



NOISE MITIGATION SCHEME

LAND SOUTH OF MARKFIELD ROAD, RATBY
- PHASE 2

Lagan Homes Limited

2062442-RSKA-RP-002-(01)





General notes

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Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

This work has been undertaken in accordance with the quality management system of RSK Acoustics Ltd.



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1 Introduction

1.1 Instruction

RSK Acoustics (RSKA) has been appointed by Lagan Homes Ltd to undertake a noise assessment to discharge noise related planning conditions, pursuant to outline planning application ref: 22/00648/OUT (dated 01 July 2022) for their Phase 2 development on Land South of Markfield Road, Ratby, Leicestershire.

Outline planning permission was granted on 18 September 2023 for residential development of up to 75 dwellings alongside associated site infrastructure and open space, with all matters reserved except for access.

This report provides the supporting information required to discharge planning Condition 11 relating to the operational phase noise levels incident on the proposed dwellings. The report describes the assessment methodology, baseline conditions (obtained from a survey undertaken in June 2022 by M-EC Ltd) prevailing across the site and proposed mitigation scheme, sufficient to ensure appropriate acoustic conditions are met within internal and external amenity space.

1.2 Relevant Planning Condition(s)

Planning Condition 11, applicable to noise states:

“Development shall not begin until a scheme for protecting the proposed dwellings from noise from the nearby road network has been submitted to 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.

Reason: To prevent and mitigate noise pollution in accordance with Policy DM7 of the Site Allocations and Development Management Policies DPD 2016.”

1.3 Site Location and Description

The site is located approximately 850 metres, north-west of Ratby, immediately west of a new residential development (planning reference: 20/00462/FUL), which is understood to be in the final phases of construction at the time of writing this report.

The north of the site is bordered by open fields, leading to Markfield Road, with the aforementioned new development immediately east of the site, with existing residential areas further east. To the south of the site is agricultural farmland, leading to Burroughs Road approximately 150 metres from the site boundary. To the west of the development is woodland, namely Pear Tree Wood and Burroughs Wood.

The M1 motorway is approximately 500 metres from the northern and eastern site boundaries, flowing in a north-west and south-east direction.

1.4 Development Proposals

The development proposals comprise of 75 dwellings across 2.26 hectares, through a mix of 1 to 5 bed houses and two 2-storey apartment blocks (ground and first floor), with a buffer zone incorporated into the design adjacent to Markfield Road. An internal road is adjoined to the existing network via Markfield Road to the north with existing public right of way footpaths retained.

Figure 1 below shows the proposed site layout and application boundary of the development.





Figure 1 – Site Layout Plan (Drawing No: LWRAT-MCB-ZZ-ZZ-DR-A-0230, Status D5-P3)



2 Guidance Documents

2.1 British Standard 8233:2014 ‘Guidance on sound insulation and noise reduction for buildings’

Guidance on the acceptable noise levels for living rooms and bedrooms within residential buildings is given in BS 8233:2014. Advice is given on the design range of internal noise levels, depending on the use of each room and the sensitivity to noise of the operations expected to be conducted in the rooms. An extract of the indoor ambient noise levels for dwellings is reproduced in Table 1.

Activity	Location	Time period	
		07:00 – 23:00	23:00 – 07:00
Resting	Living room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining room / area	40 dB $L_{Aeq,8hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$

Table 1 – Noise modelling parameters

BS 8233 also provides design criteria for external noise and Section 7.7.3.2 states:

“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.”

2.2 World Health Organisation – ‘Guidelines for Community Noise’, 1999

The World Health Organisation (WHO) Guidelines for Community Noise was published as a response to a need for action together with a generic need for improvements in legislation at a national level. Although not legislation, this document provides general guidance and guidelines which have been set for different health effects, using the lowest noise level that produces an adverse health effect in specific human environments. The guidelines levels which are relevant to this assessment are set out in Table 2.

Activity	Location	L _{Aeq} , dB	Time base, 'T' hours	L _{AFmax} dB
Outdoor Living Area	Serious annoyance, daytime and evening	55	16	--
	Moderate annoyance, daytime and evening	50		
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	8	45
Inside bedrooms	Sleep disturbance, night-time	30		
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45		
(1) Should not exceed 45 dB L _{AFmax} more than 10-15 times a night				

Table 2 - WHO guidelines for community noise



2.3 Approved Document O (2021 Edition) – The Building Regulations: 2010

Approved Document O (AD-O), 2021 edition (under Building Regulations 2010) aims to protect the health and welfare of occupants of the building by reducing the occurrence of high indoor temperatures. The document specifies internal noise limits which should be met to ensure the overheating mitigation strategy is usable.

A summary of the recommended levels for the most noise-sensitive spaces (bedrooms) are provided in Table 3 for average ambient noise levels throughout a given time period (L_{Aeq}) and maximum noise levels (L_{max}) during the night.

Period	Normal condition (as per BS 8233)	Overheating condition (ADO)
Daytime (07:00 to 23:00)	35 dB $L_{Aeq,16hr}$	--
Night-time (23:00 to 07:00)	30 dB $L_{Aeq,8hr}$	40 dB $L_{Aeq,8hr}$
	45 dB L_{AFmax}	55 dB L_{Amax}^*
* L_{AFmax} refers to the level not normally exceeded, and not the 10-th highest L_{AFmax} highest level used within WHO guidelines		

Table 3 - AD-O overheating condition criteria

In November 2024, a document titled 'Approved Document O: Noise Guide – V1.1'. This guide was overseen by a Working Group consisting of representatives of the Association of Noise Consultants (ANC) and Institute of Acoustics (IOA).

The purpose of this guide was to provide methodology for the acoustic assessment of noise levels, in accordance with AD-O. The guide has updated the thresholds (presented in Table 4 below) at which the simplified method cannot be used, based on the risk of the sites location. High risk sites are considered to be within London only, as defined in the document.

Parameter	High risk location	Moderate risk location
$L_{Aeq,8h}$ (dB) – averaged over 8 hours (between 23:00 – 07:00)	45 dB	50 dB
L_{AFmax} (dB) – more than 10 times a night (between 23:00 – 07:00)	60 dB	65 dB

Table 4 - External levels above which the 'Simplified Method' cannot be used (ADO Noise Guide v1.1)

2.4 Local Authority Consultation

Confirmation was sought via email to the Environmental Health team at Hinckley and Bosworth Borough Council on 18 March 2024, for approval to use the existing third-party noise data for assessment purposes, obtained from a noise survey undertaken by M-EC Ltd in June 2022. Further justification was communicated to the Local Authority, concerning the potential for nearby construction works to impact the current acoustic environment, rendering any new data unreliable.

In addition, further clarification was sought regarding the design targets applicable to the mitigation scheme, namely:

- Scheme to be assessed against the internal criteria within BS 8233:2014, specifically the design target thresholds of 35 dB(A) daytime and 30 dB(A) night. In addition, the WHO guidance on maximum internal night-time levels for residential amenity of 45 dB L_{AFmax} would also be incorporated into the assessment;
- The mitigation afforded would include specific recommendations of glazing and ventilation requirements to comply with the appropriate standards/guidance. Detailed break-in calculations for



a representative number of dwellings will be undertaken to determine the internal noise level based on specifications including, façade area, window area and room volume;

- Scheme to be assessed against the upper external criteria within BS 8233:2014 for amenity areas, specifically a design target thresholds of 55 dB(A) daytime;
- Where applicable, any suggested acoustic barriers associated with the assessment would include details such as their location, height and specification.

A response was received from Simon Smith, Team Leader, Environmental Protection at Hinckley and Bosworth Borough Council on 18 March 2024, confirming the use of third-party data for the purposes of discharging Planning Condition 11. No objection to the proposed assessment methodology was received.



3 Baseline Noise Survey

3.1 Noise Survey Methodology

The development benefits from a pre-planning baseline noise survey undertaken by M-EC Ltd between Thursday 28 April and Thursday 5 May 2022 (report reference: 27283-ENV-0401 REV A) with the acquisition of continuous noise data over six complete daytime periods (07:00 – 23:00) and seven complete night-time periods (23:00 – 07:00).

The measurement locations are summarised in Table 5 and are graphically presented in Figure 2. Details of the survey equipment, observations and weather conditions are provided in Appendix B.

Ref.	Measurement	OSGB coordinates	Description
CM1	Unattended	X: 450490; Y: 306565	Located approximately 8 m north of Markfield Road to establish sound levels from Markfield Road and the M1.
CM2	Unattended	X: 450966; Y: 305980	Located in the south-east corner of the original site extents to establish sound levels from Burroughs Road and Main Street.

Table 5 - Measurement location details

Noise measurements were undertaken under free field conditions with the microphone positioned at approximately 1.5 metres above ground level, considered to be to the requirements of BS 7445-1:2003, 'Description and measurement of environmental noise – Part 1: Guide to quantities and procedures'.

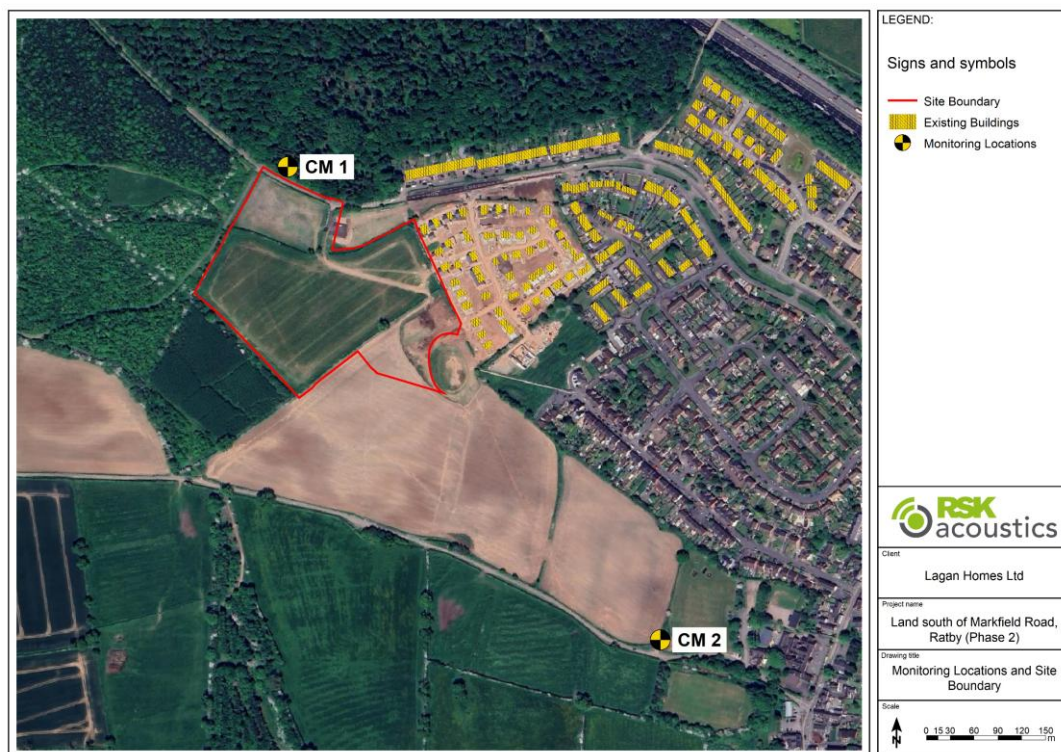


Figure 2 - Baseline measurement locations (M-EC survey 2022)

It should be noted that at the time of the 2022 survey, the proposed site boundary extended significantly further to the south-east, towards Burroughs Road and Main Street. The second monitoring location (CM2), although some distance from the current site extent, has been included to inform the verification of propagation across the site.



3.2 Noise Survey Results

A summary of the measured noise levels at the long-term, continuous measurement locations CM1 and CM2 is presented in Tables 6 and 7.

Analysis of the dataset accounting for the standard 16-hour daytime period (07:00 – 23:00) and 8-hour night-time period (23:00 – 07:00) is presented in accordance with BS 8233: 2014. Values are rounded to the nearest whole number.

Date	Time period, T	Measured noise levels (dB) ⁽¹⁾			
		L _{Aeq, T}	L _{Amax, T}	L _{A90, T}	L _{A10, T}
Thursday 28/04/2022	11:00 to 23:00	62	93	62	48
	23:00 to 07:00	55	83	48	43
Friday 29/04/2022	07:00 to 23:00	62	90	63	47
	23:00 to 07:00	54	82	50	45
Saturday 30/04/2022	07:00 to 23:00	61	89	61	42
	23:00 to 07:00	51	80	44	38
Sunday 01/05/2022	07:00 to 23:00	61	100	58	39
	23:00 to 07:00	51	81	40	34
Monday 02/05/2022	07:00 to 23:00	60	91	59	43
	23:00 to 07:00	55	85	49	44
Tuesday 03/05/2022	07:00 to 23:00	62	94	62	42
	23:00 to 07:00	55	81	47	41
Wednesday 04/05/2022	07:00 to 23:00	64	94	65	48
	23:00 to 07:00	56	81	52	47
Thursday 05/05/2022	07:00 to 09:45	64	93	67	51
Average⁽²⁾	Daytime	62	100	62	45
	Night-time	54	85	47	42

⁽¹⁾ L_{Aeq, T} values are the logarithmic average of L_{Aeq,15min} samples, and the L_{A10, T} and L_{A90, T} are the arithmetic average of L_{A10,15min} and L_{A90,15min} samples. L_{AFmax} accounts for the highest L_{AFmax,15min} sample within the period.

⁽²⁾ Arithmetic average of derived daytime 16hr and night-time 8hr values. Partial daytime periods on 28/04/2022 and 05/05/2022 are also included.

Table 6 - Measured noise levels at Position CM1



Date	Time period, T	Measured noise levels (dB) ⁽¹⁾			
		L _{Aeq, T}	L _{Amax, T}	L _{A90, T}	L _{A10, T}
Thursday 28/04/2022	10:00 to 23:00	53	77	54	51
	23:00 to 07:00	54	73	50	47
Friday 29/04/2022	07:00 to 23:00	52	84	53	50
	23:00 to 07:00	53	78	51	46
Saturday 30/04/2022	07:00 to 23:00	46	76	47	41
	23:00 to 07:00	48	77	45	38
Sunday 01/05/2022	07:00 to 23:00	47	79	47	38
	23:00 to 07:00	48	78	38	31
Monday 02/05/2022	07:00 to 23:00	50	83	49	44
	23:00 to 07:00	53	80	50	46
Tuesday 03/05/2022	07:00 to 23:00	49	84	49	44
	23:00 to 07:00	53	79	47	41
Wednesday 04/05/2022	07:00 to 23:00	52	79	52	47
	23:00 to 07:00	52	81	52	47
Thursday 05/05/2022	07:00 to 09:30	54	79	55	51
Average⁽²⁾	Daytime	51	84	51	46
	Night-time	52	81	48	42
⁽¹⁾ L _{Aeq, T} values are the logarithmic average of L _{Aeq, 15min} samples, and the L _{A10, T} and L _{A90, T} are the arithmetic average of L _{A10, 15min} and L _{A90, 15min} samples. L _{AFmax} accounts for the highest L _{AFmax, 15min} sample within the period.					
⁽²⁾ Arithmetic average of derived daytime 16hr and night-time 8hr values. Partial daytime periods on 28/04/2022 and 05/05/2022 are also included.					

Table 7 - Measured noise levels at Position CM2



3.3 Maximum Event Noise Levels

A detailed appraisal of the night-time event levels has been undertaken to establish the 10-th highest event level which occurred on each night of the survey (in line with WHO guidance). The appraisal has been undertaken by plotting the third-party 5-minute measurement data over the night-time periods, from which individual noise events can be derived.

Table 8 presents the 10-th highest event level occurring on each night of the survey at each monitoring location. The maximum noise level highlighted in bold has been used for assessment purposes.

Night-time period date (23:00-07:00)	10 th Highest L _{AFmax} , dB	
	CM1	CM2
Thursday 28/04/2022	79	68
Friday 29/04/2022	79	61
Saturday 30/04/2022	76	73
Sunday 01/05/2022	76	62
Monday 02/05/2022	77	65
Tuesday 03/05/2022	78	65
Wednesday 04/05/2022	78	63
Maximum 10th Highest L_{AFmax}	79	73

Table 8 - 10th highest maximum night-time noise levels

The maximum 10-th highest noise level (L_{AFmax}) has been adopted for night-time assessment purposes (in accordance with the requirements of WHO guidelines).



4 Assessment Methodology

4.1 Noise Prediction Model

A computer noise model of the proposed development has been constructed using SoundPLAN 9.1. Noise levels across the proposed development site have been derived from a noise prediction model which has been calibrated against the measured levels at the baseline survey locations. The model has considered the following scenarios:

- Daytime - ambient $L_{Aeq,16hr}$ (07:00 – 23:00);
- Night-time - ambient $L_{Aeq,8hr}$ (23:00 – 07:00); and
- Night-time – individual events L_{AFmax} (within period 23:00 – 07:00).

An overview of the modelling parameters is given in Table 9. Noise contour maps for both daytime and night-time periods are provided in Appendix C.

Item	Setting
Algorithm	Calculation of Road Traffic Noise (CRTN) - for roads during daytime and night-time. ISO 9613-2:2024 'Attenuation of sound during propagation outdoors – Part 2: Engineering method for the prediction of sound pressure levels outdoors' for maximum vehicle pass-by events.
Ground absorption	Hard, acoustically reflective ground (0.1 coefficient) – Roads, pavements and hard standing areas. Acoustically soft (assumed 0.6 coefficient) – grass or vegetated areas.
Meteorological conditions	10 degrees Celsius. 70% humidity. Wind from source to receiver.
Receptor height	Ground Floor 1.5 m above ground First Floor 4 m above ground Second Floor 6.5 m above ground
Barriers/screening	Garden fencing and walls (1.8 m height) incorporated to the proposed dwellings as per CAD drawings supplied.
Source Modelling	Calibration of the model accounts for the road network acting as the primary source of noise impacting the site (line source). The night-time L_{AFmax} levels from road pass-by events has been calibrated against the representative event level occurring at all monitoring positions i.e. the value typically not exceeded more than 10 times per night.
Site Layout	Existing buildings and intervening structures modelled as structures (heights identified on site or through 3D views). Development buildings incorporated from the supplied layout plan CAD drawing (ref. LWRAT-MCB-ZZ-ZZ-DR-A-0220-S2-P3). Building heights following dimensions associated with each dwelling type.
Terrain	OS Terrain data (LiDAR 2m resolution) has been included within the model.

Table 9 - Modelling parameters



4.2 Model Calibration

The noise levels across the proposed development site have been derived from a computer noise prediction model. The model has been validated against the measured levels at the 2022 baseline survey locations undertaken by M-EC Ltd.

Differences between measured and predicted levels are presented in Table 1010.

Location (Survey year)	Measured noise level, dB			Predicted noise level, dB			Difference, dB		
	Day	Night	Night	Day	Night	Night	Day	Night	Night
	L _{Aeq, T}	L _{Aeq, T}	L _{AF,max} *	L _{Aeq, T}	L _{Aeq, T}	L _{AF,max}	L _{Aeq, T}	L _{Aeq, T}	L _{AF,max}
CM1	62	54	79	62	54	79	0	0	0
CM2	51	52	73	52	51	73	+1	-1	0

*Derived from measured 5-minute L_{AFmax} noise levels

Table 10 - Noise model calibration levels

Predicted noise levels at the monitoring locations are generally within +/- 1 dB of the measured noise levels at each respective location, thus providing an acceptable level of confidence to the modelling exercise.

4.3 Design Targets for Residential Development

For the purposes of this assessment, the acoustic design targets presented in Table 11 have been adopted. The design targets are based on the requirements of the appropriate guidelines for residential developments.

Condition	Criterion
Internal ambient daytime noise levels within bedroom / living room areas daytime (BS 8233)	35 dB L _{Aeq,16hrs}
Internal ambient noise levels within bedrooms at night (BS 8233)	30 dB L _{Aeq,8hrs}
Internal individual event levels within bedrooms during the night (>10 occurrences – WHO/ProPG)	45 dB L _{AFmax}
Noise levels within external amenity areas associated with the proposed dwellings* (BS 8233)	50 to 55 dB L _{Aeq,16hrs}

* 50 dB L_{Aeq,T} is the desirable threshold level, 55 dB L_{Aeq,T} is the upper guideline level. However, these guideline values may not be achievable in all circumstances where development might be desirable. In such a situation, development should be designed to achieve the lowest practicable noise levels.

Table 11 - Noise design target for residential use



5 Mitigation Scheme

5.1 Predicted Noise Levels – Residential Indoor Living Areas

The required acoustic performance specification for each façade at ground and upper floor levels has been derived from predicted façade noise levels. The mitigation scheme is based on the design targets stated in Table 11 (derived from BS 8233: 2014 and WHO, 1999) and specification of the living room/bedroom/glazing layout of the various building/house types per floor.

For the purposes of the mitigation scheme, the specification per floor is based on the most restrictive noise break-in calculation derived from individual façade predictions against the relevant living rooms/bedrooms per plot type (and therefore providing a worse-case assessment of noise ingress). This method provides a robust and conservative assessment of the required mitigation specifications to ensure future residents are suitably protected from external noise ingress.

The BS 8233 calculations used to derive the acoustic specifications are noted to have an expected precision of ± 2 dB. To account for this, a 2 dB margin has been adopted.

5.2 Building Façade Specifications

Noise level reduction can be provided through various façade treatment methods such as glazing or ventilation products, however, the final level of mitigation would be dependent on factors such as room size and room volume.

On the basis that a partially open window typically provides in the order of 15 dB attenuation (in accordance with WHO Guidelines, it is apparent that the predicted noise levels at most exposed façades to road traffic will result in an exceedance of the recommended internal acoustic design target during a situation in which windows are partially open for ventilation purposes.

It has been discussed with Lagan Homes that all windows are triple glazed to a specification of 6/16/4/16/4. Zehnder are also the air extract systems manufacturer, therefore trickle vents are specified using products from the Zehnder range.

For the purposes of providing a tailored mitigation strategy for the proposed dwellings, one which accounts for the varying levels of noise exposure across the site, two acoustic performance specifications, have been considered for acoustically sensitive spaces within the proposed dwellings i.e. living rooms, dining rooms and bedrooms. The considered specifications are set out below in Table 12 and Table 13, which relates to the figures presented in Appendix D.

5.2.1 Acoustic Façade Specifications – Type 1

The minimum performance requirements for the glazing and ventilator specification type 1 are defined below:

Element	Freq. Hz	125	250	500	1000	2000	$R_w + C_{tr} / D_{n,ew} + C_{tr}$
Glazing	SRI:	18	19	30	43	46	27
Trickle Vents	$D_{n,e}$:	39	38	31	44	43	37
Note: An example Zehnder ventilator specification which achieves the performance noted above would be a single Zehnder 5000EA+1 Acoustic Set							

Table 12 - Façade mitigation Type 1



5.2.2 Acoustic Façade Specifications – Type 2

The minimum performance requirements for the glazing and ventilator specification type 2 are defined below:

Element	Freq. Hz	125	250	500	1000	2000	$R_w + C_{tr} / D_{n,ew}$
Glazing	SRI:	18	19	30	43	46	27
Trickle Vents	$D_{n,e}$:	41	39	36	42	44	42
Note: An example Zehnder ventilator specification which achieves the performance noted above would be a single Zehnder EAQ42W							

Table 13 - Façade mitigation Type 2

5.2.3 Acoustic Façade Specifications – Wall and Roof

The external wall and roof specifications are consistent across the performance specifications.

Element	Freq. Hz	125	250	500	1000	2000	$R_w + C_{tr} / D_{n,ew}$
Solid Façade	SRI:	42	48	52	59	66	52
Roof	SRI	26	39	46	50	51	39
Note 1: The external wall build-up is based on 110 mm brick (1,600 kg/m ³), 100 mm void + 50 mm of 33 kg/m ³ Rockwool insulation, timber stud + 10 mm plasterboard (7.1 kg m/m ³). Note 2: The roof construction is based on a tiled finish over a trussed or purlin/rafter roof structure, with a single layer of 12.5 mm plasterboard to the soffit of the ceiling joists, overlaid with 200 mm thermal insulation.							

Table 14 - Acoustic performance specification - walls and roof

A summary of the highest required acoustic performance specifications for any given façade per plot is provided in Table 15 below:

Acoustic façade specification	Plot No.
Type 1	2, 3, 5 to 40, 42 to 69, 71 to 75
Type 2	1, 4, 41, 70

Table 15 - Acoustic performance specification – summary



5.3 Internal Noise Levels – Overheating

It is widely considered that a relaxation in the above acoustic criteria is permissible during peak summer months where occupants may be willing to compromise on noise ingress for the purpose of thermal comfort.

Based upon the night-time predicted noise levels, additional calculations have been undertaken at each façade location to determine the maximum equivalent area requirements for windows to avoid exceeding Approved Document O (AD-O) noise limits.

Based on the simplified assessment methodology within Approved Document O: Noise Guide – V1.1, the assumed window opening area within a single bedroom to control overheating at night would correspond to approximately 10 dB reduction from outside to inside. To meet an internal ambient level of 40 dB $L_{Aeq,8hr}$ (and 55 dB L_{AFmax} more than 10 times) in line with the requirements of the published AD-O, the external noise limit for moderate risk areas during night-time hours must not exceed 50 dB $L_{Aeq,8hr}$ and 65 dB L_{AFmax} . Where external noise levels exceed this, a detailed assessment is required to determine if overheating can be controlled by more restrictive opening of windows.

Using the methodology set out in Approved Document O: Noise Guide – V1.1, the maximum allowable equivalent area (EA) of openable windows in bedrooms at night to control overheating and meet AD-O acoustic requirements has been calculated. The results are presented as a percentage of room floor area (%) in the attached figures in Appendix E. These results should be used to inform a detailed overheating assessment.

For example, assuming a 10 m² bedroom on a façade with 2-3% openable window allowance, the maximum equivalent area (EA) would be calculated as:

$$EA \text{ (max)} = (\text{Floor Area in m}^2) \times (\%/100) = (10) \times (2/100) = 0.2 \text{ m}^2$$

Façades marked without an assigned colour (>4%) comply with the AD-O simplified assessment criteria for moderate risk areas. Only façades inclusive of bedroom windows have been marked up.

A suitable attenuation strategy should be developed at detailed design in conjunction with the overheating engineer to ensure suitable internal conditions can be met. As a first step, dynamic thermal modelling may be undertaken to determine if partially open windows can be used at night to control overheating. Compliance would be subject to the minimum open area required and the corresponding external to internal sound reduction achievable.

Other strategies may include:

- Installation of attenuated or plenum windows / louvres to affected bedrooms.
- Mechanical or comfort cooling systems. Where a mechanical solution is required, the impact of the noise generated both internally and externally should be considered to ensure BS 8233:2014 recommended noise levels can be achieved within development dwellings.

5.4 External Noise Levels – Outdoor Amenity Areas

Due to the building orientation and screening provided to private amenity areas, predictions indicate that noise levels within amenity gardens across the development site would be below the upper design target of 55 dB $L_{Aeq,16hr}$, as specified within BS 8223: 2014 incorporating garden fences of 1.8 metres in height.

A standard type specification for the garden amenity timber fencing should include;

- A superficial timber mass of at least 10 - 15 kg/m².



-
- Avoid using timbers that show signs of warping, knot holes or any visible damage that could affect the sound transmission.
 - For a longer life, lower maintenance solution with potentially more acceptable visual impact other materials could be considered providing they have the same surface density.
 - For its installation it is recommended to ensure there is a board timber thickness of at least 25 mm which is fixed to timber rails and connected to galvanised steel posts or similar. This ensures that no gaps occur which sound could pass through; therefore, maximising performance.



6 Conclusions

RSK Acoustics have been appointed by Lagan Homes Ltd to undertake a noise mitigation scheme to discharge Planning Condition 11 for Phase 2 of the residential development on land south of Markfield Road, Ratby, Leicestershire. This assessment considers the development masterplans by Lagan Homes comprising of 75 dwellings.

This assessment benefits from a noise survey undertaken by a third-party consultancy (M-EC Ltd) in June 2022, to establish the prevailing baseline noise levels across the site. The survey consisted of unattended measurements throughout continuous daytime and night-time periods between 28 April and 5 May 2022.

A detailed scheme of façade specifications has been provided to achieve suitable indoor ambient noise levels for all sensitive façades at ground and upper floors. Break-in noise calculations have considered the dimensions of sensitive rooms and the spectrum of dominant external levels.

Predicted levels, in conjunction with highest maximum noise levels, are of a magnitude where the proposed triple glazed system, providing a minimum sound reduction of between 27 dB R_{w+Ctr} and accompanied by a ventilator providing a performance between 37 and 42 dB $D_{n,e,w+Ctr}$, would be required to meet the internal design targets for residential use within BS 8233: 2014/WHO, 1999 during daytime and night-time periods.

An appraisal of the potential risk of exceeding night-time noise limits during periods where windows are opened for overheating control has been undertaken. During the night-time, the ambient and maximum noise limits specified by Approved Document O of the Building Regulations for the majority of the proposed residential units are likely to be exceeded should windows be partially open (simple method); the maximum allowable equivalent area (EA) of openable windows has been calculated in bedrooms at night to control overheating and meet ADO acoustic requirements. The results are presented as percentage of room floor area (%) to inform a detailed overheating assessment.

External noise levels across public amenity areas (ground floor level) are predicted to be below the recommended upper guidance limit of 55 dB $L_{Aeq,16hr}$ throughout the site as specified within BS 8223: 2014.

The final construction of the development should adhere to the recommendations within this mitigation scheme, to ensure appropriate acoustic conditions are met within internal space and external amenity. It is considered that the details provided within this mitigation scheme meet the requirements of planning condition 11 (ref: 22/00648/OUT, from Hinckley and Bosworth Borough Council). It is recommended that this condition be discharged accordingly.



References

1. Approved Document O: 'Overheating mitigation' 2021 Edition – The Building Regulations 2021
2. Approved Document O: Noise Guide – V1.1. Association of Noise Consultants (ANC) and Institute of Acoustics (IOA) 2024
3. British Standard 7445-1:2003, Description and measurement of environmental noise – Part 1: Guide to quantities and procedures. British Standards Institution, 2003
4. British Standard 8233:2014, Sound insulation and noise reduction in buildings – code of practice. British Standards Institution, 2014
5. Calculation of Road Traffic Noise. Department of Transport, Welsh Office HMSO
6. International Standard ISO 9613:2024 - Acoustics – Attenuation of sound during propagation outdoors
7. WHO Guidelines for Community Noise, 1999



Appendix A: Glossary

Term	Definition
Ambient sound	The total sound at a given place, usually a composite of sounds from many sources near and far.
Background sound, $L_{A90,T}$	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval.
dB	Decibel. Scale for expressing sound pressure level. It is defined as 20 times the logarithm of the ratio between the root mean square pressure of the sound field and a reference pressure i.e. 2×10^{-5} Pascal.
dB(A)	A-weighted decibel. This provides a measure of the overall level of sound across the audible spectrum with a frequency weighting to compensate for the varying sensitivity of the human ear to sound at different frequencies. Example sound levels include: 140 dB(A) Threshold of pain 120 dB(A) Threshold of feeling 100 dB(A) Loud nightclub 80 dB(A) Traffic at busy roadside 60 dB(A) Normal speech level at 1m 40 dB(A) Quiet office 20 dB(A) Broadcasting studio 0 dB(A) Median hearing threshold (1000 Hz)
Frequency	The repetition rate of a sound wave. The subjective equivalent in music is pitch. The unit of frequency is the Hertz (Hz), which is identical to cycles per second. A thousand hertz is often denoted as kHz, e.g. 2 kHz = 2000 Hz. Human hearing ranges approximately from 20 Hz to 20kHz.
$L_{Aeq,T}$	This is defined as the notional steady sound level 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.
NR	Noise rating. A set of curves based on the sensitivity of the human ear. They are used to give a single-figure rating for a range of frequencies.
Rating level	Specific sound level of a source plus any adjustment for the characteristic features of the sound.
Residual sound	Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.
Sound absorption	Process whereby sound energy is converted in to heat. Sound absorption properties is expressed as the sound absorption coefficient α or the sound absorption class (A-E).
Sound insulation	The reduction or attenuation of airborne sound by a solid element between source and receiver.
Specific sound	Sound pressure level produced by the source being assessed at the assessment location.

Table A.1 Glossary of terms



Appendix B: Noise Measurement Equipment

The noise measurements undertaken by were undertaken M-EC Ltd used the following equipment:

Equipment	Make / Model	Serial number	Calibration Due Date
Sound level meter	Norsonic Type NOR140	1407773	17/11/2023
	Norsonic Type NOR140	1407599	19/09/2022
Acoustic calibrator	Norsonic 1255	125525772	18/11/2022
	Norsonic 1255	125525494	12/09/2022

Table B.1 - Monitoring equipment

The sound level meters used conform to the Class 1 requirements of BS EN 61672-1:2013 '*Electroacoustics. Sound level meter, Specifications*'. The calibrator used conforms to the Class 1 requirements of BS EN IEC 60942:2018 '*Electroacoustics, Sound calibrators*'.

The calibration of the sound level meters was checked before and after the measurements, with no significant calibration drift noted i.e. within a +/- 0.5 dB tolerance.

The sound level meters were set up to capture L_{Aeq} and L_{AFmax} values and data was shared with RSKA in these broadband indices with additional one-third octave data also supplied. Measurements were logged in 5-minute integration periods, with additional verification analysis undertaken by RSKA to confirm validity of data.

Noise Environment Observations

From the information provided, dominant sources of noise affecting the site were attributable to road traffic noise from Markfield Road and the M1 motorway.

At CM2, towards the southern portion of the site, it was noted that car pass-bys on Burroughs Road were infrequent and the prevailing dominant source of noise was also attributable to road traffic noise from the M1 to the north - east.

Weather Conditions

From the information provided, at the time of the survey installation weather conditions were overcast, with no precipitation and wind speeds observed at 0.5 m/s from the southwest. Upon collection of the monitoring equipment, weather was reported to be partially cloudy with wind speeds observed at 0.9 m/s from the north-east.

During periods of absence, meteorological conditions were considered suitable for the purposes of the noise monitoring exercise, in accordance with BS 7445.



Appendix C: Noise Contour Maps



Figure C.1 Daytime noise contour map (1.5m height)





Figure C.2 Night-time noise contour map (4m height)



Appendix D: Façade Mitigation Maps

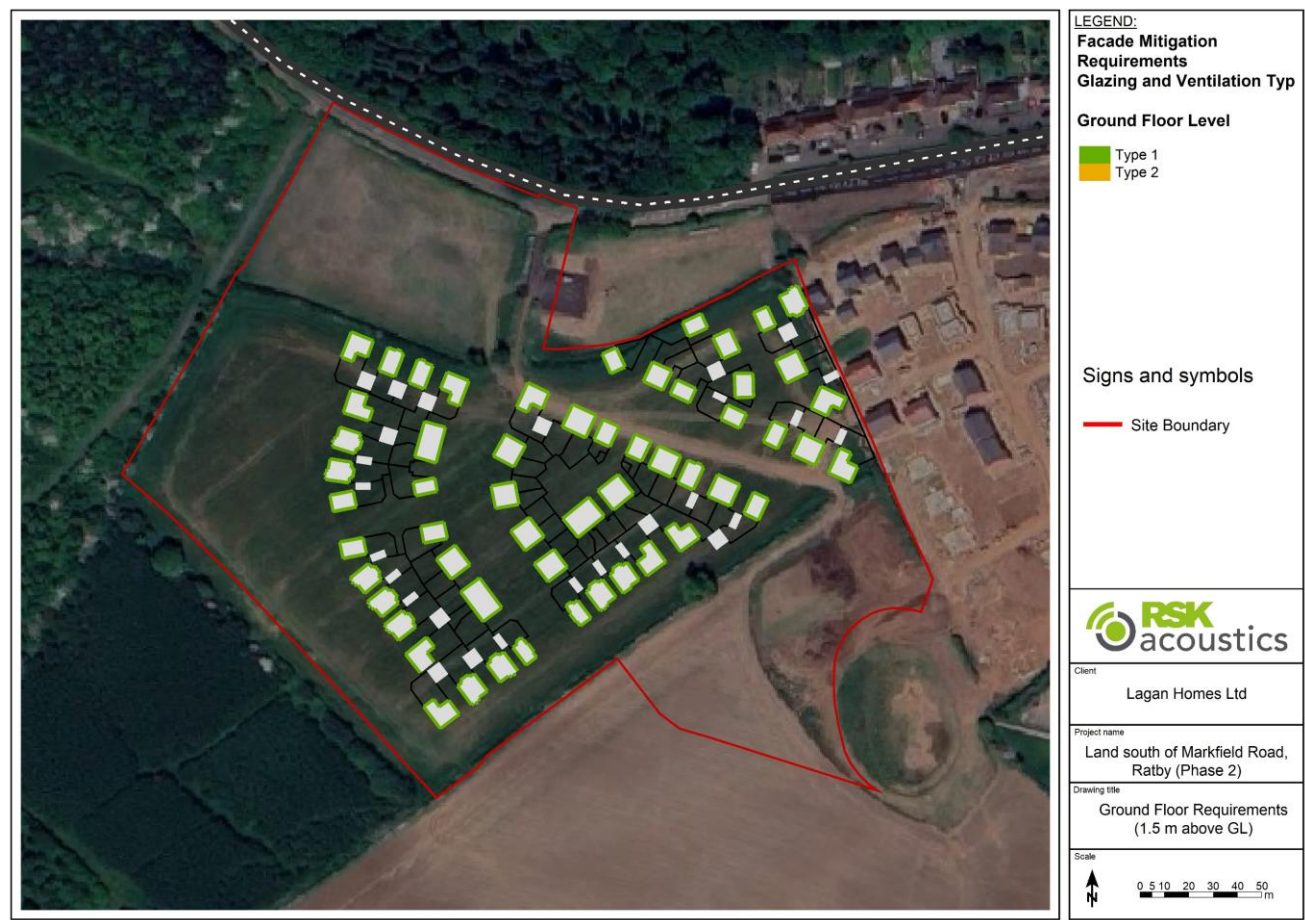


Figure D.1 Façade mitigation map (ground floor)



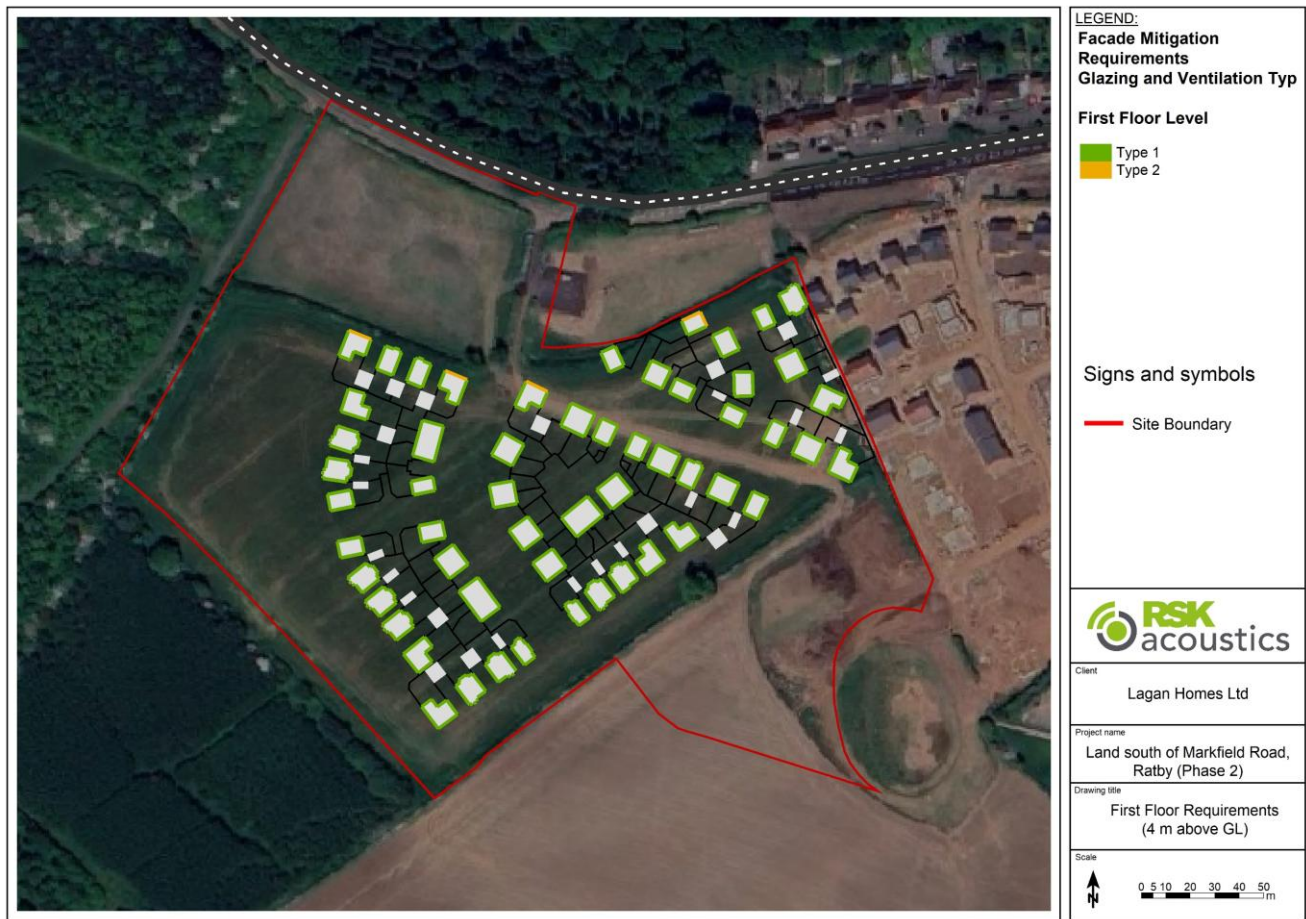


Figure D.2 Façade mitigation map (first floor)



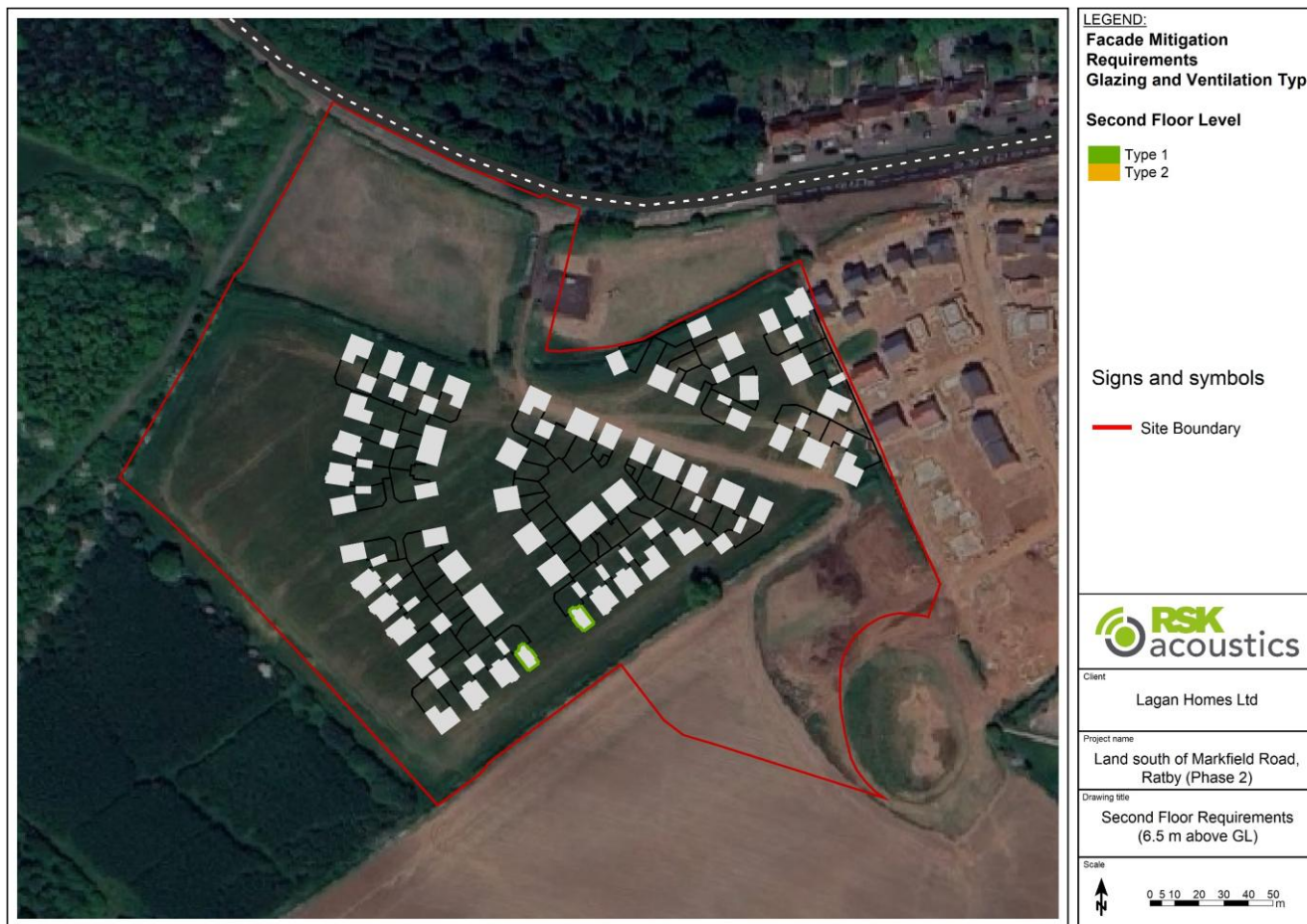


Figure D.3 Façade mitigation map (second floor)



Appendix E: Overheating Noise Assessment (sensitive rooms)

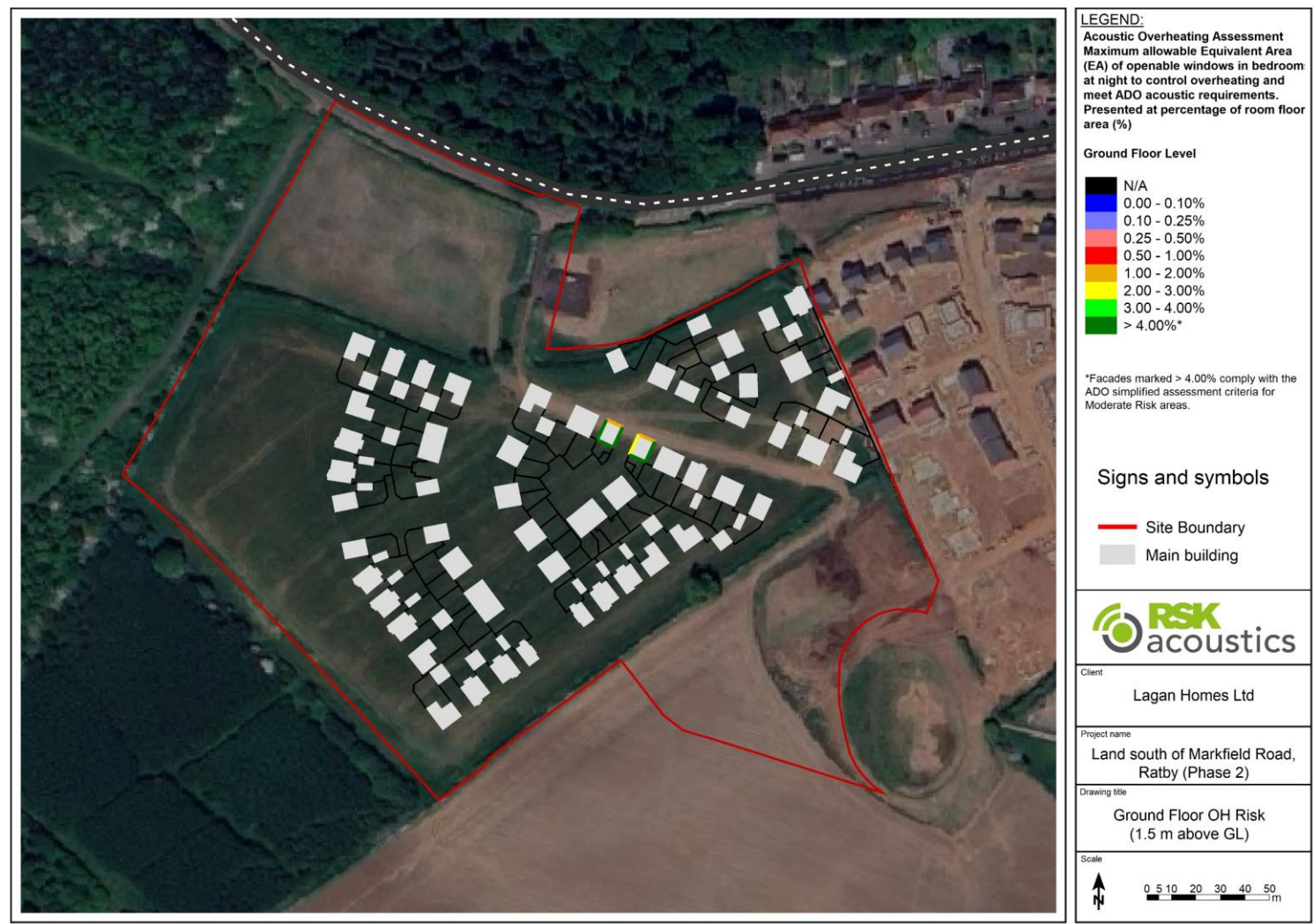


Figure E.1 Overheating noise assessment (ground floor)



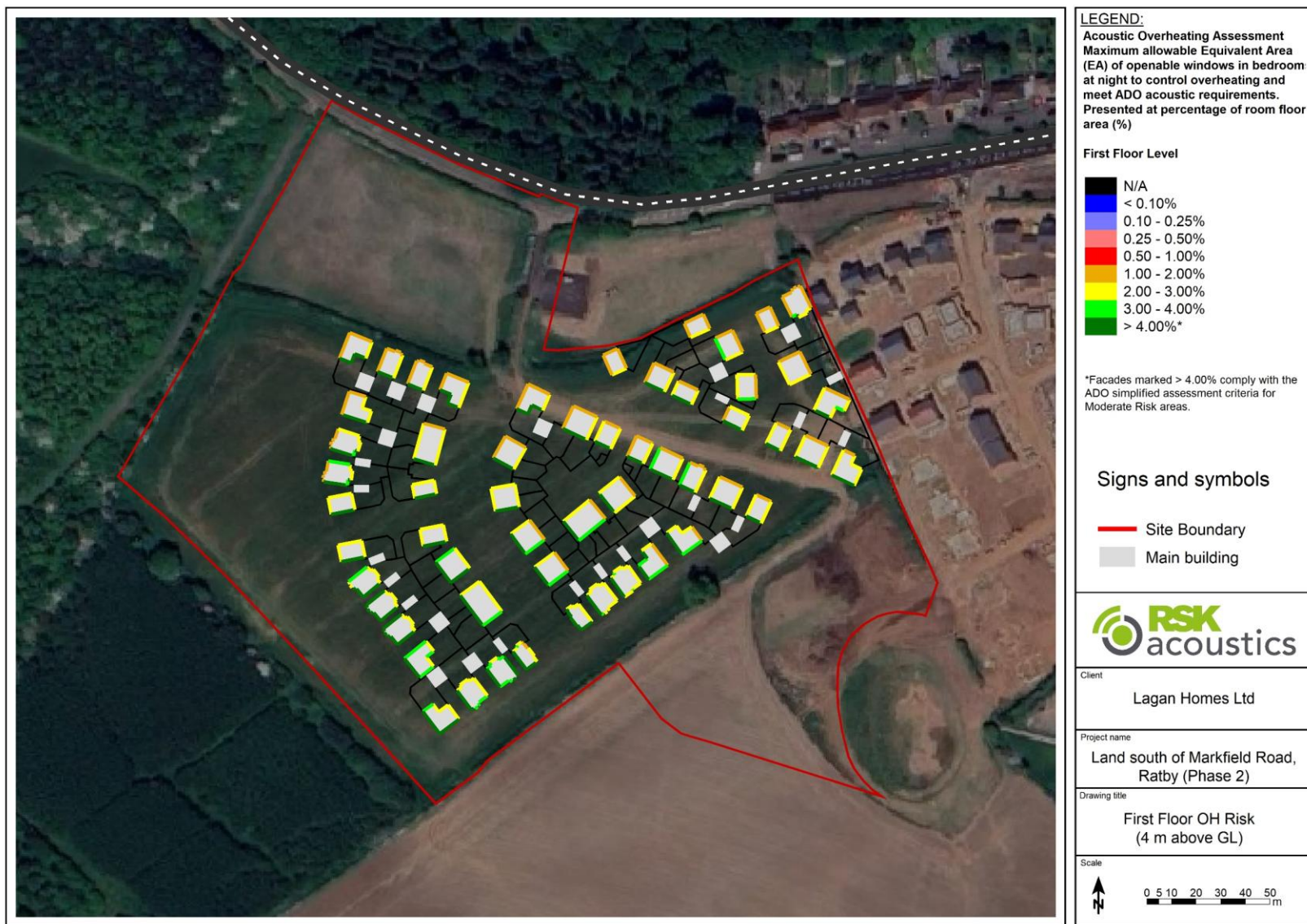


Figure E.2 Overheating noise assessment (first floor)



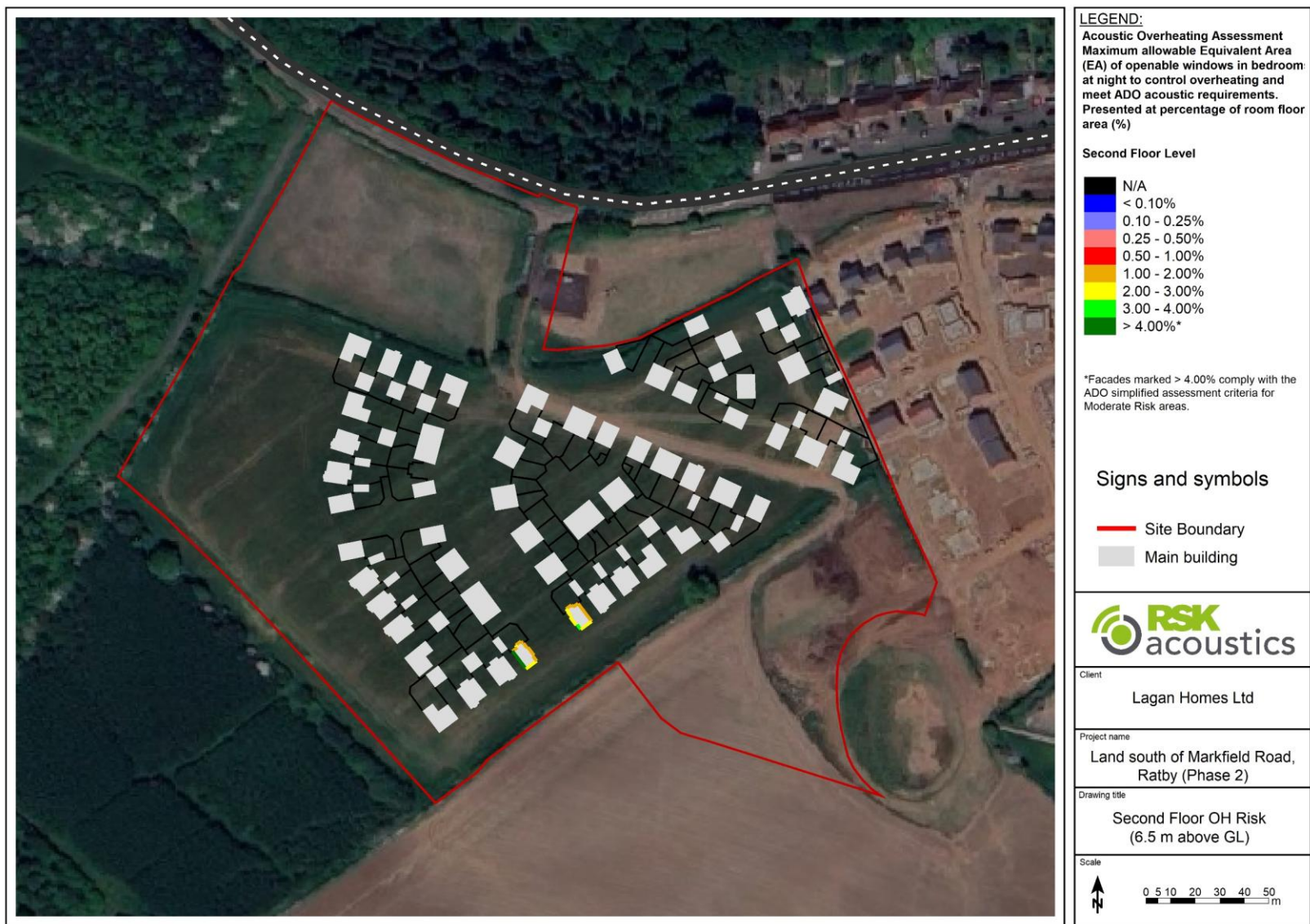


Figure E.3 Overheating noise assessment (second floor)



