



Dice
Environmental
Acoustics

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Noise Impact Assessment
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Executive Summary

Dice Environmental were commissioned by Redcliffe Homes to undertake a Noise Impact Assessment to support a planning application for a residential development on an area of land at Melksham Road, Holt, BA14 6QW.

Noise surveys

Environmental noise surveys have been completed to quantify the prevailing soundscape at the site. This comprised two unattended logging surveys running simultaneously over a full weekend and weekday period. The surveys captured the existing background noise level and the potential local noise sources consisting of Melksham Road and the equestrian site.

Residential Planning Noise Assessment

A 3D CadnaA noise model has been constructed including all significant noise sources at the site, primarily noise from road traffic on the B3107/Melksham Road. This has been used to predict the noise levels incident upon the facades of the proposed residential development.

Accordingly, appropriate consideration has been given towards the mitigation measures required to ensure that the internal ambient noise level requirements set out in BS8233:2014 can be met for the development. A range of double-glazing configurations from $R_w + C_{tr}$ 25 dB to $R_w + C_{tr}$ 39 dB would be required to control noise break-in from external sources and achieve the requirements of BS8233.

Where trickle vents are required, these should have a sound insulation performance of $D_{n,ew} + C_{tr}$ greater than or equal to the performance of the window in which it is installed. This assumes one vent will be installed per window.

As standard, the proposal includes for 1.8 m garden fences to all gardens at the site. In order to meet the criterion contained within BS8233, it is proposed to install 2.2m garden fences at plots 47 and 48.

Overheating Assessment

A number of plots are predicted to exceed the noise levels set out in Approved Document O Overheating for bedrooms at night. Open windows should not be relied upon as the standard means of cooling for overheating scenarios in these locations.

BS4142 Assessment – ASHP

The proposal includes the installation of an Air Source Heat Pump (ASHP) at each of the residential units. Accordingly, an assessment of the proposed plant items has been undertaken to confirm compliance

with Wiltshire Councils requirements. The compliance assessment has determined that the proposed ASHP will meet the criterion.

BS4142 Assessment

An assessment has been carried out in line with BS4142 in relation to the neighbouring equestrian site. It has been established that noise levels are unlikely to be cause for complaint and that no further noise mitigation measures will be required.

Initial consideration was given to the Wessex Water facility located southeast of the proposed site. On-site surveys confirmed that no noise was detectable from this facility; therefore, no further assessment has been undertaken.

The assessment is based upon robust and worst-case assumptions and demonstrates that, in principle and subject to the incorporation of the identified mitigation measures, there should be no adverse impact at the proposed dwellings as a result of existing noise. The site is suitable for the promotion of residential development.

1. Introduction

1.1. Background

Dice Environmental has been commissioned by Redcliffe Homes, to provide a Noise Impact Assessment to support a planning application for a residential development at Melksham Road, Holt, BA14 6QW, to be referred to hereafter as “the site”.

The site is located on Melksham Road, Holt, and is identified as a potential site for residential development. The development comprises up to 55 new-build dwellings including Access, Open Space, Attenuation Basin, Landscaping and Associated Works at Land North of Melksham Road, Holt.

The B3107/Melksham Road runs along the southern boundary of the site. The west of the site comprises existing residential development. Hillview Riding Stables is located to the northeast of the site. The majority of the remaining surrounding land is agricultural in nature.

The key sources of noise impacting upon the site are the B3107/Melksham Road, and the equestrian centre north east of the site.

This assessment has been undertaken with due regard to the supplied site layout from Redcliffe Homes Drawing *Site Layout* Drawing no. SL01, Rev P11, dated 21/08/2025. The proposed layout is shown in Figure 2 in Appendix III.

1.2. Limitations

All limitations of this report are presented in Appendix I.

1.3. Confidentiality

Dice Environmental has prepared this report solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from Dice Environmental; a charge may be levied against such approval.

2. Assessment Methodology

2.1. National Planning Policy Framework

National Planning Policy Framework [1] states that noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment. When preparing local or neighbourhood plans, or taking decisions about new development, there may also be opportunities to consider improvements to the acoustic environment.

Local planning authorities' plan-making and decision-taking should take account of the acoustic environment and in doing so consider:

- Whether or not significant adverse effect is occurring or is likely to occur
- Whether or not adverse effect is occurring or is likely to occur; and
- Whether or not a good standard of amenity can be achieved.

In line with the Explanatory Note of the Noise Policy Statement for England [2], this would include identifying whether the overall effect of the noise exposure (including the impact during the construction phase wherever applicable) is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation.

The Observed Effect Levels are as follows:

- Significant Observed Adverse Effect Level:
This is the level of noise exposure above which significant adverse effects on health and quality of life occur;
- Lowest Observed Adverse Effect Level:
This is the level of noise exposure above which adverse effects on health and quality of life can be detected;
- No Observed Adverse Effect Level (NOAEL):
This is the level of noise exposure at which the noise is noticeable but has no effect at all on health or quality of life.
- No Observed Effect Level (NOEL):
This is the level of noise exposure below which noise is not audible.

Table 1 summarises the noise exposure hierarchy, based on the likely average response.

Table 1: Noise exposure hierarchy

Perception	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, e.g., regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable adverse effect	Prevent

The subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any particular situation.

These factors include:

- The source and absolute level of the noise together with the time of day it occurs. Some types and level of noise will cause a greater adverse effect at night than if they occurred during the day – this is because people tend to be more sensitive to noise at night as they

are trying to sleep. The adverse effect can also be greater simply because there is less background noise at night;

- For non-continuous sources of noise, the number of noise events, and the frequency and pattern of occurrence of the noise; and
- The spectral content and general character of the noise. The local topology and topography should also be taken into account along with the existing and, where appropriate, the planned character of the area.

More specific factors to consider when relevant:

- Where applicable, the cumulative impacts of more than one source should be taken into account, along with the extent to which the source of noise is intermittent and of limited duration.
- Consideration should also be given to whether adverse internal effects can be completely removed by closing windows and, in the case of new residential development, if the proposed mitigation relies on windows being kept closed most of the time. In both cases a suitable alternative means of ventilation is likely to be necessary. Further information on ventilation can be found in the Building Regulations.
- If external amenity spaces are an intrinsic part of the overall design, the acoustic environment of those spaces should be considered so that they can be enjoyed as intended.

2.2. British Standard 8233:2014 *Guidance on sound insulation and noise reduction for buildings*

2.2.1. Noise Criterion Limits

The scope of this standard [3] is the provision of recommendations for the control of noise in and around buildings. It suggests appropriate criteria and limits for different situations, which are primarily intended 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 ambient noise levels in dwellings from external noise sources should not exceed the values given in Table 2.

Table 2: BS8223 Recommended indoor ambient noise level limits

Activity	Location	Limit $L_{Aeq,T}$ (dB)	
		Daytime (07:00-23:00)	Night-time (23:00-07:00)
Suitable resting/sleeping conditions	Living Room	35	-
	Bedroom	35	30
Dining	Dining room	40	-

BS8233 goes on to recommend noise levels for external amenity spaces (i.e., gardens, balconies etc.). According to BS8233;

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 recognised 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 might be warranted.

BS8233 goes on to say:

In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces but should not be prohibited.

2.2.2. Ventilation Requirements

Where a partially open window cannot be relied upon to provide an adequate level of facade sound insulation, it is necessary to consider alternative ventilation for habitable rooms. Section 8.4.5.4 of BS8233 states:

The Building Regulations' supporting documents on ventilation [4, 5, 6] recommend that habitable rooms in dwellings have background ventilation. Where openable windows cannot be relied upon for this ventilation, trickle ventilators can be used and sound attenuating types are available. However, windows may remain openable for rapid or purge ventilation, or at the occupant's choice.

Alternatively, acoustic ventilation units (see 7.7.2) are available for insertion in external walls. These can provide sound reduction comparable with double glazed windows. However, ducted systems with intakes on the quiet side of the building might be required in very noisy situations, or where appearance rules out through-the-wall fans.

Section 7.7.2 states:

NOTE 5: If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level.

2.3. Building Regulations Approved Document O: Overheating

Approved Document O of the Building Regulations 2010 *Overheating* (ADO) [7] concerns ventilation and overheating requirements in dwellings. Requirement O1(2)(a) concerns the maximum acceptable noise levels in homes during overheating scenarios. These represent a 10 dB relaxation on the noise levels set out in BS8233 [3] and WHO Guidelines [8] that apply in non-overheating scenarios. Table 3 sets out these limits.

Table 3: Internal noise level limits in overheating scenarios

Location	Time	Noise limits in overheating conditions
Bedroom	Daytime (07:00-23:00)	$L_{Aeq,16h}$ 45 dB
	Night (23:00-07:00)	$L_{Aeq,8h}$ 40 dB
		L_{AFmax} 55 dB not exceeded more than 10 times per night

2.4. World Health Organisation's (WHO) Guidelines for Community Noise

The WHO *Guidelines for Community Noise* [8] offer advice with regard to setting noise criteria applicable to sleep disturbance. Section 4.2.3 specifies:

If the noise is not continuous, L_{Amax} or SEL are used to indicate the probability of noise-induced awakenings. Effects have been observed at individual L_{Amax} exposures of 45 dB or less. Consequently, it is important to limit the number of noise events with a L_{Amax} exceeding 45 dB.

The guidelines go on to state:

At night, sound pressure levels at the outside façades of the living spaces should not exceed 45 dB L_{Aeq} and 60 dB L_{Amax} , so that people may sleep with bedroom windows open. These values have been obtained by assuming that the noise reduction from outside to inside with the window partly open is 15 dB.

The sound insulation performance value of 15 dB for a façade containing a partially open window accords with the guidance offered in BS8233 [3]. The guidelines reference a study by Vallet & Vernet [9], which concluded that:

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

Accordingly, this assessment has utilised the 10th highest measured maximum noise level from the night-time period and allows for an assessment of a typical maximum noise level in determining façade sound insulation performance.

2.5. British Standard 4142:2014+A1:2019 *Methods for rating and assessing industrial and commercial sound*

BS4142 [10] describes methods for rating and assessing sound of an industrial or commercial nature which includes:

- Sound from industrial and manufacturing processes
- Sound from fixed installations which comprise mechanical and electrical plant and equipment
- Sound from the loading and unloading of goods and materials at industrial and/or commercial premises
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from processes or premises, such as that from forklift trucks, or that from train or ship movements on or around an industrial or commercial site.

The procedure detailed in the standard compares the measured or predicted noise level, 'the specific noise level', from any of the above detailed noise sources with the background sound level at a residential dwelling. The measured background sound level at a receptor should be reliable and should not necessarily ascertain a lowest measured background sound level, but rather to quantify what is typical.

The specific noise level also acknowledges the following reference time intervals depending upon whether the noise source operates during daytime or night-time periods:

- Daytime (07:00-23:00): 1 hr; and,
- Night-time (23:00-07:00): 15 minutes.

There are a number of 'penalties' which can be attributed to the specific sound level depending upon the 'acoustic features' of the sound under investigation as follows. These penalties vary in their weighting depending upon the severity of the acoustic feature, as follows:

Tonality

- +2 dB: where the tonality is just perceptible
- +4 dB: where the tonality is clearly perceptible
- +6 dB: where the tonality is highly perceptible

Impulsivity

- +3 dB: where the impulsivity is just perceptible
- +6 dB: where the impulsivity is clearly perceptible
- +9 dB: where the impulsivity is highly perceptible

Intermittency

- +3 dB: where the intermittency is readily distinctive against the acoustic environment

In addition to the above acoustic features, there is a penalty for 'other sound characteristics' of +3 dB where a sound exhibits characteristics that are neither tonal nor impulsive, though are readily distinctive against the acoustic environment.

BS4142 goes on to state that the rating level is equal to the specific sound level if there are no such features present or expected to be present.

Assessment of the rating level relative to the background noise level can yield the following commentary:

- Typically, the higher the rating level is above the background sound level, the greater the magnitude of impact.
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
- Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact.

With the above in mind, it is common that a Local Planning Authority will specify their own criteria for the rating level relative to the background sound level and, where this is the case, this criterion usually takes precedence over a simple comparison of the rating level against the background sound level.

BS4142 includes the following text in relation to areas with low and very low noise levels:

Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.

2.6. ISO 9613 – Part 2:1996

The International Standards Organisation (“ISO”) published ISO 9613 – Part 2: 1996 entitled “Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculations” which details the corrections that are required to established the resultant noise levels of the existing and proposed plant at the assessment position.

2.6.1. Source Directivity (Dc)

A correction is made to account for the location of the source and the effect of additional reflective surfaces excluding the ground and is contained within section 6 of ISO 9613 - Part 2:1996.

Table 4: Source Directivity

Number of Surfaces	Correction in dB
1 Reflective Surface	+3
2 Reflective Surfaces	+6
3 Reflective Surfaces	+9

2.6.2. Barrier Effect

A correction is made for any barrier in the direct line of site between the source and the assessment position and is detailed in section 7.4 of ISO 9613-Part 2:1996. For clarity the K_{met} meteorological correction has been ignored and C_2 equals 40 and C_3 equals 1.

Table 5: Barrier Effect

Formula	Symbols
$A_{bar} = 10 \cdot \log_{10} [3 + (40 \cdot \delta / \lambda) - A_g]$ *Note 1 where $\delta = a + b - r$ and $\lambda = c / f$	A_{bar} = Effective barrier attenuation (dB) A_g = Total Ground Absorption (dB) *Note 1: Only apply the A_g correction if $A_g > 0$ δ = Path difference (m) a = Distance from source to barrier head (m) b = Distance from barrier head to assessment position (m) r = Distance from source to assessment position (m) λ = Wavelength of sound (m) c = Speed of sound – Assumed to be 342 ms ⁻¹ f = Octave band centre frequency (Hz)

2.7. Professional Practice Guidance: Planning and Noise (ProPG)

Professional Practice Guidance (ProPG) on Planning and Noise [11] has been produced to provide practitioners with guidance on a recommended approach to the management of noise within the planning system in England. The guidance encourages better acoustic design for new residential development and aims to protect people from the harmful effects of noise. It aims to complement Government planning and noise policy and guidance. In particular, it strives 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 effect; and
 - Assist the delivery of sustainable development.

This ProPG advocates a systematic, proportionate, risk based, 2-stage, approach. The approach encourages early consideration of noise issues, facilitates straightforward accelerated decision making for lower risk sites, and assists proper consideration of noise issues where the acoustic environment is challenging.

The two sequential stages of the overall approach are:

Stage 1 – an initial noise risk assessment of the proposed development site

It is important that the assessment of noise risk at a proposed residential development site is not the basis for the eventual recommendation to the decision maker. The recommended approach is intended to give an early indication of the likely initial suitability of the site for new residential development from a noise perspective and the extent of the acoustic issues that would be faced.

Stage 2 – a systematic consideration of four key elements

Element 1 – Demonstrating a “Good Acoustic Design Process”

It is imperative that acoustic design is considered at an early stage of the development control process. A good acoustic design process takes a multi-faceted and integrated approach to achieve optimal acoustic conditions, both internally and externally. Good acoustic design should avoid “unreasonable” acoustic conditions and prevent “unacceptable” acoustic conditions.

Element 2 – observing internal “Noise Level Guidelines”

Table 6: ProPG internal noise level guidelines

Activity	Location	Daytime (07:00-23:00)	Night (23:00-07:00)
Resting	Living room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$ 45 dB $L_{Amax,fast}$ ⁴

NOTE 1: The table provides recommended internal L_{Aeq} target levels for overall noise in the design of a building. These are the sum total of structure-borne and airborne noise sources. Ground-borne noise is assessed separately and is not included as part of these targets, as human response to ground-borne noise varies with many factors such as level, character, timing, occupant expectation and sensitivity.

NOTE 2: The internal L_{Aeq} target levels shown in the table are based on the existing guidelines issued by the WHO [8] and assume normal diurnal fluctuations in external noise. In cases where local conditions do not follow a typical diurnal pattern, for example on a road serving a port with high levels of traffic at certain times of the night, an appropriate alternative period, e.g., 1 hour, may be used, but the level should be selected to ensure consistency with the internal L_{Aeq} target levels recommended in the table.

NOTE 3: These internal L_{Aeq} target levels are based on annual average data and do not have to be achieved in all circumstances. For example, it is normal to exclude occasional events, such as fireworks night or New Year's Eve.

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 $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values. 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.

NOTE 5: Designing the site layout and the dwellings so that the internal target levels can be achieved with open windows in as many properties as possible demonstrates good acoustic design. Where it is not possible to meet internal target levels with windows open, internal noise levels can be assessed with windows closed. However, any façade openings used to provide whole dwelling ventilation (e.g., trickle ventilators) should be assessed in the “open” position and, in this scenario, the internal L_{Aeq} target levels should not normally be exceeded, subject to the further advice in Note 7.

NOTE 6: Attention is drawn to the requirements of the Building Regulations.

NOTE 7: Where development is considered necessary or desirable, despite external noise levels above the WHO Guidelines [8], the internal L_{Aeq} target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved. The more often internal L_{Aeq} levels start to exceed the internal L_{Aeq} target levels by more than 5 dB, the more that most people are likely to regard them as “unreasonable”. Where such exceedances are predicted, applicants should be required to show how the relevant number of rooms affected has been kept to a minimum. Once internal L_{Aeq} levels exceed the target levels by more than 10 dB, they are highly likely to be regarded as “unacceptable” by most people, particularly if such levels occur more than occasionally. Every effort should be made to avoid relevant rooms experiencing “unacceptable” noise levels at all and where such levels are likely to occur frequently, the development should be prevented in its proposed form.

Element 3 – undertaking an “External Amenity Area Noise Assessment”

BS8233 [3] provides the following advice:

If external amenity spaces are an intrinsic part of the overall design, the acoustic environment of those spaces should be considered so that they can be enjoyed as intended. 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 $L_{Aeq,16hr}$. These guideline values may not be achievable in all

circumstances where development might be desirable. In such a situation, development should be designed to achieve the lowest practicable noise levels in these external amenity spaces.

Where, despite following a good acoustic design process, significant adverse noise impacts remain on any private external amenity space then that impact may be partially offset if the residents are provided, through the design of the development or the planning process, with access to:

- a relatively quiet facade or a relatively quiet externally ventilated as part of their dwelling; and/or
- a relatively quiet alternative or additional external amenity space for sole use by a household; and/or
- a relatively quiet, protected, nearby, external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings; and/or
- a relatively quiet, protected, publicly accessible, external amenity space that is nearby.

Element 4 – consideration of “Other Relevant Issues”

- compliance with relevant national and local policy;
- magnitude and extent of compliance with ProPG;
- likely occupants of the development;
- acoustic design v unintended adverse consequences; and
- acoustic design v wider planning objectives.

Following the above stages, including the initial site risk assessment and full assessment, a recommendation to the decision maker is determined as follows:

- Grant without noise conditions; or
- Grant with noise conditions; or
- Avoid (significant adverse effects); or
- Prevent (unacceptable adverse effects).

3. SURVEYS

3.1. Background and Ambient Noise Survey

Dice Environmental has conducted a background and ambient noise survey over an entire weekend and weekday period and another over a 24-hour period. The respective surveys were used to capture noise levels from the surrounding noise sources including Melksham Road and the equestrian site. The dominant noise source at the site is road traffic noise, primarily from the B3107/Melksham Road. The noise survey took place over the following period:

- 14:00 on 22nd November 2023 to 14:00 on 27th November 2023.

Positions N1 and N2 are shown in Figure 1. The unattended logger position is shown in green, with the sample measurement position shown in blue. N1 was selected to be representative of noise arising from Melksham Road and N2 of noise from the equestrian site.



Figure 1: Site measurement locations

A summary of the sound pressure levels measured at N1 is presented in Table 7.

Table 7: Summary of measured noise levels at N1 – Background and Road Traffic

Date	Period	Average levels, L _{Aeq,T} (dB)	Range of background levels, L _{A90} (dB)		Maximum night level, L _{AFmax,1min} (dB)
			Range	Typical*	
Wed 22 Nov. 23 – Mon 27 Nov. 23	Day (07:00-23:00)	70	32-53	49	-
	Night (23:00-07:00)	60	29-48	32	84

A summary of the sound pressure levels measured at N2 is presented in Table 8.

Table 8: Summary of measured noise levels at N2 – Background and Equestrian Noise

Date	Period	Average levels, L _{Aeq,T} (dB)	Range of background levels, L _{A90} (dB)		Maximum night level, L _{AFmax,1min} (dB)
			Range	Typical*	
Wed 22 Nov. 23 - Sat 25 Nov. 23	Day (07:00-23:00)	50	40-51	43	-
	Night (23:00-07:00)	45	37-46	41	57

3.2. Noise Survey Conditions

The weather conditions during the noise surveys were conducive towards the measurement of environmental noise being fine and dry with wind speeds generally below 5 m/s.

The noise survey was completed using the following noise measurement equipment.

Table 9: Noise Measurement Equipment

Position	Description	Manufacturer & Type	Serial No.	Calibration Expiry
N1	Sound Level Meter	01dB Solo	65211	Jun. 25
	Pre-amplifier	01dB-Metravib Pre21S	15766	
	Microphone	01dB MCE 212	181856	
	Calibrator	01dB-Metravib CAL31	84062	Jun. 24
N2	Sound Level Meter	01dB Solo	65947	Nov. 23*
	Pre-amplifier	01dB-Metravib Pre21S	16255	
	Microphone	01dB MCE 212	175280	
	Calibrator	01dB-Metravib CAL31	84062	Jun. 24

*Valid at time of testing.

The sound level meters were field-calibrated on site prior to and after the measurements were taken. No significant drift was witnessed.

4. Noise Impact Assessment

In order to accurately assess noise propagation across the site, a 3D noise model has been constructed using the modelling software CadnaA. The following assumptions, inputs and considerations have been included in the model:

- Terrain data taken from DEFRA Data Services Platform [12];
- Planning layout drawing as described in Section 1;
- Existing buildings that provide shielding from any of the noise sources;
- Positions N1 and N2 has been successfully used to calibrate the model;
- A reflection order of 2 has been used in all calculations;
- Building heights are as supplied by the client; and
- Noise levels generated using ISO 9613-1 [13] and ISO 9613-2 [14] as incorporated into CadnaA software.

4.1. Internal Noise Impact for Proposed Dwellings (Non-overheating scenarios)

In order to accurately determine the noise level within habitable rooms, noise levels at 1 m outside the façades have been calculated in the noise model for the proposed layout.

Table 13 of BS6262-2 [15] suggests that a standard double-glazing unit with configuration 4mm glass/12mm cavity/4mm glass affords a sound insulation performance in the order of R_w 29 dB; however, this is for a pink noise spectrum. The same unit, weighted for road traffic noise using the '+ C_{tr} ' correction, has a sound insulation performance of approximately $R_w + C_{tr}$ 25 dB and so this value, along with the attenuation values for further glazing configurations, has been used to determine internal noise levels.

The Acoustics Ventilation and Overheating: Residential Design Guide [14] also recommends that a partially open window provides approximately 13 dB attenuation, and this value is also used in the following assessment.

In order to achieve the noise criteria stated within the BS8233 and WHO Guidelines [8] for bedrooms and living areas, a range of glazing specifications are required. Figure 3-6 of Appendix III presents the minimum glazing sound insulation performance required to achieve the WHO's noise criteria across each façade. Table 10 relates this to a typical glazing configuration and ventilation strategy for achieve this.

Table 10: Typical glazing configuration and sound insulation requirements

Sound insulation performance, $R_w + C_{tr}$ (dB)	Typical glazing configuration (mm)	Ventilation strategy*
13	4/12/4	Open windows
15		$D_{n,e,w} + C_{tr} \geq 15$ dB trickle vent
16		$D_{n,e,w} + C_{tr} \geq 16$ dB trickle vent
18		$D_{n,e,w} + C_{tr} \geq 18$ dB trickle vent
20		$D_{n,e,w} + C_{tr} \geq 20$ dB trickle vent
22		$D_{n,e,w} + C_{tr} \geq 22$ dB trickle vent
25		$D_{n,e,w} + C_{tr} \geq 25$ dB trickle vent
30	6/12/6	$D_{n,e,w} + C_{tr} \geq 30$ dB trickle vent
33	6.4/12/6	$D_{n,e,w} + C_{tr} \geq 33$ dB trickle vent
36	6.4/12/10	$D_{n,e,w} + C_{tr} \geq 36$ dB trickle vent
39	12.8/12/10	$D_{n,e,w} + C_{tr} \geq 39$ dB trickle vent

* Based on a single trickle vent per window. If more than one vent is to be used, the performance should increase by 3dB with every doubling of the number of vents, i.e., +3dB for 2 vents, +6dB for 4 vents, etc.

4.2. Overheating noise assessment

Analysis of the noise model indicates that there are a number of plots where open windows cannot be relied upon to provide cooling in overheating scenarios, as the noise limits of ADO [7] will be exceeded. These are the indicated in Figure 7 and 8 in Appendix III.

In these locations, an alternative form of cooling will be required in overheating scenarios. Where this will be a mechanical system, the noise generated by the system must also be assessed.

4.3. Air Source Heat Pump Compliance

An assessment of the proposed air source heat pumps (ASHP) has been undertaken to ensure compliance with the requirements of Wiltshire Council. Wiltshire Council require that the ASHP's do not exceed 35dB at the façade of the nearest noise sensitive window.

Table 11 below demonstrates the calculation of plant noise levels at the respective windows. This assessment has been undertaken to account for the worst-case scenario based on the site layout and plant location.

Table 11: Air Source Heat Pump Compliance Assessment

Step	Description	Ground Floor Living Room	First Floor Bedroom
1	A-Weighted sound power level of ASHP	52	
2	Reflective Surfaces	+3dB	+3dB
3	Distance to nearest noise sensitive window (m)	3	4
4	Barrier type – If applicable	NA	NA
5	Sound pressure level at receptor	32.5	29.5
6	Pass/Fail noise limit of 35dB	Pass	Pass

Table 11 above has identified that the resultant noise level from the proposed air source heat pump will fall below the 35dB at the respective window façade's in accordance with Wiltshire Councils requirements.

4.4. External Amenity

It is proposed that fences will be constructed to a height of 1.8m around the private gardens of each property as standard. With these in place, the predicted noise levels in the gardens of the new properties will be in the range of $L_{Aeq,16h}$ 39-60 dB, with plots 47, 48 and 49 exceeding the upper guideline level of 55dB as given in BS8233 [3]. This has been shown in Figure 9 of Appendix III. It is recommended to increase the fence height to 2.2m at the road facing boundary at plots 47 and 48 to ensure the criterion can be achieved. This has been shown in Figure 10 of Appendix III.

In order to achieve the necessary noise screening from the fences, they should be free from gaps and holes and constructed of any suitable material with a surface density of $>10 \text{ kg/m}^2$. For example, 18mm plywood would be suitable.

4.5. Proposed Plant

Table 12 illustrates the calculation of plant rating level limits for the daytime and night-time periods based on BS4142 [10]. These limits apply to all plant units operating simultaneously.

Table 12: Plant noise limits

Period	Representative background level $L_{A90,T}$ (dB)	Plant rating level $L_{A,r,T,r}$ (dB)
Day (07:00-23:00)	49	49
Night (23:00-07:00)	32	32

No information is known at this stage in the project of the details of the plant to be installed. It is therefore appropriate only to set noise limit levels that the plant should meet. These levels apply at the worst-affected window of a noise-sensitive property with all plant units operating simultaneously.

It should be noted that the emission limit is a rating level which can include for a range of penalties or 'acoustic' features', as detailed in BS4142 and Section 2.5. As such, the actual measured or calculated sound pressure level outside the nearest window of a noise sensitive property could be up to 18dB lower than the rating level values presented here.

It is considered that the likelihood of adverse comment arising as a result of noise from the plant is low and that the NOAEL will be achieved, which would be barely noticeable and not intrusive, resulting in the following:

Noise can be heard but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.

4.6. BS4142 Assessment – Equestrian Noise

The following numerical assessments have been provided in accordance with BS4142 [10] to provide a comparison between rating sound levels of the combined activities associated with the Equestrian Centre against the typical sound levels existing prior to development. These calculations were undertaken using the CadnaA noise model described previously.

Figure 11 of Appendix III demonstrates the resultant noise levels at the proposed NSR's due to the existing operations of the equestrian site. The assessment has determined a specific sound level of 41dB. This figure has been used for the BS4142 assessments below. Due to the nature of the existing equestrian centre, it has been confirmed that no activity will occur during the nighttime period, and as such, this has been omitted from the assessment.

Table 13 below identifies applicable acoustic penalties based on the proposed operations of the development.

Table 13: Identification of applicable acoustic penalties

Penalty	Applicable?	Attributable Penalty	Comment
Tonality	No	--	No tonal penalties applied with other characteristics included.
Impulsivity	No	--	No impulsivity penalties applied with other characteristics included.
Intermittency	No	--	No penalties for intermittency applied with other characteristics included.
Other Sound Characteristic	Yes	+5	Due to the unknown and changing nature of the existing equestrian centre, a +5dB penalty has been applied. Noise at this location is no prominent and as such, an adverse impact is not predicted.

Table 14 demonstrates the assessment in accordance with BS4142.

Table 14: BS4142 Assessment of Proposed Development

Results	Day 07:00-23:00	Commentary
Background sound level, $L_{A90,T}$ dB	49	Representative background sound levels at the NSR
Reference time interval	1 hour	
Specific sound level, $L_{A90,T}$ dB	41	Highest off-site values established from calculations undertaken within CadnaA model
Acoustic feature correction, dB	+5	A 5 dB feature correction has been applied to account for the unknown and varying nature of the noise sources.
Rating level, $L_{A90,T}$ dB	46	Specific sound level plus acoustic feature correction
Excess of rating over background sound level	-3	Achieves BS4142 requirements
Assessment indicates likelihood of *depending on context	Where the rating level does not exceed the representative background sound level this is an indication of low impact.	
Uncertainty of the assessment	Uncertainty was minimized by measuring over an extended period and at a location directly representative of the nearest proposed NSRs	

4.7. Statement of Uncertainty

Uncertainty has been considered as a limit to the accuracy of any noise assessment, including associated steps of measurement, calculation, or prediction. Factors have been considered to include (but not limited to) the following:

- The inherent accuracy limitation of methodology in Standards and guidance.
- Variability in meteorological conditions.
- The accuracy of sound source input data of a calculation.

It has been a requirement of the assessment standard BS4142 [10] to minimise uncertainty to a level commensurate with the intention of the assessment objective. Measures taken in this assessment to minimise uncertainty have included:

- Baseline sound levels have been measured over a reasonably long period and therefore provide a good indication of representative background and residual sound levels;
- Baseline sound level measurements undertaken in accordance with recognised Standards, using a tall environmental windshield and during acceptable weather conditions e.g., low wind speeds and precipitation;
- Noise associated with the equestrian centre (N2) was captured over a full 24-hour period to determine a typical level of activity;

-
- Field calibration checks were undertaken before and after measurements to record very low levels of equipment drift; and
 - The calculations have been conservative as not to under-predict the resulting impacts.

These measures have been considered to reduce uncertainty to a level considered not to have any significance to the outcome of this assessment.

4.8. Context

The numerical assessments in the above tables have highlighted a low impact at the nearest noise sensitive locations beyond any reasonable uncertainty in the assessment. Rating sound levels have been predicted below the representative background sound level during all times of operation.

It has been acknowledged that this assessment needs to be considered in context, following the requirements of BS4142 [10]. The concept of “context” has been notably emphasised in Section 11 of BS4142 when considering numerical impacts established from applying the standard.

The assessed sound sources have been viewed to support a “low impact” in accordance with BS4142 and in the environment in which they have been proposed, where possible effects of the proposal have been considered and supported in context.

5. CONCLUSION

Dice Environmental has been commissioned by Redcliffe Homes to provide a Noise Impact Assessment to support a planning application for a residential development at Melksham Road, Holt, BA14 6QW.

Environmental noise surveys have been completed to quantify the prevailing noise environment, dominated by road traffic noise from the B3107/Melksham.

This noise survey has been used to develop a 3D computer model of noise propagation across the site including all significant noise sources and with full topography, and to inform a scheme of mitigation measures required to ensure a commensurate level of protection against noise for future occupants.

Accordingly, appropriate consideration has been given towards the mitigation measures required to ensure that the internal ambient noise level requirements set out in BS8233 can be met for the development. A range of double-glazing configurations from $R_w + C_{tr}$ 25 dB to $R_w + C_{tr}$ 39 dB would be required to control noise break-in from external sources and achieve the requirements of BS8233 and ADO.

As standard, the proposal includes for 1.8m garden fences to all gardens at the site. In order to meet the criterion contained within BS8233, it is proposed to install 2.2m garden fences at plots 47 and 48.

Noise limits have been set to apply to all externally located plant units proposed for the site. These are determined in accordance with BS4142.

The proposal includes the installation of an Air Source Heat Pump (ASHP) at each of the residential units. Accordingly, an assessment of the proposed plant items has been undertaken to confirm compliance with Wiltshire Councils requirements. The compliance assessment has determined that the proposed ASHP will meet the criterion.

A number of plots are predicted to exceed the noise levels set out in Approved Document O *Overheating* for bedrooms at night. Open windows should not be relied upon as the standard means of cooling for overheating scenarios in these locations.

The proposal includes the installation of an Air Source Heat Pump (ASHP) at each of the residential units. Accordingly, an assessment of the proposed plant items has been undertaken to confirm compliance with Wiltshire Councils requirements.

An assessment has been carried out in line with BS4142 in relation to the neighbouring equestrian site. It has been established that noise levels are unlikely to be cause for complaint and that no further noise mitigation measures will be required.

Initial consideration was given to the Wessex Water facility located southeast of the proposed site. On-site surveys confirmed that no noise was detectable from this facility; therefore, no further assessment has been undertaken

The assessment is based upon robust and worst-case assumptions and demonstrates that, in principle and subject to the incorporation of the identified mitigation measures, there should be no adverse impact at the proposed dwellings as a result of existing noise. The site is suitable for the promotion of residential development.

Appendix I – Limitations

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between Dice Environmental and the Client as indicated in Section 1.2.
2. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.
3. Dice Environmental cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by Dice Environmental is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by Dice Environmental in this connection without their explicit written agreement there to by Dice Environmental.
4. Where a noise survey is required to inform the assessment, Dice Environmental will endeavour to ensure that all noise measurements taken are robust, representative and reliable in order to inform an accurate noise impact assessment. Where limitations or constraints exist which prevent a suitable noise survey being completed, Dice Environmental will take all reasonable steps to make the client fully aware of any such limitations or constraints with a view to achieving the best possible outcome for the client. Where additional sound surveys are required, over and above those specified in our scope of works, then Dice Environmental reserves the right to charge additional fees.
5. Where mitigation measures are specified in our report, it should be noted that these measures are relative to a specific sound source, both in terms of the measured sound pressure level and the character of the source. Where either the sound pressure level or the character of the sound varies following completion of the sound survey, Dice Environmental cannot be held responsible for any subsequent variations in the proposed mitigation performance.

Appendix II – Glossary of Acoustic Terminology

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

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

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

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

An indication of the range of sound levels commonly found in the environment is given in the following table.

Table A1: Typical Sound Pressure Levels

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

Table A2: Terminology

Descriptor	Explanation
Ambient Noise	Encompassing sound, at a given place, being usually a composite of sounds from many sources near and far.
C_{tr}	Sound insulation performance spectrum adaptation term that accounts for the A-weighted urban traffic noise spectrum.
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 (20 μ Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with the 'A' frequency weighting to compensate for the varying sensitivity of the human ear to sound at different frequencies.
$D_{n,e,w}$	Weighted element normalized level difference. A single-number quantity that describes the sound insulation of ventilators.
$L_{Aeq, T}$	A-weighted, equivalent continuous sound pressure level. L_{Aeq} is defined as the notional steady sound level which, over a stated period of time (T), would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period.
L_{Amax}	L_{Amax} is the maximum A-weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' time-weighting response.
$L_{Ar,Tr}$	Sound rating level. The A-weighted L_{eq} sound level of an industrial noise during a specified time period, adjusted for tonal character and impulsivity.
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. Hence L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the 'average minimum level' and is often used to describe the background noise. It is common practice to use the L_{10} index to describe traffic noise.
Free-Field Level	A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other reflective surfaces. Generally, this is measured outside and away from buildings.
Fast	A time-weighting used in the root mean square section of a sound level meter with a 125-millisecond time constant.
Pink Noise Spectrum	Noise whose power spectral density is inversely proportional to frequency.
Residual Noise	The ambient sound remaining when the specific sound is suppressed.
R_w	Weighted Sound Reduction Index. A single number quantity which characterises the airborne sound insulation of a material or building element over a range of frequencies, based on laboratory measurements.
Slow	A time-weighting used in the root mean square section of a sound level meter with a 1000-millisecond time constant.
Specific Noise	Noise from the sound source under investigation as defined in BS4142, method for rating industrial noise affecting mixed residential and industrial areas.

[illegible]

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Figure 3: Glazing and Ventilation Strategy – Living Spaces, Ground Floor

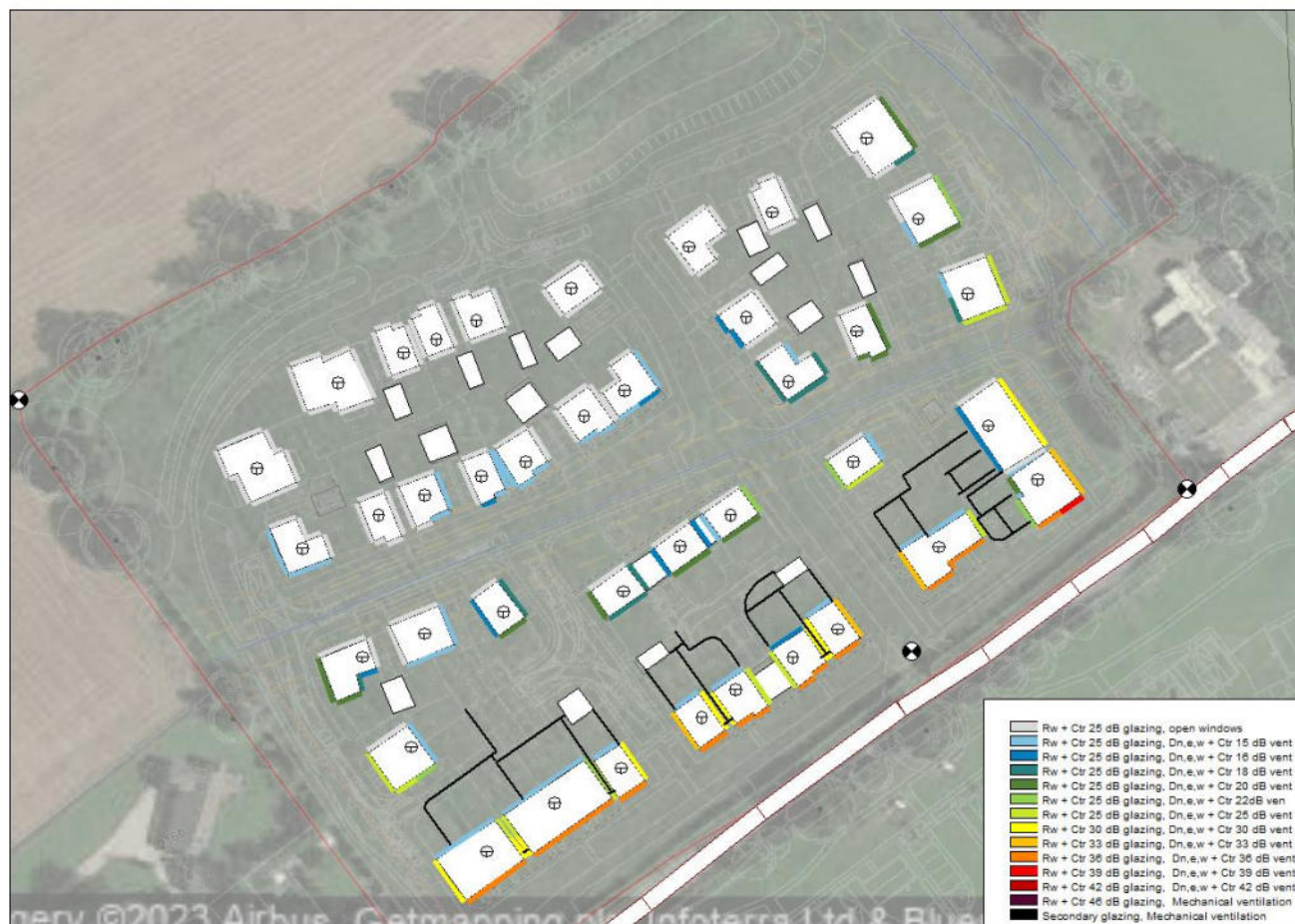


Figure 4: Glazing and Ventilation Strategy – Living Spaces, First Floor

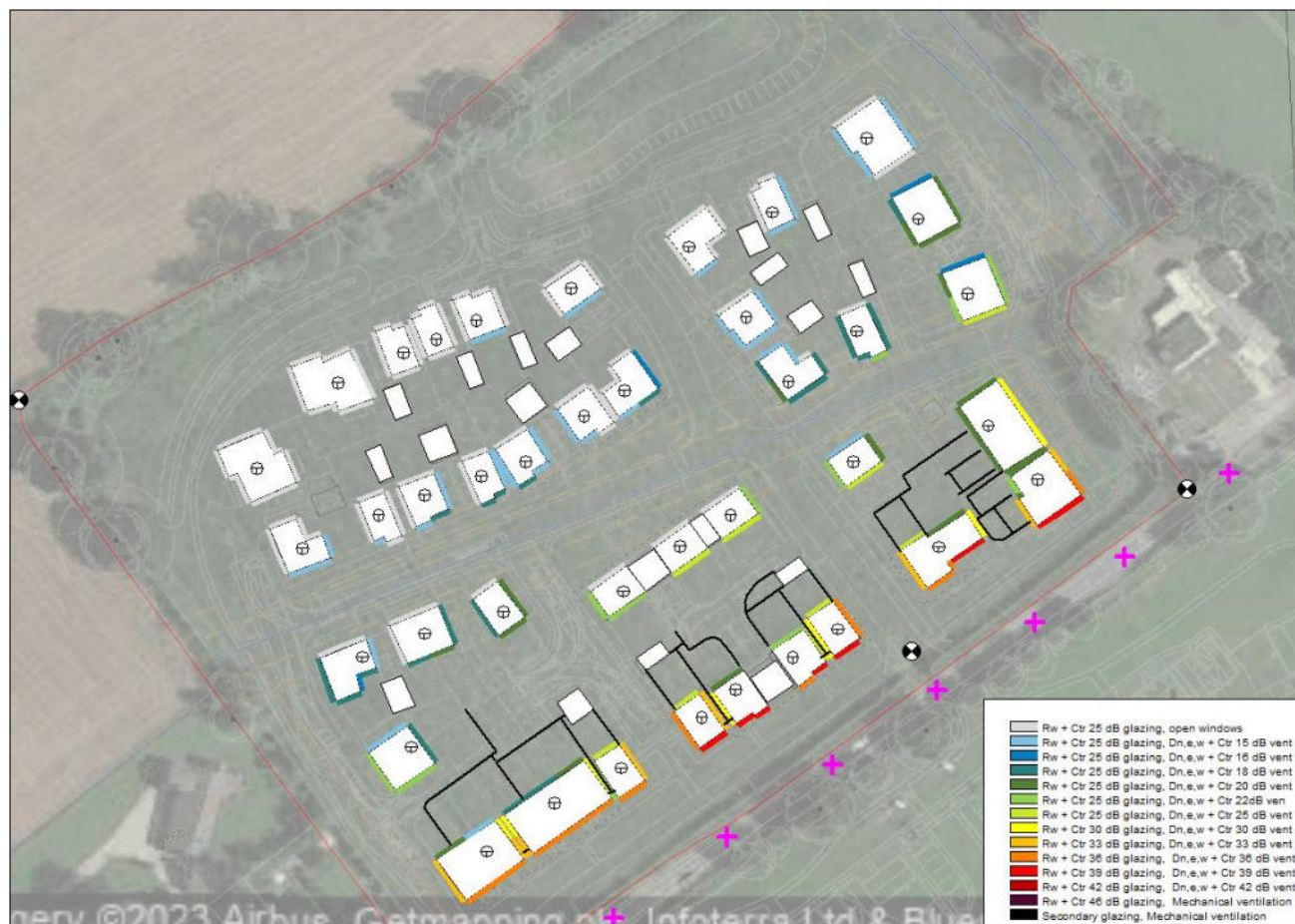


Figure 5: Glazing and Ventilation Strategy – Bedrooms, Ground Floor



Figure 6: Glazing and Ventilation Strategy – Bedrooms, First Floor



Figure 7: Cooling strategy for overheating scenarios – Ground Floor (bedrooms only)



Figure 8: Cooling strategy for overheating scenarios – First Floor (bedrooms only)

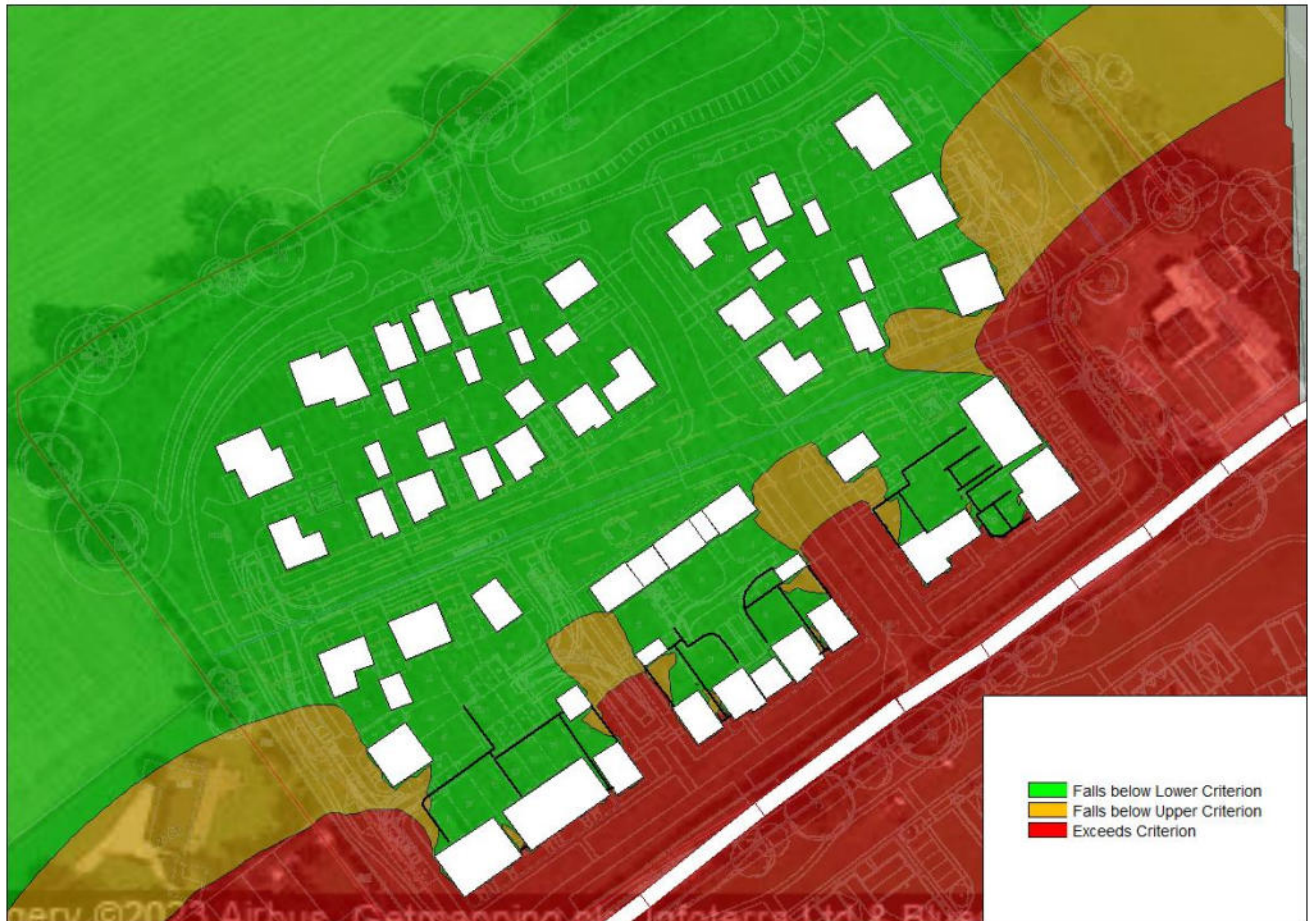


Figure 9: External amenity area noise levels



Figure 10: External amenity with 2.2m fence mitigation at plots 47 and 48

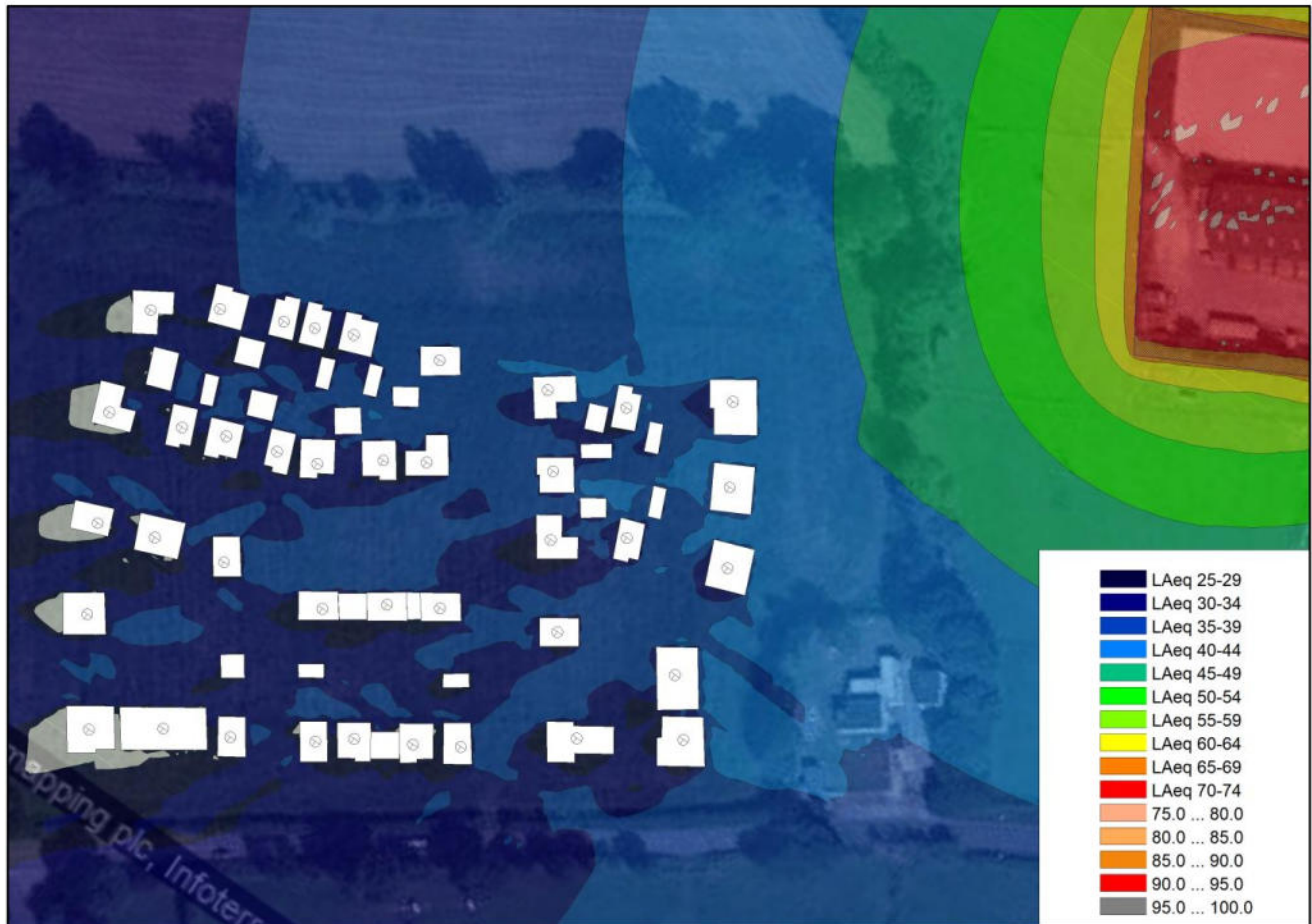
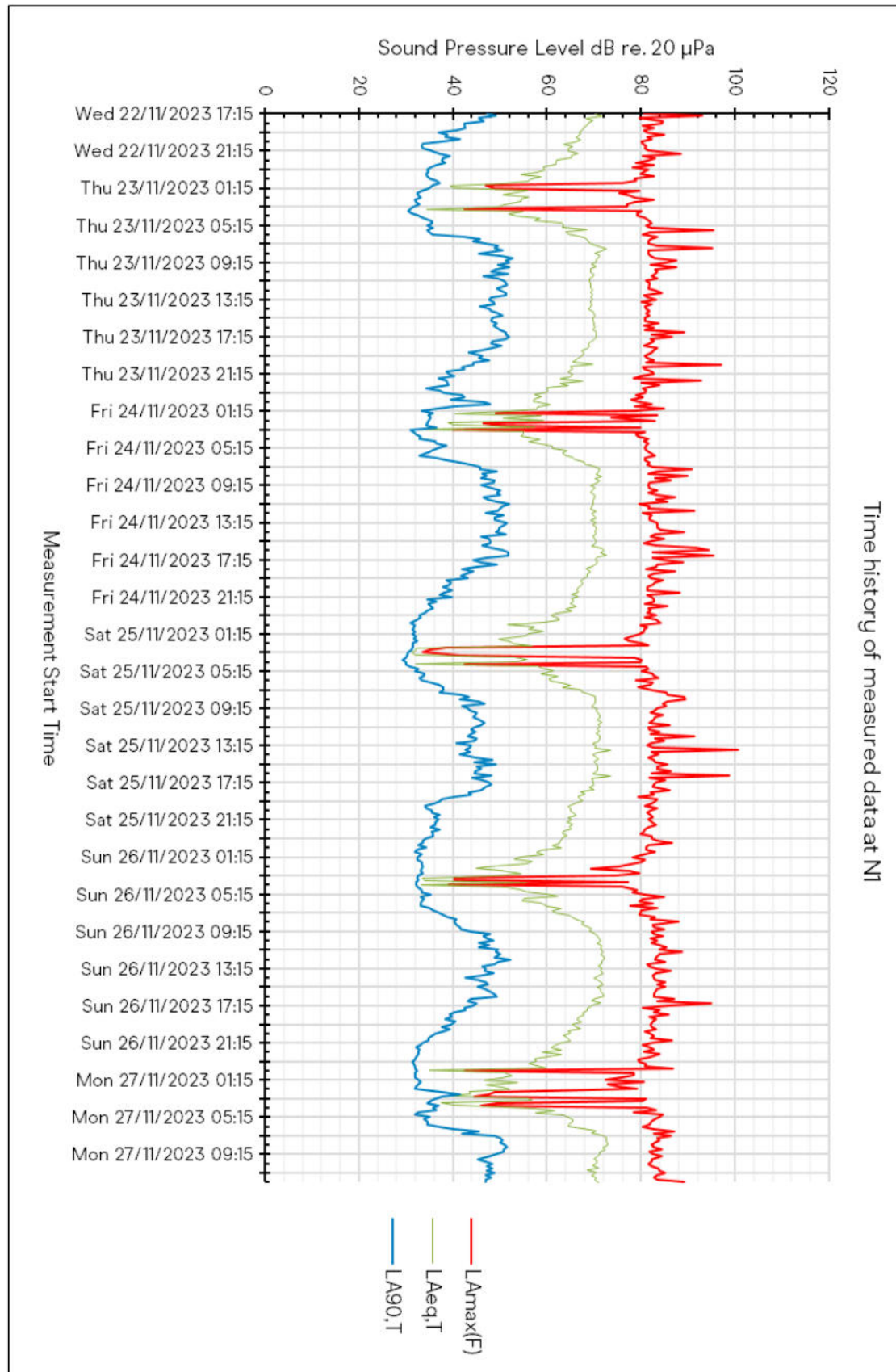
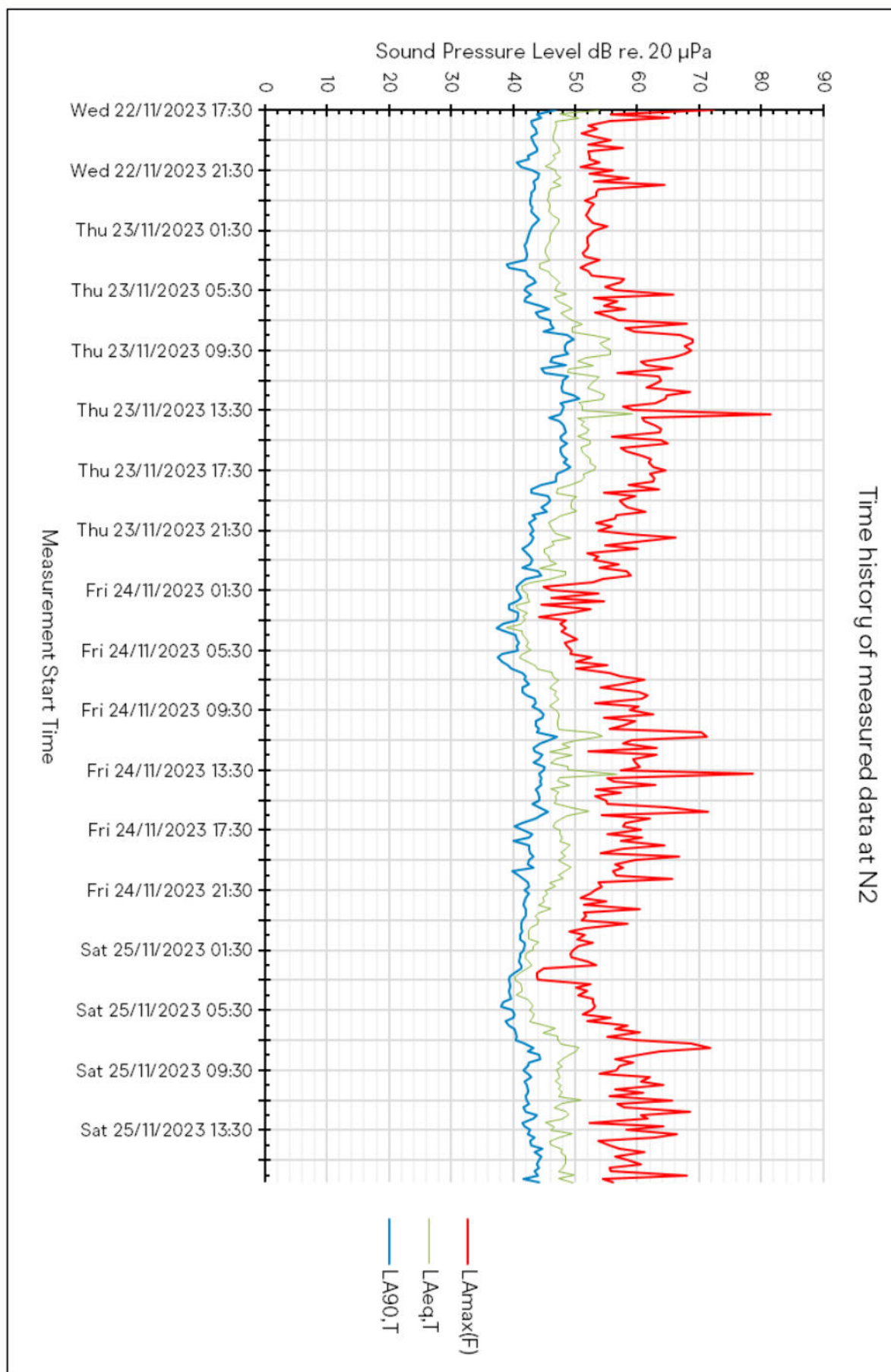


Figure 11: Noise levels due to equestrian centre

Appendix IV – Survey results





Appendix V – Bibliography

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