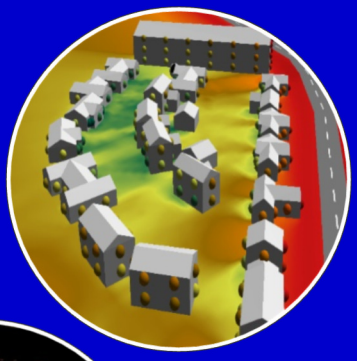

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INDEPENDENT ENVIRONMENTAL CONSULTANCY

Noise Impact Assessment

Project: Proposed Residential Development

Site: 18 High Street
Lakenheath
Suffolk
IP27 9JS

Report Ref: IEC/4548/01/AVH

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Noise Impact Assessment

Proposed Residential Development at
18 High Street, Lakenheath, Suffolk, IP27 9JS

Prepared For:	B J Rutherford & Partners
Report No.:	IEC/4548/01/AVH
Report Prepared By:	A V Hook BSc(Hons) MSc MIOA MIEnvSc MIAQM
Issue Date:	12 September 2023

Document Review Sheet

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Recommendations given in this report are solely for acoustic purposes. The project manager or architect must ensure that any measures adopted for acoustic purposes comply with other requirements and regulations, including (but not limited to) structural requirements, Standards, building controls, safety and control of fire.

This report has been prepared with all reasonable skill, care and diligence.

Issue Ref.	Date	Description	Author	Checked	Authorised
1	12/09/2023	First issue	AVH	AVH	

Professional Membership

Independent Environmental Consultancy are full members of the Association of Noise Consultants and a Registered Pre-Completion Test Body.

Contents

Appendices

1.0 Introduction

1.1 B J Rutherford & Partners are seeking full planning permission for a residential dwelling on land at 18 High Street, Lakenheath.

1.2 As part of the application submission, West Suffolk Council has requested the following relating to a Noise Impact Assessment:

> *"MOD Noise Impact Assessment - This is required for all new development which may involve a noise generating activity to surrounding areas, particularly where proposed close to existing sites that may be particularly harmed by such development (such as air bases, industrial estates, trunk roads) and for any development for sensitive use (such as new dwellings) situated close to an existing noise generating activity. The noise assessment should include an Acoustic Design Statement prepared in accordance with the ProPG publication: Planning and Noise (2017)."*

1.3 At the request of B J Rutherford & Partners, Independent Environmental Consultancy Limited have been commissioned to undertake an assessment of aircraft noise and provide technical advice, as required, for noise mitigation measures for the proposed residential development.

1.4 This report therefore provides detailed information on the existing noise climate and as appropriate, provides recommendations for amelioration measures to reduce the effects of noise on the proposed dwellings to an acceptable level.

1.5 This study benefits from a noise survey carried out between Thursday 27th July 2023 and Thursday 3rd August 2023.

Aims and Objectives of Assessment

1.6 The aim of this assessment is to provide information to determine the likely impact of noise from existing transportation and industrial sources on the proposed noise-sensitive receptors. The assessment includes consideration of the following issues:

- Provides information on the existing daytime and night-time noise levels; and
- Provides recommendations for any relevant noise mitigation measures necessary to meet appropriate noise guidance and standards.

Sources of Information

1.7 The following drawings and documents have been supplied by the applicant for use in the assessment.

Issued By	Drawing/Document Title	Reference	Revision	Issue Date
2 The Drawing Board	Block Plan / Location Plan	024L	-	28/05/2023
2 The Drawing Board	New Build Bungalow	024B	-	28/05/2023

1.8 Information used in this assessment has been obtained from the following sources:

- National Planning Policy Framework NPPF (2021) Ministry of Housing, Communities & Local Government (Department for Levelling Up, Housing and Communities).
- Planning Practice Guidance PPG (2021) Ministry of Housing, Communities & Local Government (Department for Levelling Up, Housing and Communities).
- Noise Policy Statement for England: NPSE (2010) Department for Environment, Food & Rural Affairs.
- ProPG: Planning and Noise (2017) Professional Practice Guidance on Planning & Noise.
- World Health Organisation (1999) - Guidelines for Community Noise.
- British Standard 8233 (2014) Guidance on sound insulation and noise reduction in buildings.
- British Standard 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound.
- British Standard 7445 (2003) Description and measurement of environmental noise.
- ISO 9613-2 (1996) Acoustics – Attenuation of sound during propagation outdoors: General method of calculation.
- Acoustics Ventilation and Overheating: Residential Design Guide (2020) Association of Noise Consultants & Institute of Acoustics.
- Approved Document E of the Building Regulations (2003) Resistance to the passage of sound. HM Stationary Office.
- Approved Document F of the Building Regulations (2021) Volume 1: Dwellings - Means of Ventilation. HM Stationary Office
- Approved Document O of the Building Regulations (2021) Overheating. HM Stationary Office.
  Guide to Demonstrating Compliance with the Noise Requirements of Approved Document O (2022) Association of Noise Consultants. Version 1.

2.0 Site Description

2.1 Introduction

2.1.1 The proposed dwelling at 18 High Street is located north-west of RAF Lakenheath and lies within the 66 dB $L_{Aeq,16hour}$ contour based on the OEM/06/20 report[1].

Figure 2.1: Location of Proposed Development

Approximate Position of Proposed Dwelling *Source: Google Earth*

2.2 General Environs

2.2.1 The main sources affecting the existing noise climate relates to the following:

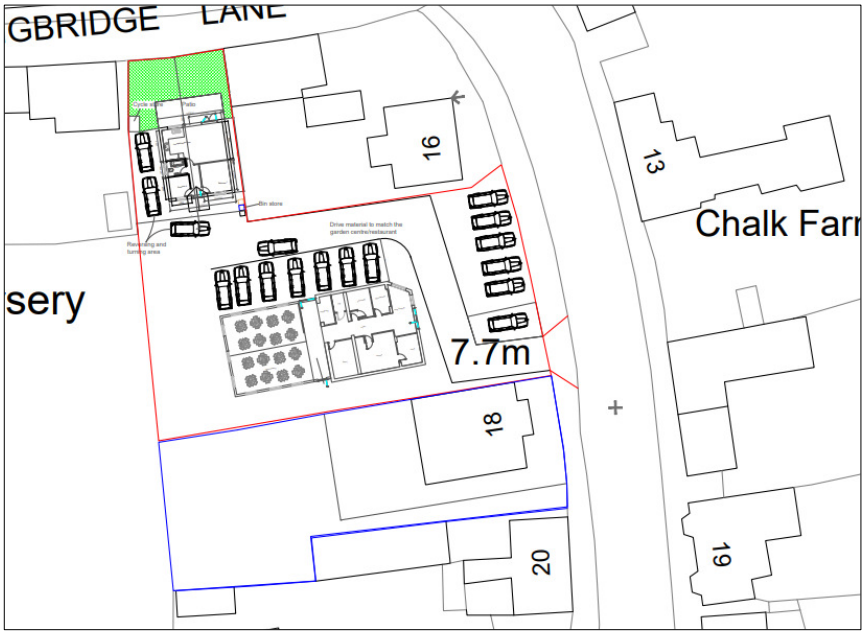
(i) Traffic Military aircraft flyovers; and
(ii) Traffic using the local road network.

[1] *A report on a Military Aviation Noise Contour of station-based Aircraft Activity at RAF Lakenheath (2020) Noise and Vibration Report: OEM/06/20.*

2.3 Development Proposals

2.3.1 The proposed layout of the residential development is shown in Figure 2.2.

Figure 2.2: Site Layout Plan



3.0 Noise Criteria

3.1 Legislation, Policy and Guidance

3.1.1 The following section outlines the key planning policy and guidance that relates to the assessment of residential amenity and protection of residents from environmental noise sources.

3.2 National Planning Policy Framework (NPPF): 2021

3.2.1 The National Planning Policy Framework (NPPF)[2] was updated in July 2021 and sets out the government's planning policies for England and how these are expected to be applied.

3.2.2 In terms of considering noise impact, Chapter 15 of NPPF 'Conserving and enhancing the natural environment' states:

> *"174. Planning policies and decisions should contribute to and enhance the natural and local environment by:*
>
> *e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans."*

3.2.3 The following section within the NPPF also specifically refers to noise.

> ***"Ground conditions and pollution***
>
> *185. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*
>
> *a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
>
> *b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and*
>
> *c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.*

3.2.4 The NPPF considers the impact of new development on existing businesses and community facilities stating:

[2] *National Planning Policy Framework NPPF, July (2021) Ministry of Housing, Communities & Local Government. (Department for Levelling Up, Housing and Communities).*

> *"187. 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."*

3.3 The Noise Policy Statement for England (NPSE): 2010

3.3.1 The Noise Policy Statement for England (NPSE) was published in March 2010[3]. It specifies the following long-term vision in policy aims: "*Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*

- *Avoid significant adverse impacts on health and quality of life;*
- *Mitigate and minimise adverse impacts on health and quality of life; and*
- *Where possible, contribute to the improvement of health and quality of life."*

3.3.2 The NPSE introduced three concepts to the assessment of noise, which includes:
NOEL – No Observed Effect Level
This is the level below which no effect can be detected and below which there is no detectable effect on health and quality of life due to noise.
LOAEL – Lowest Observed Adverse Effect Level
This is the level above which adverse effects on health and quality of life can be detected.
SOAEL – Significant Observed Adverse Effect Level
This is the level above which significant adverse effects on health and quality of life occur.

3.3.3 The above categories are however undefined in terms of noise levels and for the SOAEL the NPSE indicates that the noise level will vary depending upon the noise source, the receptor and the time of day/day of the week, etc. The need for more research is therefore required to establish what may represent an SOAEL. It is acknowledged in the NPSE that not stating specific SOAEL levels provides policy flexibility until there is further evidence and guidance.

3.3.4 The following commentary is given on the representation of NOEL, LOAEL and SOAEL in relation to existing British Standards/ International guidelines:
NOEL – Inaudibility
LOAEL – The guideline values for community noise in specific environments as set out in Table 1 of the WHO Guidelines for Community Noise 1999 and Table 4 of British Standard 8233: 2014 Guidance on sound insulation and noise reduction in buildings.

3.3.5 The NPSE concludes how the LOAEL and SOAEL relate to the three aims listed in paragraph 3.3.1 above. The initial aim relates to avoiding significant adverse effects on health and quality of life, it then addresses the situation where the noise impact falls between the LOAEL and the SOAEL when:

[3] *Noise Policy Statement for England: NPSE (2010) Department for Environment, Food & Rural Affairs.*

"all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development."

3.3.6 The final aim envisages pro-active management of noise to improve health and quality of life, again taking into account the guiding principles of sustainable development.

3.3.7 The Government is undertaking a review of technical guidance but currently there is no agreed methodology for noise to accompany the NPPF guidance.

3.3.8 The Government has recently removed the existing Planning Policy Guidance on noise, which was known as PPG24: 1994. The National Planning Policy Framework, which has recently been published states "*109. The planning system should contribute to and enhance the natural and local* environment by:

- *Preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability;"*

3.4 Planning Practice Guidance (PPG): 2021

3.4.1 The Ministry of Housing, Communities & Local Government (formerly the Department for Communities and Local Government) published the final version of the Planning Practice Guidance (PPG) on 06 March 2014. The PPG provides further information with regard new developments which may be sensitive to the prevailing acoustic environment. The main section of PPG was also updated in July 2019 and consultation and pre-decision matters updated in June 2021[4].

3.4.2 The PPG includes a table summarising the noise exposure hierarchy, based on the likely average response. Under the heading of 'perception' the 'noticeable and not intrusive' assessment of noise is defined as '*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 there is a perceived change in the quality of life'*. The increasing effect level under these conditions is deemed to be '*no observed adverse effect*' and no specific measures are required.

3.4.3 Full details of the Planning Practice Guidance on effects are provided in Table 3.1.

[4] *Planning Practice Guidance PPG (2021) Ministry of Housing, Communities & Local Government (Department for Levelling Up, Housing and Communities).*

Table 3.1: Noise Exposure Hierarchy

Perception	Example of Outcomes	Increasing Effect Level	Action
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	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.	No Observed Adverse Effect	No specific measures required
	Lowest Observed Adverse Effect Level		
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, 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 perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
	Significant Observed Adverse Effect Level		
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, 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 Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Present

3.4.4 The subjective nature of noise means there is not a simple relationship between noise levels and its effects. Factors to be considered in determining if noise is a concern are identified including the absolute noise level of the source, the existing ambient noise climate, time of day, frequency of occurrence, duration, character of the noise and cumulative impacts.

3.5 Professional Practice Guidance on Planning & Noise (ProPG): 2017

3.5.1 The Professional Practice Guidance on Planning and Noise (ProPG) guidance document was released in May 2017[5] to provide a recommended approach to the management of noise within the planning system in England. The guidance document uses relevant noise legislation, guidance and standards appropriate for assessing residential development sites.

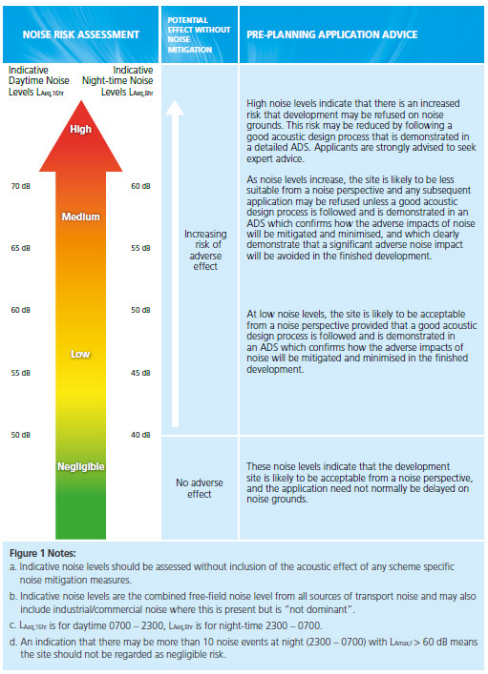
3.5.2 The scope of the guidance is restricted to the consideration of new residential development that will be exposed predominantly to airborne noise from transport sources. In particular, it aims to:

- *advocate full consideration of the acoustic environment from the earliest possible stage of the development control process;*
- *encourage the process of good acoustic design in and around new residential developments;*
- *outline what should be taken into account in deciding planning applications for new noise-sensitive developments;*
- *improve understanding of how to determine the extent of potential noise impact and effect; and*
- *assist the delivery of sustainable development.*

3.5.3 In order to fulfil the aims of the ProPG, the guidance sets out "*two sequential stages of the overall approach are:*

- *Stage 1 - an initial noise risk assessment of the proposed development site* (see Figure 3.1)*; and*
- *Stage 2 – a systematic consideration of four key elements."*

Figure 3.1: ProPG Initial Site Noise Risk Assessment



[5] *ProPG: Planning & Noise (2017) Professional Practice Guidance on Planning & Noise. Working Group from CIEH/IOA/ANC.*

3.5.4 Stage 2 of the ProPG recommended approach includes four key elements:

- *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".*

"The approach is underpinned by the preparation and delivery of an Acoustic Design Statement (ADS). An ADS for a site assessed as high risk should be more detailed than for a site assessed as low risk. An ADS should not be necessary for a site assessed as negligible risk."

3.5.5 In cases where the site is exposed to noise of an industrial and/or commercial nature, the document provides guidance which should be considered at Stage 1 of the ProPG approach.

"In the special case where industrial and/or commercial noise is present on the site but is "not dominant" (i.e. where the impact would be rated as lower than adverse (subject to context) if a BS4142: 2014 assessment was to be carried out), its contribution may be included in the noise level used to establish the degree of risk in Stage 1 and may also be included in the consideration of Stage 2 Element 2 Internal Noise Guidelines (and if included, this should be clearly stated.

Where industrial or commercial noise is present on the site and is considered to be "dominant" (i.e. where the impact would be rated as adverse or greater (subject to context) if a BS4142:2014 assessment was to be carried out), then the risk assessment should not be applied to the industrial or commercial noise component and regard should be had to the guidance in BS4142:2014. The judgement on whether or not to undertake a BS4142 assessment to determine the dominance should be proportionate to the level of risk. In low risk cases a subjective judgement of dominance, based on audibility, would normally be sufficient."

3.5.6 The Good Acoustic Design Process with ProPG states the use of fixed unopenable windows should be avoided, as occupants generally prefer to have control over the internal environment, even if resultant acoustic conditions are considered unsatisfactory.

3.5.7 ProPG's Internal Noise Level Guidelines provides additional advice that internal noise level guidelines are generally not applicable under "purge ventilation" conditions as defined by Approved Document F of The Building Regulations, as this is an occasional event (e.g. to remove odour from painting and decorating or from burnt food).

3.5.8 In terms of Internal Noise Level Guidelines, ProPG refers to BS8233: 2014 for recommended noise levels inside sensitive rooms. The following supplementary commentary to BS8233: 2014 is provided:

"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."

"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."

3.6 British Standard 4142: 2014 + A1: 2019 'Methods for rating and assessing industrial and commercial sound

3.6.1 British Standard BS4142[6] was revised in 2014 and updated in 2019. The scope of the Standard has been extended to methods for rating and assessing sound of an industrial and/or commercial nature, which includes:

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

3.6.2 The method is based on the difference between the background noise level without the industrial/commercial source and the noise level of the industrial source (specific sound) at the receiver location. The noise is rated for having tonality, impulsivity, intermittency or other distinguishable characteristics that may attract attention. In cases where the noise contains multiple characteristics, the penalties are cumulative.

3.6.3 In the majority of cases, the greater the difference between the rated noise level (specific noise and corrections for character) and background noise level, the greater the magnitude of impact (see Table 3.2).

Table 3.2: Assessment of the Impacts

Difference	Assessment
Around +10 dB or more	Likely to be an indication of a significant adverse impact, depending on the context
Around +5 dB	Likely to be an indication of an adverse impact, depending on the context

3.6.4 In Section 8 of the 1997 version of the Standard "Assessing the noise for complaint purposes" it is stated that an excess above the existing background noise level L_{A90} of up to 5 dB(A) due to noise from fixed plant at a new development is of 'marginal

[6] *British Standard BS4142 (2014)+A1 (2019) 'Methods for rating and assessing industrial and commercial sound'' British Standards Institution.*

significance'. This has been interpreted, since the introduction of the Standard in 1967, that a 5 dB(A) excess due to new, fixed plant noise source is, in general, acceptable.

3.6.5 In terms of establishing the rating level, corrections for the noise character has to be taken into consideration. These include the following factors:

Tonality
For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible.

Impulsivity
A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible and 9 dB where it is highly perceptible.

Other sound characteristics
Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

NOTE 2 Where tonal and impulsive characteristics are present in the specific sound within the same reference period then these two corrections can both be taken into account. If one feature is dominant then it might be appropriate to apply a single correction. Where both features are likely to affect perception and response, the corrections ought normally to be added in a linear fashion.

Intermittency
When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. This can necessitate measuring the specific sound over a number of shorter sampling periods that are in combination less than the reference time interval in total, and then calculating the specific sound level for the reference time interval allowing for time when the specific sound is not present. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

3.6.6 BS4142:2014 acknowledges that where background and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background (particularly at night).

3.6.7 The 2014 version of BS4142 (updated in 2019) should not be used in the assessment of conversational, skate park and entertainment-related noise. Section 1.3 of the standard specifically states that "*the standard is not intended to be applied to the rating and assessment of sound from:*

a) recreational activities, including all forms of motorsport;
b) music and other entertainment;
c) shooting grounds;
d) construction and demolition;
e) domestic animals;
f) people;

g) public address systems for speech; and
h) other sources falling within the scopes of other standards or guidance.

3.7 World Health Organisation Guidelines: 1999 – Guidelines for Community Noise (WHO)

3.7.1 The World Health Organisation's (WHO) 'Guidelines for Community Noise'[7] report for external environmental noise levels states that;

> *"4.2.7 Annoyance responses*
>
> *During the daytime, few people are seriously annoyed by activities with L_{Aeq} levels below 55 dB; or moderately annoyed with L_{Aeq} levels below 50 dB. Sound pressure levels during the evening and night should be 5-10 dB lower than during the day…"*

3.7.2 For night-time noise sources the WHO guidelines recommend a night-time (23.00-07.00) 8-hour noise level of 30 dB L_{Aeq} inside bedrooms (for a reasonably steady noise source) to avoid sleep disturbance.

3.7.3 For internal noise levels during the daytime and evening period it is suggested that a noise level of 35 dB $L_{Aeq,16h}$ (07.00-23.00 hours) is achieved to avoid speech intelligibility and moderate annoyance.

3.7.4 A summary of the guideline internal noise levels, taken from Table 1 of the WHO guidelines, is given in Table 3.3.

Table 3.3: Relevant Information from WHO Guidelines

Specific Environment	Critical Health Effect(s)	L_{Aeq} [dB]	Time Base [hours]	$L_{Amax,\ fast}$ [dB]
Dwelling, indoors	Speech intelligibility & moderate annoyance daytime & evening	35	16	-
Inside bedrooms	Sleep disturbance, night-time	30	8	45
Outdoor living area	To avoid serious annoyance, daytime and evening	55	16	-
Outdoor living area	To avoid minimal moderate annoyance, daytime and evening	50	16	-

3.7.5 An extract from Section 3.4 of 'Guidelines for Community Noise' states that;

> *"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10-15 times per night (Vallet & Vernet 1991), and most studies show an increase in the percentage of awakenings at SEL values of 55-60 dBA (Passchier-Vermeer 1993; Finegold et al. 1994; Pearsons et al. 1995."*

3.7.6 The extract confirms that some researchers believe that people can be exposed to 10 -15 events above 45 dB L_{Amax} and still achieve a good nights sleep, and that as the

[7] *Guidelines for Community Noise, World Health Organisation (1999).*

noise level from an event increases above 45 dB(A) then the risk of sleep disturbance increases. As the WHO tend (not unreasonably) to take a cautious approach, the 45 dB(A) in their Table 4.1 is actually a level below which there is a not a material effect on the quality of sleep.

3.7.7 The World Health Organisation (WHO) Europe has published the WHO Environmental Noise Guidelines for the European Region (2018)[8]. This provides Guidance on outdoor environmental noise levels and the potential effects on human health, supplementing WHO Guidelines (1999).

3.7.8 The Guidelines are based on long-term yearly average day-evening-night (L_{den}) and night (L_{night}) parameters which are primarily intended to aid policy makers.

3.8 British Standard 8233: 2014 (BS8233: 2014)

3.8.1 British Standard 8233:2014 'Guidance on sound insulation and noise reduction of buildings'[9] offers guidance on suitable internal noise levels for spaces when they are unoccupied.

3.8.2 The suggested design criteria for reasonable listening and resting/sleeping conditions are given in Table 4 of BS8233, and reproduced in Table 3.4.

Table 3.4: Relevant Information from BS 8233:2014

Activity	Location	Design Range $L_{Aeq,T}$	
		07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	-

3.8.3 It can be seen that a design standard should be adopted to ensure internal noise from steady external sources in living rooms should not exceed 35 dB $L_{Aeq,16hour}$.

3.8.4 The design criteria for bedrooms suggests that a noise level not exceeding 35 dB $L_{Aeq,16hour}$ during the daytime (07:00 to 23:00) and 30 dB $L_{Aeq,8hour}$ during the night-time (23:00 to 07:00).

3.8.5 In terms of external areas, BS8233:2014 (Section 7.7.3.2) states:

> *"For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50dB $L_{Aeq,T}$, with an upper guideline value of 55dB $L_{Aeq,T}$ 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 such as the*

[8] *The World Health Organisation (WHO) Europe has published the WHO Environmental Noise Guidelines for the European Region (2018).*
[9] *British Standard BS 8233 (2014) 'Guidance on sound insulation and noise reduction of buildings' British Standards* Institution.

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."

3.9 Approved Document O of The Building Regulations (2021) Overheating

3.9.1 Approved Document O takes effect on 15 June 2022 for use in England. It does not apply to work subject to a building notice, full plans application or initial notice submitted before that date, provided the work for each building is started before 15 June 2023.

3.9.2 The new Approved Document O: Overheating, aims to reduce the occurrence of high indoor temperatures which has become an increasing issue for residential developments. The main aim of ADO is to protect the health and welfare of occupants of the building by reducing the occurrence of high indoor temperatures:

"Requirement
O1 Overheating mitigation
(1) 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) 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."

3.9.3 There are two methods of demonstrating compliance with ADO: 1. Simplified method; or 2. Dynamic thermal modelling.

3.9.4 Section 3 of ADO provides additional considerations regarding the safety and reasonable enjoyment of the dwelling that must be taken into account when meeting the overheating obligation, including noise.

3.9.5 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 23:00 and 07:00 hours).
b. 55dB L_{AFmax}, more than 10 times a night (between 23:00 and 07:00 hours)

3.10 Noise Criterion

3.10.1 The assessment will follow ProPG: Planning and Noise (2017) Professional Practice Guidance on Planning & Noise and refer to relevant standards/guidance such as BS8233: 2014 and WHO Guidelines for internal and external noise sources.

3.10.2 The proposed noise criteria for the development is based on guidance from BS 8233:2014 with regards daytime and night-time noise levels within habitable rooms:

(a) Within Living Rooms and Bedrooms (07:00-23:00 hours): 35 dB(A) $L_{eq,16\ hour}$.
(b) Within Bedrooms (23:00-07:00 hours): 30 dB(A) $L_{eq,8\ hour}$.
(c) Within Bedrooms (23:00-07:00 hours): 45 dB(A) L_{Amax}.

4.0 Environmental Noise Survey Methodology

4.1 Introduction

4.1.1 This study benefits from a noise survey carried out between Thursday 27th July 2023 and Thursday 3rd August 2023.

4.1.2 The sound level meter installed at the Site included audio recording capability to assist with source identification. A subjective assessment of the ambient noise climate was also undertaken during the survey. The ambient noise environment is dominated by transient military aircraft flyovers, with traffic using the local road network also audible.

4.2 Environmental Noise Survey Instrumentation

4.2.1 The instrumentation displayed below was used for all measurements undertaken during the site noise survey. Calibration certificates are available on request.

Table 4.1: Details of Instrumentation

Manufacturer	Equipment	Serial No.	Calibration Due Date
Rion	Sound Level Meter Type NL-52	00420712	01/08/2024
Pulsar	Acoustic Calibrator Type 105	53536	12/10/2023

4.2.2 The following set-up parameters were used on the sound level meter during noise measurement procedures:

Frequency Weighting: 'A' or Linear (1:1 octave bands)
Measurement Periods: 15 minutes

4.3 Calibration

4.3.1 The sound level meter was calibrated with the electronic calibrator prior to the commencement and on the completion of the survey. No significant drift in calibration was observed. The meter used during the survey is a precision grade Class 1.

Calibration Setting: 94 dB @ 1kHz
Meter Setting: Fast Response

4.4 Measurement Procedure

4.4.1 The noise monitoring location is described below and displayed in Appendix B:

- Location MP1: Position of proposed dwelling.

4.4.2 Noise monitoring was undertaken at least 3.5m from any vertical reflecting surface and at a height of 1.5m above ground level.

4.5 Meteorological Conditions

4.5.1 Weather details were recorded during the period of the survey.

Table 4.2: Summary of meteorological conditions

Date	Description	Wind Speed (ms^{-1})	Wind Direction	Temp. (°C)
27/07/2023	Overcast with periods of rainfall	<1-3	SW	18-24
28/07/2023	Fair	<1-2	SW	15-23
29/07/2023	Fair	3-5	SW/W	15-24
30/07/2023	Overcast with periods of rainfall	4-6	SW	14-22
31/07/2023	Overcast	3-5	SW	16-20
01/08/2023	Fair	<1-5	SW/W	13-20
02/08/2023	Overcast with periods of rainfall	4-6	SW	15-20
03/08/2023	Fair	2-3	N	14-20

4.5.2 The noise survey was generally conducted in climatic conditions suitable for monitoring environmental noise levels in accordance with advice given in BS7445: 2003 `Description and measurement of environmental noise'[10].

[10] *BS7445:2003 Description and measurement of environmental noise. British Standards Institution, 2003.*

5.0 Assessment of Noise Impact

5.1 Introduction

5.1.1 In the context of this assessment, noise is defined as sound that is unwanted by the recipient. The effects of noise on the neighbourhood are varied and complicated, and include such things as interference with speech, communication, disturbance of work, leisure or sleep. A further complicating factor is that in any one neighbourhood some individuals will be more sensitive to noise than others.

5.1.2 A measure that is in general use and is recommended internationally for the description of environmental noise is the equivalent continuous noise level or L_{Aeq} (Equivalent Continuous Sound Pressure Level) parameter.

5.2 Environmental Noise Survey Results

5.2.1 The fixed monitoring location measurement data has been processed to provide daytime (16-hour) and night-time (8-hour) L_{Aeq} values. The results of the survey are summarised in Tables 5.1 & 5.2. The results of the survey are presented fully in graphical form within Appendix D.

Table 5.1: Daytime noise levels at fixed monitoring location

Ref.	Date	Time Period (hh:mm)	Statistical Parameters (dB)			
			$L_{Aeq,16h}$	$L_{A10,16h}$	$L_{A90,16h}$	$L_{Amax,15mins}$
MP1	28/07/2023	07:00-23:00	57.7	49.5	36.1	49.0-97.3
MP1	29/07/2023	07:00-23:00	46.0	48.1	37.2	54.8-72.2
MP1	30/07/2023	07:00-23:00	46.3	48.1	38.4	49.9-72.2
MP1	31/07/2023	07:00-23:00	60.1	51.4	36.9	58.1-92.8
MP1	01/08/2023	07:00-23:00	59.4	52.6	37.3	53.4-91.5
MP1	02/08/2023	07:00-23:00	58.6	51.2	38.7	51.1-91.5

Table 5.2: Night-time noise levels at fixed monitoring location

Ref.	Commencement Date	Time Period (hh:mm)	Statistical Parameters (dB)			
			$L_{Aeq,8h}$	$L_{A10,8h}$	$L_{A90,8h}$	$L_{Amax,15mins}$
MP1	27/07/2023	23:00-07:00	40.2	36.1	22.7	42.2-73.8
MP1	28/07/2023	23:00-07:00	38.3	37.6	26.0	45.9-68.3
MP1	29/07/2023	23:00-07:00	38.4	38.9	28.5	43.2-70.0
MP1	30/07/2023	23:00-07:00	41.0	40.9	30.5	40.5-69.8
MP1	31/07/2023	23:00-07:00	40.8	38.4	29.0	55.1-71.3
MP1	01/08/2023	23:00-07:00	44.2	40.3	29.9	45.0-66.6
MP1	02/08/2023	23:00-07:00	41.0	40.8	31.5	40.8-73.7

5.2.2 The results of the survey show that the highest daytime equivalent continuous free-field sound pressure level ($L_{Aeq,16hour}$) at the monitoring position was 60.1 dB. The highest night-time $L_{Aeq,8hour}$ free-field noise level at the same position was 44.2 dB.

5.2.3 In terms of maximum instantaneous noise levels during the night-time periods, measurements ranged between 40.5 and 73.8 dB $L_{Amax,15mins}$.

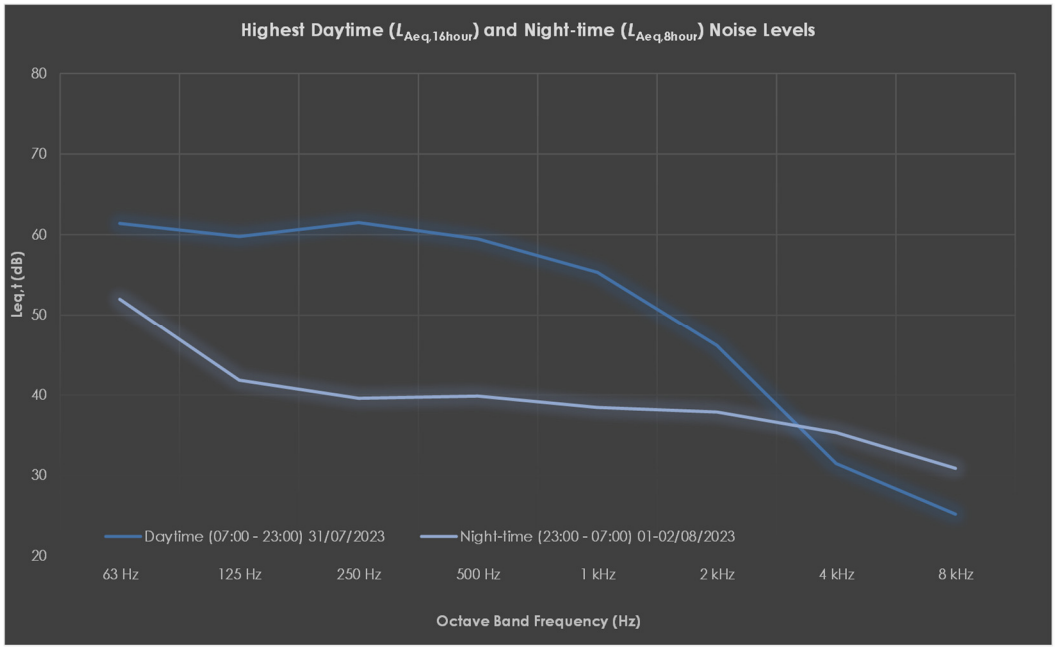
5.2.4 Maximum instantaneous noise levels should not regularly exceed 45 dB L_{Amax} (as recommended in BS8233) within bedrooms. It should be noted that this criteria is derived from Section 3.4 of 'Guidelines for Community Noise' which states that;

"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10-15 times per night (Vallet & Vernet 1991)…'

5.2.5 Based on the 10th highest L_{Amax} event during any 8-hour night-time period, the maximum instantaneous noise level was 63.9 dB.

5.2.6 Octave band frequency characteristics of the highest daytime and night-time noise levels measured at the fixed monitoring location are presented in Figure 5.1.

Figure 5.1: 1:1 octave band frequency analysis of highest daytime and night-time noise levels



5.3 Initial Site Noise Risk Assessment

5.3.1 The highest measured daytime ambient noise level was 60.1 dB $L_{Aeq,16hour}$, with an associated night-time $L_{Aeq,8hour}$ of 44.2 dB. According to the ProPG initial site risk assessment rating, the development site is considered 'low/medium risk'. Therefore, mitigation measures must be included following a good acoustic design process.

Table 5.3: Noise Risk Assessment

Noise Risk Assessment	ProPG Commentary
Low	*"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."*
Medium	*"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".*

5.3.2 The measured levels are lower than the RAF Lakenheath noise contour map which shows the proposed development site located within the 66 dB $L_{Aeq,16hour}$ contour.

5.3.3 With respect to the L_{Amax} during the night-time period, ProPG states that *"the initial site noise risk assessment should include the consideration of the individual noise events when the external $L_{Amax,F}$ exceeds 60 dB. A site should not be regarded as negligible risk if the $L_{Amax,F}$ exceeds, or is likely to exceed 60 dB more than 10 times a night. A site should be regarded as high risk if the $L_{Amax,F}$ exceeds, or is likely to exceed 80 dB more than 20 times a night."*

5.3.4 In summary, a full Stage 2 assessment is required incorporating an Acoustic Design Statement (ADS) to demonstrate a good acoustic design process has been followed.

5.3.5 Windows and standard ventilation units are typically the weakest elements of a building façade in terms of sound insulation. The overall effectiveness of the building envelope will be reduced further by opening windows to provide ventilation (open windows will typically provide 13 dBA level difference between outside and inside).

5.3.6 We have calculated that with windows open, internal noise within habitable rooms during the daytime would exceed internal noise targets.

5.3.7 Our recommendations contained within Section 6.0 (Acoustic Design Statement) of this report have focused on the acoustic requirements of the external façade of the building in order to meet internal noise design targets.

6.0 Acoustic Design Statement

6.1 Introduction

6.1.1 The Initial Site Noise Risk Assessment has established that noise generated by military aircraft flyovers may result in noise intrusion with a 'low/medium' risk. Consequently, mitigation measures are required in order for the building to be suitable for residential development.

6.2 Element 1: Good Acoustic Design Process

6.2.1 The positioning of rooms within a development can be used as an effective means of reducing noise to sensitive rooms. Wherever possible the 'quiet façade' principle should be applied. This is the positioning of sensitive habitable rooms on the façade facing away from the dominant noise source.

6.2.2 Unlike road and rail sources, the dwellings cannot be orientated to protect the most sensitive rooms from the dominant noise source (aircraft). The dwellings will need to be constructed using a building envelope (including roof/ceiling) with sound insulation measures.

6.2.3 The Good Acoustic Design Process with ProPG states the use of fixed unopenable windows should be avoided, as occupants generally prefer to have control over the internal environment, even if resultant acoustic conditions are considered unsatisfactory.

6.2.4 ProPG's Internal Noise Level Guidelines provides additional advice that internal noise level guidelines are generally not applicable under "purge ventilation" conditions as defined by Approved Document F of The Building Regulations, as this is an occasional event (e.g. to remove odour from painting and decorating or from burnt food).

6.3 Element 2: Internal Noise Level Guidelines

6.3.1 Windows and standard ventilation units are typically the weakest elements of a building façade in terms of sound insulation. The overall effectiveness of the building envelope will be reduced further by opening windows to provide ventilation (open windows will typically provide 13 dBA sound reduction).

6.3.2 We have calculated that with windows open, internal noise within habitable rooms during the daytime and night-time periods would exceed internal noise targets.

6.3.3 A further series of calculation routines have been undertaken using the methodology contained in BS 8233:2014 (G.2) with windows closed. In terms of ventilation, natural ventilation with background ventilators and intermittent extract fans (known as the Natural Ventilation system, formerly ventilation system 1) is suitable only for less airtight dwellings. We have therefore also considered a Mechanical Ventilation with Heat Recovery (MVHR) system to comply with ADF and ADO. We recommend a mechanical ventilation system due to the location of Site within the 66 dB L_{Aeq} contour, even though actual measured noise levels were significantly lower.

6.3.4 Surface areas of façade elements and room volumes are based on the supplied drawings (listed in Section 1.0).

6.3.5 Glazing and ventilation specifications necessary to achieve acceptable internal noise levels have been included within the prediction routines. Any changes to the building fabric of the dwelling should be checked by an acoustic consultant.

6.3.6 Calculation routines are based on a standard brick/block cavity external wall construction achieving a sound reduction of at least 53 dB R_w.

Table 6.1: Overview of building elements

Example Specification	Glazing Configuration	Ventilation	Roof/Ceiling
Option 1 Bedrooms	6mm glass-16mm cavity-6.8mm Pilkington Optiphon glass 40 dB Rw 34 dB R_w+C_{tr}	Mechanical	2 x 12.5mm layers of SoundBloc plasterboard (sealed and skimmed) to ceiling joists with minimum 100mm insulation above (min. 10 kg/m^3). Felt liner with 14mm roof tile system
Option 1 Living Room/Kitchen	6mm glass-16mm cavity-6mm glass 33 dB Rw 28 dB R_w+C_{tr}	Mechanical	2 x 12.5mm layers of SoundBloc plasterboard (sealed and skimmed) to ceiling joists with minimum 100mm insulation above (min. 10 kg/m^3). Felt liner with 14mm roof tile system
Option 2 Bedrooms	6mm glass-16mm cavity-6.8mm Pilkington Optiphon glass 40 dB Rw 34 dB R_w+C_{tr}	Greenwood EAQ42W Trickle Vent 42 dB $D_{n,ew}$	2 x 12.5mm layers of SoundBloc plasterboard (sealed and skimmed) to ceiling joists with minimum 100mm insulation above (min. 10 kg/m^3). Felt liner with 14mm roof tile system
Option 2 Living Room/Kitchen	6mm glass-16mm cavity-6.8mm Pilkington Optiphon glass 33 dB Rw 28 dB R_w+C_{tr}	Greenwood EAQ42W Trickle Vent 42 dB $D_{n,ew}$	2 x 12.5mm layers of SoundBloc plasterboard (sealed and skimmed) to ceiling joists with minimum 100mm insulation above (min. 10 kg/m^3). Felt liner with 14mm roof tile system

6.3.7 Calculated noise levels within the habitable rooms based on the survey results are displayed in Table 6.2.

Table 6.2: Calculated internal noise levels of habitable rooms

Habitable Room	Calculated Internal Noise Levels			
	Daytime (07:00-23:00)	Criterion	Night-time (23:00-07:00)	Criterion
Bedroom 2	26-33 dB $L_{Aeq,16hour}$	35 dB $L_{Aeq,16hour}$	9-15 dB $L_{Aeq,8hour}$ 29-35 dB $L_{Amax,8hour}$	30 dB $L_{Aeq,8hour}$ 45 dB $L_{Amax,8hour}$
Living Room/ Kitchen	32-33 dB $L_{Aeq,16hour}$	35 dB $L_{Aeq,16hour}$	-	-

*L_{Amax} – Based on 10th highest event during night-time period.

Example Design Specifications for Noise-Sensitive Rooms

6.3.8 It is important that all principal building elements are tested in accordance with BS EN ISO 10140-2:2010 (or equivalent) and that the quoted minimum sound reduction specifications are met by the panels and windows, including frames, seals, etc.

Glazing

6.3.9 In order to adequately mitigate external noise levels to habitable rooms, the glazing system shown in Table 6.3 should be used as a minimum.

Table 6.3: Acoustic performance of glazing systems

Glazing Configuration (to be read in conjunction with Table 6.1)	Sound Reduction Index – SRI (dB)							R_w (dB)	$R_w + C_{tr}$ (dB)
	Octave band c.f. – Hz								
	63	125	250	500	1k	2k	4k		
6mm glass-16mm cavity-6mm glass	21	21	20	30	39	35	44	33	28
6mm glass-16mm cavity-6.8mm Pilkington Optiphon	21	21	28	37	48	48	54	40	34

Ventilation

6.3.10 Ventilation systems will need to be checked against the requirements of Approved Document F of the Building Regulations[11]. It recognises that in noisy environments, it may be appropriate to use either acoustically attenuated background ventilators or mechanical ventilation, depending on the level of noise and any planning conditions.

6.3.11 Under the new 2021 Part F Approved Document the minimum required area for background ventilators is now taken over a room by room basis. These are simplified per room amounts;

- For dwelling with multiple floors:
Habitable rooms and kitchens: 8000mm^2 EA
Bathrooms: 4000mm^2 EA

[11] *Approved Document F of the Building Regulations (2021)Volume 1: Dwellings - Means of Ventilation.*

Sanitary Accommodation/Utility Room: No minimum

● For single storey dwellings (e.g flats):
Habitable rooms and kitchens: 10000mm^2 EA
Bathrooms: 4000mm^2 EA
Sanitary Accommodation/Utility Room: No minimum

There are some sub-rules:
● Seek expert advice should the dwelling have a single exposed façade, or at least 70% of its openings on same façade, or the kitchen has no windows or façade for vents.
● If kitchen and living room not separate, at least 3 vents of same EA as for habitable rooms should be provided in that space.
● Total number of vents in habitable rooms and kitchen should be at least 5, or 4 if one bedroom property.
● If a bathroom has no window or external façade through which a ventilator can be installed, the minimum equivalent area specified should be added to the ventilator sizes specified in other rooms.

6.3.12 This guidance is only suitable for less airtight dwellings. These are dwellings that will aim to have a design air permeability of greater than 5 m^3/(h.m^2).

6.3.13 MVHR and MEV systems should be specified to achieve acceptable noise levels. Part F states that the average A-weighted sound pressure level for a ventilator operating under normal conditions and not at boost rates should not exceed the following guidance limits.

Table 6.4: MVHR/MEV Noise Criteria in Part F of The Building Regulations

Room	Noise Limit ($L_{Aeq,T}$) dB
Bedrooms and living rooms when a continuous mechanical ventilation system is running on its minimum low rate	30
Less sensitive rooms such as kitchens and bathrooms when a continuous operation system is running at the minimum high rate or an intermittent operation system is running	45

6.3.14 In terms of overheating, Approved Document O of the Building Regulations (2021) states that 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 23:00 and 07:00 hours).
b. 55dB L_{AFmax}, more than 10 times a night (between 23:00 and 07:00 hours).

6.3.15 AD-O implies that the following limiting external free-field levels above which external noise precludes the use of the simplified method, and dynamic thermal modelling should be used to demonstrate compliance[12].

[12] *Guide to Demonstrating Compliance with the Noise Requirements of Approved Document O (2022) Association of Noise Consultants. Version 1.*

Table 6.5: External noise levels above which the simplified method cannot be used

Parameter	High Risk Location	Moderate Risk Location
$L_{Aeq,8h}$, averaged over 8 hours (between 11pm and 7am)	44 dB	49 dB
L_{AFmax}, more than 10 times a night (between 11pm and 7am)	59 dB	64 dB

6.3.16 As night-time noise levels do not exceed 49 dB $L_{Aeq,8h}$ and 64 dB L_{Afmax} between 11pm and 7am, it will not be necessary to carry out dynamic thermal modelling in a TM 59 assessment[13] to demonstrate that the adopted ventilation strategy for the dwellings will not result in overheating during the summer months when the windows remain closed.

6.3.17 Approved Document F of the Building Regulations requires 4 air changes per hour for the short-term removal of pollutants, smells, etc.

6.3.18 Acoustically treated background ventilators and intermittent extract fans has been assumed for the habitable rooms at the development (see performance below). However, mechanical ventilation is recommended.

Table 6.6: Acoustic performance of ventilation systems

Ventilation Type (to be read in conjunction with Table 6.1)	Element normalised level difference - $D_{n,e}$ (dB)							$D_{n,ew}$ (dB)
	Octave band c.f. – Hz							
	63	125	250	500	1k	2k	4k	
Greenwood EAQ42W Trickle Vent	37.8	40.8	41.9	37.4	44.0	45.9	40.9	42

Note: The specification assumes no more than three ventilators will be installed per room. The specification should be increased by a factor of 10Log(N) should N ventilators be required per room. The acoustic performance of the ventilation units are based on them being in the 'open' position.

6.3.19 The required ventilation rate to avoid overheating should not be as high as the requirement for purge ventilation. Approved Document F of the Building Regulations requires 4 air changes per hour for the short-term removal of pollutants, smells, etc. Openable windows are acceptable for short-term purge ventilation provided overheating is prevented.

6.4 Element 3: External Amenity Area Noise Assessment

6.4.1 The World Health Organisation (WHO) Guidelines recommend that noise levels within gardens and external living areas should not exceed 55 dB $L_{Aeq,16hour}$ in order to avoid serious annoyance during the daytime and evening. This accords with the guidance

[13] *TM59 (2017) Design methodology for the assessment of overheating risk in homes, published by the Chartered Institution of Building Services Engineers (CIBSE).*

criteria for external noise given in Section 7.7.3.2 of BS8233 for amenity areas, although BS8233: 2014 states:

> *"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 but should not be prohibited."*

6.4.2 BS8233:2014 states that the resulting noise levels are never a reason for refusal, if levels are designed to be as low as practicable. However, policy guidance should be followed to ensure the amenity can be enjoyed as intended.

6.4.3 The noise level threshold of 55 dB $L_{Aeq,16hour}$ was exceeded during periods of flying activity (up to 60.1 dB $L_{Aeq,16hour}$), but not exceeded during the weekend when there was no flying activity (46.0-46.3 dB $L_{Aeq,16hour}$).

6.4.4 It is important to consider the daytime garden noise levels in context with the wider area. Contour data for RAF Lakenheath show similar noise levels for the surrounding area and recent planning permissions for residential development closer to the airbase show significantly higher external noise levels.

6.4.5 When considering criterion for gardens and outdoor living areas it is important to take into account the feasibility of meeting these standards. A review of health effect-based noise assessment methods reported the following[14]:

> *"Perhaps the main weaknesses of WHO-inspired document is that they fail to consider the practicality of actually being able to achieve any of the stated guideline values…We know from the most recent national survey [at that time] that around 56% of the population are exposed to daytime noise levels exceeding 55 dB L_{Aeq} and that around 65% are exposed to night-time noise levels exceeding 45 dB L_{Aeq} (as measured outside the house). … The percentages exposed above the WHO guideline values could not be significantly reduced without drastic action to virtually eliminate road traffic noise and other forms of transportation noise from the vicinity of houses. The social and economic consequences of such action would be likely to be far greater than any environmental advantages of reducing the proportion of the population annoyed by noise. In addition, there is no evidence that anything other than a small minority of the population exposed at such noise levels find them to be particularly onerous in the context of their daily lives."*

6.4.6 The environmental noise levels suggested in Guidelines for Community Noise are useful in considering potential annoyance but may be considered more 'aspirational' rather than for determining a level above which significant adverse effects on health and quality of life occur (SOEL).

6.5 Element 4: Assessment of Other Relevant Issues

6.5.1 The proposed building fabric of the residential dwellings would ensure that internal noise levels are below the Lowest Observed Effect Level (LOAEL). Appropriate and reasonable acoustic design measures have been suitably considered for the proposed development.

[14] *Health effect-based noise assessment methods: a review and feasibility study (1998) Porter, N D, Flindell, I H, Berry, B F. NPL Report CMAM 16, September 1998.*

6.5.2 Compliance with the criteria within BS 8233:2014 can therefore be considered to comply with the national policy aims to avoid significant adverse impacts.

7.0 Conclusions

7.1 A noise survey has been undertaken to establish daytime and night-time noise levels at the Proposed Development. Continuous monitoring of environmental noise levels was carried between Thursday 27th July 2023 and Thursday 3rd August 2023.

7.2 The initial noise risk assessment which considers overall noise levels has indicated that the Site is 'low/medium risk'. Therefore, mitigation measures must be included following a good acoustic design process.

7.3 Internal Noise Level Guidelines according to British Standard 8233:2014 can be met with the implementation of the façade insulation scheme detailed in Section 6.0 of the report.

7.4 With the recommendations fully implemented, it is considered that an appropriate and reasonable level of protection against noise for future occupants of the dwelling can be achieved for the Proposed Development.

Appendices

Appendix A

A.0 NOISE PERCEPTION AND TERMINOLOGY

A.1 Terminology

A.1.1 Between the quietest audible sound and the loudest tolerable sound there is a million to one ratio in sound pressure (measured in pascals, Pa). Because of this wide range a noise level scale based on logarithms is used in noise measurement called the decibel (dB) scale. Audibility of sound covers a range of approximately 0 to 140 dB.

A.1.2 The human ear system does not respond uniformly to sound across the detectable frequency range and consequently instrumentation used to measure noise is weighted to represent the performance of the ear. This is known as the 'A weighting' and annotated as dB(A).

A.1.3 The following lists the sound pressure level in dB(A) for common situations.

Table A.1: Noise Levels for Common Situations

Typical Noise Level dB(A)	Example
0	Threshold of hearing
30	Rural area at night, still air
40	Public library Refrigerator humming at 2m
50	Quiet office, no machinery Boiling kettle at 0.5m
60	Normal conversation
70	Telephone ringing at 2m Vacuum cleaner at 3m
80	General factory noise level
90	Heavy goods vehicle from pavement Powered lawnmower, operator's ear
100	Pneumatic drill at 5m
120	Discotheque - 1m in front of loudspeaker
140	Threshold of pain

A.1.4 The noise level at a measurement point is rarely steady, even in rural areas, and varies over a range dependent upon the effects of local noise sources. Close to a busy motorway, the noise level may vary over a range of 5 dB(A), whereas in a suburban area this may increase up to 40 dB(A) and more due to the multitude of noise sources in such areas (cars, dogs, aircraft etc.) and their variable operation. Furthermore, the range of night-time noise levels will often be smaller and the levels significantly reduced compared to daytime levels. When considering environmental noise, it is necessary to

consider how to quantify the existing noise (the ambient noise) to account for these second to second variations.

A.1.5 A parameter that is widely accepted as reflecting human perception of the ambient noise is the background noise level, L_{A90}. This is the noise level exceeded for 90% of the measurement period and generally reflects the noise level in the lulls between individual noise events. Over a 1-hour period the L_{A90} will be the noise level exceeded for 54 minutes.

A.1.6 The equivalent continuous A-weighted sound pressure level, L_{Aeq}, is the single number that represents the total sound energy measured over that period. The L_{Aeq} is the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period. It is commonly used to express the energy level from individual sources that vary in level over their operational cycle.

A.1.7 The $L_{Amax,fast}$ measurement parameter is the maximum instantaneous sound pressure level attained during the measurement period (30 seconds, 15 minutes etc.), measured on the 'fast' response setting of the sound level meter. It is generally used when assessing likelihood of night-time sleep disturbance.

A.1.8 The $L_{Amax,slow}$ measurement parameter is again the maximum instantaneous sound pressure level attained during the measurement period but with the sound level meter on the 'slow' response setting. PPG24 states that where individual noise events regularly exceed 82 dB L_{Amax} (S time weighting) several times in any hour during the night time period then the site should be treated as being in Noise Exposure Category C (described in detail later).

A.1.9 The R_w is a single number rating used to describe the sound insulation of building elements. Traditional masonry walls will achieve no less than 48 dB R_w, single glazed windows approximately 25 dB R_w. The figure is mostly used when calculating noise transmission through building elements.

A.1.10 The apparent sound reduction index (R') is a field measurement which attempts to measure the sound reduction index of a material on a real completed construction (e.g. a wall between two offices, houses or cinema auditoria). It is unable to isolate or allow for the result of alternate sound transmission routes and therefore will generally produce a lower result than the laboratory measured value.

A.1.11 Human subjects, under laboratory conditions, are generally capable of noticing changes in steady levels of 1 dB(A). However, in the general environment changes of around 3 dB(A) can be detected. It is generally accepted that a change of 10 dB(A) in an overall, steady noise level is perceived to the human ear as a doubling (or halving) of loudness. (These findings do not necessarily apply to transient or non-steady noise sources such as changes in noise due to changes in road traffic flow, or intermittent noise sources).

A.2 Perception - Frequency

A.2.1 Frequency is the rate at which the air particles vibrate. The more rapid the vibrations, the higher the frequency and perceived pitch. Frequency is measured in Hertz (Hz).

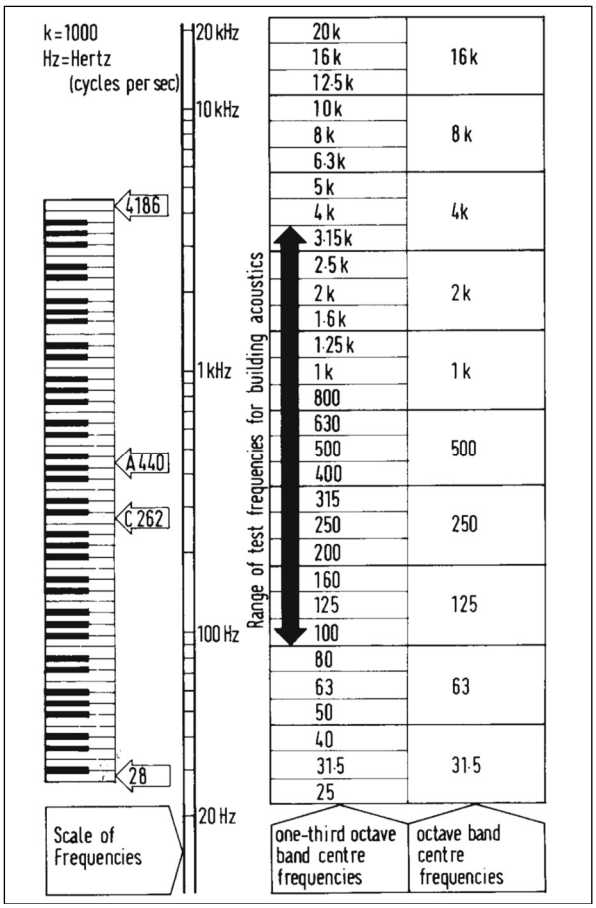
A.2.2 A young person with average hearing can generally detect sounds in the range 20 Hz to 20,000 Hz (20 kHz). Figure 3.1 below illustrates the range of frequencies, for example, the lowest note on a full scale piano, 'A', has a fundamental at 28 Hz, and the highest,

'G', a fundamental at 4186 Hz (there will be higher order harmonics). Human speech is predominantly in the range 250 Hz - 3000 Hz.

A.2.3 The musical term 'octave' is the interval between the first and eighth note in a scale and represents a doubling of frequency. A series of octave and one-third octave bands have been derived, as shown in the Figure below, and these are commonly used in noise measurements where it is necessary to describe not only the level of the source noise but also the frequency content. The frequency content of a noise source can be useful for identifying acoustic features such as a whine, hiss or screech.

A.2.4 In most instances it is necessary only to specify and use the overall A-weighted noise values, for example when assessing noise from fixed plant (pumps, motors, refrigeration plant etc.), road traffic and general industrial sources. However, in certain circumstances it is necessary to consider the contribution to the overall A-weighted noise level in individual octave frequency bands, such as when assessing architectural acoustics or noise from amplified music events.

Figure A.1: 1/1 Octave and 1/3 Octave Frequency Bands



Appendix B

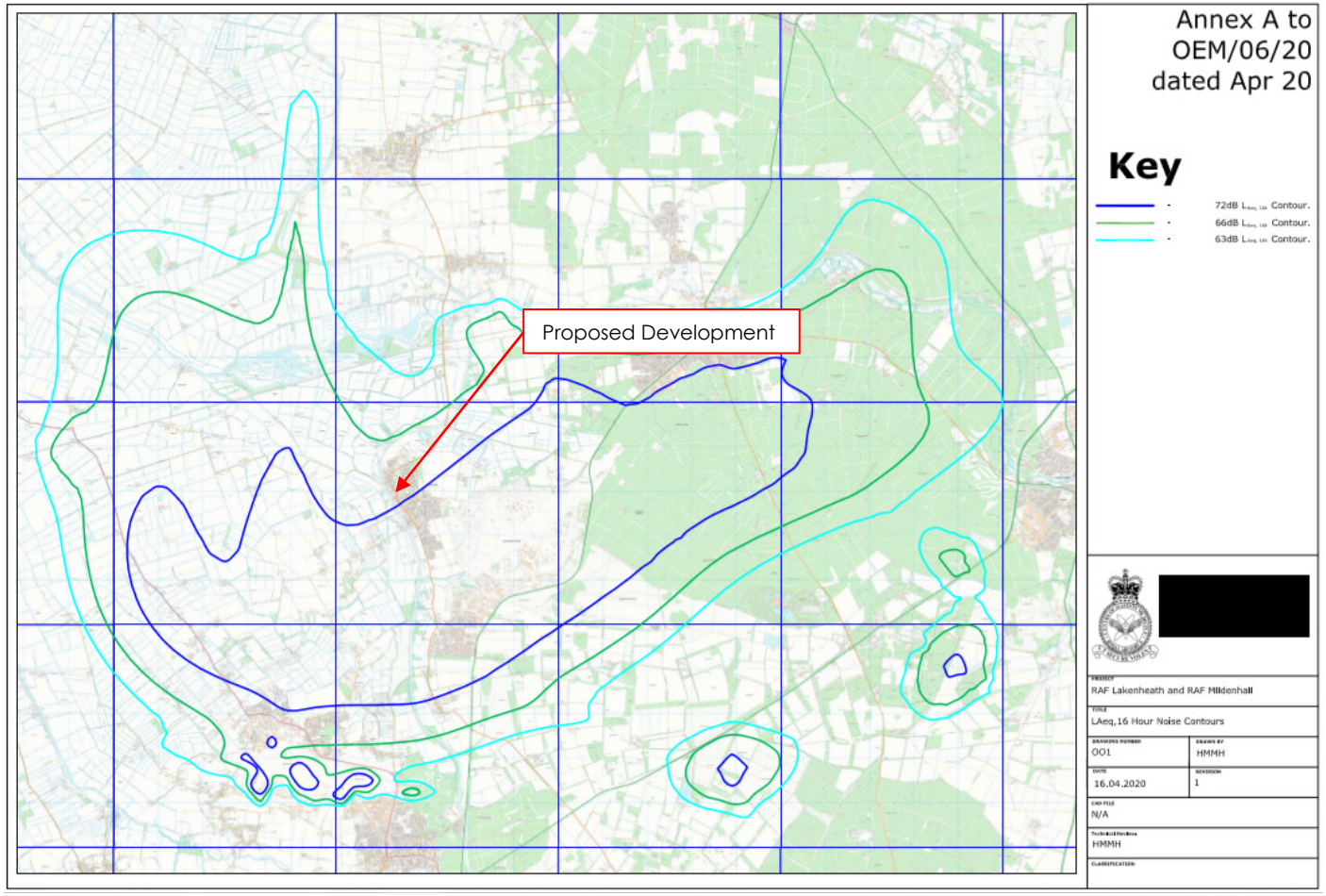
Site Plan Indicating External Noise Monitoring Location

MP Noise Monitoring Location

Source: Google Earth

Appendix C

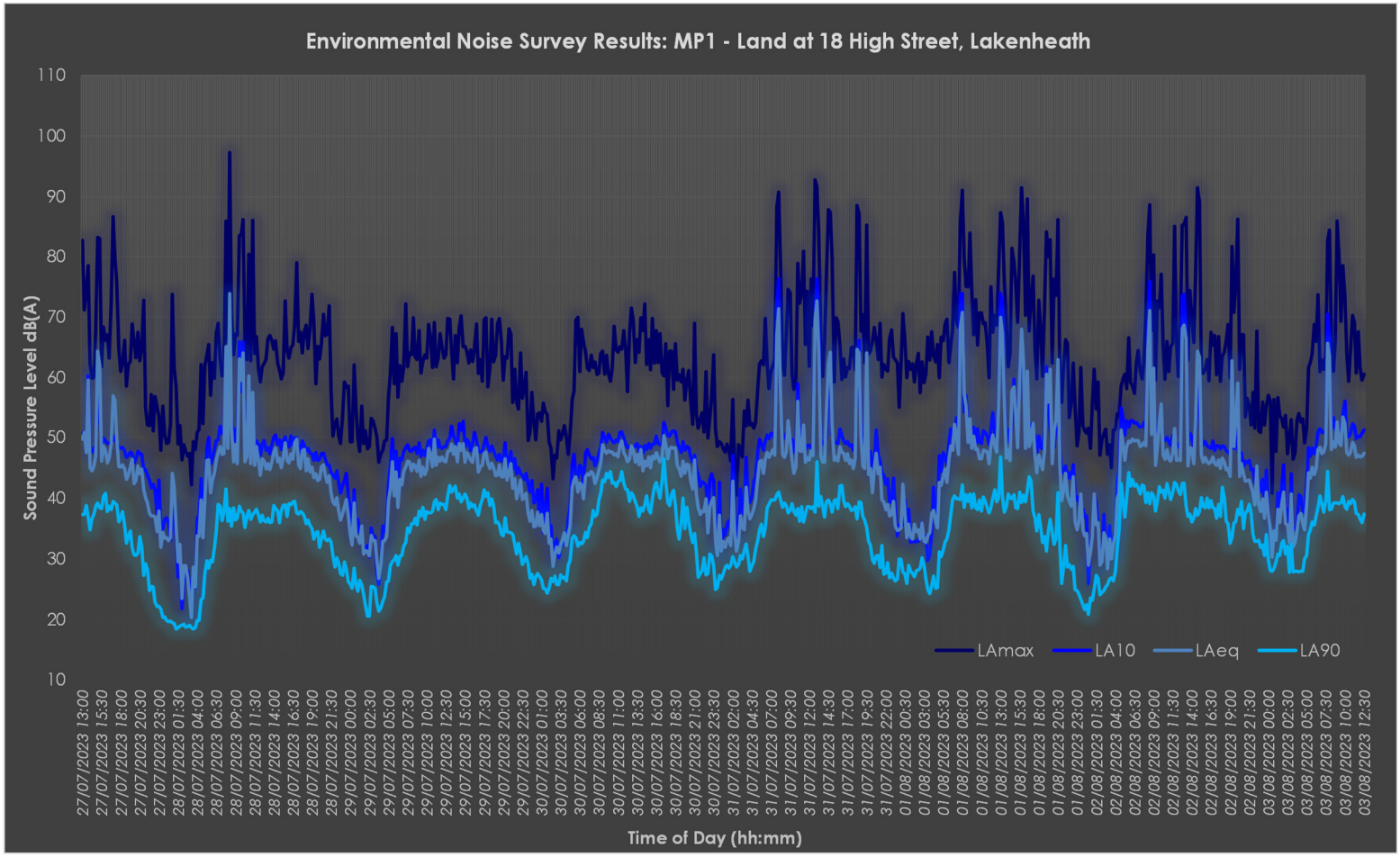
RAF Lakenheath & RAF Mildenhall Contours (2020)



Source: A report on a Military Aviation Noise Contour of station-based Aircraft Activity at RAF Lakenheath & RAF Mildenhall (2020) Noise and Vibration Report: OEM/06/20

Appendix D

Environmental Noise Survey Results
Site Monitoring Position



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