



# Land to the South of the A271 and East of the A22, Lower Horsebridge

## Noise Impact Assessment

On behalf of **Hertfordshire Holdings Ltd.**

Project Ref: 332110699/1200 | Rev: 0 | Date: December 2022

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## Document Control Sheet

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# 1 Introduction

## 1.1 Background

- 1.1.1 Stantec UK Ltd. has been commissioned by Hertfordshire Holdings Ltd. to undertake a noise impact assessment to support an outline planning application for a proposed residential development at Land at Lower Horsebridge, Hailsham.
- 1.1.2 Outline planning application is sought for up to 124 dwellings and associated infrastructure, including structural landscaping, biodiversity enhancements and new vehicular access from the A271 Horsebridge road (development principle and details of access for approval, with all other matters reserved for future consideration).
- 1.1.3 This report presents the relevant results of the environmental sound surveys and considers the suitability of the site for residential development, having regard to planning policy, national and international standards and guidance documents, in relation to environmental noise.
- 1.1.4 A glossary of acoustic terminology used within the report is contained in **Appendix A**.

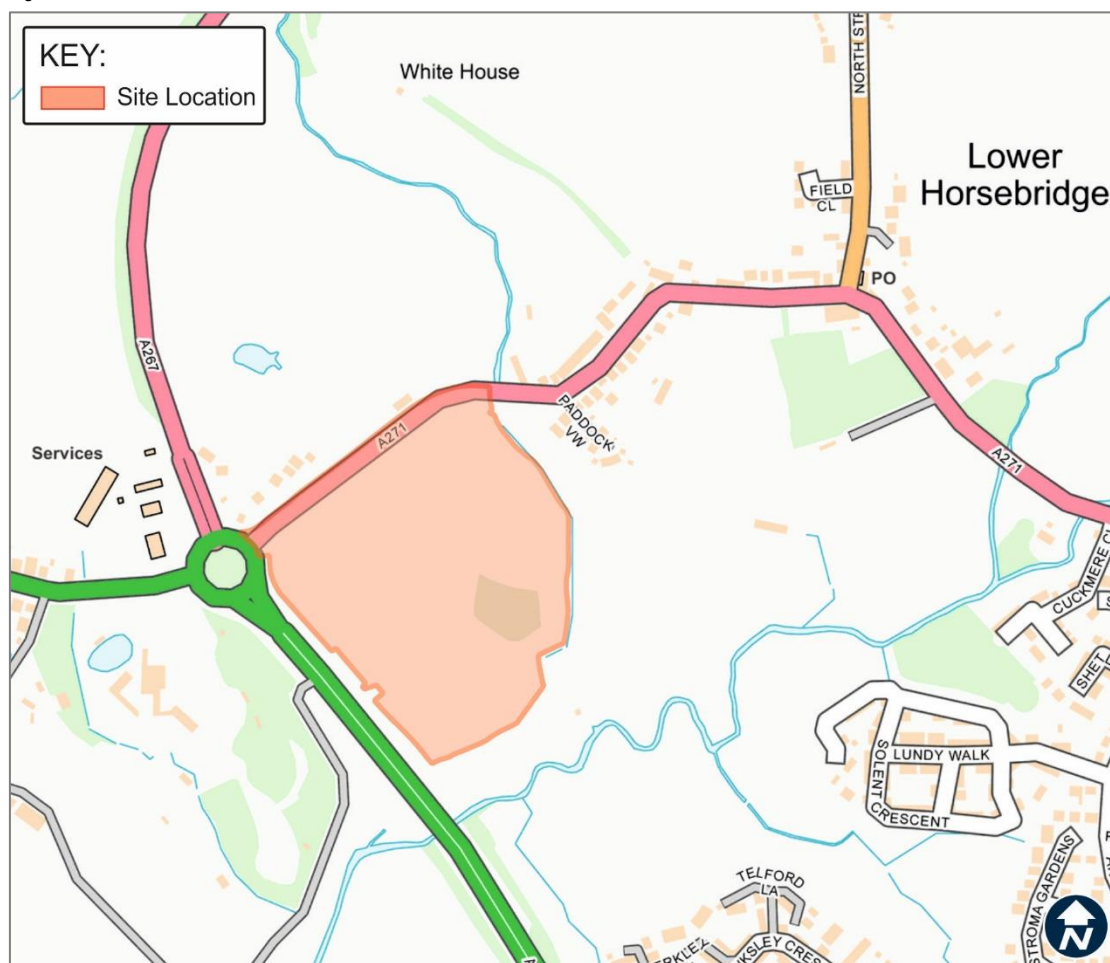
## 1.2 Scope of Assessment

- 1.2.1 The scope of the noise impact assessment report is as follows:
  - Identify relevant national and local planning policy and guidance relevant to noise for the proposed development.
  - Present the results of the environmental sound surveys undertaken by Stantec UK Ltd.
  - Consider the suitability of the site for residential development with respect to noise.

## 1.3 Site Location and Description

- 1.3.1 The proposed development site is located to the south west of Lower Horsebridge village centre in East Sussex and falls within the jurisdiction of Wealden District Council.
- 1.3.2 The site currently consists of agricultural land. The site is bound by the A271 Horsebridge to the north and east, Cuckmere River and agricultural land to the south and the A22 Hailsham Bypass to the west
- 1.3.3 A map showing the location of the proposed site along with the red line boundary is contained in **Figure 1**.

Figure 1: Site Location Plan



Contains Ordnance Survey Data © Crown Copyright and Database 2022

## 2 Policy, Standards, Guidance and Criteria

### 2.1 Local Policy

#### Environmental Health Consultation

2.1.1 The Environmental Health Department (EHD) at Wealden District Council (WDC) was contacted to discuss and agree the survey and assessment methodology. It was agreed that<sup>1</sup>:

- An environmental sound survey will be undertaken for a minimum of 24 hours in two locations at the site, chosen to represent the north-western parts of the site where residential development is proposed.
- The environmental sound survey will monitor sound levels associated with vehicular movements on the adjacent A22 Hailsham Bypass and the A271 Horsebridge; and
- The suitability of the site for residential development with respect to noise will be assessed in accordance with guidance contained within BS8233:2014.

2.1.2 Additionally, the Environmental Health Officer commented that “in addition to BS 8233:2014, you have regard to both the ANC/IOA/CIEH ‘ProPG: Planning & Noise – Professional Practice Guidance on Planning & Noise – New Residential Development’, May 2017, and the ANC/IOA ‘Acoustics Ventilation and Overheating – Residential Design Guide,’ January 2020”.

#### Planning Noise Advice Document: Sussex

2.1.3 The Planning Noise Advice Document: Sussex was published in March 2021 and provides advice for developers and their consultants to assist in making a planning application in East and West Sussex, having regard to noise.

2.1.4 With respect to New Noise Sensitive Developments, Section 6 states:

*“Where the noise assessment has shown that habitable rooms will be exposed to noise levels likely to give rise to any adverse impact, noise mitigation will be required.*

*Design control measures should aim to meet the recommended standards set out in table 4 of BS 8233:2014 and regular night time noise events such as scheduled aircraft or passing trains which can cause sleep disturbance shall be minimized and assessed as (LA<sub>max</sub>), as recommended in the WHO’s Night Noise Guidelines for Europe (2009), unless there are particular reasons why this is not considered appropriate. In such cases, a clear explanation of the reasons should be provided.*

*As the standards for BS 8233:2014 and the W.H.O. relate only to anonymous noise, e.g. distant road traffic and noise without characteristics such as impulsivity, low frequency content or tones then, if these are present, additional discussion will be required with the LPA for the purpose of establishing suitable assessment techniques and standards to be achieved e.g. BS 4142:2014 + A1: 2019 for delivery noise.*

*While noise mitigation measures can be used to achieve suitable internal sound levels, preference is to be given to criteria based on windows being partially open.*

*Specific points for consideration include:*

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<sup>1</sup> Email correspondence received from Andrew Colthurst, Senior Environmental Health Officer at Wealden District Council, dated 02 February 2022.

- *Provide appropriate distances between noise sensitive developments and noise sources.*
- *Land zoning to separate noisy uses from noise sensitive uses, for example, avoiding the siting of children's playing areas next to accommodation for the elderly.*
- *Careful orientation of building layout, such as at right angles to the noise source.*
- *Introduction of single aspect buildings.*
- *Internal layout of dwellings, through the location of non-habitable rooms such as bathrooms, kitchens and circulation areas as buffers between the noise source and habitable rooms.*
- *Screening by non-noise sensitive structures or barrier blocks such as garages and walls.*
- *The introduction of acoustic screening such as bunding/embankments, fencing and walling.*
- *Protection of external residential amenity areas by positioning them towards the centre of the development sites. “*

## 2.2 National Policy

### The National Planning Policy Framework (NPPF)

- 2.2.1 The revised National Planning Policy Framework (NPPF) was published in July 2021. In respect of noise, paragraph 174 states that in relation to conserving and enhancing the natural environment:

*“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 ... noise pollution...”*

- 2.2.2 In relation to ground conditions and pollution, paragraph 185 states that:

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

- mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and quality of life;*
- Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason...”*

- 2.2.3 In relation to the integration of new development with existing premises and community facilities, paragraph 187 states that:

*“Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its*

*vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed."*

### National Planning Practice Guidance

- 2.2.4 The Planning Practice Guide (PPG) was launched in 2014 (with the latest update being in 2019) and provides additional guidance and interpretation to the Government's strategic policies outlined within the NPPF in a regularly updated, web-based resource.
- 2.2.5 The PPG provides guidance on the effects of noise exposure, relating these to people's perception of noise, and linking them to the no observed effect level (NOEL) and, as exposure increases, the lowest observed adverse effect level (LOAEL) and significant observed adverse effect level (SOAEL).
- 2.2.6 As exposure increases above the LOAEL, the noise begins to have an adverse effect and consideration needs to be given to mitigating and minimising those effects, taking account of the economic and social benefits being derived from the activity causing the noise. As the noise exposure increases, it will then at some point cross the SOAEL boundary.
- 2.2.7 Exposure to noise above the LOAEL is described in PPG (Paragraph: 005 Reference ID: 30-005-20190722) as:

*"...noise starts to cause small changes in behaviour and/or attitude, for example, having to turn up the volume on the television or needing to speak more loudly to be heard. The noise therefore starts to have an adverse effect and consideration needs to be given to mitigating and minimising those effects (taking account of the economic and social benefits being derived from the activity causing the noise)."*

- 2.2.8 Exposure to noise above SOAEL is described as:

*"...noise causes a material change in behaviour such as keeping windows closed for most of the time or avoiding certain activities during periods when the noise is present. If the exposure is predicted to be above this level the planning process should be used to avoid this effect occurring, for example through the choice of sites at the plan-making stage, or by use of appropriate mitigation such as by altering the design and layout. While such decisions must be made taking account of the economic and social benefit of the activity causing or affected by the noise, it is undesirable for such exposure to be caused."*

### Noise Policy Statement for England

- 2.2.9 The Noise Policy Statement for England (NPSE) was published in March 2010 and clarifies the underlying principles and aims of existing policy documents that relate to noise. It also sets out the long-term vision of Government noise policy which is: *"to promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development"*.
- 2.2.10 The NPSE states that noise should not be considered in isolation of the wider benefits of a scheme or development, and that the intention is to minimise noise and its effects as far as is reasonably practicable having regard to the underlying principles of sustainable development.
- 2.2.11 Paragraphs 2.20 and 2.21 define 'significant adverse' and 'adverse' impacts as applied to noise as follows:

*"There are two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. They are:*

*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.*

*Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.*

*SOAEL – Significant Observed Adverse Effect Level*

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

2.2.12 Paragraph 2.22 clarifies that:

*“It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.”*

2.2.13 The three aims of the NPSE are defined as follows:

*“Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.”*

*“Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.” (Note: Applies when the impact lies somewhere between the LOAEL and SOAEL and does not mean that adverse effects cannot occur).”*

*“Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.”*

## 2.3 Standards

### **British Standard 8233: 2014 ‘Guidance on Sound Insulation and Noise Reduction for Buildings’**

2.3.1 BS 8233, in relation to this planning application, sets out desirable guideline values in habitable rooms, such as living rooms and bedrooms.

2.3.2 The guideline values relate to steady external noise without a specific character, previously termed ‘anonymous noise’. According to the standard, noise has a specific character if it contains features such as a distinguishable, discrete and continuous tone, is irregular enough to attract attention, or has strong low-frequency content, in which case lower noise limits might be appropriate. Examples of noise with a character may include tonal/intermittent plant noise emissions, music playback, and workshop noise. Examples of external steady noise sources may include environmental noise sources such as busy road traffic.

2.3.3 The desirable internal ambient noise levels for dwellings are presented in **Table 2.1**.

Table 2.1: BS 8233 Desirable Internal Ambient Noise Levels for Dwellings

| Activity                                                                                                                                                                                                                                                                                                                 | Location         | 07:00 to 23:00 hours | 23:00 to 07:00 hours |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|----------------------|----------------------|
| Resting                                                                                                                                                                                                                                                                                                                  | Living room      | 35 dB $L_{Aeq,16h}$  | -                    |
| Dining                                                                                                                                                                                                                                                                                                                   | Dining room/area | 40 dB $L_{Aeq,16h}$  | -                    |
| Sleeping (daytime resting)                                                                                                                                                                                                                                                                                               | Bedroom          | 35 dB $L_{Aeq,16h}$  | 30 dB $L_{Aeq,8h}$   |
| <p>*Note 4 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 <math>L_{Amax,f}</math>, depending on the character and number of events per night. Sporadic noise events could require separate values.</p> |                  |                      |                      |
| <p>Note 5 If relying on closed windows to meet the guide values, there needs to be an appropriate alternative source of ventilation that does not compromise the façade insulation or the resulting noise levels.</p>                                                                                                    |                  |                      |                      |
| <p>Note 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5dB and reasonable internal conditions still achieved.</p>                                                                                      |                  |                      |                      |

\*A selection of the available notes

2.3.4 The Standard also provides advice in relation to desirable levels for external noise. 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 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.*

*Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate.*

*Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses. However, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation.*

*In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55 dB  $L_{Aeq,T}$  or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space.”*

## 2.4 Guidance

### Professional Practice Guidance on Planning and Noise, 2017

- 2.4.1 The Professional Practice Guidance on Planning and Noise (ProPG) was jointly published in 2017 by the Institute of Acoustics, the Chartered Institute of Environmental Health and the Association of Noise Consultants and provides guidance on a recommended approach to the management of noise within the planning system in England.
- 2.4.2 The scope of ProPG is limited to new residential development that will be predominantly exposed to airborne noise from transport sources.
- 2.4.3 The guidance is mostly focused on new flats and houses, although there is some relevant content in regard to other types of residential units, such as care homes and residential institutions.
- 2.4.4 Noise sources other than airborne transport (i.e. industrial, commercial, entertainment, etc.) and ground-borne noise and vibration fall outside of the scope of ProPG.
- 2.4.5 ProPG details a two-stage approach to the consideration of noise issues including:
- Stage 1 – an initial noise risk assessment of the proposed development site.
  - Stage 2 – a systematic consideration of four key elements.
- 2.4.6 **Table 2.2** is a reproduction of Figure 1 within ProPG which summarises the noise risk categories for Stage 1 of the assessment process.

Table 2.2: Stage 1 ProPG Risk Categories

| Noise Risk Assessment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Potential Effect Without Noise Mitigation                                              | Pre-Planning Application Advice                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div> <div>Indicative Daytime Noise Levels<br/><math>L_{Aeq,16hr}</math></div> <div>Indicative Night-time Noise Levels<br/><math>L_{Aeq,8hr}</math></div> <div> <div>70 dB</div> <div>65 dB</div> <div>60 dB</div> <div>55 dB</div> <div>50 dB</div> </div> <div> <div>High</div> <div>Medium</div> <div>Low</div> <div>Negligible</div> </div> <div> <div>60 dB</div> <div>55 dB</div> <div>50 dB</div> <div>45 dB</div> <div>40 dB</div> </div> </div>                                                                                                                                                                                                                                                                                           | <div> <div>Increasing risk of adverse effect</div> <div>No adverse effect</div> </div> | <p>High noise levels indicate that there is an increased risk that development may be refused on noise grounds. This risk may be reduced by following a good acoustic design process that is demonstrated in a detailed ADS. Applicants are strongly advised to seek expert advice.</p> <p>As noise levels increase, the site is likely to be less suitable from a noise perspective and any subsequent application may be refused unless a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised, and which clearly demonstrate that a significant adverse noise impact will be avoided in the finished development.</p> <p>At low noise levels, the site is likely to be acceptable from a noise perspective provided that a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised in the finished development.</p> <p>These noise levels indicate that the development site is likely to be acceptable from a noise perspective, and the application need not normally be delayed on noise grounds.</p> |
| <p><b>Figure Notes:</b></p> <ol style="list-style-type: none"> <li>Indicative noise levels should be assessed without inclusion of the acoustic effect of any scheme specific noise mitigation measures.</li> <li>Indicative noise levels are the combined free-field noise level from all sources of transport noise and may also include industrial/commercial noise where this is present but is “not dominant” .</li> <li><math>L_{Aeq,16hr}</math> is for daytime 0700 – 2300, <math>L_{Aeq,8hr}</math> is for night-time 2300 – 0700.</li> <li>An indication that there may be more than 10 noise events at night (2300 – 0700) with <math>L_{Amax,F} &gt; 60</math> dB means the site should not be regarded as negligible risk.</li> </ol> |                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

2.4.7 Stage 2 comprises four key elements which are undertaken in parallel:

- Element 1 – demonstrating a ‘Good Acoustic Design Process’.
- Element 2 – observing internal ‘Noise Level Guidelines’.
- Element 3 – undertaking an ‘External Amenity Area Noise Assessment’; and

- Element 4 – consideration of ‘Other Relevant Issues’.
- 2.4.8 Following a good acoustic design process involves considering acoustics at an early stage in the design process; avoid ‘unreasonable’ acoustic conditions and prevent ‘unacceptable’ acoustic conditions; and achieve an integrated, optimum solution without overdesign.
- 2.4.9 Demonstration of good acoustic design should include:
- Checking the feasibility of relocating or reducing noise levels from relevant sources.
  - Consider options for planning the site or building layout.
  - Consider the orientation of proposed building(s).
  - Select construction types and methods for meeting building performance requirements.
  - Consider the effects of noise control measures on ventilation, fire regulation, health and safety, CDM, etc.
  - Assess the viability of alternative solutions.
  - Assess external amenity areas noise.
- 2.4.10 With respect to internal noise levels, ProPG recommends that noise levels set out in BS 8233 are used for residential development. However, an additional criterion is proposed by ProPG for night-time  $L_{Amax}$  levels as follows:
- “[...] In most circumstances in noise-sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45 dB  $L_{Amax, F}$  more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability and regularity of noise events.”*
- 2.4.11 With respect to external noise levels, ProPG again makes reference to the guideline levels detailed in BS8233 stating that:
- “The acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50 – 55 dB  $L_{Aeq,16hr}$ .”*
- 2.4.12 The final element indicates that the assessment should consider ‘Other Relevant Issues’ which may include:
- Compliance with relevant national and local policy.
  - Magnitude and extent of compliance with ProPG.
  - Likely occupants of the development.
  - Acoustic design verses unintended adverse consequences.
  - Acoustic design verse wider planning objectives.

### Approved Document O Overheating

- 2.4.13 Approved Document O of the Building Regulations 2010 Overheating was published in December 2021 and took effect in England on 15 June 2022. It applies to schemes which have not had a planning application submitted prior 15 June 2022, and to schemes which start on site after 15 June 2023.
- 2.4.14 Approved Document O gives guidance on how to comply with Part O of the Building Regulations and applies to residential buildings (excluding hotels) only.
- 2.4.15 Requirement O1(1) states that:
- “Reasonable provision must be made in respect of a dwelling, institution or any other building containing one or more rooms for residential purposes, other than a room in a hotel (“residences”) to –*
- (a) Limit unwanted solar gains in summer.*
- (b) Provide an adequate means to remove heat from the indoor environment.”*
- 2.4.16 Requirement O1(2) states that:
- “In meeting the obligations in paragraph (1) –*
- (a) Account must be taken of the safety of any occupant, and their reasonable enjoyment of the residence; and*
- (b) Mechanical cooling may only be used where insufficient heat is capable of being removed from the indoor environment without it.”*
- 2.4.17 Compliance with Requirement O1(1) can be demonstrated by using the ‘simplified method’ or by ‘dynamic thermal modelling’, as described in Approved Document O.
- 2.4.18 In relation to noise, Paragraphs 3.2 and 3.3 of Approved Document O state:
- “3.2 In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am).*
- 3.3 Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.*
- a. 40dB  $L_{Aeq,T}$ , averaged over 8 hours (between 11pm and 7am).*
- b. 55dB  $L_{AFmax}$ , more than 10 times a night (between 11pm and 7am).”*
- 2.4.19 Based on the above, the ‘simplified method’ cannot be relied upon if either of the internal noise criteria are exceeded.

### Guide to Demonstrating Compliance with the Noise Requirements of Approved Document O

- 2.4.20 The Guide to Demonstrate Compliance with the Noise Requirements of Approved Document O was jointly published by the Association of Noise Consultants and Institute of Acoustics in July 2022. This guide provides clarity for practitioners and regulators so that assessments can be carried out consistently, and the outcome is repeatable and reliable.
- 2.4.21 While the requirements of Approved Document O are succinct, there is some ambiguity regarding important details, some of which are addressed within the guide.

2.4.22 The guide makes the following clarifications:

- The noise requirements apply only to bedrooms at night.
- Natural sound sources (e.g. meteorological sounds, sounds from animals and water) should be excluded from contributing to the assessed noise level.

2.4.23 The guidance document provides anticipated level differences through window openings which are necessary to satisfy the 'simplified method' of Approved Document O, based on typical assumptions. For 'high' risk locations (as described as areas in London and Manchester in Approved Document O) this is 4 dB, and for 'medium' risk locations (as described as other areas outside London and Manchester in England and Wales in Approved Document O) this is 9 dB.

2.4.24 Paragraph 4.1.9 states that if external sound levels exceed the limiting external free-field levels outlined in **Table 2.3** the 'simplified method' cannot be used, and 'dynamic thermal modelling' should be used to demonstrate compliance:

Table 2.3: External Noise Levels Above Which the Simplified Method Cannot be Used

| Parameter                                                                                                                                                                                                                                                                                                                                     | High Risk Location | Moderate Risk Location |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|------------------------|
| L <sub>Aeq,8hr</sub> averaged over 8 hours (between 11pm and 7am)                                                                                                                                                                                                                                                                             | 44 dB              | 49 dB                  |
| L <sub>AFmax</sub> more than 10 times a night (between 11pm and 7am)                                                                                                                                                                                                                                                                          | 59 dB              | 64 dB                  |
| Note: Several assumptions have been used to determine the outside-to-inside level difference. There are: 2.4 m bedroom height, 0.5s bedroom RT, simple hole in the façade of area sufficient to provide the required equivalent area, no sound transmission other than via the opening. Calculation according to Equation G.1 of BS 8233:2014 |                    |                        |

2.4.25 Paragraph 6.1.2 of the guide states:

*“Given the uncertainty of measuring noise levels internally and the complexity of remedial work to adapt a completed building to remove excess heat by means other than opening a window, it is recommended that determination of compliance with AD-O is completed pre-construction.”*

## 2.5 Proposed Assessment Criteria

### Internal and External Sound Levels

2.5.1 Based on the requirements of the Local Authority and relevant standards and guidance documents, **Table 2.4** details the proposed assessment criteria for determining the suitability of the site for residential development with respect to noise. The proposed assessment criteria are considered to be the LOAEL for the site.

Table 2.4: Proposed Assessment Criteria – Internal and External Sound Levels

| Internal Ambient Noise Levels     |                                                                                                        | Noise Levels in External Amenity Areas |
|-----------------------------------|--------------------------------------------------------------------------------------------------------|----------------------------------------|
| Daytime<br>(07:00 to 23:00 hours) | Night-time<br>(23:00 to 07:00 hours)                                                                   | Daytime<br>(07:00 to 23:00 hours)      |
| 35 dB $L_{Aeq,16h}$               | 30 dB $L_{Aeq,8h}$<br>$\leq 45$ dB $L_{AFmax}$ based on no more<br>than 10-15 exceedances per<br>night | 55 dB $L_{Aeq,16h}$                    |

## 3 Environmental Sound Survey

### 3.1 Procedure

- 3.1.1 An unattended environmental sound survey was undertaken between 14:45 hours on Tuesday 22 March 2022 and 15:00 hours on Wednesday 23 May 2022. Measurements were logged in 15-minute periods of the  $L_{Aeq}$ ,  $L_{A90}$  and  $L_{AFMax}$  sound levels.
- 3.1.2 The measurements were undertaken to determine the existing sound climate at locations considered representative of sound levels incident on the future redevelopment. The sound level meters were located in environmental cases. The microphones were connected to the meters via an extension cable and fitted with the manufacturer's windshield.
- 3.1.3 The instrumentation used in the survey (including calibration information) is listed in **Appendix B**. Field calibrations were performed before and after the measurements with no significant fluctuations recorded ( $< 0.5$  dB). Calibration certificates are available upon request.

### 3.2 Measurement Locations

- 3.2.1 Measurements were undertaken at two positions detailed in **Figure 2** and described in **Table 3.1**.

Figure 2: Environmental Sound Survey Measurement Locations



Courtesy of Terence O'Rourke Ltd.

Table 3.1: Description of Survey Measurement Positions

| Position | Description                                                                                                                                                  |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| P1       | The microphone was located 1.5 m above ground level, in a free field position on the western site boundary, approximately 15 m from the A22 Hailsham Bypass. |
| P2       | The microphone was located 1.5 m above ground level, in a free-field position on the northern site boundary, approximately 3 m from the A271 Horsebridge.    |

### 3.3 Meteorological Conditions

- 3.3.1 Due to the nature of the survey (i.e. unattended), it is not possible to comment on the weather conditions for the entire duration of the survey. However, at the beginning of the survey period, the temperature was warm (16°C) with light winds from the south east (approx. 3 m/s) and clear skies with no precipitation.
- 3.3.2 At the end of the survey period, the temperature was warm (15°C) with light winds from the south (approx. 3 m/s). There was clear skies with no precipitation.
- 3.3.3 These weather conditions, as described above, are considered to be suitable for obtaining representative sound level measurements.

### 3.4 Assumptions/Limitations

- 3.4.1 The engineer noticed nothing unusual in terms of the sound climate at the time of the survey. This report refers, within the limitations stated, to the environment of the Site in the context of the surrounding area at the time of the inspections. Environmental conditions can vary. No warranty is given as to the possibility of changes in the environment of the Site and surrounding area at differing times.

### 3.5 Environmental Sound Climate

- 3.5.1 Due to the nature of the survey (i.e. unattended) it is not possible to accurately comment on the dominant noise sources or specific noise events during the entire survey period. However, the dominant noise sources noted at each measurement position are described in **Table 3.2**.

Table 3.2: Dominant Noise Sources

| Position | Dominant Noise Sources                                                                                               |
|----------|----------------------------------------------------------------------------------------------------------------------|
| P1       | Vehicular movements on the A22 Hailsham Bypass                                                                       |
| P2       | Vehicular movements on the A22 Hailsham Bypass. Vehicular movements on the A271 Horsebridge dominant when occurring. |

- 3.5.2 During the survey, the sound climate was noted to be dominated by vehicle movements. During their time on-site, the engineer did not consider natural sound sources (e.g. tree leaves or grass rustling in the wind, birdsong, sound from water flow etc.) to have a significant impact on the overall measured sound level at the measurement locations.

### 3.6 Environmental Sound Survey Results

- 3.6.1 A summary of the unattended sound survey results is presented in **Table 3.3**. Time-history graphs detailing the full results of the unattended sound survey are contained in **Appendix C**.

Table 3.3: Summary of Environmental Sound Survey Results

| Position                                                                                                                                                                                                                                             | Period, T                   | Measured Environmental Sound Levels |                                    |                                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-------------------------------------|------------------------------------|-----------------------------------|
|                                                                                                                                                                                                                                                      |                             | dB L <sub>Aeq,T</sub>               | Typical<br>dB L <sub>AFMax</sub> * | Typical<br>dB L <sub>A90</sub> ** |
| P1                                                                                                                                                                                                                                                   | Daytime (07:00 to 23:00)    | 66                                  | -                                  | 57                                |
|                                                                                                                                                                                                                                                      | Night-time (23:00 to 07:00) | 58                                  | 75                                 | 36                                |
| P2                                                                                                                                                                                                                                                   | Daytime (07:00 to 23:00)    | 67                                  | -                                  | 52                                |
|                                                                                                                                                                                                                                                      | Night-time (23:00 to 07:00) | 62                                  | 82                                 | 30                                |
| <p>* Based on the 10th highest measured L<sub>AFmax</sub> level.</p> <p>** Calculated based on the statistical distribution of background sound levels during the measurement period in general accordance with guidance in BS 4142:2014+A1:2019</p> |                             |                                     |                                    |                                   |

- 3.6.2 The results of the environmental sound surveys have been reviewed against the Department for Environment, Food & Rural Affairs (DEFRA) Strategic Noise Mapping 2017 (Round 3) data. The data indicates that road traffic noise levels across the site are likely to be between 60 and 70 dB L<sub>Aeq,16hr</sub> during the daytime. This shows strong correlation with the results of the survey, which indicates that sound levels at the site boundary are likely to be between 66 and 67 dB L<sub>Aeq,16hr</sub>.
- 3.6.3 A telephone mast is located in the western area of the site, close to the boundary with the A22 Hailsham Bypass. It was noted by the engineer that noise emissions from the mast were not considered to be significantly contributing to the sound climate and was not audible over the dominant noise source (traffic on the surrounding road network). A review of the environmental sound survey data at Position P1 indicates that the lowest background sound level measured during the night-time period, when road traffic noise is unlikely to be contributing significantly to the ambient levels was 34 dB L<sub>A90,15minutes</sub>, and 32 dB L<sub>AFmin</sub> measured during the same 15-minute period. On the basis of these results it is considered that noise from the telephone mast is not a significant on-site noise source in comparison to the overall ambient levels on the site.

## 4 Suitability of Site for Residential Development

### 4.1 Overview

- 4.1.1 An analysis of the results of the environmental sound survey has been undertaken to determine the suitability of the site for residential development with regards to both internal and external sound levels within residential dwellings and external sound levels within external amenity areas.
- 4.1.2 The assessment has been informed by the Illustrative Proving Layout plan. It should be noted that the exact layout of the proposed development has not yet been finalised and would be confirmed at the detailed design stage.
- 4.1.3 Using the results of the environmental sound survey, the data obtained from a topographical survey of the development site and free topographical data available from Ordnance Survey (OS), a computer acoustic model has been produced, using computer software SoundPLAN v8.2. The environmental sound survey results were used to verify the model, using traffic flow data prepared by the Stantec transport team. The computer acoustic model has calculated the propagation of sound across the proposed development in accordance with both 'ISO9613-2:1996 Acoustics – Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation' and The Calculation of Road Traffic Noise (CRTN).

### 4.2 Calculated Incident Sound Levels

- 4.2.1 Based on the results of the computer acoustic model and the Illustrative Proving Layout plan, **Table 4.1** details the calculated indicative incident sound levels based on a notional dwelling located close to the site boundary overlooking the relevant sound source. Sound contour plots illustrating the calculated external sound levels can be found in **Appendix D**.

Table 4.1: Calculated Incident Sound Levels

| Façade / Location                          | Calculated Incident Sound Level (dB) |                            |                            |
|--------------------------------------------|--------------------------------------|----------------------------|----------------------------|
|                                            | Daytime (07:00 – 23:00)              | Night-time (23:00 – 07:00) |                            |
|                                            | L <sub>Aeq,16h</sub>                 | L <sub>Aeq,8h</sub>        | Typical L <sub>AFMax</sub> |
| Dwellings fronting the A22 Hailsham Bypass | 64                                   | 57                         | 71                         |
| Dwellings fronting the A271 Horsebridge    | 63                                   | 57                         | 72                         |

- 4.2.2 It should be noted that vehicle movements on the A22 Hailsham Bypass were the dominant noise source at all locations within the proposed Site boundaries with pass by's on the A271 Horsebridge Lane dominant when occurring. Therefore, the incident sound levels outlined above should be considered to represent a worst-case scenario. The majority of dwellings within the development, located at greater distances from the nearby roads, are expected to have lower incident noise levels than those detailed in **Table 4.1**.

### 4.3 External Sound Levels

- 4.3.1 Based on the results of the computer acoustic model, daytime sound levels across the majority of the site are below 60 dB L<sub>Aeq,16h</sub>, and fall into the 'low noise risk' category according to ProPG.
- 4.3.2 Based on the results of the computer acoustic model, night-time sound levels across the majority of the site are below 50 dB L<sub>Aeq,8h</sub>, and fall into the 'low noise risk' category according to ProPG.

4.3.3 When sites are deemed to be in the 'low noise risk' category, ProPG advises that:

*"At low noise levels, the site is likely to be acceptable from a noise perspective provided that a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised in the finished development."*

4.3.4 Within 47 m of the A22 Hailsham Bypass and within 25 m of the A271 Horsebridge, daytime sound levels are greater than 60 dB  $L_{Aeq,16h}$ , indicating that these parts of the site should be considered to be a 'medium noise risk' category according to ProPG.

4.3.5 Within 25 m of the A22 Hailsham Bypass and within 13 m of the A271 Horsebridge, night-time sound levels are 56 dB  $L_{Aeq,8h}$  indicating that this part of the site should be considered to be a 'medium noise risk' category according to ProPG.

4.3.6 When sites are deemed to be in the 'medium noise risk' category, ProPG advises that:

*"The site is likely to be less suitable from a noise perspective and any subsequent application may be refused unless a good acoustic design process is followed and is demonstrated in an Acoustic Design Statement which confirms how the adverse impacts of noise will be mitigated and minimised, and which clearly demonstrate that a significant adverse noise impact will be avoided in the finished development."*

4.3.7 With respect to an outline planning application, the requirements for an Acoustic Design Statement can usually be conditioned as part of a planning approval. We would highlight that the area falling into a 'medium noise risk' category is a relatively small part of the overall site and that the site as a whole is considered to be suitable for residential use, subject to the final design demonstrating that a good acoustic design process has been followed and that adverse impacts of noise have been mitigated and minimised, with significant adverse impacts of noise avoided.

4.3.8 To promote the inclusion of good acoustic design within the development and based on guidance within ProPG, we would recommend that planning consent should be granted, and that the planning consent should include a suitable noise condition. The condition should request that a noise assessment be undertaken during the detailed planning stage of the development, and that mitigation elements outlined within the noise assessment are included within the finished development. Below is an example condition based on the above:

*"The dwellings shall be designed and/or insulated as to provide attenuation against externally generated noise in accordance with a mitigation scheme to be submitted to and approved in writing by the Local Planning Authority before commencement of development. The approved mitigation measures to serve each dwelling shall be implemented prior to occupation."*

#### 4.4 Internal Noise Levels – Windows Closed

4.4.1 The calculated incident sound levels have been used to determine the likely internal sound levels within dwellings at the proposed development. Exact construction proposals are yet to be determined; however a preliminary assessment has been undertaken based on typical construction details as detailed in **Appendix D**.

4.4.2 Based on the calculated incident sound levels and the typical sound reductions of standard construction details, **Table 4.2** details the results of the noise impact assessment.

Table 4.2 Calculated Worst Case Internal Noise Levels

| Façade / Location                          | Indicative Construction                | Calculated Internal Noise Levels |                                  |                            |
|--------------------------------------------|----------------------------------------|----------------------------------|----------------------------------|----------------------------|
|                                            |                                        | Daytime (07:00 – 23:00 hours)    | Night-Time (23:00 – 07:00 hours) |                            |
| Dwellings fronting the A22 Hailsham Bypass | Non-Acoustic Glazing and Trickle Vents | 33 dB L <sub>Aeq,16h</sub>       | 29 dB L <sub>Aeq,8h</sub>        | 45 dB L <sub>AFMax</sub> * |
| Dwellings fronting the A271 Horsebridge    | Non-Acoustic Glazing and Trickle Vents | 31 dB L <sub>Aeq,16h</sub>       | 28 dB L <sub>Aeq,8h</sub>        | 44 dB L <sub>AFMax</sub> * |
| *exceeded < 10-15 times per night          |                                        |                                  |                                  |                            |

- 4.4.3 Based on the results of **Table 4.2**, our calculations indicate that standard external constructions should be capable of providing sufficient sound insulation to achieve suitable internal ambient noise levels, below the guideline levels of BS 8233:2014, across the site. This should be confirmed by a detailed assessment once detailed information of the development is available.

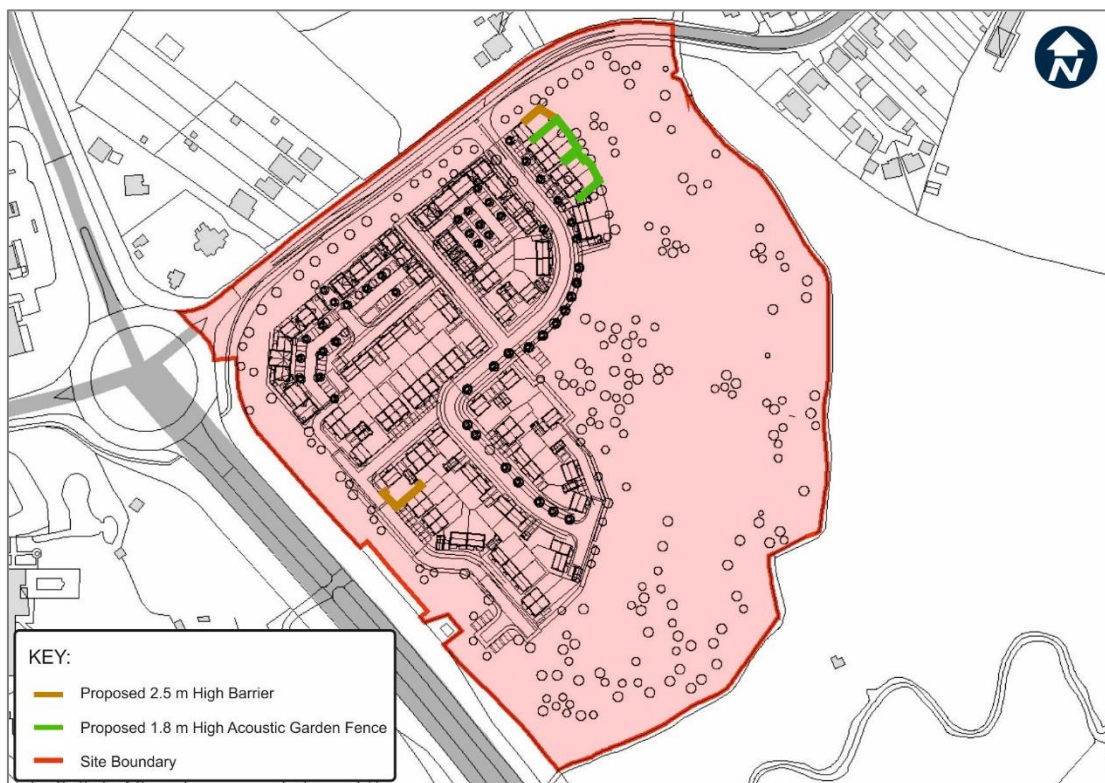
## 4.5 Internal Noise Levels – Overheating

- 4.5.1 Based on the measured survey data, external night-time sound levels are anticipated to be below 49 dB L<sub>Aeq,8hours</sub> and 64 dB L<sub>Amax,f</sub> across the majority of the site, indicating that with respect to Approved Document O, the use of opening windows to control overheating is likely to be suitable in these areas, based on the ventilation requirements of the 'simplified method' in Approved Document O.
- 4.5.2 In areas of the site within approximately 63 m of the A22 Hailsham Bypass and approximately 27 m of the A271 Lower Horsebridge, external night-time sound levels are anticipated to be above 49 dB L<sub>Aeq,8h</sub> and 64 dB L<sub>Amax,f</sub> indicating that dynamic thermal modelling may to be required to demonstrate compliance with Approved Document O, depending on the final site and dwelling layout. Use of opening windows to control overheating may not be suitable in these areas and alternative forms of mitigation may be required.
- 4.5.3 Internal sound levels within dwellings should be considered during the detailed planning and design stage of the development, to ensure the target criteria are complied with.

## 4.6 Noise Levels in External Amenity Areas

- 4.6.1 Based on the Illustrative Proving Layout plan, proposed house dwellings are to feature private external amenity areas in the form of gardens. An indicative assessment has been undertaken, based on the calculated incident levels and the Illustrative Proving Layout plan. Alternative layouts are likely to result in different noise levels in private external amenity areas. As part of the provision of an Acoustic Design Statement, an assessment of noise levels in private external amenity areas should be undertaken.
- 4.6.2 The results of the assessment indicate that, with the use of acoustic barriers as indicated in **Figure 3**, sound levels within proposed garden areas are likely achieve 55 dB L<sub>Aeq,16h</sub>. The use of non-acoustic garden fences to other external amenity areas is likely to be suitable.

Figure 3: Proposed Barriers



Courtesy of Terence O'Rourke Ltd.

- 4.6.3 Based on the results of the assessment, sound levels in external amenity areas are likely to achieve guidance levels based on the Illustrative Proving Layout.

## 4.7 Summary

- 4.7.1 A noise impact assessment has been undertaken to ascertain the suitability of the site for residential use with respect to the prevailing environmental sound climate. The assessment has indicated that the proposed LOAEL are likely to be achieved, subject to the development following a good acoustic design process during the detailed design stage. Therefore, the site is considered suitable for residential use.
- 4.7.2 Good acoustic design is a holistic design process combining both consideration of objective acoustic design standards with the subjective human experience of a space or place. It seeks to address noise and vibration issues with wider consideration of scheme design as a whole and not in isolation.
- 4.7.3 The following design measures can be used to influence the acoustic environment in and around the development and should be considered as the design of the development is progressed:
- Masterplan layout.
  - Building location, design, orientation and room layout.
  - Buildings as noise shields.
  - Noise barriers, mounds, bunds, screens and fences; and
  - Building elements.

- 4.7.4 The Illustrative Proving Layout plan features good acoustic design measures, where the majority of private external amenity areas are acoustically screened from surrounding road traffic noise sources by the proposed dwellings.
- 4.7.5 Additionally, with the use of barriers as indicated in **Figure 3** and the suitable specification of external building fabric elements, guidance internal and external sound levels are likely to be achieved.
- 4.7.6 The following further design measures can be incorporated to improve the acoustic design of the site:
- Buildings should be orientated to ensure that private amenity areas are screened from the surrounding road network.
  - The layout of dwellings should be considered such that sleeping and other habitable areas are oriented away from the A22 Hailsham Bypass and the A271 Horsebridge. This would result in these areas being exposed to lower external sound levels.
  - The use of continuous buildings adjacent to the surrounding road network should be considered to maximise acoustic screening to other areas of the site which do not front onto the A37. If this is not practicable, reducing gaps between dwellings should be considered.
- 4.7.7 The assessment considers the use of screening along the A271 Horsebridge in areas where no dwellings are proposed. The following points highlight the main acoustic considerations when incorporating a noise barrier into the design. Considerations of other factors, including structural stability and lifespan, should be considered separately by others. A specification for acoustic barriers can be found in **Appendix F**.
- The closer the noise barrier is to the noise source, the more effective the barrier is.
  - The higher the barrier is, the more effective the barrier is.
  - Barriers are more effective when the site slopes away from the source.
  - Wider barriers tend to be more effective – barriers should ideally extend beyond the ends of the built development, where practicable.
  - Any holes or discontinuities in a barrier will significantly reduce the acoustic performance.
  - Material used should have a suitable surface density, to be confirmed during the detailed assessment stage.
  - Reflective acoustic barriers can increase sound levels in areas opposite the barrier. In these case absorptive barriers may be more appropriate.

## 5 Conclusions

- 5.1.1 Stantec UK Ltd. has been commissioned by Hertfordshire Holdings Ltd. to undertake a noise impact assessment to support an outline planning application for a proposed residential development at Land at Lower Horsebridge, Hailsham.
- 5.1.2 An environmental sound survey has been undertaken by Stantec UK Ltd. to establish the existing environmental sound levels at the Site.
- 5.1.3 This report presents the relevant results of the environmental sound surveys and considers the suitability of the site for residential development, having regard to planning policy, national and international standards and guidance documents in relation to environmental noise.
- 5.1.4 The assessment has indicated that the proposed LOAEL are likely to be achieved, subject to the development following a good acoustic design process during the detailed design stage. This can be secured using a suitably worded planning condition. Therefore, the site is considered suitable for residential use.
- 5.1.5 Subject to detailed assessments undertaken at the detailed design stage, the assessment also indicates that:
- With appropriate specification of building elements, internal ambient noise levels are likely to fall below the guideline levels of BS 8233:2014.
  - Compliance with Approved Document O could be achieved using a combination of the simplified method (for the majority of the site) and dynamic thermal modelling for those areas within 63 m of the A22 Hailsham Bypass and 27 m of the A271 Lower Horsebridge.
  - Appropriate noise levels in private external amenity areas are achievable subject to the inclusion of good acoustic design measures

## Appendix A Glossary of Acoustic Terminology

Table A.1: Glossary of Acoustic Terminology

| Parameter                            | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ambient Noise Level                  | The totally encompassing sound in a given situation at a given time, usually composed of a sound from many sources both distant and near ( $L_{Aeq,T}$ ).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Daytime                              | The period 07:00-23:00 hours.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Decibel (dB)                         | A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds $s_1$ and $s_2$ is given by $20 \log_{10} (s_1/s_2)$ . The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is $20\mu\text{Pa}$ . The threshold of normal hearing is in the region of 0 dB and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.                                                                                                  |
| dB(A), $L_{Ax}$                      | Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A). |
| Fast Time Weighting                  | Setting on sound level meter, denoted by a subscript F, that determines the speed at which the instrument responds to changes in the amplitude of any measured signal. The fast time weighting can lead to higher values than the slow time weighting when rapidly changing signals are measured. The average time constant for the fast response setting is 0.125 (1/8) seconds.                                                                                                                                                                                                                                                                             |
| Free-field                           | Sound pressure level measured outside, far away from reflecting surfaces (except the ground), usually taken to mean at least 3.5 metres                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Façade                               | Sound pressure level measured at a distance of 1 metre in front of a large sound reflecting object such as a building façade.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| $L_{AE}$ or SEL                      | A noise level which, if maintained for a period of 1 second, would cause the same A-weighted sound energy to be received as is actually received from a given noise event.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| $L_{Aeq,T}$                          | A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.                                                                                                                                                                                                                                                                                                                                                                                                        |
| $L_{max,T}$                          | A noise level index defined as the maximum noise level recorded during a noise event with a period T. $L_{max}$ is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall $L_{eq}$ noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.                                                                                                                                                                                                                                                                         |
| $L_{90,T}$ or Background Sound Level | A noise level index. The noise level exceeded for 90% of the time over the period T. $L_{90}$ can be considered to be the "average minimum" noise level and is often used to describe the background noise.                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| LOAEL                                | Lowest Observed Adverse Effect Level. This is the noise level above which adverse effects on health and quality of life can be detected.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Night-time                           | The period 23:00-07:00 hours.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 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.                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

| Parameter                                                        | Description                                                                                                                                                                                                                                                                                              |
|------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SOAEL                                                            | Significant Observed Adverse Effect Level. This is the level above which significant adverse effects on health and quality of life occur.                                                                                                                                                                |
| Sound Pressure                                                   | Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.                                                                                                                                                                                                             |
| Sound Pressure Level, $L_p$                                      | The sound pressure level, $L_p$ is the sound pressure relative to a standard reference pressure of 20 $\mu\text{Pa}$ ( $20 \times 10^{-6}$ Pascals) on a decibel scale.                                                                                                                                  |
| Peak                                                             | This value gives the maximum excursion of the vibration oscillation above or below zero. This value is useful for indicating the level of short duration shocks.                                                                                                                                         |
| Peak to Peak                                                     | This value gives the total excursion of the vibration oscillation about zero.                                                                                                                                                                                                                            |
| RMS                                                              | Root Mean Square of a time-varying quantity is obtained by squaring the Amplitude at each instant, obtaining the average of the squared values over the interval of interest, and then taking the Square Root of this average.                                                                           |
| Vibration Dose Value<br>( $\text{VDV}_{b/d, \text{day/night}}$ ) | The fourth root of the time integral of the fourth power of frequency-weighted acceleration. Subscripts <i>b</i> and <i>d</i> refer to the frequency weighting curve that has been applied. Subscripts <i>day</i> and <i>night</i> indicate the VDV value relates to daytime or night-time respectively. |
| Frequency-Weighting Curve<br>( $W_b, W_d$ )                      | Frequency weightings $W_b$ and $W_d$ are applied for vertical and horizontal vibration directions respectively, to correspond with human response to vibration in terms of perception, comfort and adverse comment.                                                                                      |

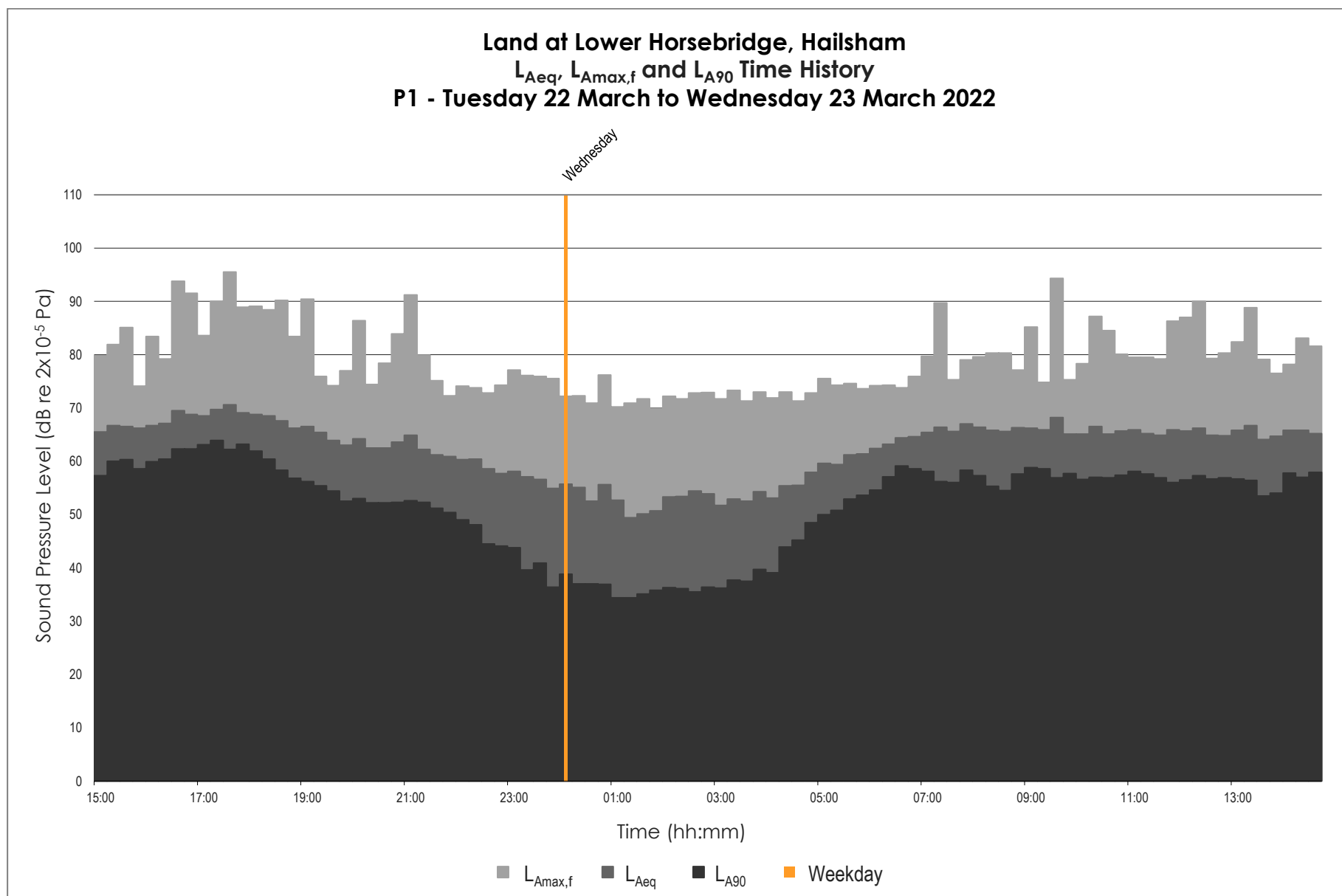
## Appendix B Instrumentation

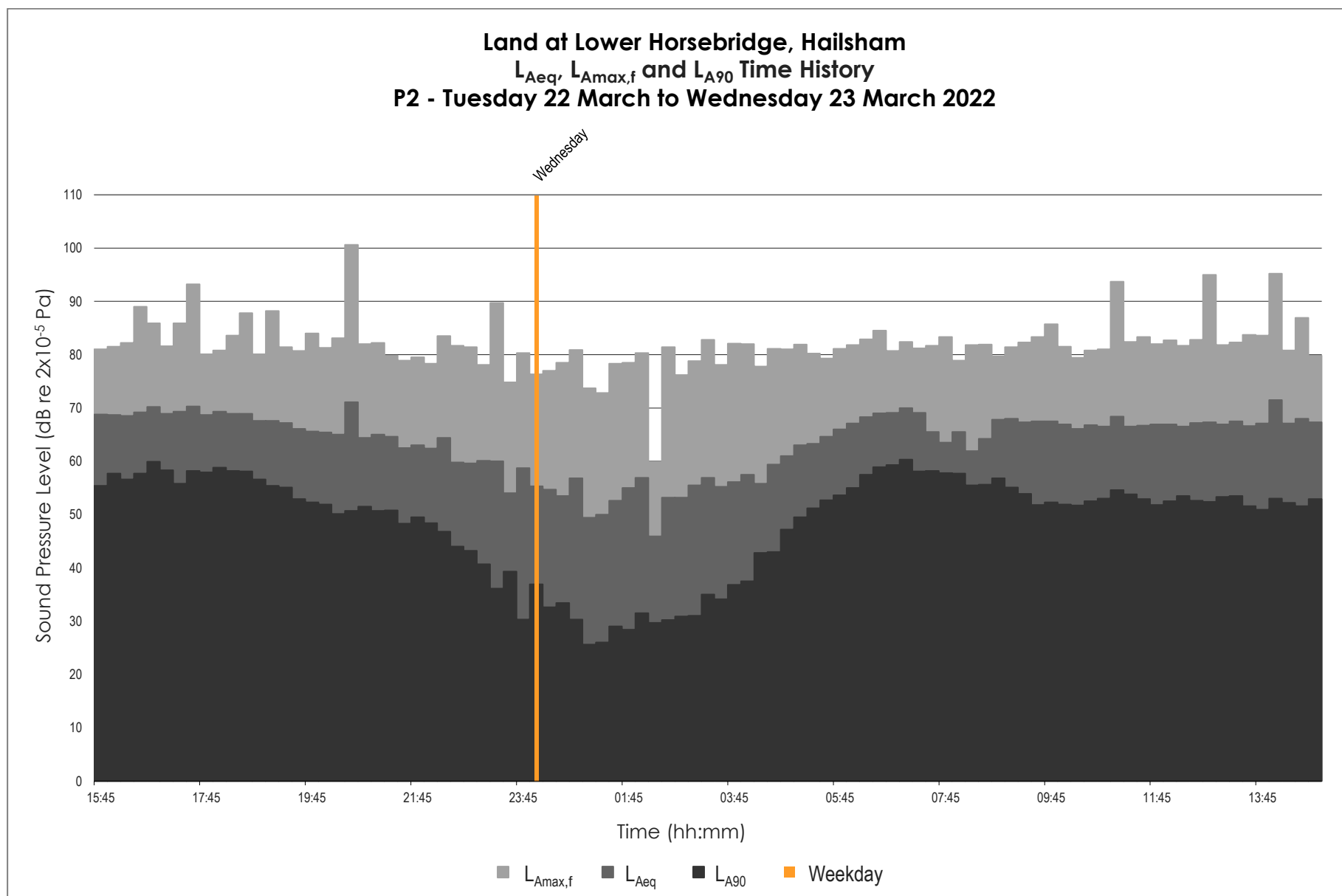
B.1.1 The instrumentation used in the environmental sound survey is listed in **Table B.1**.

Table B.1: Environmental Sound Survey Instrumentation

| Description                 | Manufacturer | Type  | Serial Number | Laboratory Calibration Date |
|-----------------------------|--------------|-------|---------------|-----------------------------|
| Sound Level Meter           | Rion         | NL-52 | 1043458       | 10/09/2021                  |
| ½" Pre-Polarised microphone |              | UC-59 | 07233         |                             |
| Pre-amplifier               |              | NH-25 | 43487         |                             |
| Sound Level Meter           | Rion         | NL-52 | 542903        | 05/02/2021                  |
| ½" Pre-Polarised microphone |              | UC-59 | 06480         |                             |
| Pre-amplifier               |              | NH-25 | 42931         |                             |
| Calibrator                  | Rion         | NC-74 | 34746691      | 15/08/2022                  |

## Appendix C    Sound Time History Graphs





## Appendix D    Sound Contour Plots

Figure D.1: Calculated Daytime External Sound Levels, dB  $L_{Aeq,16h}$



Figure D.2: Calculated Night-Time External Sound Levels, dB L<sub>Aeq,8h</sub>



## Appendix E External Noise Ingress Calculation Assumptions

- E.1.1 The following assumptions have been used to calculate the internal sound level within dwellings of the proposed development.
- E.1.2 The assumptions used should not be used to form an acoustic performance specification and are for indicative purposes only. The acoustic performance specification of these elements should be considered at the detailed design stage.

Table E.1: Indicative External Noise Ingress Calculation Details – Room Parameters

| Living Room Parameters |        |        |                                            |       |      |
|------------------------|--------|--------|--------------------------------------------|-------|------|
| Dimensions (m)         |        |        | Area of External Element (m <sup>2</sup> ) |       |      |
| Width                  | Length | Height | Windows                                    | Walls | Roof |
| 4                      | 5      | 2.5    | 2                                          | 10    | 0    |

| Average Acoustic Absorption Coefficients ( $\bar{\alpha}$ ) at Octave-band Centre Frequency (Hz) |      |      |      |      |      |
|--------------------------------------------------------------------------------------------------|------|------|------|------|------|
| 125                                                                                              | 250  | 500  | 1k   | 2k   | 4k   |
| 0.18                                                                                             | 0.25 | 0.27 | 0.31 | 0.32 | 0.32 |

| Bedroom Parameters |        |        |                                            |       |      |
|--------------------|--------|--------|--------------------------------------------|-------|------|
| Dimensions (m)     |        |        | Area of External Element (m <sup>2</sup> ) |       |      |
| Width              | Length | Height | Windows                                    | Walls | Roof |
| 3                  | 3      | 2.5    | 2                                          | 5.5   | 6    |

| Average Acoustic Absorption Coefficients ( $\bar{\alpha}$ ) at Octave-band Centre Frequency (Hz) |      |      |      |      |      |
|--------------------------------------------------------------------------------------------------|------|------|------|------|------|
| 125                                                                                              | 250  | 500  | 1k   | 2k   | 4k   |
| 0.18                                                                                             | 0.25 | 0.27 | 0.31 | 0.32 | 0.32 |

Table E.2: Indicative External Noise Ingress Calculation Details – Sound Insulation Details

| Sound Reduction Indices of External Elements                                                                             |     |     |    |    |    |
|--------------------------------------------------------------------------------------------------------------------------|-----|-----|----|----|----|
| Glazing Sound Reduction Indices (R dB) at Octave-band Centre Frequency (Hz)<br>(Based on typical thermal double glazing) |     |     |    |    |    |
| 125                                                                                                                      | 250 | 500 | 1k | 2k | 4k |
| 24                                                                                                                       | 23  | 30  | 33 | 33 | 30 |

| Trickle Ventilator Element Normalised Level Difference (D <sub>n,e</sub> dB) at Octave-band Centre Frequency (Hz) – assuming 1 vent per room with a free area of 8000mm <sup>2</sup><br>(Based on typical non-acoustically rated trickle ventilator) |     |     |    |    |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|----|----|----|
| 125                                                                                                                                                                                                                                                  | 250 | 500 | 1k | 2k | 4k |
| 32                                                                                                                                                                                                                                                   | 32  | 31  | 33 | 31 | 31 |

| Roof Sound Reduction Indices (R dB) at Octave-band Centre Frequency (Hz)<br>(Based on tiled/slatted roof with 12 mm plasterboard ceiling and 100mm mineral wool insulation) |     |     |    |    |    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|----|----|----|
| 125                                                                                                                                                                         | 250 | 500 | 1k | 2k | 4k |
| 24                                                                                                                                                                          | 34  | 40  | 45 | 49 | 50 |

| External Wall Sound Reduction Indices (R dB) at Octave-band Centre Frequency (Hz)<br>(Based on typical brick/blockwork construction) |     |     |    |    |    |
|--------------------------------------------------------------------------------------------------------------------------------------|-----|-----|----|----|----|
| 125                                                                                                                                  | 250 | 500 | 1k | 2k | 4k |
| 41                                                                                                                                   | 45  | 45  | 54 | 58 | 58 |

## Appendix F Barrier Specification

### F.1 Overview

- F.1.1 With respect to acoustic attenuation, garden fences can be constructed from a range of materials, including timber, masonry, concrete, cementitious wood wool or wood shaving panels, metals, plastics and recycled materials that meet the requirements for sound insulation, sound absorption, durability and structural integrity. However, timber is most common material used in these applications.

### F.2 Garden Fencing

- F.2.1 Acoustic screening shall extend as indicated in **Figure 3** up to a minimum height of 1.8 m above ground level.

#### Airborne Sound Insulation

- F.2.2 The screen shall be imperforate (solid) and have a minimum mass per unit area of at least 10 kg/m<sup>2</sup>. This requirement can usually be met with a solid and imperforate 20 mm thick timber fence.
- F.2.3 Joints between panels should be well sealed to prevent leakage through the barrier. Timber panels and planks should incorporate due allowance for expansion and shrinkage of the timber by including a rebated overlap or tongue and groove joint between boards, or an external batten to cover movement gaps. The overlap should not be less than 25% of the board width to prevent significant leakage. Where materials are stable and significant movement between panels would not occur, the gaps between panels should be sealed with a resilient gasket.

#### Mechanical Performance and Stability

- F.2.4 The barrier shall be capable of resisting wind loadings and the self-weight of its component parts without reducing its effectiveness as a garden fence. The material shall retain its structural integrity over the specified life of the barrier.

### F.3 Acoustic Barrier

- F.3.1 Acoustic screening shall extend as indicated in **Figure 3** up to a minimum height of 2.5 m above ground level.

#### Airborne Sound Insulation

- F.3.2 The screen shall be imperforate (solid) and have a minimum mass per unit area of at least 10kg/m<sup>2</sup>.
- F.3.3 The material(s) should be selected to provide a single figure of sound insulation of not less than 20 dB DL<sub>r</sub> when measured and rated in accordance with BS EN 1793-2:2012, *Road traffic noise reducing devices – Test method for determining the acoustic performance, Part 2. Intrinsic characteristics of airborne sound insulation* and should have a minimum surface density of 20 kg/m<sup>2</sup>. This requirement can usually be met with a solid and imperforate 20 mm thick timber barrier.
- F.3.4 Joints between panels should be well sealed to prevent leakage through the barrier. Timber panels and planks should incorporate due allowance for expansion and shrinkage of the timber by including a rebated overlap or tongue and groove joint between boards, or an external batten to cover movement gaps. The overlap should not be less than 25% of the board width to prevent

significant leakage. Where materials are stable and significant movement between panels would not occur, the gaps between panels should be sealed with a resilient gasket.

### **Mechanical Performance and Stability**

- F.3.5 The mechanical performance and stability will need to be considered by relevant technical specialists prior to installation.