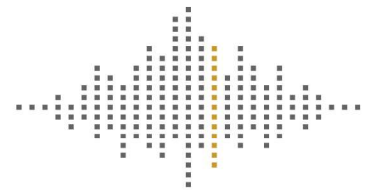


SHARPS REDMORE

ACOUSTIC CONSULTANTS ▪ Established 1990



Report

Noise Assessment
Lee Lane, Royston

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1.0 Introduction

- 1.1 Sharps Redmore have been appointed by Bellway Homes to undertake a noise assessment in relation to a proposed residential development located on land adjacent to Lee Lane, Royston.
- 1.2 This report provides an assessment to accompany the planning application for the proposed development. The assessment methodology and criteria are presented in Section 2. Baseline noise surveys have been undertaken to establish existing noise levels at the site with the details of the surveys presented in Section 3. The key findings of the assessment are presented in Section 4 with conclusions presented in Section 5.
- 1.3 A guide to the acoustic terminology used within this report is included in Appendix A.

2.0 Assessment Methodology and Criteria

- 2.1 The National Planning Policy Framework¹ (NPPF), July 2021, sets out the Government's planning policies for England and "these policies articulate the Government's vision of sustainable development." In respect of noise, Paragraph 185 of the NPPF states the following:
- 2.2 *"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 impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
 - b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and*
 - c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation".*
- 2.3 In addition, Paragraph 187 states:
- 2.4 *"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".*
- 2.5 Road traffic noise along Lee is the dominant noise source at the site. Also, with regard to tranquillity, it is not considered that there are any tranquil areas located on or within close proximity to the site which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason. Therefore, this assessment considers the requirements of Paragraph 185(a).
- 2.6 Guidance on the interpretation of the policy aims contained within the NPPF is contained within National Planning Policy Guidance² (NPPG). The NPPG introduces the concept of a noise exposure hierarchy based on likely average response. The guidance contained in the NPPG is summarised in Table 2.1:

¹ National Planning Policy Framework, Ministry of Housing, Communities and Local Government, July 2021

² Planning Practice Guidance: Noise, Ministry of Housing, Communities and Local Government, July 2019

TABLE 2.1: Noise Exposure Hierarchy

Response	Examples of Outcomes	Increasing Effect Level	Action
No Observed Effect Level			
Not present	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level (LOAEL)			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, 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 small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level (SOAEL)			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, 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
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

2.7 The NPPF and NPPG reinforce the March 2010 DEFRA publication, “Noise Policy Statement for England” (NPSE)³, which states three policy aims, as follows:

³ Noise Policy Statement for England, Department for Environment, Food and Rural Affairs, March 2010

- 2.8 *“Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*
- a) avoid significant adverse impacts on health and quality of life;*
 - b) mitigate and minimise adverse impacts on health and quality of life; and*
 - c) where possible, contribute to the improvement of health and quality of life.”*
- 2.9 Together, the first two aims require that no significant adverse impact should occur and that, where a noise level which falls between a level which represents the lowest observed adverse effect and a level which represents a significant observed adverse effect, then according to the explanatory notes in the statement:
- 2.10 *“... 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.”*
- 2.11 Taking an overview of national policy aims and guidance it is clear that when considering the impact of noise that the fact it can be heard and causes impact, is not reason to refuse an application as consideration should also be given to the significance of the impact and the mitigation measures available.
- 2.12 Neither national policy or guidance contains any technical advice on acceptable noise levels. However, documents such as the BS 8233:2014⁴ support the current national policy guidance contained within the NPPF and Noise Policy Statement for England 2010.
- 2.13 The current nationally recommended internal noise levels for dwellings are given in BS 8233. The BS 8233 guideline criteria align with the noise level guideline criteria stated within the WHO Guidelines (1999)⁵.
- 2.14 BS 8233 recommends the following internal noise standards which would be regarded as corresponding to the LOAEL:

TABLE 2.2: BS 8233:2014 Internal Noise Level Criteria

BS 8233:2014 Table 4 – Indoor ambient noise levels for dwellings			
Activity	Location	0700 to 2300	2300 to 0700
Resting	Living room	35 dB $L_{Aeq,16hour}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

- 2.15 In addition to the criteria stated within Table 2.2, the WHO guidelines suggest internal night-time noise levels should not regularly exceed 45 dB L_{Amax} (10 – 15 times per night).
- 2.16 For outdoor private external amenity areas, BS 8233:2014 recommends that *“it is desirable that the external noise level does not exceed 50 dB L_{AeqT} , with an upper guideline value of 55 dB L_{AeqT} ”*. However, the document recognises that that these guideline values are not achievable in all circumstances and in higher noise areas, a compromise might be

⁴ BS 8233:2014 'Guidance on Sound Insulation & Noise Reduction for Buildings'

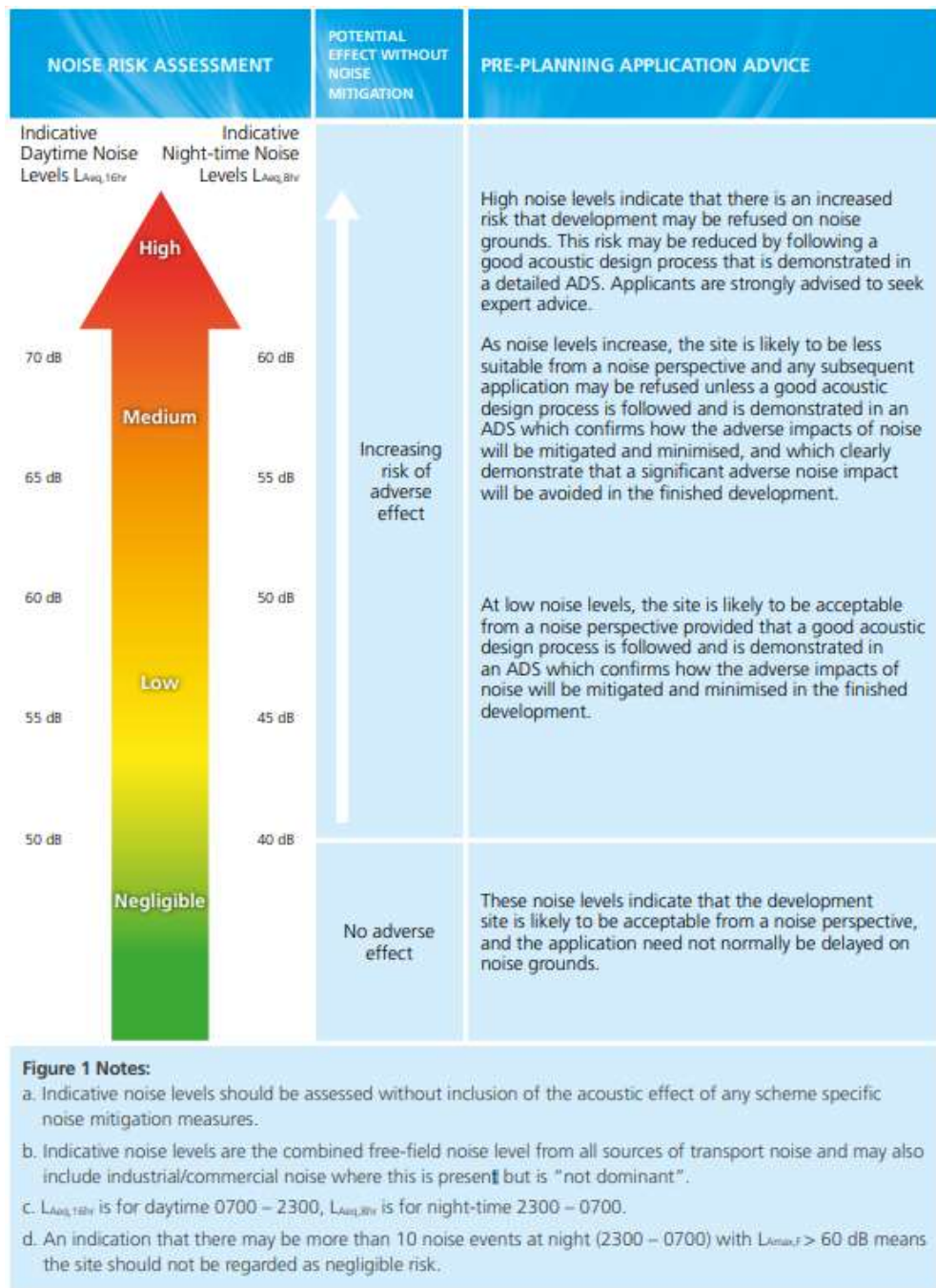
⁵ World Health Organization (1999), “Guidelines for Community Noise”

warranted. In such circumstances, development should be designed to achieve the lowest practicable levels in these external amenity spaces.

Professional Practice Guidance on Planning and Noise for new residential development (ProPG)

- 2.17 Professional Practice Guidance on Planning and Noise for new residential development (ProPG) was published in May 2017 by the Chartered Institute of Environmental Health (CIEH), the Association of Noise Consultants (ANC) and the Institute of Acoustics (IOA). The guidance has been published to provide practitioners with guidance on the management of noise within the planning system in England.
- 2.18 The guidance is specifically for ‘new residential development’ that would be exposed predominantly to noise from existing transport sources and reflects the Government’s overarching Noise Policy Statement for England (NPSE), the National Planning Policy Framework (NPPF), and Planning Practice Guidance (including PPG-Noise), as well as other authoritative sources of guidance.
- 2.19 The guidance provides advice for Local Planning Authorities (LPAs) and developers, and their respective professional advisers which complements Government planning and noise policy and guidance and, in particular, it aims to:
- Advocate full consideration of the acoustic environment from the earliest possible stage of the development control process;
 - Encourage the process of good acoustic design in and around new residential developments;
 - Outline what should be taken into account in deciding planning applications for new noise-sensitive developments;
 - Promote appropriate noise exposure standards; and
 - Assist the delivery of sustainable development (ADS).
- 2.20 There are two stages of the overall approach outlined in the ProPG:
- Stage 1 – an initial noise risk assessment of the proposed development site; and
 - Stage 2 – a systematic consideration of 4 key elements which is underpinned by an Acoustic Design Statement.
- 2.21 With regard to Stage 1, the ProPG provides guidance for producing an initial site risk assessment, pre-mitigation, with regards to noise based on the prevailing daytime and night time noise levels across the site, from which the site (or areas thereof) can be allocated a Noise Risk as shown overleaf in Figure 2.1. This shows the various Noise Risks Categories (NRC) together with their corresponding sound levels as referred to in the ProPG. It should be noted that the categories are not distinct which allows context to be included within the assessment with the purpose of the Stage 1 assessment to determine the likely acoustic challenges on the site.

Figure 2.1 ProPG Stage 1, Noise Risk Assessment



2.22 At Stage 2, which is not required to be progressed if the Stage 1 assessment determines a negligible risk, there are 4 elements which should be undertaken in parallel. These are:

- Good Acoustic Design Process
- Internal Noise Level Guidelines
- External Amenity Area Noise Assessment
- Assessment of Other Relevant Issues

- 2.23 There is then the requirement to present an ADS to provide sufficient evidence that the ProPG Stage 1 and Stage 2 Elements 1 to 4 have been followed.
- 2.24 For the development, a Stage 2 assessment including the presentation of an ADS has been undertaken.

3.0 Noise Survey

- 3.1 An environmental noise survey has been undertaken by Sharps Redmore between 20th January and 25th January 2022.
- 3.2 Measurements were collected at an unattended measurement location over the duration of the noise survey; a location along the northern boundary of the site at a distance of approximately 4m from Lee Lane (LT1). Sample attended measurements during the daytime and night-time period were undertaken at a distance of approximately 30m from the northern boundary of the site (ST1).
- 3.3 Figure 3.1 shows the noise monitoring locations with details of the monitoring periods and description of observed noise sources presented in Table 3.1. The type 1/class 1 sound level meters were calibrated before and after the survey with no drift recorded.

Figure 3.1: Noise Monitoring Location Plan



- 3.4 Weather conditions were suitable for the measurements on each visit with windspeeds being low (below 5m/s) and the weather being clear and dry.
- 3.5 A summary of observations made during the noise survey is presented in Table 3.1.

Table 3.1: Description of monitoring locations and observations

Location		Location Description	Summary of observed noise sources
LT1	09:00 20/01/22 to 11:50 25/01/22	Northern boundary of the site approximately 4m from Lee Lane.	<ul style="list-style-type: none"> ■ Road traffic noise from Lee Lane ■ Birdsong ■ Vehicle movements and the unloading of feedstock into a building were observed at Muscle Hill farm to the north west of the site on the opposite side of Lee Lane. However, road traffic noise was dominant.
ST1	20/01/22 09:08 to 12:00 & 15:55 to 17:08 21/01/22 05:59 to 08:30 & 13:32 to 14:32	North western part of the site approximately 30m from Lee Lane	<ul style="list-style-type: none"> ■ Road traffic from Lee Lane and the distant A61 ■ Infrequent vehicle movement from Muscle Hill Farm ■ Birdsong ■ Vehicle movements and the unloading of feedstock into a building were observed at Muscle Hill farm. However, road traffic noise was dominant.

- 3.6 The noise climate in the northern part of the site was observed to be dominated by road traffic noise from Lee Lane.
- 3.7 The results of the survey are summarised in Table 3.2 with the full raw survey data at LT1 available on request. The raw survey data collected at ST1 is presented in Appendix B. The stated $L_{Aeq,T}$ represents the logarithmic average whilst the $L_{A10,T}$ is the arithmetic average and $L_{A90,T}$ represents the modal value.

Table 3.2: Summary of Measured Noise Levels.

Time / Date	Location	L _{Aeq,T}	L _{Amax}	L _{A90,T}	L _{A10,T}
Daytime 09:00 to 23:00 (20/01/22)	LT1	73	90	77	54
07:00 to 23:00 (21 – 24/01/22)					
07:00 to 11:50 (25/01/22)					
Night-time 23:00 to 07:00 (20 – 25/01/22)		66	97 (90*)	53	47
09:08 to 12:00 (20/01/22)	ST1	59	73	51	62
15:55 to 17:08 (20/01/22)	ST1	61	80	56	63
06:00 to 08:30 (21/01/22)	ST1	60	75	52	63
13:32 to 14:32 (21/01/22)	ST1	60	76	53	63

*15th highest during the night-time over full survey period

4.0 Key Findings

- 4.1 The proposed development site sits within the western part of a wider development area. The masterplan framework for the wider site presents an option for a proposed relief road to the west of the site. A broad indicative alignment is presented in the Royston Masterplan Framework (October 2020) but it is our understanding that the relief road is aspirational option and no design details are available. Also, it is understood that no commitments have been made in relation to the road coming forward.
- 4.2 On this basis no further consideration has been given to the relief road with the following assessment based on road traffic noise on Lee Lane which is the dominant noise source.
- 4.3 A 3D noise model of the site and surrounding area has been created using SoundPLAN 8.2 based on 18hr AAWT base traffic data along Lee Lane provided by Optima Highways. The model calculates noise propagation according to the methods described by CRTN⁶ and allows for the prediction of noise levels at a large number of receptor points. Noise modelling details are presented in Appendix C.
- 4.4 The provided 18hr AAWT traffic data generates a $L_{A10,18\text{hour}}$ noise level and this can be converted to a $L_{Aeq,T}$ value using the following formulae:

$$L_{Aeq,16\text{hours}} = L_{A10,18\text{hours}} - 2 \text{ dB}$$

- 4.5 Table 4.1 below presents details of the verification of the modelled scenario and the measured noise levels.

Table 4.1: Noise Model Verification (Daytime: $L_{Aeq,16\text{hours}}$)

Location	Measured Noise Level (dB $L_{Aeq,T}$)	Modelled Noise Level (dB $L_{Aeq,T}$)	Difference (dB)
LT1	73	70	-3
ST1	60	59	-1

- 4.6 The verification points show a divergence between monitored and modelled results of 3 dB or less. This provides a good correlation between the modelled and measured levels. However, for robustness, a correction of +1 dB (equivalent to a 25 % increase in traffic flow) has been applied to the model. As shown in Table 4.2, this results in there being no difference between the modelled and measured noise levels at ST1 with the difference being within 3dB at LT1. As such the models are considered to be suitably verified.

Table 4.2: Noise Model Verification with Correction (Daytime: $L_{Aeq,16\text{hours}}$)

Location	Measured Noise Level (dB $L_{Aeq,T}$)	Modelled Noise Level (dB $L_{Aeq,T}$)	Difference (dB)
LT1	73	71	-2
ST1	60	60	0

⁶ Control of Road Traffic Noise (CRTN), Department of Transport, 1988

With regard to the night-time $L_{Aeq,8hours}$, a correction of -7 dB has been applied to the daytime $L_{Aeq,16hour}$ source noise level. This is representative of the difference between the measured daytime and night-time noise levels at LT1.

In addition to $L_{Aeq,T}$ noise levels, consideration has also been given to the L_{Amax} during the night-time period. The 15th highest L_{Amax} (90 dB L_{Amax}) measured at LT1 over the course of the survey has been used as a basis of the assessment.

ProPG Stage 1 Assessment

- 4.7 Based on the verified daytime $L_{Aeq,16hours}$ and night-time $L_{Aeq,8hours}$, SK01 and SK02 in Appendix D present noise contour plots during the day and night-time periods which provide a representation of the range of noise levels across the site. Based on these levels, a summary of the ProPg Stage 1 Risk Assessment categories is presented in Table 4.3.

Table 4.3: ProPg Stage 1 Risk Assessment

Period	ProPg Stage 1 Risk Assessment Noise levels
Daytime $L_{Aeq,16hr}$	Negligible to Medium
Night-time $L_{Aeq,8hr}$	Negligible to Medium (very small segment of the site being classed as high risk immediately adjacent to Lee Lane)

- 4.8 On the basis of the above, the Stage 1 risk assessment shows that the acoustic challenges within the site range from negligible to, within close proximity to Lee Lane, medium risk.

ProPG Stage 2 Assessment

- 4.9 A Good Acoustic Design Process has been incorporated within the scheme design. Noise mitigation measures included within the proposed layout include the inclusion of a stand-off to Lee Lane with proposed dwellings positioned to the rear of the access road to the dwellings. In addition, the 1st row of buildings facing Lee Lane have been orientated so that the buildings provide a barrier to rear gardens and dwellings located further into the site.

Noise Intrusion Assessment (Habitable Rooms)

- 4.10 Noise ingress calculations have been carried out based on the façade noise levels generated by the noise model. Ingress calculations are carried out in accordance with the methods and procedures described by BS 8233:2014 and BS 12354-3:2000⁷. Room dimensions have been taken from the housebuilders drawings.
- 4.11 Tables 4.4 and 4.5 below present the acoustic performance for the example window and ventilator specifications used in calculations. Windows as a whole must achieve the given performance, including seals and frames. Noise break-in through the walls is negligible in comparison to the window unit.

⁷ BS EN ISO 12354-3: Building acoustics – Estimation of acoustic performance of buildings from the performance of elements – Airborne sound insulation against outdoor sound

Table 4.4 Example Window Sound Insulation Performance

Option	Description	Octave-band centre frequency sound reduction index (dB)						R_w (C_{tr}) (dB)
		125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	
A	'Standard' double-glazed window 4mm / 16mm / 4mm	21	17	25	35	37	31	29 (-4)
B	8mm/16mm/4mm	22	21	28	38	40	47	33 (-4)

Table 4.5 Example Ventilator Sound Insulation Performance

Option	Ventilator	Octave-band element sound reduction index, $D_{n,e}$ (dB)						$D_{n,e,w}$ (dB)
		125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	
A	'Standard' trickle vent: Vent 5000EA	39.5	37.3	35.5	32	31	31	33
B	Acoustic trickle vent: Vent 2500EA + 1 Acoustic Set	40.7	38.8	35.8	42.3	43.9	42	42

- 4.12 Based on the sound insulation performance of the products shown in Tables 4.4 and 4.5 (Assuming up to two trickle vents per room) and sample room calculations, the noise reduction provided by the window unit and façade is predicted to be:
- Option A: Standard' double glazing and a 'standard' trickle vent: 25 dB or greater
 - Option B: 32 dB or greater
- 4.13 Internal noise levels at the proposed development, based on the existing ambient noise climate, have been assessed. Contour plots SK03 and SK04 are presented in Appendix D which show predicted noise levels at selected worst-case receptors for the daytime $L_{Aeq,16hours}$ and night-time $L_{Aeq,8hours}$ scenarios. Noise modelling of peak (L_{Amax}) noise levels has also been undertaken.
- 4.14 The highest predicted daytime and night-time $L_{Aeq,T}$ noise levels at proposed dwellings summarised in Table 4.6. With windows closed, a reduction of 32 dB has been used to represent the noise reduction provided by the Option B glazed unit.

Table 4.6: Predicted Internal Noise Levels (Plot 18 northern façade)

Parameter	Predicted External Noise Level dB(A)	Predicted Internal Noise Level (window closed) dB(A)
(Daytime) L _{Aeq,16hours}	63	31
(Night-time) L _{Aeq,8hours}	58	26
(Night-time) L _{Amax}	76	44

- 4.15 Based on the calculated predicted internal noise levels at most proposed dwellings within the site, assuming a reduction from a partially open window of 15 dB, the target internal BS 8233 / WHO noise level criteria is predicted to be met when windows are open.
- 4.16 For some properties in the northern part of the site closest to Lee Lane, internal noise levels are predicted to be above the relevant BS 8233 / WHO criteria when windows are open for some habitable rooms. Therefore, to achieve whole house ventilation with windows closed, trickle vents are proposed. At these locations, the Option A or B specification is proposed
- 4.17 SK05 in Appendix D presents the locations where glazing and ventilators with a minimum acoustic performance are proposed to habitable rooms (example specifications are shown in Tables 4.4 and 4.5).

External Amenity Assessment

- 4.18 SK03 presents a visual representation of noise levels in proposed external private amenity areas in the northern part of the site closest to the local road network. Predicted noise levels in all gardens within the site are predicted to be 55 dB L_{Aeq,16hours} or below.
- 4.19 To reduce noise levels in gardens most exposed to traffic noise, where predicted noise levels are around 55 dB L_{Aeq,16hours}, 1.8m barriers (solid wall or acoustic grade fence) are recommended. The recommended barrier locations are shown in SK05.

Acoustic Design Statement

- 4.20 Noise surveys have been undertaken and verified against traffic data provided by Optima Highways. The results have been used to inform the masterplanning process with road traffic noise being the dominant noise source at the site. The level of noise intrusion across the site has been established and it has been established that acoustic challenges at the site are of low to medium risk.
- 4.21 A good acoustic design process has been included within the design of the site which includes a stand-off to Lee Lane with proposed dwellings positioned to the rear of the access road to the dwellings. In addition, the 1st row of buildings facing Lee Lane have been orientated so that the buildings provide a barrier to rear gardens and dwellings located further into the site.
- 4.22 A glazing and ventilator strategy has been recommended to meet the relevant BS 8233 / WHO criteria in proposed internal habitable spaces.

- 4.23 Noise levels are predicted to be 55 dB $L_{Aeq,16hours}$ or below in private external amenity areas and below the SOAEL. 1.8m high acoustic grade barriers (close boarded fence) are proposed for garden boundaries most exposed to traffic noise from Lee Lane.
- 4.24 With respect to mitigation within the scheme design:
- SK05 in Appendix D presents the locations where specific glazing and acoustic ventilators are proposed to habitable rooms. The plan should be read in conjunction with Tables 4.4 and 4.5.
 - Barriers are in the form of solid boundary walls or close boarded fences which are of solid construction and no air gaps and a minimum mass of 10kg/m². A barrier location plan is presented in SK05 in Appendix D.

5.0 Conclusion

- 5.1 Sharps Redmore have been appointed by Bellway Homes to undertake a noise assessment in relation to a proposed residential development off Lee Lane, Royston.
- 5.2 A baseline noise survey has been undertaken and local road traffic noise from Lee Lane is the dominant noise source at the site. It has been identified that the acoustic challenges at the site are of negligible to medium risk. The design of the site incorporates dwellings being set back from Lee Lane and positioned to the rear of the access road to the dwellings. In addition, the 1st row of buildings facing Lee Lane have been orientated so that the buildings provide a barrier to rear gardens and dwellings located further into the site.
- 5.3 A scheme of sound insulation for proposed dwellings has been recommended to meet the relevant BS 8233 / WHO criteria in proposed internal in selected locations in the northern part of the site closest to Lee Lane. Whilst noise levels are predicted to be 55 dB L_{Aeq,16hours} or below in private external amenity areas, 1.8m high acoustic grade barriers (close boarded fence) are proposed for garden boundaries most exposed to traffic noise from Lee Lane.
- 5.4 This assessment has objectively demonstrated in the context of nationally recognised standards and planning guidance that the effects of identified sources of noise being emitted from the surrounding environment would not give rise to a significant adverse impact.
- 5.5 Noise associated with the proposed development would, therefore, comply with the requirements of the NPPF to avoid “significant adverse impact” and, with the proposed mitigation measures, an acceptable internal and external noise climate can be provided for future residents.

APPENDIX A

ACOUSTIC TERMINOLOGY

Acoustic Terminology

- A1 Noise, which is sometimes defined as unwanted sound, is measured in units of decibels, dB. Commonly noise is used as an alternative to sound and for the purpose of this assessment there is no difference between the meaning of noise or sound. The range of audible sounds is from 0 dB to 140 dB. Two equal sources of sound, if added together will result in an increase in level of 3 dB, i.e. $50\text{ dB} + 50\text{ dB} = 53\text{ dB}$. Increases in continuous sound are perceived in the following manner:
- 1 dB increase - barely perceptible
 - 3 dB increase - just noticeable
 - 10 dB increase - perceived as twice as loud
- A2 Frequency (or pitch) of sound is measured in units of Hertz. 1 Hertz (Hz) = 1 cycle/second. The range of frequencies audible to the human ear is around 20Hz to 18000Hz (or 18kHz). The capability of a person to hear higher frequencies will reduce with age. The ear is more sensitive to medium frequency than high or low frequencies.
- A3 To take account of the varying sensitivity of people to different frequencies a weighting scale has been universally adopted called "A-weighting". The measuring equipment has the ability automatically to weight (or filter) a sound to this A scale so that the sound level it measures best correlates to the subjective response of a person. The unit of measurement thus becomes dBA (decibel, A-weighted).
- A4 The second important characteristic of sound is amplitude or level. Two units are used to express level, a) sound power level - L_w and b) sound pressure level - L_p . Sound power level is an inherent property of a source whilst sound pressure level is dependent on surroundings/distance/directivity, etc. The sound level that is measured on a meter is the sound pressure level, L_p .
- A5 External sound levels are rarely steady but rise or fall in response to the activity in the area - cars, voices, planes, birdsong, etc. A person's subjective response to different noises has been found to vary dependent on the type and temporal distribution of a particular type of noise. A set of statistical indices have been developed for the subjective response to these different noise sources.
- A6 The main noise indices in use in the UK are:
- L_{A90} : The sound level (in dBA) exceeded for 90% of the time. This level gives an indication of the sound level during the quieter periods of time in any given sample. It is used to describe the "background sound level" of an area.
 - L_{Aeq} : The equivalent continuous sound level in dBA. This unit may be described as "the notional steady noise level that would provide, over a period, the same energy as the intermittent noise". In other words, the energy average level. This unit is now used to measure a wide variety of different types of noise of an industrial or commercial nature, as well as aircraft and trains.
 - L_{A10} : The sound level (in dBA) exceeded for 10% of the time. This level gives an indication of the sound level during the noisier periods of time in any given

sample. It has been used over many years to measure and assess road traffic noise.

L_{AMAX} The maximum level of sound measured in any given period. This unit is used to measure and assess transient noises, i.e. gun shots, individual vehicles, etc.

- A7 The sound energy of a transient event may be described by a term SEL - Sound Exposure Level. This is the L_{Aeq} level normalised to one second. That is the constant level in dBA which lasting for one second has the same amount of acoustic energy as a given A weighted noise event lasting for a period of time. The use of this unit allows the prediction of the L_{Aeq} level over any period and for any number of events using the equation;

$$L_{AeqT} = SEL + 10 \log n - 10 \log T \text{ dB.}$$

Where

n = Number of events in time period T.

T = Total sample period in seconds.

- A8 In the open, known as free field, sound attenuates at a rate of 6 dB per each doubling of distance. This is known as geometric spreading or sometimes referred to as the Inverse Square Law. As noise is measured on a Logarithmic scale, this attenuation in distance = 20 Log (ratio of distances), e.g. for a noise level of 60 dB at ten metres, the corresponding level at 160 metres is:

$$60 - 20 \text{ Log } \frac{160}{10} = 60 - 24 = 36 \text{ dB.}$$

APPENDIX B

ATTENDED NOISE SURVEY TABLES (ST1)

Date	Time	L _{Aeq,T}	L _{AFmax}	L _{A10,T}	L _{A90,T}
20/01/2022	09:08	59.8	70.3	62.9	52.4
20/01/2022	09:23	59.1	69.9	62.5	51.7
20/01/2022	09:38	59.3	67.2	62.2	53.5
20/01/2022	09:40	52.1	55.2	52.8	51.1
20/01/2022	09:40	59.1	64.9	63.0	49.3
20/01/2022	09:42	57.6	68.4	60.2	48.8
20/01/2022	09:44	60.0	65.7	63.6	54.3
20/01/2022	09:45	59.4	73.1	62.5	51.9
20/01/2022	10:03	58.6	66.8	62.0	51.2
20/01/2022	10:18	59.1	66.3	62.4	51.0
20/01/2022	10:33	59.4	72.3	62.9	49.7
20/01/2022	10:48	58.9	68.9	62.4	48.9
20/01/2022	11:03	59.8	73.2	63.1	50.5
20/01/2022	11:18	58.7	68.1	62.1	49.6
20/01/2022	11:33	58.9	69.8	62.1	50.0
20/01/2022	11:49	58.5	71.4	61.9	49.2
20/01/2022	15:55	60.4	71.2	62.8	55.7
20/01/2022	16:10	60.8	68.4	63.6	53.4
20/01/2022	16:25	60.5	66.9	62.9	56.0
20/01/2022	16:38	61.6	79.6	63.7	56.4
20/01/2022	16:53	61.4	68.3	63.7	56.2
20/01/2022	17:08	63.9	65.6	65.2	62.8
21/01/2022	05:59	57.1	71.3	61.4	42.7
21/01/2022	06:14	59.4	74.5	63.2	47.1
21/01/2022	06:29	59.7	67.5	63.0	51.6
21/01/2022	06:44	59.5	73.9	63.2	47.7
21/01/2022	06:59	59.8	72.2	63.0	50.6
21/01/2022	07:14	61.1	73.7	63.9	53.0
21/01/2022	07:29	60.0	68.9	63.3	50.8
21/01/2022	07:44	60.2	68.8	63.0	54.4
21/01/2022	07:59	61.0	70.7	63.7	54.1
21/01/2022	08:14	60.3	69.9	63.1	54.3
21/01/2022	08:29	61.7	71.8	64.4	55.5
21/01/2022	08:44	61.5	71.2	64.1	55.3

Date	Time	L _{Aeq,T}	L _{AFmax}	L _{A10,T}	L _{A90,T}
21/01/2022	08:59	60.7	67.6	63.6	53.9
21/01/2022	08:14	60.0	68.3	63.2	52.9
21/01/2022	13:32	59.7	69.6	62.7	52.9
21/01/2022	13:47	59.8	71.3	62.8	52.8
21/01/2022	14:02	61.1	76.1	64.2	54.0
21/01/2022	14:17	60.4	69.6	63.3	53.2
21/01/2022	14:32	59.9	61.4	60.6	58.8

T=15 minutes

APPENDIX C

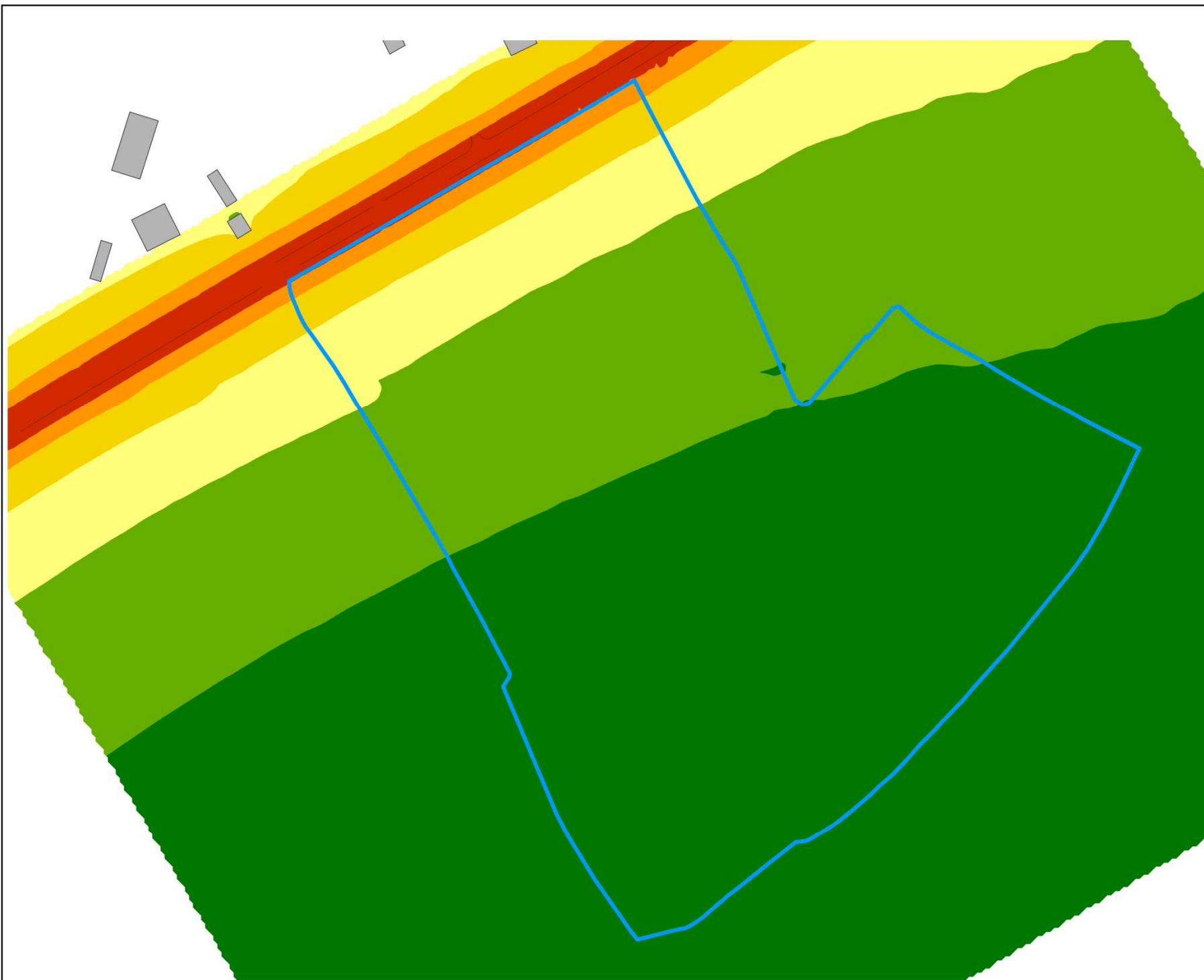
NOISE MODEL INPUT DETAILS

TABLE C.1: SoundPLAN Model Sources and Parameters

Parameter	Source	Details
Base OS	Bellway Homes	OS Base
Ground Levels	DEFRA	2m LIDAR (DTM)
Building Heights	SR	8m for all buildings, 3m for garages
Traffic Data	Optima Highways SR	18hr AAWT traffic flows Verified against measured noise levels
Barriers	SoundPLAN	1.8m proposed barriers as presented on SK05 in Appendix D
Receptor Positions	SoundPLAN	Garden: 1.5m height Façade: 0.05m from façade (façade correction included in noise break-in calculations), 1.5m height (daytime) and 4.5m height (night-time)
Reflections	SoundPLAN	1st order reflections
Site Layout	STEN	Planning layout: Rev B Planning layout Rev G (As shown in SKo05) has been reviewed with there being no material changes to Rev B in terms of noise.

APPENDIX D

SKETCHES



Noise Level Bands

	≤ 50
	50 < ≤ 55
	55 < ≤ 60
	60 < ≤ 65
	65 < ≤ 70

SK01: ProPg Daytime
Noise Contour Plot

(LAeq,16hours)

Contour Grid / Calculations
at 1.5m height

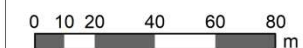
(Noise contour plot provided
for indicative purposes only)

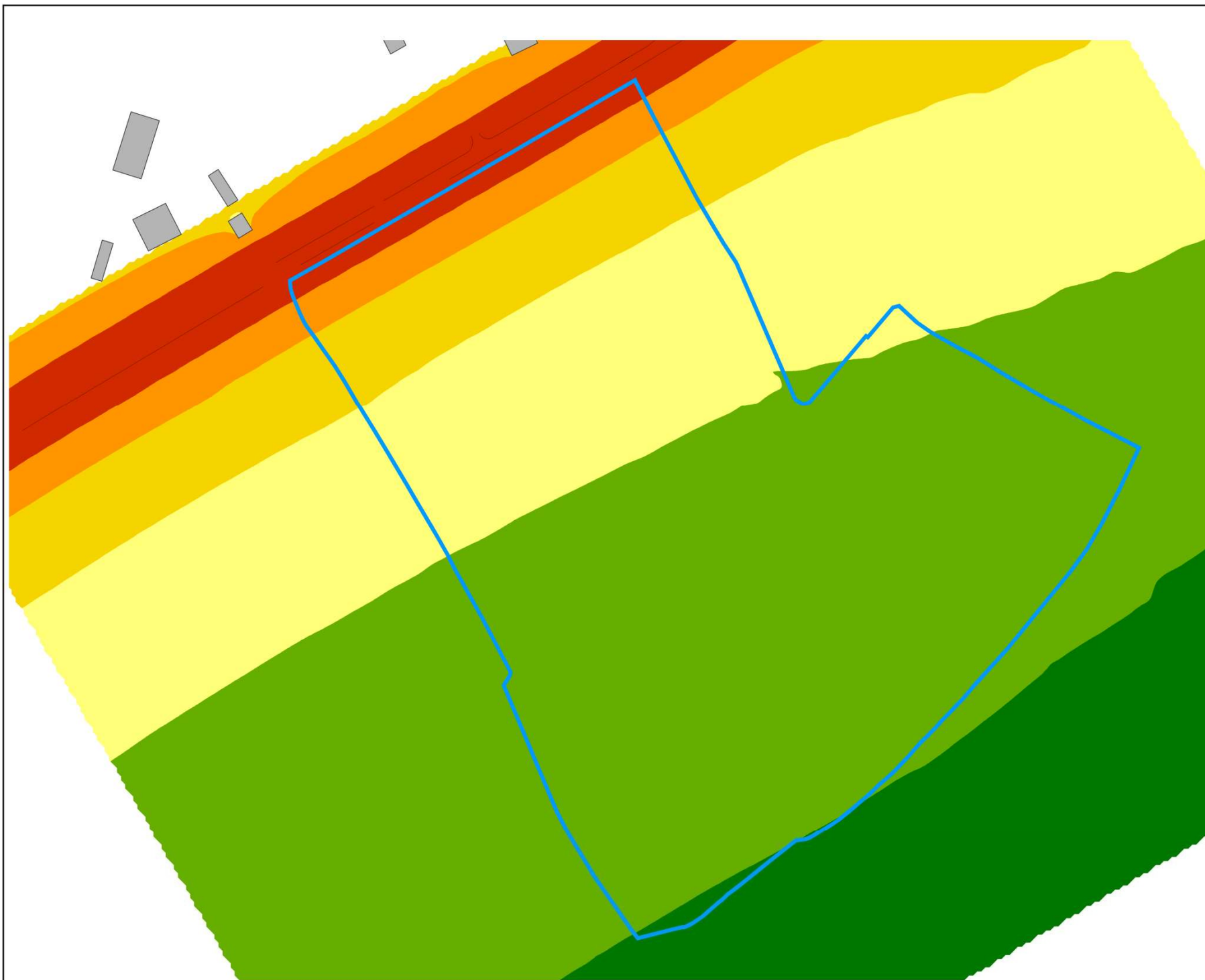
Date: 11.03.2022

Project No: 2220945

Consultant: S Moran

Scale 1:2500





Noise Level Bands

<= 40
40 < <= 45
45 < <= 50
50 < <= 55
55 < <= 60
60 <

SK02: ProPg Night-time
Noise Contour Plot

(LAeq,8hours)

Contour Grid / Calculations
at 4.5m height

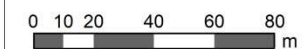
(Noise contour plot provided
for indicative purposes only)

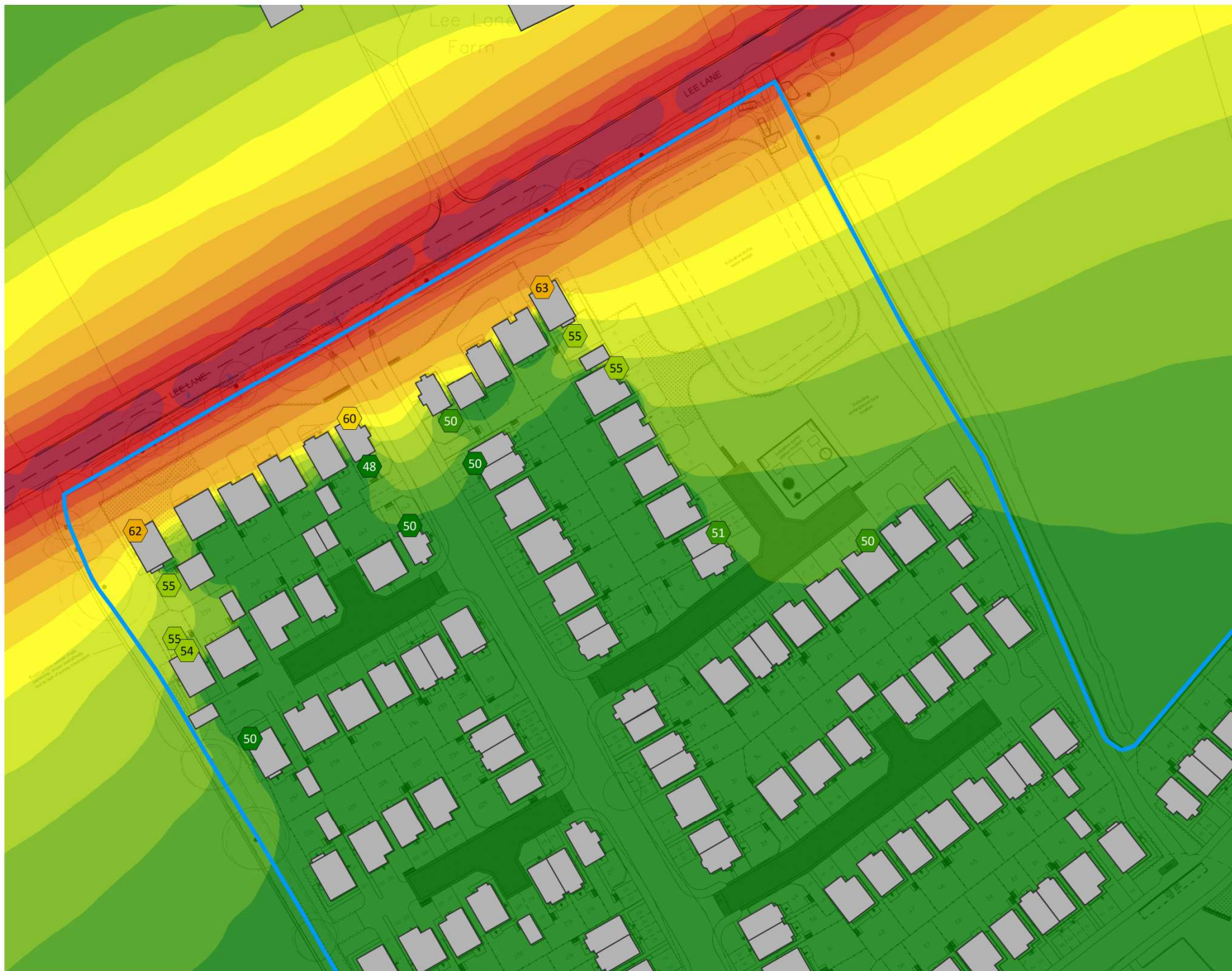
Date: 11.03.2022

Project No: 2220945

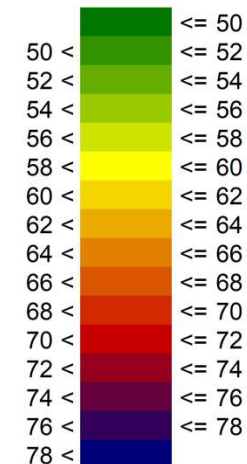
Consultant: S Moran

Scale 1:2500





dBa



SK03: Daytime
Noise Contour Plot
(LAeq,16hours)

Contour Grid / Calculations
at 1.5m height

(Noise contour plot provided
for indicative purposes only)

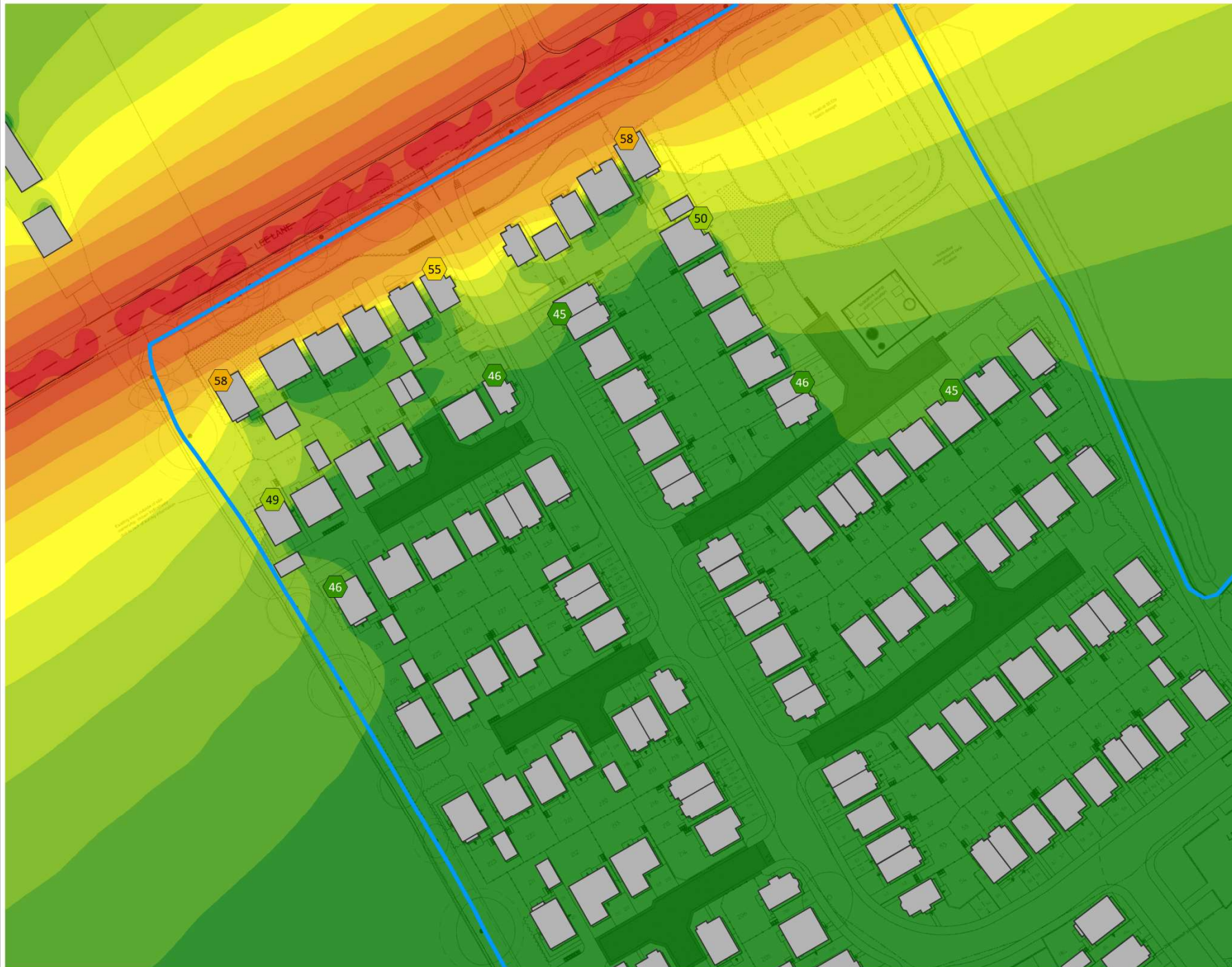
Date: 11.03.2022

Project No: 2220945

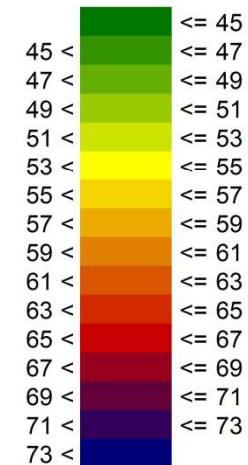
Consultant: S Moran

Scale 1:1250





dBA



SK04: Night-time
Noise Contour Plot
(LAeq,8hours)

Contour Grid / Calculations
at 4.5m height

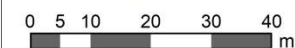
(Noise contour plot provided
for indicative purposes only)

Date: 11.03.2022

Project No: 2220945

Consultant: S Moran

Scale 1:1250





SK05: Proposed Noise Mitigation Strategy

Glazing & Ventilators

- Option A Habitable Rooms:
Windows (4mm/16mm/4mm, 25 dB $R_{w,C,w}$)
and Trickle Vents* (33 dB $D_{n,e,w}$)
- Option B Habitable Rooms:
Windows (8mm/16mm/4mm, 29 dB $R_{w,C,w}$)
and Trickle Vents* (42 dB $D_{n,e,w}$)

*Notes: This plan should be read in conjunction with the noise report including Tables 4.4 and 4.5 which present the reference frequency spectrum of the windows and vents.

The scheme of ventilation will be designed by others.

Barriers

- 1.8m Wall or Acoustic fence. All acoustic barriers will be of solid construction with no gaps. Fences will be double boarded with either staggered joints or butt jointed and a minimum mass of 10 kg/m²