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CONSULTING

Allison Homes

Land East of Normanton Road, Crowland

Noise Impact Assessment

DC5140-NR1

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Limitations to this Report

This report entails a physical investigation of the site with a sufficient number of sample measurements to provide quantitative information concerning the type and degree of noise affecting the site. The objectives of the investigation have been limited to establishing sources of noise material to carrying out an appropriate assessment.

The number and duration of noise measurements have been chosen to give reasonably representative information on the environment within the agreed time, and the locations of measurements have been restricted to the areas unoccupied by building(s) that are easily accessible without undue risk to our staff.

As with any sampling, the number of sampling points and the methods of sampling and testing cannot preclude the existence of “hotspots” where noise levels may be significantly higher than those actually measured due to previously unknown or unrecognised noise emitters. Furthermore, noise sources may be intermittent or fluctuate in intensity and consequently may not be present or may not be present in full intensity for some or all of the survey duration.

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1.0 INTRODUCTION

1.1 Details of Instruction

Allison Homes has instructed Dragonfly Consulting to carry out a Noise Impact Assessment in support of a planning application for a residential development at Land East of Normanton Road, Crowland.

The noise assessment has been conducted with reference to the National Planning Policy Framework, the (NPPF) and *Noise Policy Statement for England* (NPSE) and to appropriate British Standards, recognised guidance and reference documents relevant to this site.

This report describes a noise survey of the site and the subsequent analysis to determine the noise environment of the proposed development. It then compares the results with the adopted criteria. Recommendations are also made with respect to the design of the development.

Measurement of external noise levels have been completed for the proposed development to allow demonstration by calculation that suitable internal noise levels will be achieved within the most noise exposed rooms.

A glossary of technical terminology is included in Appendix A.

1.2 Site Description

1.2.1 Existing Site Conditions

The development site is a currently vacant section of agricultural land, located north of the A16, and northeast of the town of Crowland.

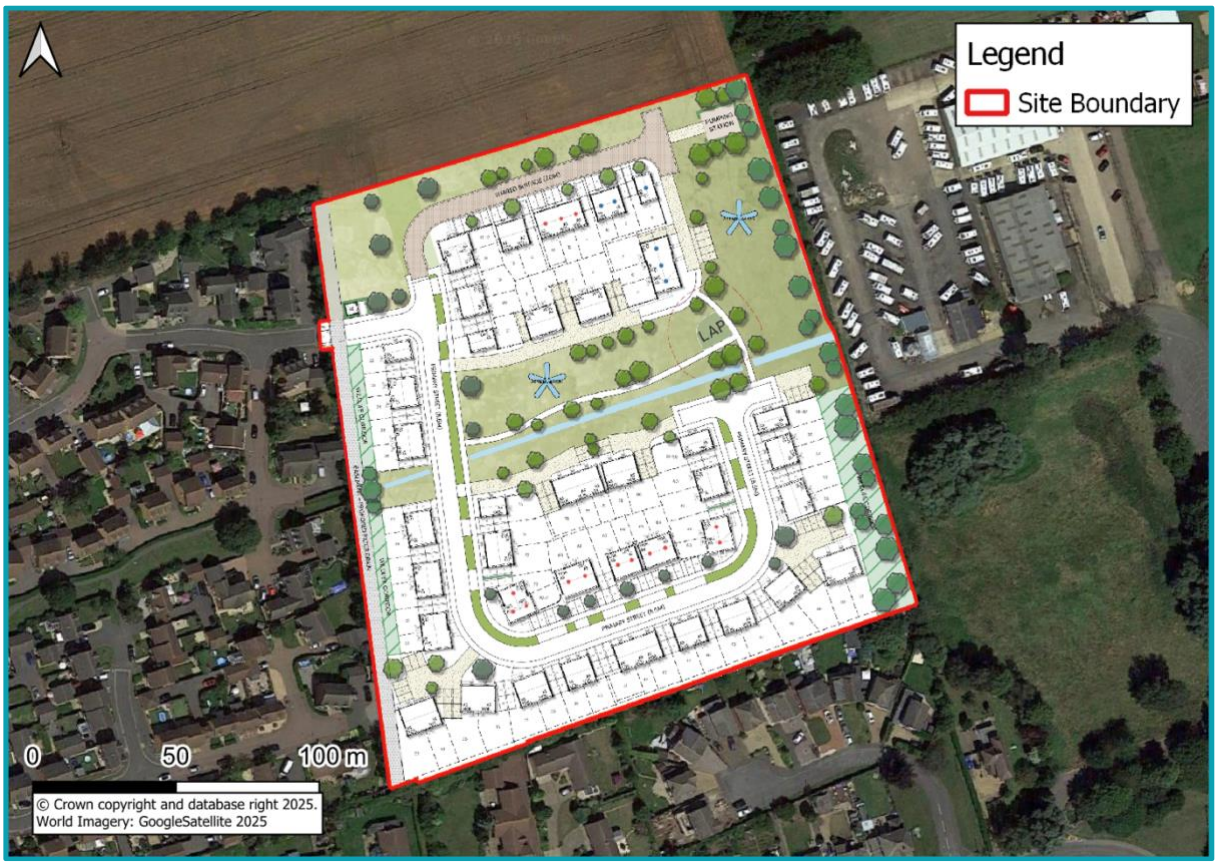
1.2.2 Proposed Site Conditions

The proposed site is for a mixed development of 80 dwellings (6 of which being shared ownership, and 20 being affordable housing), with the dwellings spanning 71150sqft. The net developable area is 14542 sqft/acre.

Figure 1.1 overleaf shows the site plan of the proposed residential development which has been provided by Pegasus Group (13/5/25, DWG: P24-1403_DE_003_G_01).

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Figure 1.1
Site Layout Plan



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2.0 GUIDANCE

2.1 National Planning Guidance

2.1.1 National Planning Policy Framework

The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these are expected to be applied. At the heart of the NPPF is a presumption in favour of sustainable development. It requires Local Plans to be consistent with the principles and policies set out in the NPPF with the objective of contributing to the achievement of sustainable development.

The NPPF states that the planning system has three overarching objectives in achieving sustainable development including a requirement to 'contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.'

Paragraph 187 of the NPPF states:

"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."

Additionally, Paragraph 198 of the NPPF states:

"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

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

2.1.2 Noise Policy Statement for England

The document 'Noise Policy Statement for England' sets out the following vision for ongoing noise policy:

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

This vision should be achieved through the following Noise Policy Aims:

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

- *avoid significant adverse impacts on health and quality of life;*

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- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life."*

To achieve this vision, the Noise Policy Statement sets 3 noise levels to be defined by the assessor:

NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms: below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur.

The Noise Policy Statement considers that noise levels above the SOAEL would be seen to have, by definition, significant adverse effects and would be considered unacceptable. Where the assessed noise levels fall between the LOAEL and the SOAEL noise levels, the Policy Statement requires that:

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

Where noise levels are below the LOAEL, it is considered there will be no adverse effect. Once noise levels are below the NOEL, there will be no observable change.

2.2 Local Planning Guidance

Adopted on 8th March 2019, the Southeast Lincolnshire Local Plan 2011-2036 (developed by South Holland District and Boston Borough Council) refers to noise specific policies. For clarity, the policies have been reproduced below:

"Policy 2: Development Management

Proposals requiring planning permission for development will be permitted provided that sustainable development considerations are met, specifically in relation to:

…

6. Impact upon neighbouring land uses by reason of noise, odour, disturbance or visual intrusion:"

"Policy 30: Pollution

Development proposals will not be permitted where, taking account of any proposed mitigation measures, they would lead to unacceptable adverse impacts upon:

…

5. Noise including vibration…"

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2.2.1 Planning Practice Guidance for Noise

With reference to the NPPF and NPSE above, further guidance is given within the Noise Exposure Hierarchy Table, shown overleaf, forming part of the Planning Practice Guidance for Noise:

Table 2.1
Noise Exposure Hierarchy Table – Planning Practice Guidance for Noise

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			
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			
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

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2.3 British Standards and Guidance Documents

2.3.1 British Standard (BS) 7445-1:2003

The assessment of noise impact for this development has been undertaken by measuring external noise levels in accordance with the guidance detailed in BS 7445-1:2003 *Description and Measurement of Environmental Noise – Part 1: Guide to Quantities and Procedures*.

This document defines the basic quantities to be used for the description of noise in community environments and describes basic procedures for the determination of these quantities.

The methods and procedures described in this British Standard are intended to be applicable to sounds from all sources, individually and in combination, which contribute to the total noise at a site. This British Standard does not specify limits for environmental noise.

2.3.2 BS 8233:2014

The scope of British Standard 8233:2014: *Sound insulation and noise reduction for buildings* is the provision of guidance for the control of noise in and around buildings. It suggests appropriate criteria and limits for different situations; the primary intention of these is to guide the design of new buildings or refurbished buildings undergoing a change of use rather than to assess the effect of changes in the external noise climate. The standard suggests suitable internal noise levels within different types of buildings, including residential dwellings, as shown in Table 2.2.

Table 2.2
Indoor Ambient Noise Levels in Spaces When They Are Unoccupied

Activity	Typical Situations	Design Range $L_{Aeq,T}$ dB	
		0700h to 2300h	2300h to 0700h
Resting	Living rooms	35	--
Dining	Dining Room / Area	40	--
Sleeping	Bedrooms	35	30

BS 8233:2014 states in Note 4 that:

"Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{AMax,f}$ depending on the character and number of events per night. Sporadic noise events could require separate values."

As such, it has been considered appropriate to define a limit for regular maximum noise levels of 45dB(A) with sporadic events not exceeding 50dB(A).

BS 8233:2014 also suggests noise limits for external areas of a property such as gardens or balconies. It states that:

"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

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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."

2.4 ProPG: Planning and Noise

The document 'ProPG: Planning & Noise - Professional Practice Guidance on Planning & Noise' provides advice for Local Planning Authorities, developers and their respective advisors and compliments government planning, noise policy and guidance. The document seeks 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;
- Improve understanding of how to determine the extent of potential noise impact and its effect;
- Assist in the delivery of sustainable development.

Following the guidance in paragraph 17 of the NPPF, planning should always seek to secure high quality design and a good standard of amenity for all existing and future occupants of land and buildings. ProPG describes an acoustic design process which seeks to deliver the best acoustic outcome for the site.

2.4.1 Approved Document F1 – Means of Ventilation

Whilst not directly related to the acoustic performance and noise impact assessment covered within this report, Table 1.7 of the document provides the guidance with respect to minimum passive ventilator space installed within the external façade of spaces depending on the overall ventilation strategy.

2.4.2 BS ISO 9613-2:2024 Attenuation of Sound during Propagation Outdoors.

ISO 9613 presents a calculation methodology for the determination of the attenuation of sound outdoors. The methodology enables the prediction the levels of environmental noise at a distance from a variety of sources.

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3.0 ASSESSMENT METHODOLOGY

3.1 Potential Sources of Environmental Noise

The following sources of environmental noise have been considered within this assessment:

Table 3.1
Assessed Sources of Environmental Noise

Potential Noise Source	Relevant Assessment Methodology
Road Traffic	BS 8233:2014

3.2 Selection of Assessment Criteria

With reference to the guidance detailed in Section 2, the following criteria have been selected to determine the threshold of effect levels in the context of the National Planning Policy Framework and Noise Policy Statement for England.

Table 3.2
Assessment Criteria: BS 8233:2014

Effect Level	Criteria	Justification
Lowest Observed Adverse Effect Level (LOAEL)	Internal noise levels achieve the requirements of the BS 8233:2014 standard assuming windows are closed, and an additional source of ventilation is provided	Noise levels within the BS 8233:2014 criteria whilst ensuring no conflict with acceptable levels of indoor air quality management are considered to be suitable
Significant Observed Adverse Effect Level (SOAEL)	Internal noise levels fail to achieve the BS 8233:2014 standard by more than 5dB assuming windows are closed, and an additional source of ventilation is provided	None Mitigate to achieve LOAEL Criteria

With reference to the guidance within BS 8233:2014 and the *'ANC Green Book: Environmental Noise Measurement Guide'* (ANC, 2019), the predicted internal levels have been assessed against the following criteria:

- $L_{Aeq,16h}$ (Daytime) – internal levels must not exceed 35dB $L_{Aeq,16h}$;
- $L_{Aeq,16}$ (Daytime) – external levels within private amenity spaces must not exceed 55dB $L_{Aeq,16h}$;
- $L_{Aeq,8h}$ (Night-time) – internal levels must not exceed 30dB $L_{Aeq,8h}$; and
- L_{AFMax} (Typical) – the 95th percentile of all 1min night-time L_{Amax} noise levels must not exceed 45dB L_{AFMax}.

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With regard to the determination of the L_{Amax} design case, the ANC Green Book Notes:

> *"Only in the most extreme situations would it be appropriate to adopt the highest measured L_{Amax} value... as a descriptor of an appropriate design case. In most situations, an average, typical or modal value, specific to the time period in question, needs to be selected or derived from the survey data. The frequency of occurrence of specific L_{Amax} events is critical in determining their typicality (hence the importance of sample period selection during scoping) ... Some common approaches to selecting the Design Case L_{Amax}, for instance, include ranking events during an assessment period and selecting the nth value (NB sample period is critical), taking a 10th percentile 'high average' level or simply selecting an appropriate looking value 'by eye'."*

As can be seen above, the approach adopted within the assessment is more onerous than recommended within the ANC Green Book. By adopting the 95th percentile as the design case it is considered that the assessment presents a reasonable worst-case approach.

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4.0 ENVIRONMENTAL NOISE SURVEY

4.1 Survey Methodology

Daytime and night-time measurements were undertaken at three (3no.) measurement locations from the 10th to the 12th of June 2025. A three-hour attended measurement was also undertaken at one (1no.) measurement location on the 10th of June 2025. The noise measurements established typical external ambient and background noise levels at the site. The measurement locations are hereby referred to in this report as follows:

- 'Location 1' – sound level meter positioned approximately 1.5m from the ground, northwest of the proposed development site, adjacent to Cloot Drove;
- 'Location 2' – sound level meter positioned approximately 1.5m from the ground, east of the proposed development site;
- 'Location 3' – sound level meter positioned approximately 1.5m from the ground, southeast of the proposed development site, adjacent to James Road; and
- 'Location 4' – attended sound level meter positioned approximately 1.5m from the ground, south of the proposed development site and 4m north of the A16 carriageway.

The equipment used during the survey is detailed in Appendix B. The sound level meters were calibrated before and after the measurements and no significant calibration drifts were found to have occurred (>0.2dB). The noise monitoring equipment had been calibrated to a traceable standard within the twenty-four months preceding the survey. Calibration certificates are available on request.

The measurement locations are shown in Appendix C.

4.2 Survey Results

Weather conditions were collated throughout the duration of the survey and all periods were considered suitable. Summaries of the measured noise levels are given in Table 4.1 below. Full noise measurement survey data available upon request.

Table 4.1
Summary of Measured Noise Levels – 10/06/25 to 12/06/25 – Free Field, dB

Location	Date	Period	Time (h)	$L_{Aeq,T}$	L_{A10}	L_{A90}	L_{AFMax}
1	10/06/25	Daytime	1300h-2300h	44.1	43.9	34.8	81.2
	10/06/25-11/06/25	Night-time	2300h-0700h	42.4	41.1	34.0	68.2
	11/06/25	Daytime	0700h-2300h	50.1	45.8	37.0	87.6
	11/06/25-12/06/25	Night-time	2300h-0700h	43.6	42.6	36.3	73.8
	12/06/25	Daytime	0700h-1100h	45.9	44.6	38.2	75.6
2	10/06/25	Daytime	1400h-2300h	50.0	47.6	38.2	77.7
	10/06/25-11/06/25	Night-time	2300h-0700h	52.2	49.8	41.1	78.5
	11/06/25	Daytime	0700h-2300h	52.2	51.6	44.4	86.3
	11/06/25-12/06/25	Night-time	2300h-0700h	54.6	52.3	42.8	80.9
	12/06/25	Daytime	0700h-1200h	51.4	52.4	46.0	77.0
3	10/06/25	Daytime	1500h-2300h	45.7	46.6	38.5	73.1
	10/06/25-11/06/25	Night-time	2300h-0700h	48.9	48.6	38.6	75.7
	11/06/25	Daytime	0700h-2300h	50.7	49.7	43.0	84.7

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Location	Date	Period	Time (h)	$L_{Aeq,\ T}$	L_{A10}	L_{A90}	L_{AFMax}
	11/06/25-12/06/25	Night-time	2300h-0700h	52.9	51.1	40.4	78.7
	12/06/25	Daytime	0700h-1300h	49.6	50.5	44.7	73.1
4	10/06/2025	Daytime	1250h-1450h	65.9	64.6	48.3	91.8

4.3 Calculation of Road Traffic Noise (CRTN) Calculation

Shortened (3hr) CRTN measurements were undertaken at Location 4 to determine the daytime ($L_{Aeq,16hr}$) noise levels pervading the site.

In accordance with CRTN, the following equation has been utilised:

$$L_{A10\ (18-hour)} = L_{A10\ (3-hour)} - 1dB(A)$$

$$\text{where } L_{A10\ (3-hour)} = \frac{1}{3}\sum_{10\leq t\leq 14}^{t+2} L_{A10\ (hourly)}$$

In accordance with the CRTN short measurement method, the following indices have been derived:

Table 4.2
Summary of Calculated (CRTN) Noise Levels – Free-field, dB

Location	Measured $L_{A10,\ 3h}$	Derived $L_{A10,18h}$	Derived $L_{Aeq,16h}$
Location 4	64.6	63.6	60.6

4.4 Observations and Comments

During the attended portions of the survey, the acoustic environment was dominated by road traffic noise from the surrounding road networks to the west and south.

For both the daytime and night-time assessments, it is considered that the levels measured are representative of the typical acoustic environments at the survey locations.

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5.0 NOISE MODELLING METHODOLOGY

5.1 Data Sources

Modelling calculations have been undertaken based on the spatial settings and data sources identified in Table 5.1.

Table 5.1
Noise Model Input Data

Parameter	Data Source	Assumptions
Site Plans	*Testing Layout (Allocation Land) P24_1403_DE_003_G_01*	Existing and proposed building heights modelled as 8.5m AGL (typical 2-storey building height) unless noted to be otherwise through global mapping software
Ground Heights	Environment Agency Open Data LiDAR Digital Terrain Model (2.0m resolution)	None
Ground Absorption	*n/a*	Mixed ground conditions on and off site (G=0.5)
Reflections	*n/a*	3rd order reflections have been accounted for within the noise model

5.1.1 Source Noise Assumptions

Source Noise Validation

The existing ambient noise was calculated by utilising the measured noise data summarised in Section 4 as validation points on the noise model. The noise output of the main noise-producing elements of the wider site were subsequently calibrated to provide values representative of the measured levels at each of the measurement locations.

To assess maximum event levels, the surrounding road network was subsequently converted to a moving point source within CadnaA and calibrated using the measured data at 'Location 1' and 'Location 3' as receivers on the model, considered to be the nearest to the noise sources in question.

During the night-time period at 'Location 3', the period between 0330h-0700h has been removed from the source noise validation due to the influence from birdsong, which significantly influenced noise levels during this period, and their proximity to the sound level meter was unrepresentative of the wider source noise environment.

'Location 2' was also not utilised for the source noise validation model, as the adjacent garden centre is no longer active. A summary of the validation exercise can be seen in Table 5.2 below.

Table 5.2
Comparison of Measured and Modelled Data

Location	Assessment Metric	Period	Measured Level, dB $L_{Aeq,T}$	Modelled Level, dB $L_{Aeq,T}$	Difference, dB
Location 1	$L_{Aeq,16h}$	0700-2300	50.1	50.1	0.0
	$L_{Aeq,8h}$	2300-0700	43.6	43.6	0.0
	L_{AFMax}		63.4	63.4	0.0

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Location	Assessment Metric	Period	Measured Level, dB $L_{Aeq,T}$	Modelled Level, dB $L_{Aeq,T}$	Difference, dB
Location 3	$L_{Aeq,16h}$	0700-2300	50.7	50.7	0.0
	$L_{Aeq,8h}$	2300-0700	41.8	41.8	0.0
	L_{AFMax}		61.4	61.4	0.0
Location 4*	$L_{Aeq,\ 16h}$	0700-2300	60.6	60.6	0.0

**Location 4 utilises a derived $L_{Aeq,T}$ value.*

There is no difference between the measured and modelled levels, dB, and therefore, the models are considered to be suitably verified.

5.2 Uncertainty

5.2.1 Survey

Standard equipment uncertainties have been considered by applying allowable tolerances minus the maximum allowable test laboratory uncertainties given in IEC 61672-1, as defined by Narang and Bell (*Narang, P. and Bell, T., 2008. New IEC standards and periodic testing of sound level meters. Proceedings of the Internoise, Shanghai, China, pp.26-29*).

The following table provides an overview of standard equipment uncertainties relevant to the SLM class utilised within the survey.

Table 5.3
Standard uncertainties using allowable tolerances minus test laboratory tolerances given in IEC 61672-1 (source: Narang and Bell, Table 14)

SLM Class	Frequency Weighting	Directional Response	Level Linearity	Toneburst Response	Calibrator (IEC 61672)	Supply Voltage	Combined Standard Uncertainty +/- dB
Class 1	0.5	0.5	0.4	0.25	0.125	0.05	0.9

5.2.2 Modelling

CadnaA noise modelling software has been utilised to ascertain how noise propagates throughout the proposed development. The software directly incorporates the ISO 9613 calculation procedure which has an uncertainty rating of +/- 3dB.

5.2.3 Design Calculations

Where design calculations have been utilised to determine the required performance of the glazing and ventilation strategy for the scheme, the method outlined within Annex G of BS 8233 (which is based on the BS EN 12354-3 calculation methodology) has been followed. The expected precision of this calculation methodology is quoted as +/- 2dB.

5.2.4 Combined Uncertainty

Based on the information provided above, the combined Root Sum Squared (RSS) uncertainty for the assessment has been calculated as +/- 3.9dB.

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6.0 ASSESSMENT

6.1 Predicted Internal Noise Levels within Dwellings

Calculations of internal noise levels have been completed for the proposed development to demonstrate that suitable internal noise levels can be achieved within the most noise-exposed rooms.

The internal noise levels have been calculated for six (6no.) noise sensitive receptors (NSRs), which include NSRs at the most exposed façades of the proposed site.

The NSR locations utilised within this assessment are shown in Appendix C.

6.1.1 Predicted Internal Levels – Partially Open Window

Internal noise ambient noise levels within habitable rooms have been assessed with open windows.

To account for the attenuation afforded by a partially open window, a nominal correction of 15dB has been applied.

The results of the assessment are presented in Table 6.1. The plot ref. for each proposed NSR has been gathered from the Testing Layout (P24-1403_DE_003_G_01). For brevity, the highest noise impact upon the façade of the NSR has been assessed.

Table 6.1
Assessment of Noise Intrusion Levels – Open Windows (Natural Ventilation)

NSR (Plot ref.)	External Noise Level			Internal Noise Level		
	$L_{Aeq,16h}$	$L_{Aeq,8h}$	L_{AfMax}	$L_{Aeq,16h}$	$L_{Aeq,8h}$	L_{AfMax}
Plot 8	45.1	37.8	51.1	30.1	22.8	36.1
Plot 22	40.7	34.5	49.0	25.7	19.5	34.0
Plot 42	45.7	38.6	67.4	30.7	23.6	52.4
Plot 46	46.8	39.7	67.2	31.8	24.7	52.2
Plot 56	48.4	41.0	55.9	33.4	26.0	40.9
Plot 71	45.1	36.8	60.8	30.1	21.8	45.8

As shown in the table above, the attenuation afforded by a partially open window is sufficient to meet BS 8233:2014 internal ambient noise levels for Plots 8, 22 and 56.

This is likely as these NSRs are situated further from the noise sources impacting upon the development, that being the road network to the south, as can be seen in Appendix D.

However, for the remaining plots considered, the attenuation afforded by a partially open window is not sufficient to meet BS 8233:2014 internal ambient noise levels as defined in Section 3.0, and therefore further in-façade noise mitigation is required.

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6.2 In-Façade Mitigation

Based on the results of the assessment outlined above, an alternative glazing and ventilation strategy will be required to ensure noise levels within the proposed dwellings fall within the criteria outlined in Section 3.0.

At the current stage, no detailed floor plans of the proposed dwellings have been finalised, and therefore, the area of external façade that is glazed and unglazed and floor area for the NSRs has been calculated using the following assumptions:

- Living Room dimensions of 5m (length) x 4m (width) x 2.3m (height);
- Bedroom dimensions of 3m (length) x 4m (width) x 2.3m (height); and
- Double glazed window dimensions of 1m (width) x 1.8m (height).

These assumptions have made based upon typical room sizes of modern family houses. It has been assumed that the most exposed façade would be 4m x 2.3m (9.2m^2), unglazed, and 7.4m^2 with the aforementioned glazing, for both the Living Room and Bedroom.

Also, at the current design stage there is no fixed ventilation strategy for the development. The following ventilation strategy have been considered to demonstrate site suitability; this should be viewed as indicative only.

Table 6.2
Building Regulations Approved Document F Requirements

Specification	Approved Document F – Indicative Ventilation Strategy	Passive Ventilation Requirement within Habitable Spaces
Specification A	Natural ventilation with background ventilators and intermittent extract fans	8000mm^2 EA in each habitable room for dwellings spanning multiple floors or 10000mm2 EA for single storey dwellings or flats

Please note, consideration for the requirements of Part F of the Building Regulations has been given to support the assessment of acoustic suitability only. Part F compliance should be determined through consultation with a qualified ventilation specialist.

Table 6.3 overleaf presents a summary of the proposed specification. Please note, the below does not provide an exhaustive list of suitable options for glazing and ventilation, but care should be taken to ensure the selected product meets the octave band performance requirements set out below.

Table 6.3
Example Glazing & Ventilation Strategy

Specification	Building Element	Unit	Minimum Recommended Sound Reduction Performance					R_w	$D_{ne,w}$
			125	*250*	*500*	*1000*	*2000*		
Specification A	Example Glazing	Pilkington 4mm / (6 – 16mm) / 4mm	21.0	17.0	25.0	35.0	37.0	29	-
	Example Ventilation	2no. Zehnder Greenwood 5000EAW.AC1	38.9	38.4	30.6	43.7	43.0	-	39

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Façade performance calculations are not limited to the impact of glazing and ventilation systems. To account for the attenuation afforded by the external wall, the calculations include the performance afforded by a typical brick/block cavity wall. Table 6.4 shows the sound reduction performance of the external wall.

Table 6.4
SRI of Façade, dB (R_W)

Frequency in Hz	125	250	500	1000	2000	4000	R_w (dB)
SRI of Façade	46.0	44.0	46.0	54.0	62.0	67.0	52

6.2.1 Predicted Internal Noise Levels – Closed Windows

Following incorporation of the specification outlined in Table 6.3 and 6.4, Table 6.5 presents the results of the predicted internal noise levels for any habitable rooms at the NSRs, using the assumptions based on typical dwelling dimensions.

Table 6.5
Assessment of Noise Intrusion Levels – Closed Windows

NSR (Plot ref.)	Room Type	Internal Noise Level		
		$L_{Aeq,16h}$	$L_{Aeq,8h}$	L_{AfMax}
Plot 42	Lounge/Kitchen/Dining Room	16.7	--	--
	Bedroom	18.9	11.0	41.4
Plot 46	Lounge/Kitchen/Dining Room	17.8	--	--
	Bedroom	20.0	12.1	41.2
Plot 71	Lounge/Kitchen/Dining Room	16.1	--	--
	Bedroom	18.1	9.1	34.8

As shown in Table 6.5, the attenuation afforded by the proposed glazing and ventilation strategy, detailed in Table 6.3, is sufficient to meet the requirements within BS 8233:2014 for internal ambient noise level criteria.

It is therefore considered that the calculated internal noise levels are below the LOAEL set for this project, as defined in Section 3.0 of this Report.

6.3 External Noise Levels

BS 8233:2014 suggests noise limits for external areas of a property such as gardens or balconies. It states that:

"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."

Figure D-1 within Appendix D shows a noise contour map, illustrating noise propagation across the site at 1.5m AGL (above ground level) due to the impact of noise from the road network during the daytime period.

External amenity areas shaded in green denote levels which are below the external noise level criteria of 50 dB $L_{Aeq,T}$.

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External amenity areas shaded in yellow denote levels which exceed the desirable criteria of 50 dB $L_{Aeq,T}$, however all areas are within the upper guideline value of 55 dB $L_{Aeq,T}$. A small area in the south-east corner of the development falls within this category. However, this area that exceeds the desirable criteria is not within the external amenity area of any proposed plot.

Therefore, as can be seen in Figures D-1, all external amenity areas are within the adopted criteria desirable guideline value of 50dB $L_{Aeq,T}$.

6.4 Recommendation to Decision Makers

The ProPG recommends that the acoustician make one of the following recommendations to a decision maker when considering the suitability in noise terms of a site for residential development. The recommendations are as follows:

1. Planning consent may be granted without any need for noise conditions;
2. Planning consent may be granted subject to the inclusion of suitable noise conditions;
3. Planning consent should be refused on noise grounds in order to avoid significant adverse effects (“avoid”); or
4. Planning consent should be refused on noise grounds in order to prevent unacceptable adverse effects (“prevent”).

Based on the assessment of noise risk, the subsequent detailed noise impact assessment and taking account of the recommended mitigation measures, it is the recommendation of Dragonfly Consulting that:

“…planning consent be granted subject to the inclusion of suitable noise conditions.”

6.5 Assertion of Competence

This assessment has been completed by Travis Smith, Acoustic Consultant with responsibilities for completing acoustic reports on behalf of Dragonfly Consulting. I hold a Bachelor of Science in Geography from the University of Hull. I have experience of undertaking acoustic consultancy work since July 2022 and I am an Affiliate member of the IOA.

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7.0 CONCLUSIONS

Allison Homes has instructed Dragonfly Consulting to carry out a Noise Impact Assessment in support of a planning application for a residential development at Land East of Normanton Road, Crowland.

The noise assessment has been conducted with reference to the National Planning Policy Framework, the (NPPF) and *Noise Policy Statement for England* (NPSE) and to appropriate British Standards, recognised guidance and reference documents relevant to this site.

This report describes a noise survey of the site and the subsequent analysis to determine the noise environment of the proposed development. It then compares the results with the adopted criteria and, where applicable, recommendations are made with respect to the design of the development.

7.1 Residential Noise Assessment

The assessment identifies that the attenuation afforded by the example glazing and ventilation strategy is sufficient to meet the requirements within BS 8233:2014 for internal ambient noise level criteria, as defined in Section 3.0 of the Report.

7.2 External Noise Levels

The assessment identifies that all external amenity areas across the proposed development fall within the adopted criteria desirable guideline value of 50dB $L_{Aeq,T.}$

Based on the assessment of noise risk, the subsequent detailed noise impact assessment and taking account of the recommended mitigation measures, it is the recommendation of Dragonfly Consulting that:

"…planning consent be granted subject to the inclusion of suitable noise conditions."

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Appendix A – Glossary of Terminology

In order to assist the understanding of acoustic terminology and the relative change in noise, the following background information is provided.

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

Table A-1
Sound Levels Commonly Found in the Environment

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

Acoustic Terminology

dB (decibel) The scale on which sound pressure level is expressed. 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 ($2x10^{-5}$ Pa).

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} This is defined as the notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period.

L_{10} & 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. L_{10} is the level exceeded for 10% of the time and is often used as a descriptor for road traffic noise. Similarly, L_{90} is the level exceeded for 90% of the time and is often used to describe the background level. It is common practice to use the L_{10} index to describe traffic noise.

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.

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Appendix B – Monitoring Equipment

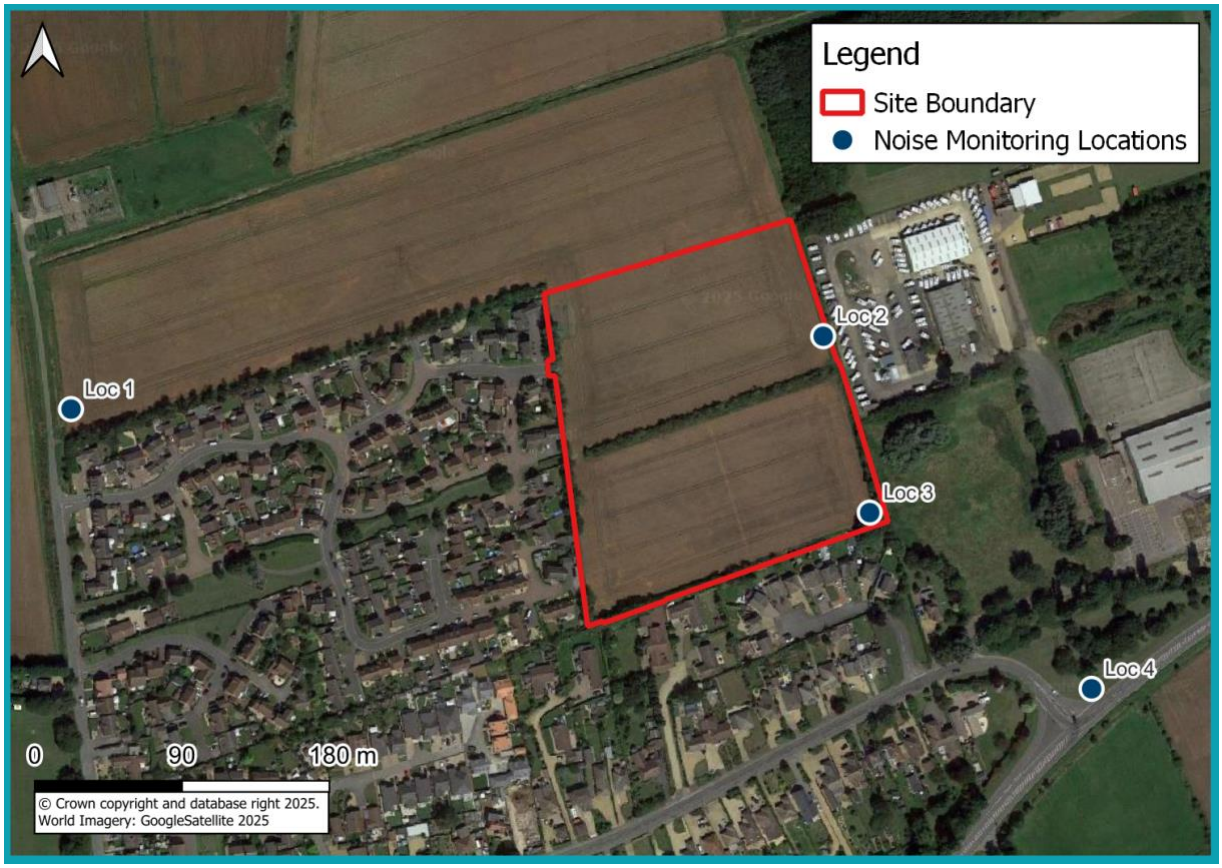
Table B-1
Noise Monitoring Equipment

Equipment	Serial Number
01dB Cube Sound Level Meter	10889
G.R.A.S 40CD Microphone	231555
01dB PRE22N Preamplifier	1610358
01dB Fusion Sound Level Meter	11860
G.R.A.S 40CD Microphone	331802
01dB PRE22N Preamplifier	1707207
01dB Fusion Sound Level Meter	12298
G.R.A.S 40CD Microphone	332011
01dB PRE22N Preamplifier	1936193
01dB Fusion Sound Level Meter	12823
G.R.A.S MCE212 Microphone	134719
01dB PRE22N Preamplifier	2004181
Cirrus CR:515 Acoustic Calibrator	98862

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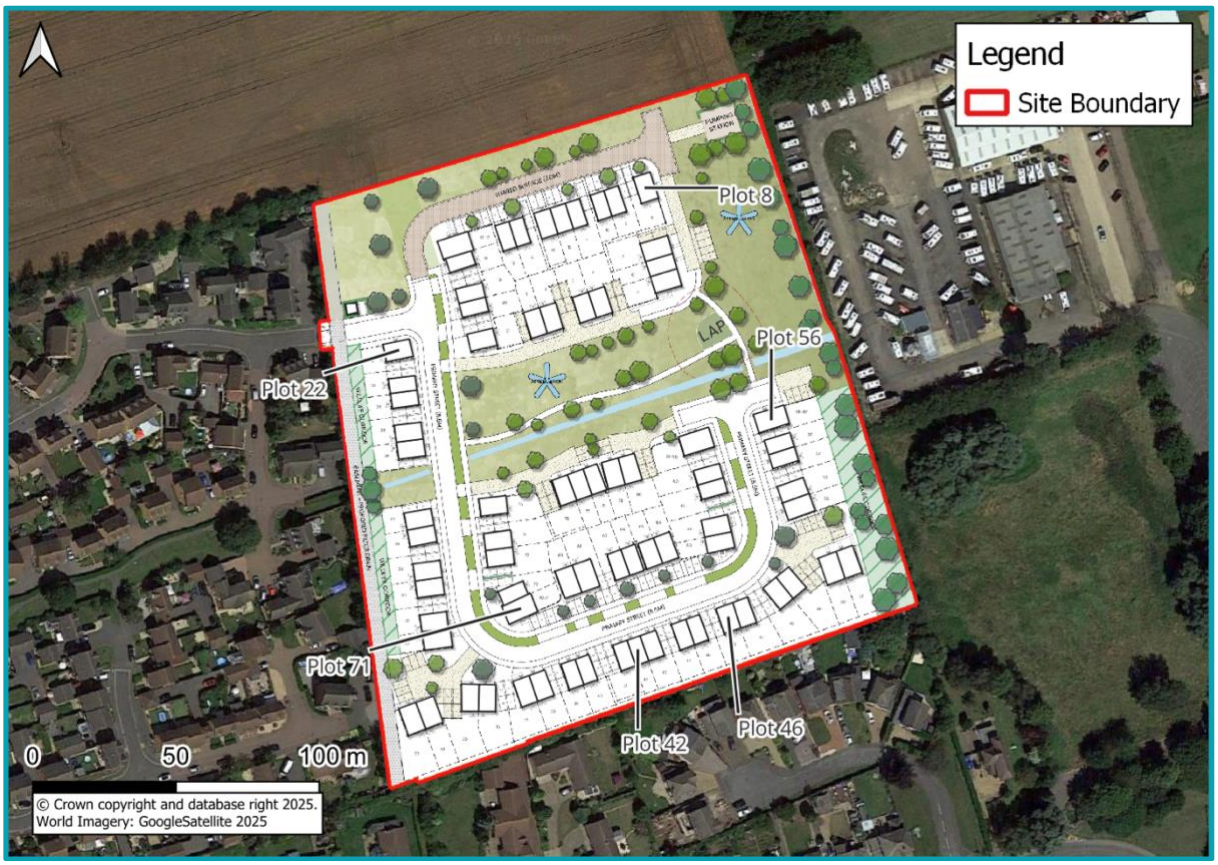
Appendix C – Measurement Locations

Figure C-1
Measurement Location Plan



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Figure C-2
Plot Locations



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Appendix D – Noise Contour Maps

Figure D-1
Noise Contour Map – 1.5m AGL Daytime – dB $L_{Aeq,16h}$



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