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# TECHNICAL REPORT

**LAND EAST AND WEST OF**
**REEPHAM ROAD, HELLESDON**
**Aircraft Noise Assessment**

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# Adrian James Acoustics Document Control Sheet

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**Revision History**

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# 1 INTRODUCTION

## 1.1 Background

We have been appointed by CODE Development Planners Ltd to produce an outline assessment of the impact of aircraft noise onto land adjoining Holt Rd and Reepham Road in Hellesdon. The owners of the land are promoting these two sites for inclusion within the Greater Norwich Development Plan.

The two sites lie to the West of Norwich Airport and we have used noise data for current and future airport operations to assess the likely impact of any future residential developments on these sites.

## 1.2 Structure of this report

The structure of this report is as follows:

- Section 2 describes relevant development planning policy and technical guidance;
- Section 3 describes the development site and proposals;
- Section 4 summarises the aircraft noise levels on the site and presents our initial site noise risk assessment in accordance with *ProPG: Planning & Noise*;
- Section 5 discusses potential noise mitigations for residential developments on the site
- Section 6 presents our conclusions.
- An explanation of the technical terms used in this report is given in Appendix A.
- Details of the noise measurement equipment and calibration are set out in Appendix B.

# 2 NOISE CRITERIA

## 2.1 National Planning Policy Framework

The National Planning Policy Framework (NPPF) came into force in March 2012 and was revised in February 2019. It does not set out numerical criteria for noise affecting proposed developments, but states in Section 180 that planning policies and decisions should aim to:

- 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; and
- identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

## 2.2 Local planning policy

The sites are within the area covered by the Greater Norwich Development Plan and the owners are promoting them for allocation for residential use within the plan. We understand that the Greater Norwich Development Partnership officers have raised concerns about the possible impact of aircraft noise on the two sites (identified as 0332R and 0334R on the Draft Development Plan). We are not aware of any previous work to assess the impact of aircraft noise onto any potential residential developments on the site.

The site adjoins the boundary between Norwich City Council and Broadland District Council. We are not aware of either local authority adopting specific policies in relation to the assessment of aviation noise on residential developments, or providing detailed comments on the potential for residential developments on these sites.

## 2.3 Relevant technical guidance

### *2.3.1 BS 8233:2014*

British Standard 8233:2014 *'Guidance on sound insulation and noise reduction for dwellings'* (BS 8233) provides guideline limits for ambient noise levels inside dwellings.

BS 8233 suggests the following internal ambient noise levels for dwellings:

**Table 1 - Internal Ambient noise levels for dwellings (Table 4 of BS 8233:2014)**

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

Note 4 of Section 7.7.2 of BS8233 states:

> *"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."*

Note 5 states:

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

Note 7 states:

> *"Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved."*

Section 7.7.3.2 recommends that noise levels in external amenity areas should ideally not exceed 50 dB $L_{Aeq,T}$ and that 55 dB $L_{Aeq,T}$ should be considered as an upper limit. However, BS8233 also accepts that these guideline values are not achievable in all circumstances where development might be desirable.

### *2.3.2 World Health Organisation guidance*

The WHO *'Guidelines for community noise'* were first published in 1999 and generally remain the most relevant WHO guidance for appropriate noise levels inside dwellings. The guidance recommends internal ambient noise levels not exceeding 35 dB $L_{Aeq,16hr}$ during the day (0700-2300hrs) and 30 dB $L_{Aeq,8hr}$ at night. This is consistent with the recommended guideline limits in Table 4 of BS 8233, as reproduced in Table 1.

The WHO guidelines also recommend that *"noise exceeding 45dB $L_{AF,max}$ should be limited, if possible"* and 45 dB $L_{AF,max}$ is commonly adopted as a limit for bedrooms. The WHO guidelines also refer to 1991 research by Vallet and Vernet recommending that levels should not exceed 45 dB more than 10-15 times a night to protect sleep.

The WHO recommendations for outdoor *"living"* (amenity) areas is also consistent with BS 8233, with daytime average noise levels between 50-55 dB $L_{Aeq,T}$ representing the levels at which annoyance would normally range between *"moderate"* and *"serious"*.

Guidance on outdoor environmental noise levels and the potential effects on human health are provided in the WHO *'Environmental noise guidelines for the European region'* (2018). However, this is based on long-term yearly average day-evening-night ($L_{den}$) and night ($L_{night}$) parameters.

For aviation noise sources, the WHO 2018 guidelines recommend that:

> *"For average noise exposure, the GDG [Guideline Development Group] strongly recommends reducing noise levels produced by aircraft below 45 dB $L_{den}$, as aircraft noise above this level is associated with adverse health effects.*
>
> *For night noise exposure, the GDG strongly recommends reducing noise levels produced by aircraft during night time below 40 dB $L_{night}$, as night-time aircraft noise above this level is associated with adverse effects on sleep.*
>
> *To reduce health effects, the GDG strongly recommends that policy-makers implement suitable measures to reduce noise exposure from aircraft in the population exposed to levels above the guideline values for average and night noise exposure. For specific interventions the GDG recommends implementing suitable changes in infrastructure."*

It is important to note that the WHO 2018 guidance is primarily intended to aid policy makers worldwide and is not adopted as formal government policy in the UK; indeed it has no formal status in the UK planning system. Individual developments are normally assessed using the more specific criteria set out in ProPG: Planning and Noise, Aviation Policy Framework and other associated UK government policy.

### *2.3.3 Government policy on Aviation Noise*

The Government's Aviation Policy Framework was published in March 2013. This guidance is primarily intended to set policy in relation to new airport developments but it does provide some useful guidance on the impact of aviation noise on surrounding communities.

The document requires airport operators to produce daytime noise contour maps down a level of 57 dB $L_{Aeq,16hour}$ on the basis that this level marks the approximate onset of significant community annoyance to aircraft noise. The guidance goes to define a figure of 63 dB $L_{Aeq,16hour}$ as the threshold at which airport operators are required to offer acoustic insulation to noise-sensitive buildings.

### *2.3.4 ProPG: Planning and Noise*

The Professional Practice Guidance on Planning and Noise (ProPG) was published in May 2017 and produced jointly by the Association of Noise Consultants, the Institute of Acoustics and the Chartered Institute of Environmental Health.

The guidance adopts a two-stage approach to assessing potential residential developments exposed predominately to airborne noise from transport sources and is generally consistent with the guidance in BS 8233:2014.

*ProPG: Stage 1 – Initial Noise Risk Assessment*

Stage 1 is an initial risk assessment to indicate whether noise poses a negligible, low, medium or high risk. *'Risk'* in this context refers to the general acoustic suitability for residential development.

The Stage 1 daytime ($L_{Aeq,16hr}$) and night-time ($L_{Aeq,8hr}$) noise levels and corresponding risk categories from ProPG are reproduced in Figure 1. Regardless of the $L_{Aeq}$ levels, ProPG advises that if there are more than 10 individual noise events at night exceeding 60 dB $L_{AF,max,}$ the site should not be regarded as a negligible noise risk.

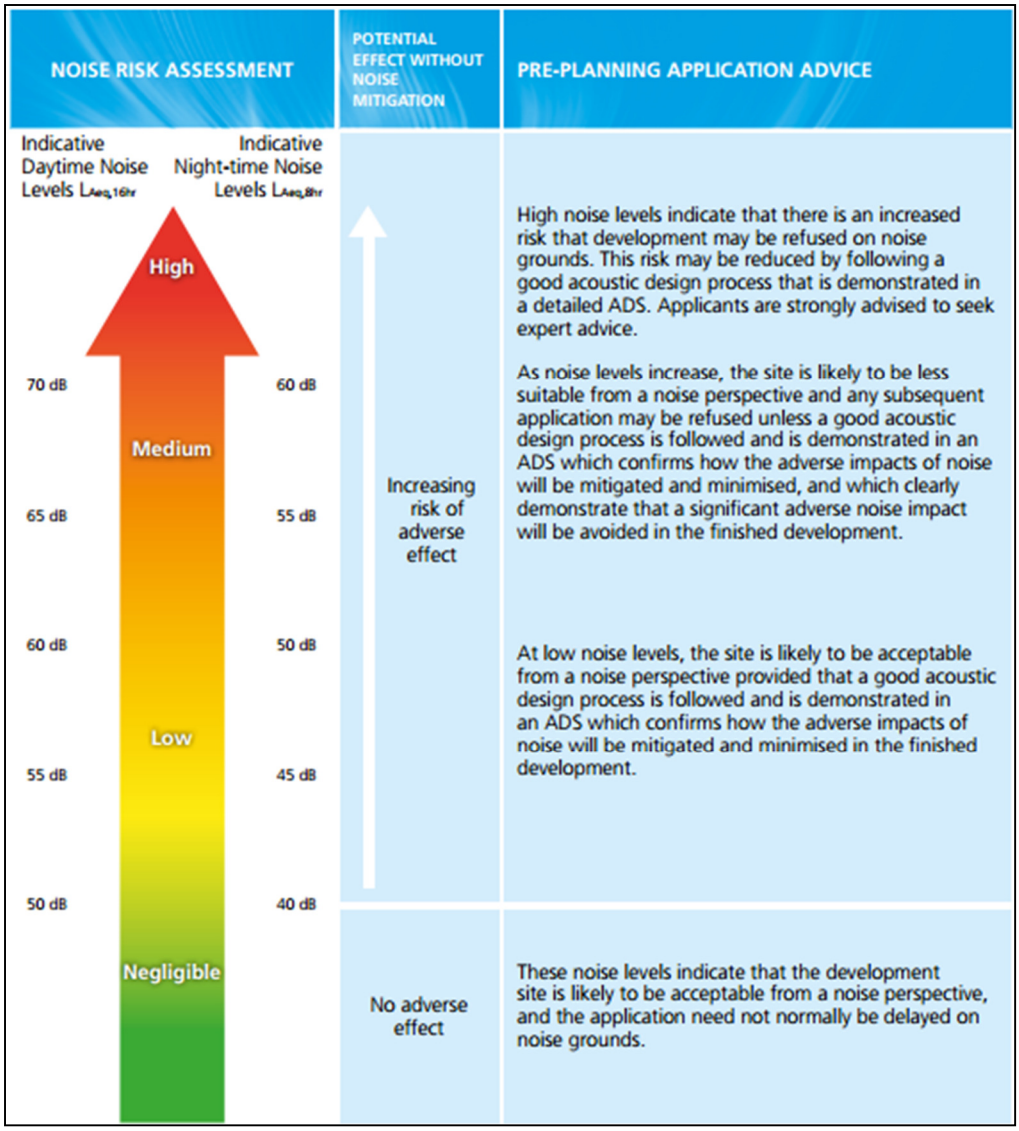


**Figure 1 – ProPG Stage 1 Initial Noise Risk Assessment**

ProPG: Stage 2 – Full Assessment

The Stage 2 assessment is four key elements to be undertaken in parallel:

1. Good acoustic design
2. Internal noise level guidelines
3. External amenity area noise assessment
4. Assessment of other relevant issues

The target noise levels are shown in Table 2 and are based upon the levels in BS8233:2014 and the WHO Guidelines.

| **Activity** | **Location** | **07:00 to 23:00hrs** | **23:00 to 07:00hrs** |
|---|---|---|---|
| Resting | Living room | 35dB $L_{Aeq,16hr}$ | - |
| Dining | Dining room/area | 45dB $L_{Aeq,16hr}$ | - |
| Sleeping (daytime resting) | Bedroom | 35dB $L_{Aeq,16hr}$ | 30dB $L_{Aeq,8hr}$<br>45dB $L_{AF,max}$ |
| For external amenity areas that are an intrinsic part of the overall design, noise levels should ideally not be above the range of 50 – 55dB $L_{Aeq,16hr}$. | | | |

**Table 2 – ProPG Stage 2 assessment target noise levels**

## 3 DETAILS OF THE SITES

The two sites lie either side of Reepham Rd to the North of Hellesdon, with Norwich Airport to the East.

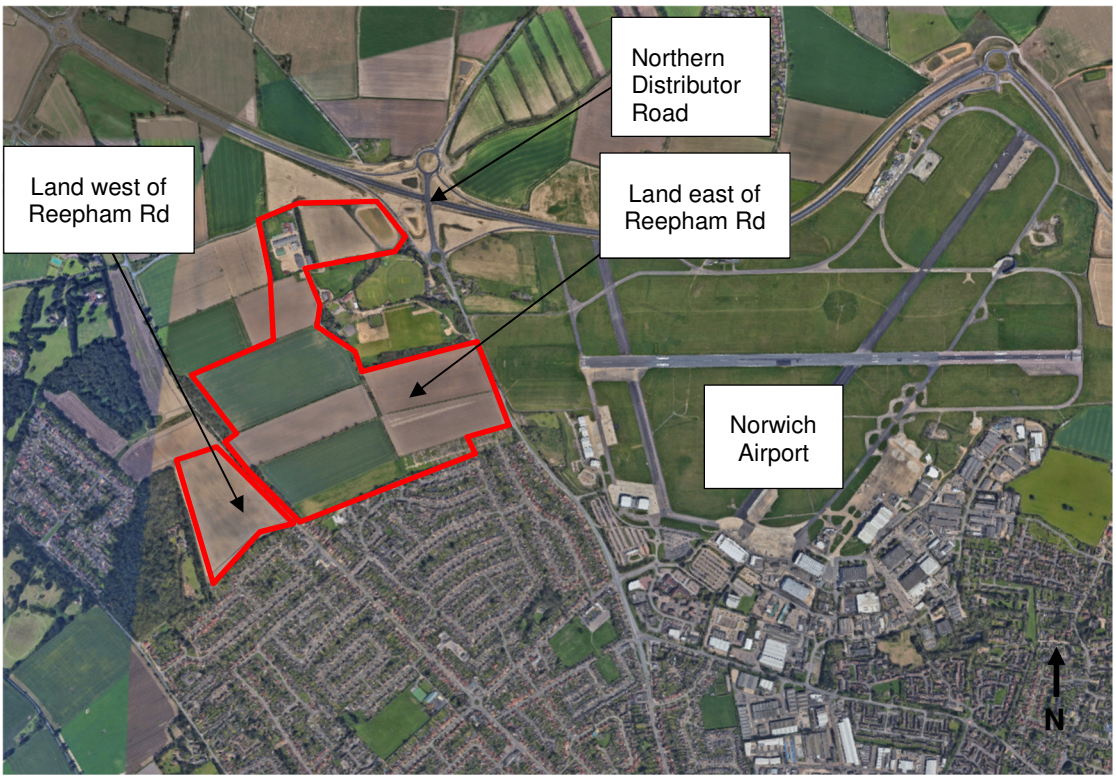


**Figure 2 - Aerial view showing site and surrounding area © Google 2020**

Should the sites be developed, it is initially proposed to allocate the different portions of land as follows, based on the various site constraints:

- Residential - Southern part of the East site and the whole of the West site.
- Commercial – Northern part of the East site and the whole to the East site.
- Public amenity land – Central part of the East site


**Figure 3 - Illustrative development framework plan**

Parts of the site are directly under the western flightpath for Norwich airport and noise from aircraft movements is the dominant source of noise on the sites. Besides activity associated with the airport, the only significant sources of noise affecting the sites is traffic on the roads which adjoin the site. The impact of traffic noise would have to be considered as part of a detailed assessment for residential developments on the site. However, we would not expect road traffic noise levels to be a significant consideration in any areas other than those immediately adjacent to the carriageways.

# 4 NOISE FROM AIRCRAFT

The Norwich International Airport Draft Masterplan was published in 2017. This document reports existing (2015) and predicted (2030 and 2045) noise levels in and around the airport site in accordance with the requirements of the Aviation Policy Framework. It should be noted that in general, levels are predicted to increase between 2015 and 2030, and then to decrease as quieter aircraft are introduced.

## 4.1 Daytime levels (LAeq)

The daytime plots show noise contours in 6 dB increments from 57 dB $L_{Aeq(16\ hours)}$ upwards. Figure 4, Figure 5 and Figure 6 below show excerpts from these plots with the proposed residential areas overlaid in orange.

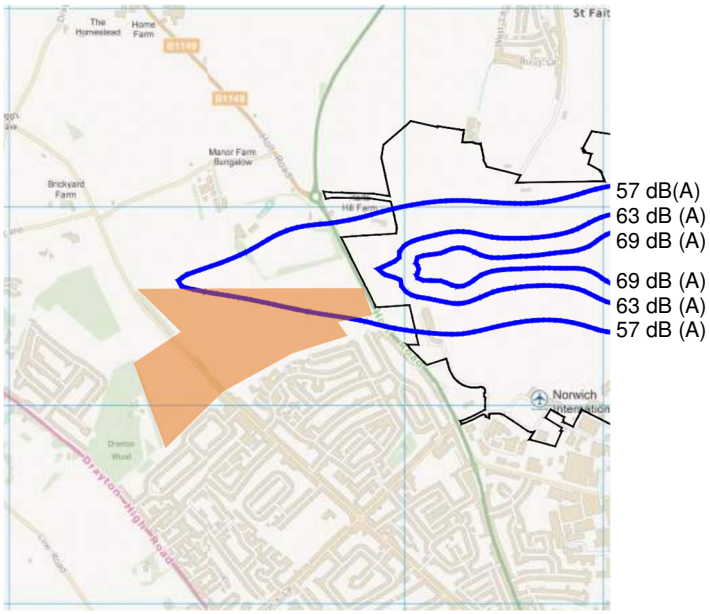


**Figure 4 - 2015 Daytime noise contours © Norwich Airport**

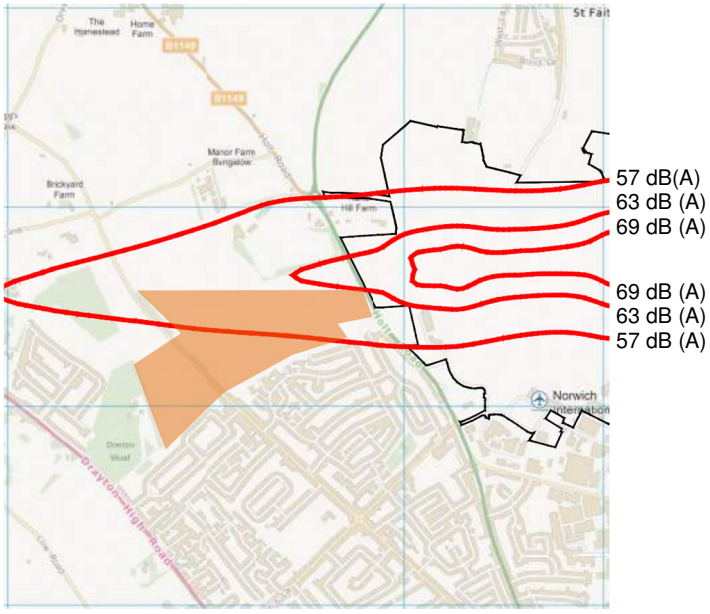


**Figure 5 – 2030 Predicted Daytime noise contours © Norwich Airport**

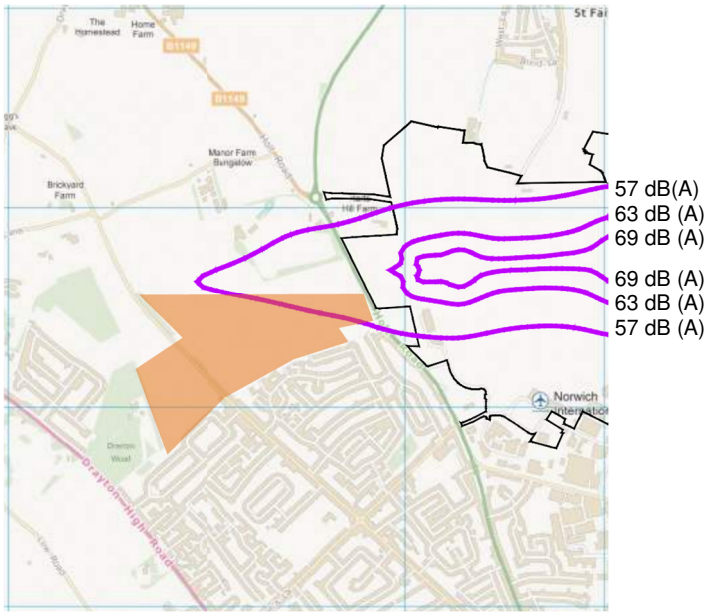


**Figure 6 - 2045 Predicted daytime noise contours © Norwich Airport**

These graphs show that aircraft noise levels will be within the 57 to 63 dB $L_{Aeq(16\ hr)}$ contour in the north-east corner of the proposed residential area but outside the 63 dB $L_{Aeq(16\ hr)}$ contour. Noise levels in the remainder of the proposed residential areas will be below 57 dB $L_{Aeq(16\ hours)}$ but the precise levels are not known because this data is below threshold of the noise maps.

## 4.2 Night-time levels (LAeq)

Figure 7, Figure 8 and Figure 9 show the night-time noise plots with the proposed residential areas overlaid in orange.

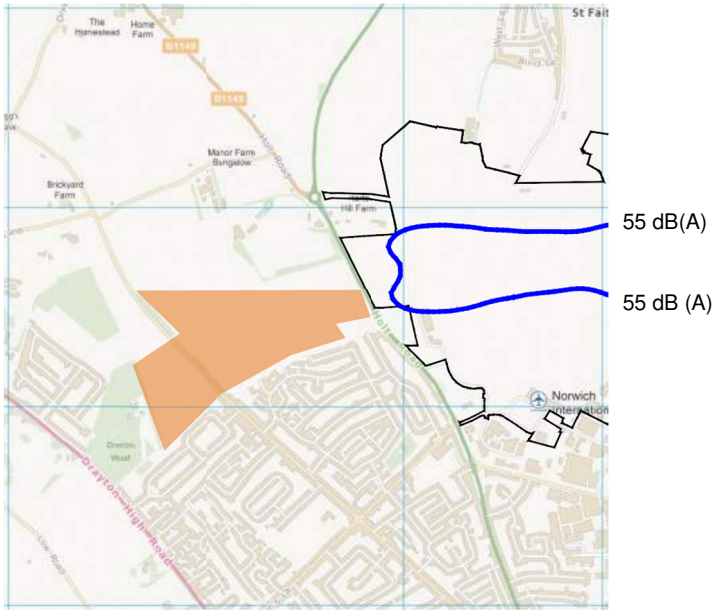


**Figure 7 - 2015 Night-time noise contours © Norwich Airport**

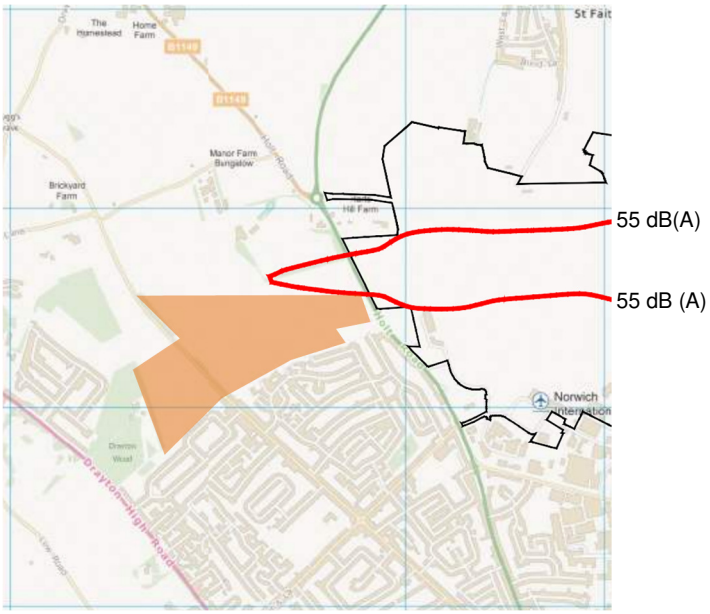


**Figure 8 - 2030 Predicted Night-time noise contours © Norwich Airport**

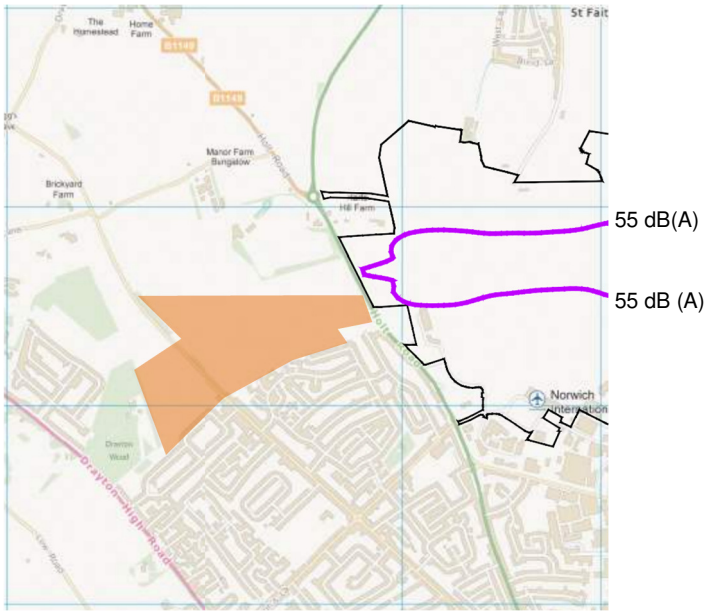


**Figure 9 – 2045 Predicted Night-time noise contours © Norwich Airport**

These graphs show that night-time aircraft noise levels will below 55 $L_{Aeq(8\ hr)\ the}$ across the proposed residential area in all instances. Noise levels are likely to be substantially lower than this towards the southwest of the site, but the precise levels are not known because this data is below threshold of the noise maps.

### 4.3 Night-time levels ($L_{AFmax}$)

For night-time (23:00 – 07:00 hours) aircraft noise, maximum noise levels are normally considered as well as average ($L_{Aeq}$) levels.

We understand that in normal circumstances there are no aircraft movements flights after 23:00 but that there are a number of early morning fixed wing and helicopter movements between 06:00 and 07:00.

The NIA draft masterplan does not include plots of typical maximum noise levels from individual events. During a visit to the site we noted that individual helicopters leaving the site on the western flight path generated max levels of between 68 and 84 dB $L_{AFmax}$ across the site. There were no fixed wing aircraft movements during our visit to site due to the COVID 19 related travel restrictions in place at the time. Based on our experience of measurements at similar sized regional airports, we would expect medium sized commercial fixed wing aircraft passes on the western flight path to generate broadly similar maximum noise levels.

### 4.4 Discussion

The data published by Norwich Airport shows that even at the worst case 2030 predictions, noise levels are expected to be below the threshold at which the Aviation Policy Framework requires airport operators to provide sound insulation to noise sensitive buildings.

An initial risk assessment using the ProPG methodology suggests that without any noise mitigation measures in place, the proposed residential areas fall within the negligible risk category in the south-west corner rising to low-medium risk in the north-east.

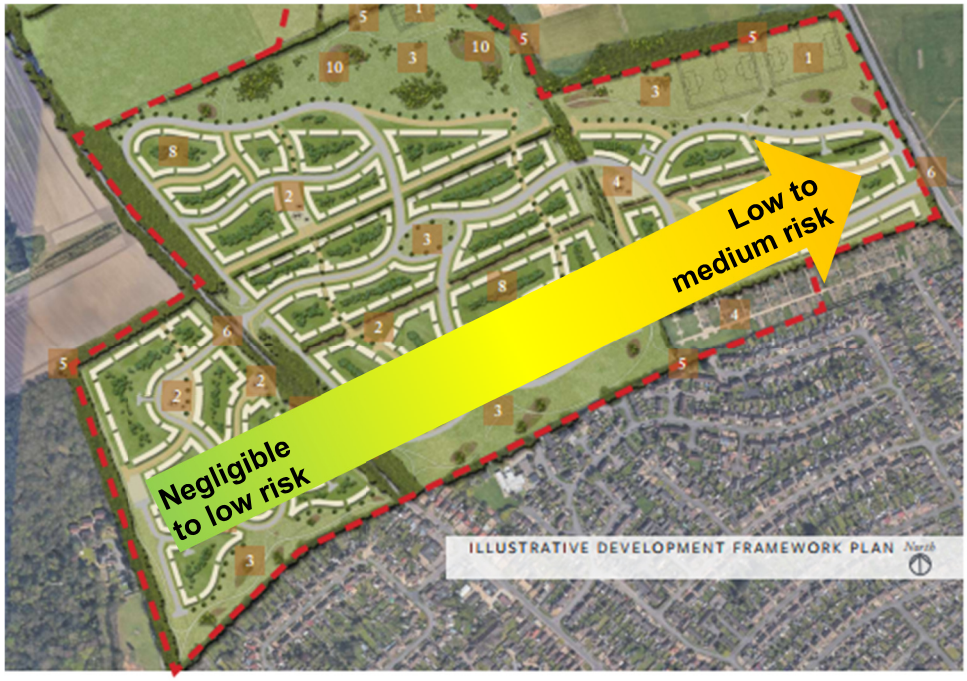


**Figure 10 - ProPg Stage 1 Risk Assessment for proposed residential areas**

For areas of a site at low risk, ProPG states:

*"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 acoustic design statement which confirms how the adverse impacts of noise will be mitigated and minimised in the finished development."*

For areas of a site at medium risk, ProPG states:

*"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 acoustic design statement which confirms how the adverse impacts of noise will be mitigated and minimised, and which clearly demonstrate that a significant adverse noise impact will be avoided in the finished development."*

On this basis, we would not expect aviation noise levels at the site to preclude residential developments on the proposed sites, provided appropriate noise mitigation measures are incorporated with these developments. Typical noise mitigation measures are discussed in Section 5 of this report.

# 5 NOISE MITIGATION MEASUREMENTS

## 5.1 Design criteria

We would expect the local authority to require any residential development on the site to be designed to meet the BS8233:2014 internal ambient noise criteria as set out in Section 2 of this report. These levels are summarised below:

- 35 dB $L_{Aeq,16hr}$ daytime
- 30 dB $L_{Aeq,8hr}$ night-time
- 45 dB $L_{AF,max}$ night-time (bedrooms only)

BS8233 also recommends that noise levels in external amenity areas should ideally not exceed 50 dB $L_{Aeq,T}$ and that 55 dB $L_{Aeq,T}$ should be considered as an upper limit. However, BS8233 accepts that these guideline values are not achievable in all circumstances where development might be desirable.

## 5.2 Achieving the criteria

### *5.2.1 Internal levels*

The sound insulation requirements for dwellings on the site are likely to be governed by the BS8223 night-time $L_{AF,max}$ criterion in bedrooms.

The performance specification of individual building elements to meet the above design criteria would be determined during a detailed design assessment for dwellings on the site. However, we would expect the internal ambient noise criteria to be achievable with conventional constructions even on those parts of the site closest to the airport. This is based on our calculations using data for the following notional building elements:

- **Walls** –Cavity masonry external walls
- **Roof** / **Ceilings** – Conventional roof constructions with acoustically absorbent loft insulation and sound insulating plasterboard ceilings in rooms.
- **Glazing** – Double glazing and frames with a combined minimum sound insulation performance of 40 dB Rw.
- **Ventilation** – Acoustically attenuated ventilation systems such as a centralised whole house MVHR system or passive equivalent to match the sound insulation performance of the building envelope.

### *5.2.2 External levels – East site*

The external levels towards to the north-east corner of the designated residential area could exceed the BS8233 recommended upper limit for external amenity spaces recommended in BS8233 by up to 8 dBA (based on the worst case 2030 projections). Noise levels along the northern boundary of the site are likely to exceed the BS8233 recommendation by around 3 dBA (based on the worst case 2030 projections). Noise levels on the remainder of the site are likely to be substantially lower and are below the BS8233 recommended upper limit to the southwest of the site.

BS8233 states that these guideline values are not achievable in all circumstances where development might be desirable and we would not normally expect noise levels in external amenity areas on their own to be a deciding factor in the allocation of land for residential developments.

### *5.2.3 External levels – West site*

We would expect noise levels on the West site to meet the BS8233 recommendations for external amenity areas.

## 6 CONCLUSIONS

- We have assessed the impact of aircraft noise onto land to the East and West of Reepham Road in relation to a potential allocation for residential development within the Greater Norwich Development Plan.
- A review of Norwich Airport Draft Masterplan confirms that noise levels from aircraft will be below the 63 dB $L_{Aeq,(16hr)}$ threshold at which the Aviation Policy Framework requires airport operators to provide sound insulation to noise sensitive buildings.
- An initial site risk noise assessment in accordance with ProPG indicates that the proposed residential areas fall within the negligible risk category in the south-west corner rising to low-medium risk in the north-east.
- ProPG advises that proposed development sites in the low risk category are *"likely to be acceptable from a noise perspective provided that a good acoustic design process is followed and is demonstrated in an acoustic design statement which confirms how the adverse impacts of noise will be mitigated and minimised in the finished development."*
- For sites in the medium risk category, ProPG states that *"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 acoustic design statement which confirms how the adverse impacts of noise will be mitigated and minimised, and which clearly demonstrate that a significant adverse noise impact will be avoided in the finished development."*
- We would expect the internal ambient noise criteria set out in BS8233 to be easily achievable in dwellings on the site with standard noise mitigation measures, as discussed in Section 5 of this report.
- Daytime average noise levels are likely to exceed the upper limit recommended for outdoor amenity areas in BS8233 on some parts of the East site. However, BS8233 accepts that these guideline values are not achievable in all circumstances where development might be desirable.
- Based on the above, we would not expect aviation noise levels to preclude residential developments in the areas proposed on the site.

## APPENDIX A TECHNICAL TERMS AND UNITS RELEVANT TO THIS REPORT

**Decibel (dB)** - This is the unit used to measure sound level. The range of human hearing from the quietest detectable sound to the threshold of pain is very large. If a normal linear scale of measurement were used, it would have to range from 20 µPa to 200,000,000 µPa. Using such large figures would be unmanageable and for this reason sound pressure levels are expressed on a logarithmic scale, which corresponds to the almost logarithmic response of the ear and which compresses the range to a manageable 0dB to140dB.

**Sound Pressure Level ($L_p$ or SPL)** - This is a function of the source and its surroundings and is a measure in decibels of the total instantaneous sound pressure at a point in space. The SPL can vary both in time and in frequency. Different measurement parameters are therefore required to describe the time variation and frequency content of a given sound. These are described below.

**Frequency** - This refers to the number of complete pressure fluctuations or cycles that occur in one second. Frequency is measured in Hertz (Hz). The rumble of thunder has a low frequency, while a whistle has a high frequency. The sensitivity of the ear varies over the frequency range and is most sensitive between 1KHz and 5KHz.

**Octave and One-Third Octave Bands** - The human ear is sensitive to sound over a frequency range of approximately 20 Hz to 20,000 Hz and is more sensitive to medium and high frequencies than to low frequencies. To define the frequency content of a sound, the spectrum is divided into frequency bands, the most common of which are octave bands. Each band is referred to by its centre frequency, and the centre frequency of each band is twice that of the band below it. Where it is necessary for a more detailed analysis octave bands may be divided into one-third octave bands.

'**A' Weighting** - The sensitivity of the human ear varies with frequency, some frequencies sound louder than others. The 'A'-weighting curve represents the non-linear frequency response of the human ear and is incorporated in an electronic filter used in sound level meters. Measurements using an 'A'-weighting filter makes the meter more sensitive to the middle range of frequencies, which approximates to the response of the ear and the subjective loudness of the sound. Sound level measurements using 'A'-weighting will include the subscript A, e.g. dB(A).

**Statistical Analysis** - These figures are normally expressed as LN, where L is the sound pressure level in dB and N is the percentage of the measurement period. The LN figure represents the sound level that is exceeded for that percentage of the measurement period. $L_{90}$ is commonly used to give an indication of the background level or the lowest level during the measurement period. $L_{10}$ may be used to measure road traffic noise. See Figure A1.

**$L_{Amax}$** - The highest A weighted sound pressure level recorded during the measurement period. The time constant used (Fast or Slow) should be stated. See Figure A1.

**$L_{eq,T}$** - The equivalent continuous sound level is used to measure sound that varies with time. The $L_{eq,T}$ is the notional equivalent steady sound level, which contains the same acoustic energy as the actual varying sound level over the period of measurement. Because the averaging process used is logarithmic, the $L_{eq,T}$ level tends to be dominated by the higher sound levels measured. See Figure A1 overleaf.

## APPENDIX B MEASURING EQUIPMENT AND CALIBRATION

Job reference and title: 12663 Land East and West of Reepham Rd, Hellesdon

Measurement location: As above

Measurement date(s): 23/06/2020

**Measuring equipment used:**

| Equipment description / serial number | Type number | Manufacturer | Date of calibration expiration | Calibration certificate number |
|---|---|---|---|---|
| Precision sound level meter serial no. A2A-10758-E0 | XL2-TA | NTi Audio | 24/10/2021 | 33189 |
| Microphone serial no. 8133 | MC230 | NTi Audio | 24/10/2021 | 33188 |
| Microphone pre-amplifier serial no. 5308 | MA220 | Neutrik | 24/10/2021 | 33189 |
| Microphone calibrator serial no. 34541 | NOR-1251 | Norsonic | 24/10/2021 | 33187 |

Calibration level: 114.0 dB @ 1 kHz

Persons in charge of measurements: Joe Bear MIOA

Measurement parameters: 1/1 Octave band $L_{eq,\ 5\ min.}$

1/1 Octave band $L_{Fmax,\ T}$