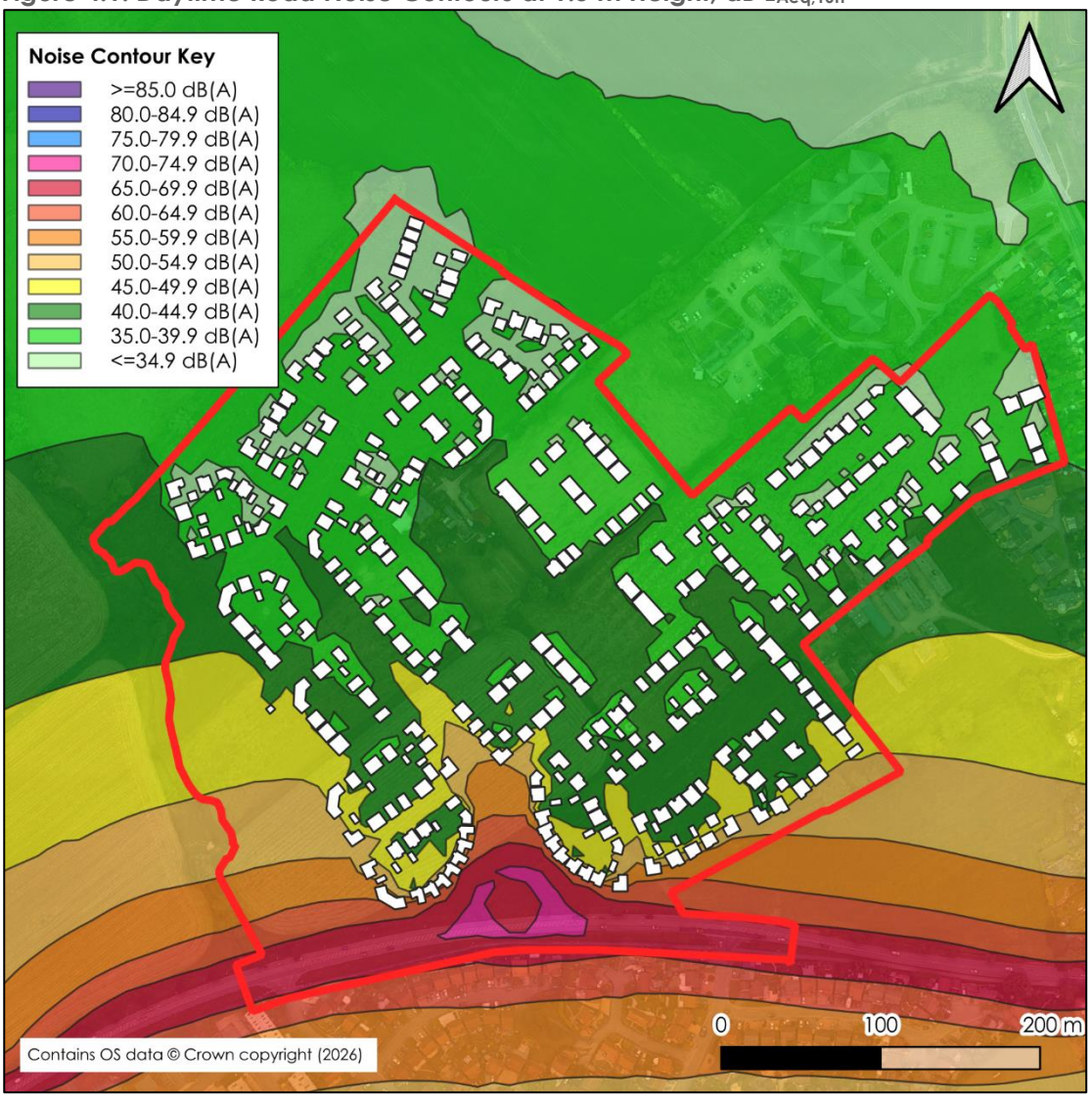
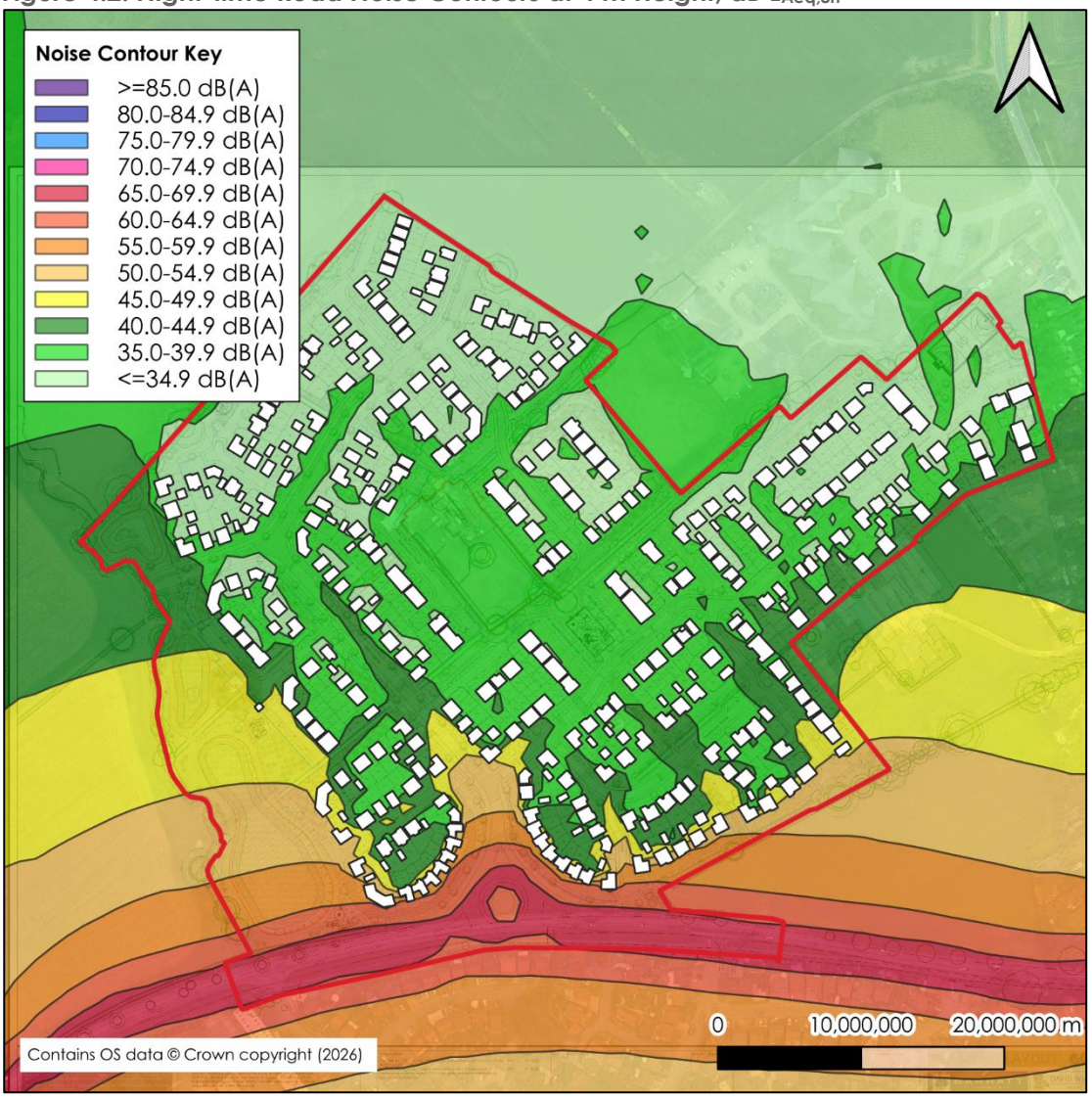


Figure 4.2: Night-time Road Noise Contours at 4 m Height, dB $L_{Aeq,8h}$



4.4 A maximum noise level of 74 dB L_{AFmax} has been used in the assessment for dwellings closest to the road, where the measurement position was a similar distance from the road as the proposed worst-case dwellings. For dwellings further back into the site, L_{AFmax} has been calculated based on propagation from a point source.

External Daytime Noise Levels

4.5 Due to the acoustic screening provided by proposed intervening buildings, the model calculates that in all instances external garden amenity areas will, in all cases, be lower than 55 dB $L_{Aeq,16h}$ and in the vast majority of cases will be lower than 50 $L_{Aeq,16h}$. These levels are considered acceptable based on BS 8233 guidelines.

Internal Noise Levels

4.6 The results of the noise modelling and calculations indicate noise levels at the worst affected receptors of 62 dB $L_{Aeq,16h}$ and 57 dB $L_{Aeq,8h}$ for daytime and night-time, respectively. The night-time L_{AFmax} noise level is 74 dB.

4.7 Assuming a 15 dB loss through a partially opened window, this would result in internal noise levels of 47 dB $L_{Aeq,16h}$ and 42 dB $L_{Aeq,8h}$ for daytime and night-time, respectively. A partially opened window would also result in an internal noise level of 60 dB L_{AFmax} during the night-time. Therefore, the criteria of 35 dB for the daytime and 30 dB and 45 dB $L_{AF,max}$ for the night-time, are likely to be exceeded/met, assuming partially opened windows. Consideration has been given to mitigation in Section 5.

Noise from Farm Operations

4.8 Consideration has been given to potential noise impacts from the existing farm situated within the centre of the Site, which is served by an access road extending to the north-east boundary.

4.9 From a review of available information, the farm appears to be solely arable farming and therefore likely to operate on a seasonal basis. As the baseline noise survey was undertaken during the winter months, operations at the farm were not considered to be typical.

4.10 To inform the assessment, measured library data of similar operations have been considered. Given the nature of the operations, it is considered likely that the most dominant source of noise will be from vehicle movements within the farm and along the access road. Tractor movements have therefore been considered for both the daytime and night-time periods.

4.11 In the absence of specific noise measurements, data for a tractor pass-by is included in **Table 4.1** which is considered to be representative of a tractor travelling along the Site access road.

Table 4.1: Summary of Historic Pass-by Noise Data Used in Assessment

Source	BS 5228 Ref	Pass by at 10m, dB $L_{AF,max}$
Tractor towing trailer	C.4, item 75	79

4.12 The noise levels from a tractor passby has been calculated using the *Method for mobile plant using a regular well-defined route (e.g. haul roads*) from BS 5228-1:2019+A1:2014[1], which is shown below:

$SWL = L_{Amax@10m} + 28$

4.13 In calculating the level of noise produced by tractor pass-bys on the site access road, two tractor movements have been assumed and vehicle speed of 10mph (16kmph) have been accounted for. The following equation has been used:

$$L_{Aeq,1hr}=L_{WA}\text{-}33+10\log_{10}Q\text{-}10\log_{10}V-10\log_{10}(d)$$ (BS5228-1:2009+A1:2014(F.6)).

Where:

[1] British Standards Institute (2014), British Standard (BS) 5228-1:2009+A1:2014 – Code of practice for noise and vibration control on construction and open sites. Part 1: Noise

L_{WA}	sound power level of the plant;
Q	number of vehicles per hour; and
V	average vehicle speed in km/h.
d	distance in m.

4.14 **Table 4.2** calculates the level of noise from the farm access road as per the calculation detailed in BS 5228-1:2009+A1:2014. The sound power level used in equation F.6 has been derived from the sound pressure level in **Table 4.1**.

Table 4.2: Calculation of Noise Level from the Access Road

Period	L_{WA}	Number of vehicles per period	Average vehicle speed in km/h	Sound pressure level of access road at 9m $L_{Aeq,1hr}$
Day	107	2	16	55

4.15 Based on the worst-case dwelling distance of 9m from the access road, the above indicates that at worst, this would achieve the recommended upper guideline threshold of 55 dB $L_{Aeq,T}$ in line with BS 8233.

4.16 Assuming a 15 dB loss through a partially opened window, this would result in internal levels of 40 dB $L_{Aeq,1h}$ for daytime and night-time periods, the criteria of 35 dB for the daytime and 30 dB for the night-time, are likely to be exceeded, assuming partially opened windows. This represents a worst-case scenario, where the farm access road is not likely to be used continuously.

4.17 A partially opened window would also result in an internal level of 64 dB L_{AFmax} during the night-time which would exceed the criteria of 45dB L_{AFmax}. However, given that this criterion should not be exceeded more than 10-15 times per night, and vehicle pass-bys will likely be the only dominant source within the site itself, it is considered unlikely that there would be more than 15 pass-bys during the night-time period. Therefore, the predicted L_{AFmax} level is considered to be acceptable.

4.18 Consideration will be given to mitigation of farm access road noise in Section 5.

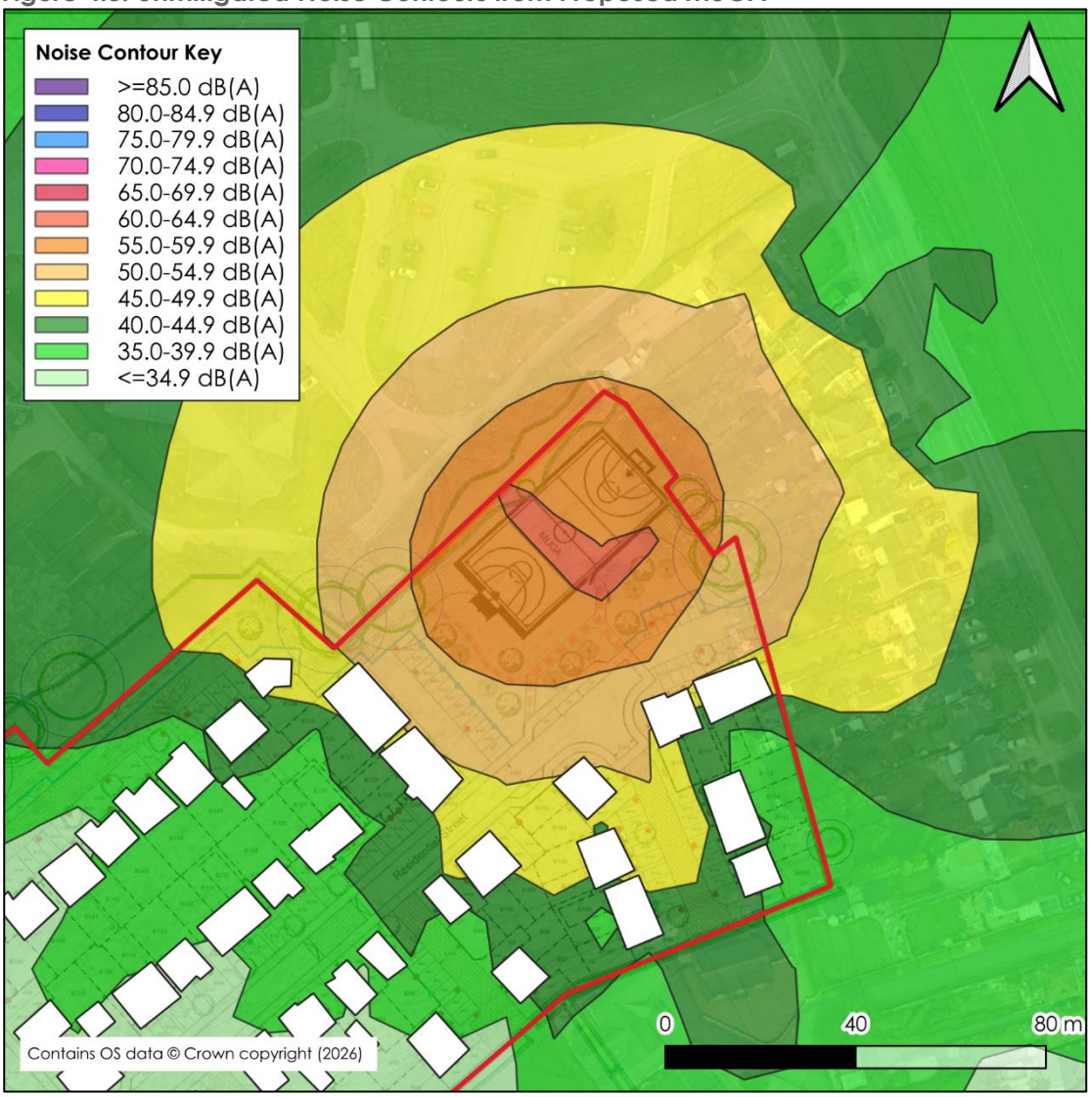
Noise from the Proposed Sports Pitches

4.19 An assessment has been undertaken to determine the potential noise levels generated by the proposed MUGA at existing and proposed residential receptors. Reference has been made to available assessment guidance set out in Sports England AGP Acoustics Note to estimate likely noise levels associated with the proposed MUGA.

4.20 The Sports England AGP Acoustics Note document has been compiled to enable assessment of artificial grass pitches and presents reference assessment data based on empirical measurements of sports sessions. It sets out a reference assessment level of 58 dB $L_{Aeq,1hr}$ taken at 10 m from the sideline halfway marking of a pitch as the representative worst-case source level for use in assessing noise propagation from these types of activities.

4.21 The proposed MUGA has been included in the noise model as an area source at 1.5m height, calibrated to a sound pressure level of 58 dB $L_{Aeq,T}$ at 10 m from the half way line in accordance with AGP guidance. The resultant noise contours are shown below in **Figure 4.3.**

Figure 4.3: Unmitigated Noise Contours from Proposed MUGA



4.22 It is considered that the façades of the nearest plots could be exposed to noise levels in the region of 53 dB $L_{Aeq,1hr}$ based on the noise contours shown in **Figure 4.3**.

4.23 Assuming a 15 dB loss through a partially opened window, this would result in an internal noise level of 38 dB $L_{Aeq,16h}$ for the daytime. Therefore, the criteria of 35 dB $L_{Aeq,16h}$ for the daytime is expected to be exceeded at proposed dwellings closest to the sports pitches and further consideration to mitigation is warranted.

Overheating

4.24 Consideration has been given to the balance between habitable noise levels within internal spaces and thermal comfort. This assessment is based on guidance set out in

ADO, the ANC "Approved Document O Noise Guide" and the predicted noise levels at the facades of proposed receptors.

4.25 As this is a moderate risk location as defined in ADO, the resulting outside-to-inside level difference for window openings necessary to satisfy the simplified method of ADO is expected to be 10 dB in line with the guidance in the ANC "Approved Document O Noise Guide".

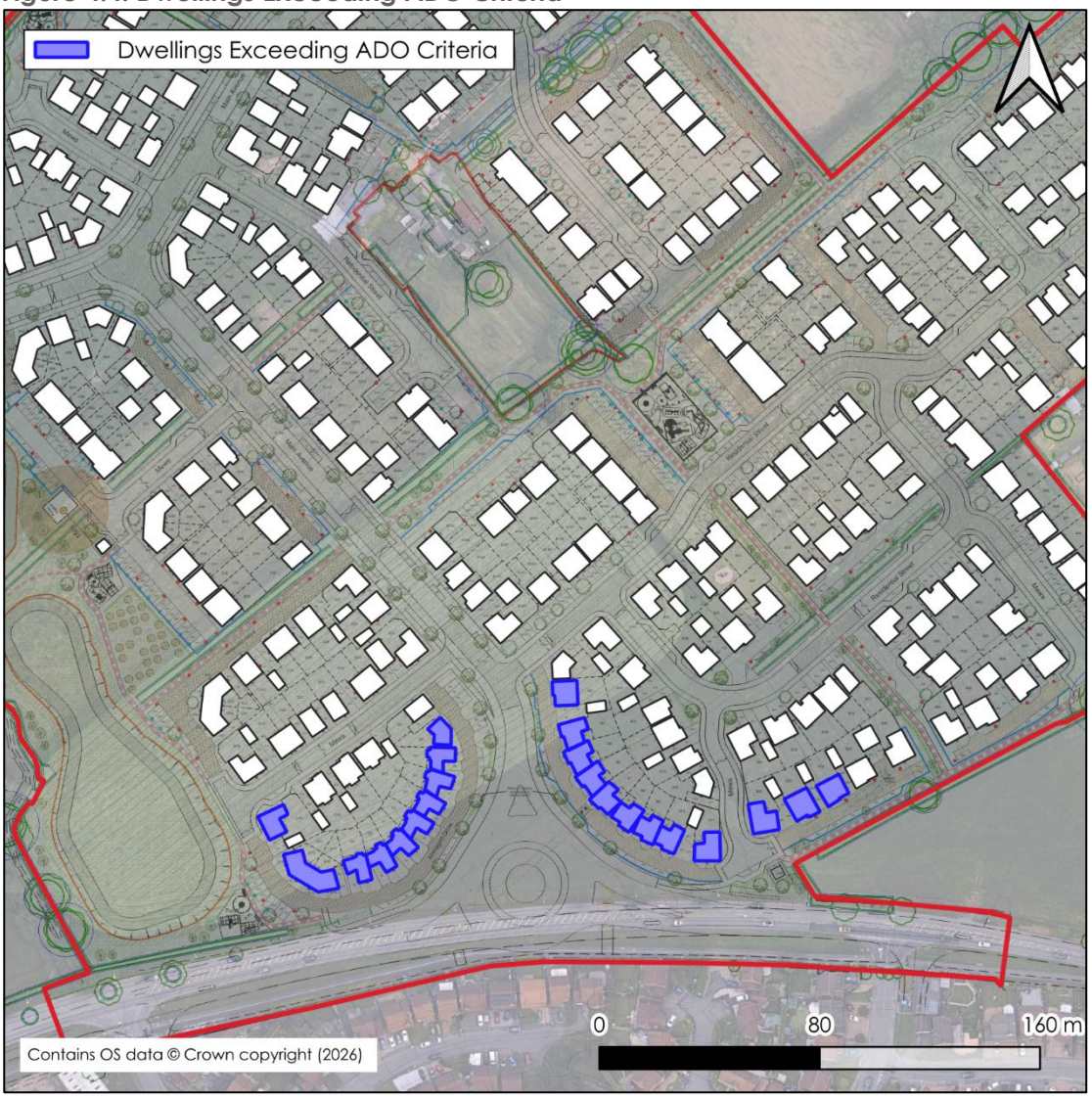
4.26 Therefore, to show the adopted criteria as stated in Approved Document O is achieved using the simplified method, the noise level at the facade of proposed properties should not exceed the following during night-time:

a. 50 dB $L_{Aeq,T}$, averaged over 8 hours (between 11pm and 7am).
b. 65 dB L_{AFmax}, more than 10 times a night (between 11pm and 7am)."

4.27 Based on the predicted road noise levels, these criteria are exceeded at some dwellings. **Figure 4.4** shows the proposed dwellings which are expected to exceed the criteria given in ADO and the ANC Approved Document O Noise Guide.

4.28 It should be noted that farm access road noise levels are not expected to exceed ADO criteria at the nearest receptors, where the access road is not expected to operate continuously through he night.

Figure 4.4: Dwellings Exceeding ADO Criteria



4.29 For proposed dwellings indicated with red hatch in **Figure 4.4**, the simplified method cannot be applied due to the influence of external noise. Consequently, dynamic thermal modelling, following the procedures of CIBSE TM59, is required to assess the risk of overheating under realistic occupancy and environmental conditions. As part of this assessment, the equivalent openable window areas necessary to mitigate overheating will be identified. These window areas can then inform an internal noise assessment, allowing comparison with the ADO acoustic criteria.

4.30 For proposed dwellings not highlighted in **Figure 4.4**, the internal noise criteria for ADO are met. Openable windows could be a viable strategy for mitigating overheating without compromising the internal acoustic environment. However, confirmation of the overheating strategy requires completion of a TM59 assessment.

5. MITIGATION

5.1 In **Section 4**, it has been determined that consideration should be given to mitigation measures to protect the amenity of sensitive receptors associated with the proposed development.

Internal Noise Levels – Road and Farm Noise

5.2 In order to assess the noise mitigation required to ensure an adequate level of protection against noise, it is appropriate to explore in the first instance the protection that could be afforded by the sound insulation performance of the external building fabric, and in particular the glazing elements.

5.3 Detailed noise break-in calculations have been undertaken in accordance with the rigorous method from section G.2 from BS 8233 based on the frequency spectra measured on Site and the following assumed dimensions and assumptions;

- Room dimensions of 3m (width) x 3 m (depth) x 2.5 m (height);
- Double glazed window dimensions of 1.8 m (width) x 1.2 m (height);
- External building fabric elements shall achieve a sound reduction performance of at least $R_w + C_{tr}$ 48 dB;
- A reverberation time of 0.5 seconds; and
- Assumed ventilator(s) provide an equivalent area of 8000 mm^2 per habitable room, in accordance with Approved Document F.

5.4 To achieve the daytime internal noise criterion of 35 dB $L_{Aeq,16h}$ adopted for this assessment, based on the façade closest to Normandy Way experiencing 62 dB $L_{Aeq,16h}$ free-field at the facade, a reduction of 27 dB would be required for habitable rooms. To achieve the internal criteria of 30 dB $L_{Aeq,8h}$ and 45 dB L_{AFmax} during the night-time, adopted for this assessment, a reduction of up to 29 dB would be required for habitable rooms.

5.5 The ventilation required for each dwelling is shown in **Figure 5.1** with the details of the glazing and ventilation in **Table 5.1**.

Figure 5.1: Glazing and Ventilation Requirements

Table 5.1: Example Glazing and Ventilation Requirements

Colour	Example Glazing	$R_w + C_{tr}$	Example Ventilation	$D_{n,e,w} + C_{tr}$	Equivalent Area and Number of Ventilators
Red	8 mm / (6-16mm) / 4 mm double glazing	29	Greenwood 2500EA + 1 Acoustic Set	40	Assumed 3no. ventilators are required to meet 8000mm²
Green	4 mm / (6-16mm) / 4 mm double glazing	25	Greenwood 2500EA	36	

5.6 For dwellings that are located further back into the Site that benefit from screening provided by the development itself, shown with no colour indicator on **Figure 5.1**, it is likely that standard double glazing and hit and miss ventilators will be sufficient to mitigate noise to acceptable levels.

5.7 The octave band sound reduction index levels for the specified glazing and ventilation is provided in **Tables 5.2 and 5.3** below.

Table 5.2: Advised Glazing Specification

Product	Octave Band Sound Reduction (SRI) (L_{eq} dB)								$R_w + C_{tr}$
	63 Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz	
8 mm / (6-16mm) / 4 mm double glazing	18	22	21	28	38	40	47	52	**29**
4 mm / (6-16mm) / 4 mm double glazing	17	21	17	25	35	37	31	36	**25**

Table 5.3: Advised Ventilation Specification

Product	Octave Band Level Difference for Ventilators (L_{eq} dB)								$D_{n,e,w} + C_{tr}$
	63 Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz	
Greenwood 2500EA + 1 Acoustic Set	32	41	39	36	42	44	45	45	**40**
Greenwood 2500EA	39	45	44	40	35	34	38	38	**36**

5.8 The above presents solutions to satisfy the proposed internal ambient noise limits within habitable room during normal ventilation conditions.

5.9 **Table 5.4** shows the resultant internal noise levels in the worst affected rooms and demonstrates that BS 8233 and WHO guidance can be met subject to implementation of the mitigation recommended in this section.

Table 5.4: Predicted External and Internal Noise Levels with Mitigation, dB

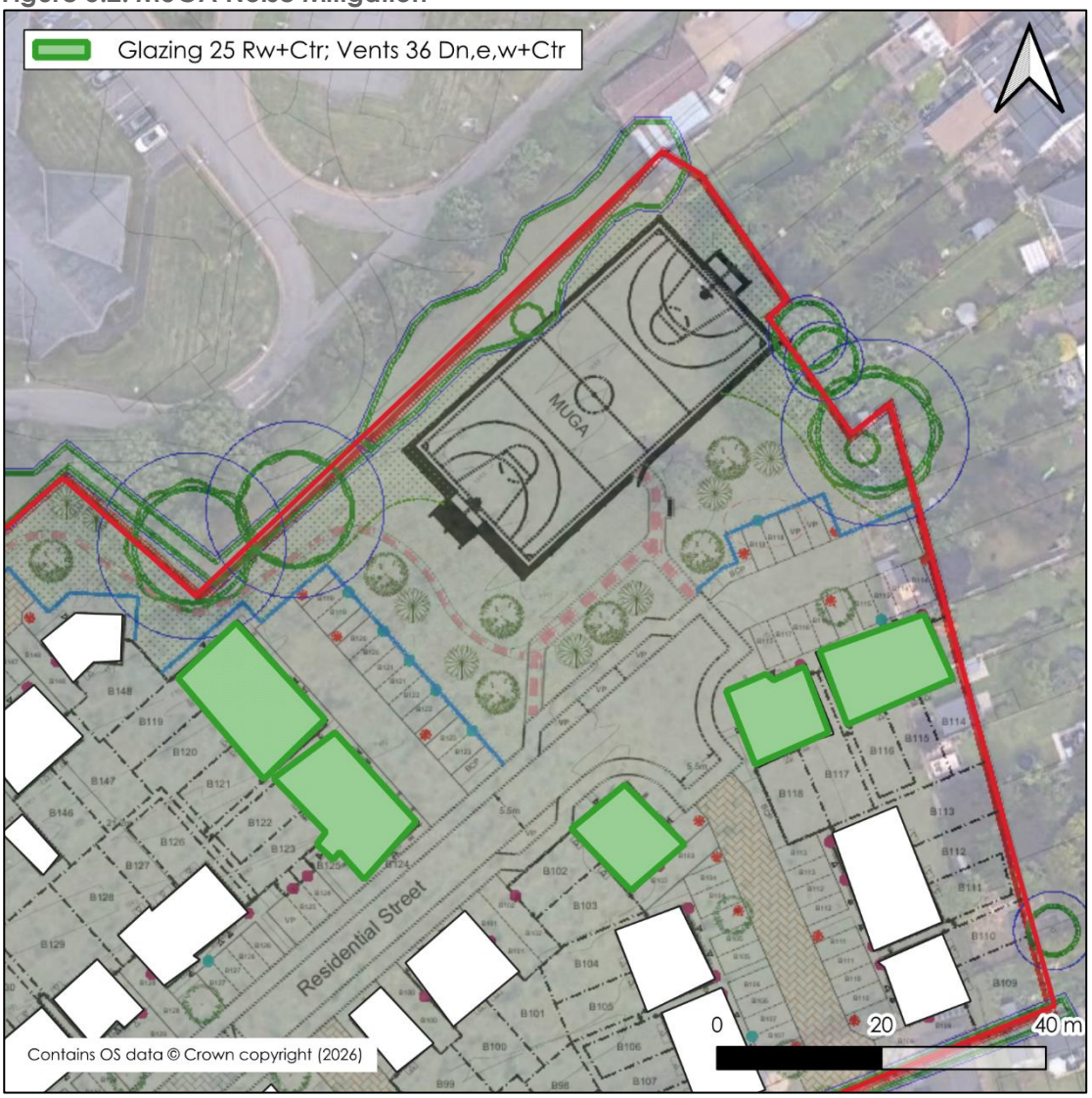
Dwelling Category	Highest Predicted External Noise Level, Free-field, dB			Resultant Internal Noise Level, dB		
	$L_{Aeq,16h}$	$L_{Aeq,8h}$	L_{AFmax}	$L_{Aeq,16h}$	$L_{Aeq,8h}$	L_{AFmax}
Red	62	57	74	34	28	45
Green	57	51	69	33	27	45
No indicator	Facades with no colour indicator achieve recommended internal noise levels with standard double glazing and hit and miss ventilators					

MUGA Mitigation

5.10 The assessment in Section 4 has identified that noise from the unmitigated MUGA is expected to exceed AGP guidance noise levels at the nearest receptors. As such, mitigation options have been explored.

5.11 It is recommended that noise can be suitably mitigated using the 'green' glazing and ventilation strategy on affected dwellings. Figure 5.2 shows dwellings where 25 dB R_w + C_{tr} glazing and 36 dB $D_{n,e,w}$ + C_{tr} vents are required.

Figure 5.2: MUGA Noise Mitigation



6. CONCLUSIONS

6.1 This noise impact assessment has been prepared by BWB Consulting (BWB) on behalf of Barrat Homes (the Client) in support of a reserved matters application for a proposed residential development comprising 415 dwellings (The Site).

6.2 A baseline noise survey was undertaken to inform the outline application in January 2022 and has been used for the basis of the subsequent assessment. A detailed noise assessment has been undertaken in accordance with current standards and guidance; and a condition enforced by Hinckley and Bosworth Borough Council.

6.3 Predictive noise modelling has demonstrated that all private garden areas are expected to achieve the upper guideline level of 55 dB $L_{Aeq,16h}$ in accordance with BS 8233. Therefore, mitigation will not be required to reduce noise levels in outdoor living areas of any dwelling.

6.4 The assessment shows that with appropriate noise mitigation measures including the provision of appropriate glazing and ventilation strategies, noise break-in from road and farm noise can be adequately controlled in accordance with BS 8233 guidance.

6.5 Noise from the unmitigated MUGA is expected to exceed AGP guidance noise levels at the nearest receptors. Mitigation has been recommended in the form of a suitable glazing and ventilation strategy for affected dwellings.

6.6 An assessment of overheating has found that some dwellings are expected to exceed the criteria given in Approved Document O. For these dwellings, the simplified method cannot be applied due to the influence of external noise. Consequently, dynamic thermal modelling, following the procedures of CIBSE TM59, is required to assess the risk of overheating under realistic occupancy and environmental conditions.

APPENDICES

APPENDIX A: Glossary of Acoustic Terms

Noise

Noise is defined as unwanted sound. Human ears are able to respond to sound in the frequency range 20 Hz (deep bass) to 20,000 Hz (high treble) and over the audible range of 0 dB (the threshold of perception) to 140 dB (the threshold of pain). The ear does not respond equally to different frequencies of the same magnitude but is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates the response of the human ear, a weighting mechanism is used. This reduces the importance of lower and higher frequencies, in a similar manner to the human ear.

Furthermore, the perception of noise may be determined by a number of other factors, which may not necessarily be acoustic. In general, the impact of noise depends upon its level, the margin by which it exceeds the background level, its character and its variation over a given period of time. In some cases, the time of day and other acoustic features such as tonality or impulsiveness may be important, as may the disposition of the affected individual. Any assessment of noise should give due consideration to all of these factors when assessing the significance of a noise source.

The most widely used weighting mechanism that best corresponds to the response of the human ear is the 'A'-weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or L_{Aeq}, L_{A90} etc., according to the parameter being measured.

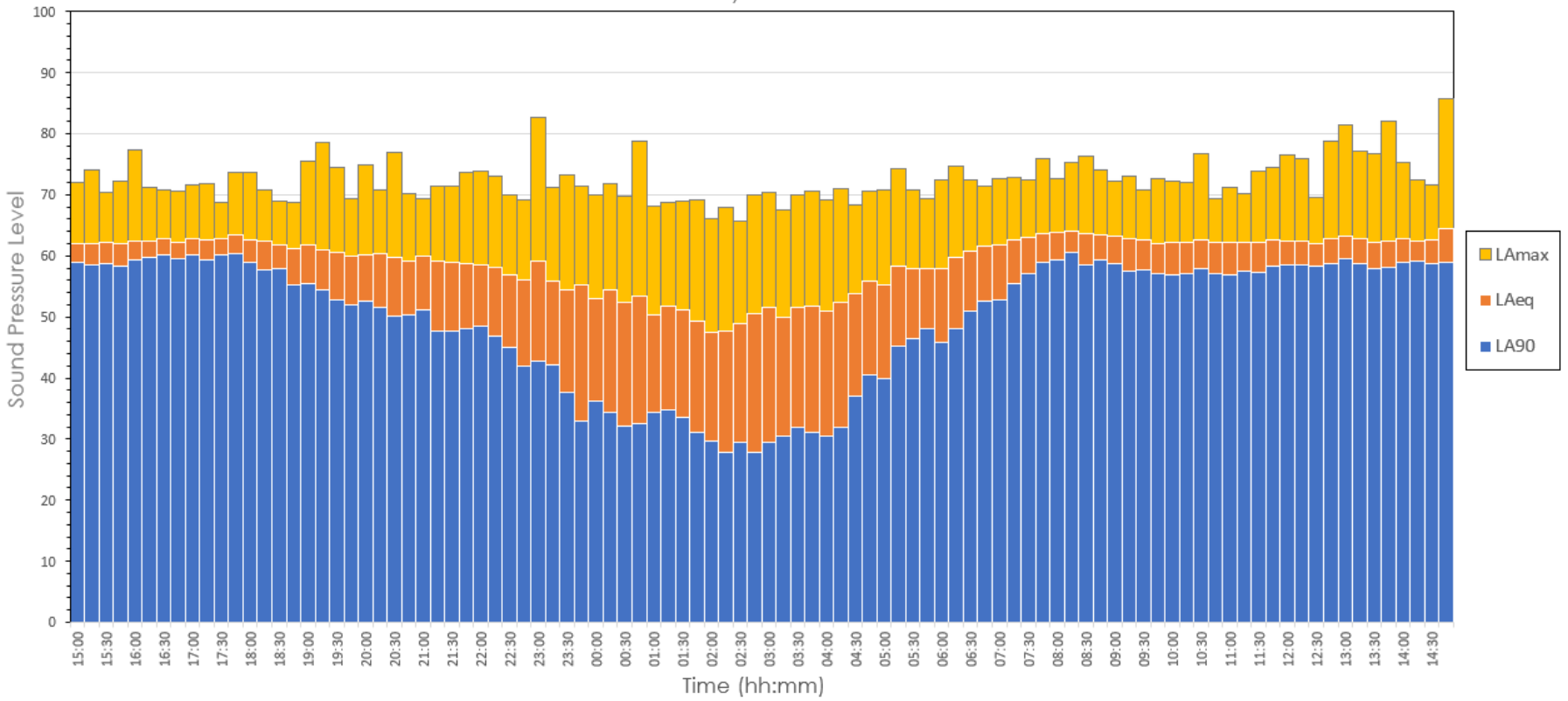
The decibel scale is logarithmic rather than linear, and hence a 3 dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective, but as a general guide a 10 dB(A) increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3 dB(A) is generally regarded as the minimum difference needed to perceive a change under normal listening conditions.

Acoustic Terminology

Term	Description
dB (decibel)	The scale on which sound pressure level is expressed. Sound pressure level is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure (2x10-5Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' - weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
$L_{Aeq,T}$	L_{Aeq} is defined as the notional steady sound level which, over a stated period of time (T), would contain the same amount of acoustical energy as the A - weighted fluctuating sound measured over that period.
L_{Amax}	L_{Amax} is the maximum A - weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L_{10} and L_{90}	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L_{10} is the level exceeded for 10% of the time, and the L_{90} is the level exceeded for 90% of the time.
Sound Power Level, L_w	logarithm of the ratio of a given sound power to the reference sound power. Such power level in decibels is ten times the logarithm to the base ten of the ratio. unless otherwise specified, the reference sound power is 1 pW. Sound power is the total sound energy radiated by a sound source and measured in watts (W). Sound power level
Free-field Level	A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other reflective surfaces. Generally as measured outside and away from buildings.
Façade Level	A sound field determined at a distance of 1m in front of a large sound reflecting object such as a building façade.
R/R_w	R is the laboratory measurement of the sound insulating properties of a material or building element in a stated frequency band R_w is the weighted Sound Reduction Index a single number quantity which characterises the airborne sound insulation of a material or building element over a range of frequencies, based on laboratory measurements.
D_{ne}/$D_{ne,w}$	D_{ne} is the laboratory measured level difference of a building element which has been normalised to a referenced absorption of $10m^{2.}$ $D_{ne,w}$ is the weighted element-normalised level difference. This is a single number quantity which characterises the airborne sound insulation of a building element over a range of frequencies, based on laboratory measurements.
C_{tr}	Spectrum Adaptation Terms (C and C_{tr}) the single number rating method defined in BS EN ISO 717 uses a standard reference curve to determine the weighted value of airborne sound insulation. The spectrum adaptation term C_{tr} is used to take into urban traffic noise.

APPENDIX B: Noise Survey Data

Hinckley North
ML1 - Time History Graph
27th - 28th January 2022



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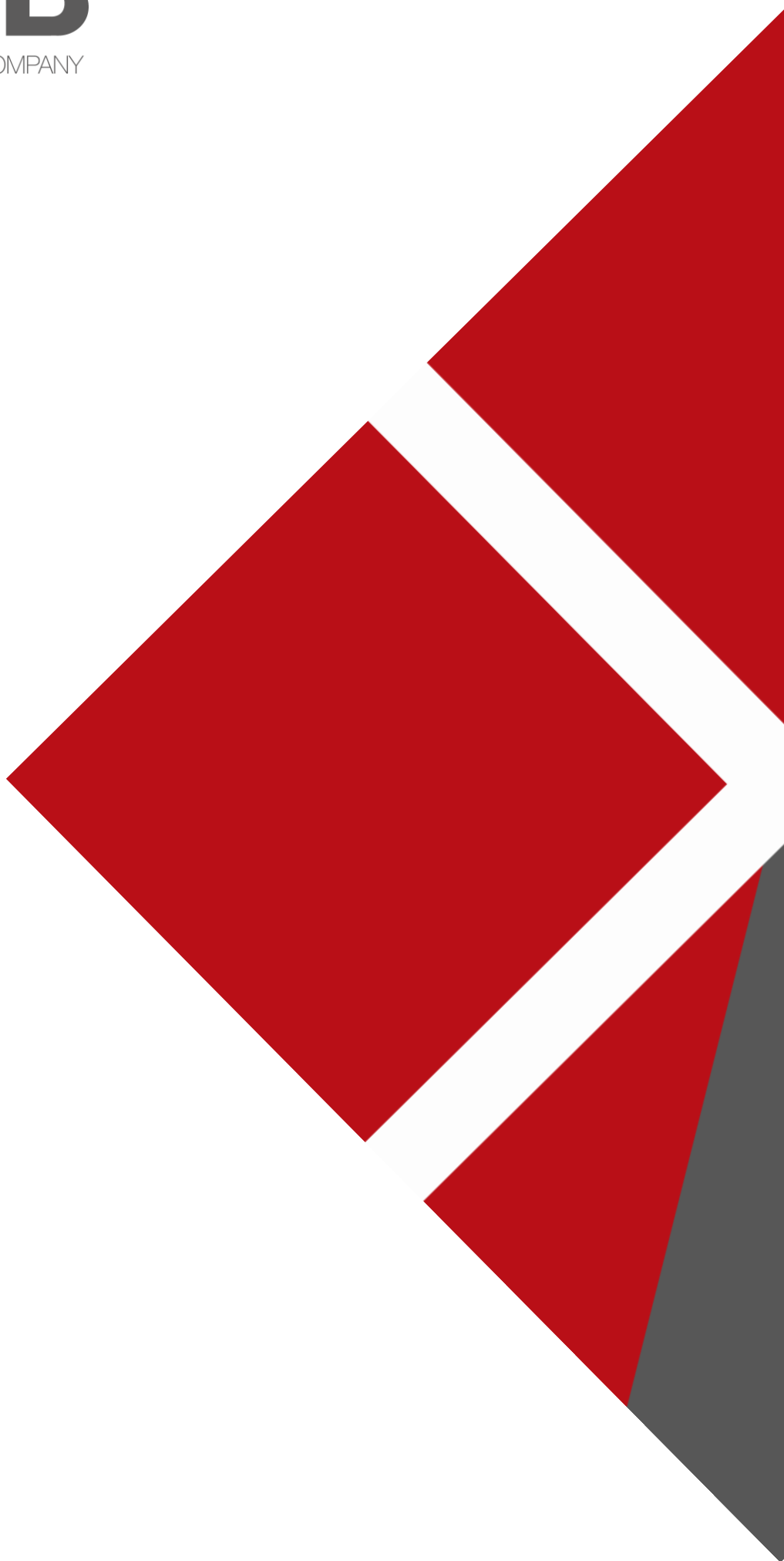

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