MAX FORDHAM

Wolfson College, Oxford - Decarbonisation Project

Noise Strategy

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Max Fordham LLP
Max Fordham LLP
42/43 Gloucester Crescent
London
NW1 7PE

T +44 (0)20 7267 5161

maxfordham.com

ISSUE HISTORY

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1.0 INTRODUCTION

Max Fordham LLP (MFLLP) has been appointed to provide advice in relation to acoustic matters for the proposed development at Wolfson College. MFLLP Acoustics Team is a member of the Association of Noise Consultants (ANC).

The proposed development consists in the upgrade of plant equipment to reduce the carbon footprint of the college. This report sets out the strategy for controlling noise impact resulting from new items of plant equipment.

A Glossary of Acoustic Terminology is included at the end of this document. Section 6.0.

1.1 The Site and Proposed Plant Equipment Location

The Wolfson College is located in North Oxford. The college site has the following adjacencies:

- open fields to the east
- residential houses to the north-west, west and south
- a sports field (associated with another college) to the north.

Figure 1 shows the building related to the college, highlighted in purple, and noise sensitive receivers that would expected to be most affected by the proposed mechanical plant, highlighted in blue. NSR1 is to the north of the college while NSR2 and NSR3 are to the west and south, respectively. In the image highlighted in yellow is a sport field not related to the college. The sport field is to the north of the college and to the east of NSR1.

Figure 1: Arial image of Wolfson College and surrounding area with college buildings, noise sensitive receivers (NSRs) and sport field highlighted.

2.0 RELEVANT POLICY AND STANDARDS

2.1 Oxford Local Plan 2001-2016

The Oxford Local Plan 2001-2016 sits within the Adopted Development Plan Framework for Oxford. Work on a revised Oxford Local Plan (to cover the period up until 2036) is underway but this document has not, at the time of submission, come into force. As such, the assessment presented in this report is based on the current 2001-2016 Local Plan. It not expected that the revised Local Plan will substantively alter the policy in regard of noise.

The Local Plan sets out the policies and proposals for future development and land use in Oxford for the period 2001 to 2016 with the objective to promote positive measures to improve the local environment and to meet the needs of local communities. The Plan needs to control development that might harm the environment, and also needs to encourage remedial action where damage has already occurred.

The Core Policies form the heart of the Oxford Local Plan, and set out the strategy the City Council will apply in promoting and controlling development throughout Oxford. These policies set the overall context in which the following detailed sections need to operate, and overarch the other policies in the Plan.

Section 2.19 of the Core Policy deals with the environmental impacts that proposals for development have to minimise. In general, development should not give rise to unacceptable levels of noise, smell, dust, fumes, light or noxious emissions affecting areas beyond the site boundary, or to unacceptable levels of air or water pollution.

In particular Policy CP21 refer to Nuisance and Noise, here extract and given in Figure 2.

POLICY CP.21 - NOISE

Planning permission will be refused for developments which will cause unacceptable noise. Particular attention will be given to noise levels:

a. close to noise-sensitive developments; and

b. in public and private amenity space, both indoor and outdoor.

The City Council will impose easily enforceable conditions to control the location, design, layout and operation of development proposals to minimise any adverse impact as a result of noise and its transmission.

Proposals for noise sensitive developments should have regard to:

c. the existing sources of noise, e.g. from roads, railways and other forms of transport; industrial and commercial developments; sporting, recreation and leisure facilities;

d. internally generated noise or associated externally generated noise; and

e. the need for appropriate sound insulation measures.

Figure 2: Policy CP21 as set out in Oxford Local Plan 2001-2016

In determine planning application, the City Council will have regard to the advice in PPG 24, Planning and Noise. This document is now defunct and not further reference to it will be made in this report.

Moreover, the City Council will pay particular attention to the effect of several proposals which each might increase the background noise level by a small (acceptable) amount, but where the total impact of the proposal is unacceptable. This cumulative effect has been defined “noise creep” in the Core Policy.

2.2 British Standard 4142:2014

British Standard 4142:2014 - *Methods for rating and assessing industrial and commercial sound*, sets the methodology for rating and assessing sound of an industrial and commercial nature, which includes sound from fixed installations such as mechanical and electrical plant and equipment.

In BS 4142:2014, a noise rating is determined and compared with the existing local background sound level based on several more cumulative acoustic feature corrections to apply where appropriate. For example if the noise includes a distinguishable tone, impulse, intermittency or other readily distinguishable sound characteristic, then additional *cumulative* penalties individually ranging from 0 to 9 dB may be applied depending on the type of noise.

BS 4142:2014 seeks to determine a "representative" background sound level, stating that "…*the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods*".

The assessment of the impact depends upon the margin by which the rating level of the specific sound source exceeds the background sound level (i.e. as before) but also promotes a consideration of the context in which the sound occurs when making an assessment. BS 4142:2014 states that an initial estimate of the impact of the specific sound is made by subtracting the measured background sound level from the rating level, while considering the following points:

a) Typically, the greater this difference, the greater the magnitude of the impact.
b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

2.3 British Standard 8233:2014

British Standard 8233:2014 – *Guidance on sound insulation and noise reduction for buildings* (BS 8233) provides guidance on internal ambient noise levels, resulting from break-in of external environmental noise that should not be exceeded in various locations within dwellings.

BS 8233 also provides guidance on desirable noise levels in areas that are intended to be used for external amenity space, such as gardens, balcony and roof gardens which are intended to use for relaxation. For these spaces it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$ up to a level of 55 dB $L_{Aeq,T}$ for noisier environment.

Note that, since the publication of BS 8233, the World Health Organisation have published "Environmental Noise Guidelines for the European Region" 2018. This includes the following statements:

- "all Community Noise Guideline (1999) values…should remain valid"
- "the current guidelines complement the Night Noise Guidelines from 2009"

It is therefore interpreted that the relevant WHO guidelines at the time of publication of BS 8233 are still valid.

3.0 NOISE ENVIRONMENT

3.1 Expected Noise Environment

The current lockdown measures due to the COVID-19 pandemic impacts on the accuracy of the noise survey measurements. The reduction in transportation affects the background noise measurements. In line with the ANC (Association of Noise Consultants) guidance on environmental noise assessment, the noise environment around the college has been established through the analysis of previous noise survey conducted by MF in proximity to the site.

Figure 3 shows an aerial view of the north and central area of Oxford indicating the location of previous noise surveys conducted by MF together with the location of the college. Measured background noise levels and the dates the measurements were taken are reported on the image.

The measured L_{A90} values, show a stable night-time background noise throughout the area. During the daytime the difference is larger, and it is most likely linked to the proximity to roads. During the night-time the L_{A90} varies between 40 and 37 dB, while during daytime between 57 and 43 dB.

The background noise levels at Location B have been selected as the representative noise environment around the college. The location is the most similar to the noise environment around the college since distant and shielded from main noise source.

Note on representative background sound levels
BS 4142:2014 seeks to determine a "representative" background sound level, stating that "…the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods". A definitive method of selecting a representative background sound level is not prescribed in BS 4142:2014, although an example is presented where the modal value is selected from a statistical analysis.

In our experience, a reasonable approach is to adopt the repeatable method of selecting the 40th percentile value of the L_{A90} data periods. This generally accounts for potentially unrepresentative high values and untypical events, while usually representing values near the median of the remaining 'valid' distribution.

Figure 3: Aerial photo of Oxford North area showing previous noise surveys conducted by MF, the measured levels, and Wolfson College location. (aerial image taken from Google Earth)

4.0 NOISE LIMITS AT RECEIVERS

Plant noise emissions are given in terms of a Noise Rating (L_{Ar}) which is evaluated from the noise level in accordance with BS 4142:2014 by including several cumulative corrections to account for factors such as distinguishable tone, impulse, intermittency or other sound characteristics.

With the background noise levels identified in Section 3.1, and following regulations and standards of Section 2.0 two noise limit targets have been identified. The first, Target A, is set to avoid noise disturbance to NSRs, while the second, Target B, is to limit noise disturbance to outdoor areas and to buildings related to the college.

Table 1: Target A- Noise limit at NSR boundary.

Period	Expected background noise level	Oxford Local Plan, 5dB less than background	BS4142, Tonality correction, dB	Target A, BS 4142 Rating Level
Daytime	L_{A90} 43 dB	-5 dB	-2 dB	L_{Ar} 36 dB
Night-time	L_{A90} 38 dB	-5 dB	-2 dB	L_{Ar} 31 dB

Table 2: Target B- Noise level limit at sport field boundary and proposed design target at college building's façades.

Period	WHO 1999 community noise guidelines	Target B, noise level outside
Daytime	50 dBA	L_{Aeq} 50 dB
Night-time*	45 dBA	L_{Aeq} 45 dB

***Night-time noise limit is a design target for the college buildings and does apply to Sport Field**

Noise Levels at Wolfson College Buildings

Noise Target B at the buildings related to the college may be difficult to achieve at all points of the building façades closest to the equipment. It is left to the college discretion if it is required to further reduce noise emitted by the plant.

5.0 NOISE PREDICTIONS

5.1 Proposed Plant

Most of the plant equipment is surrounded by college buildings. Two units are on the North boundary of the college in close proximity to the Sport Field, while a third unit is to the South of the college in proximity to The locations of the proposed plant are shown in Figure 4.

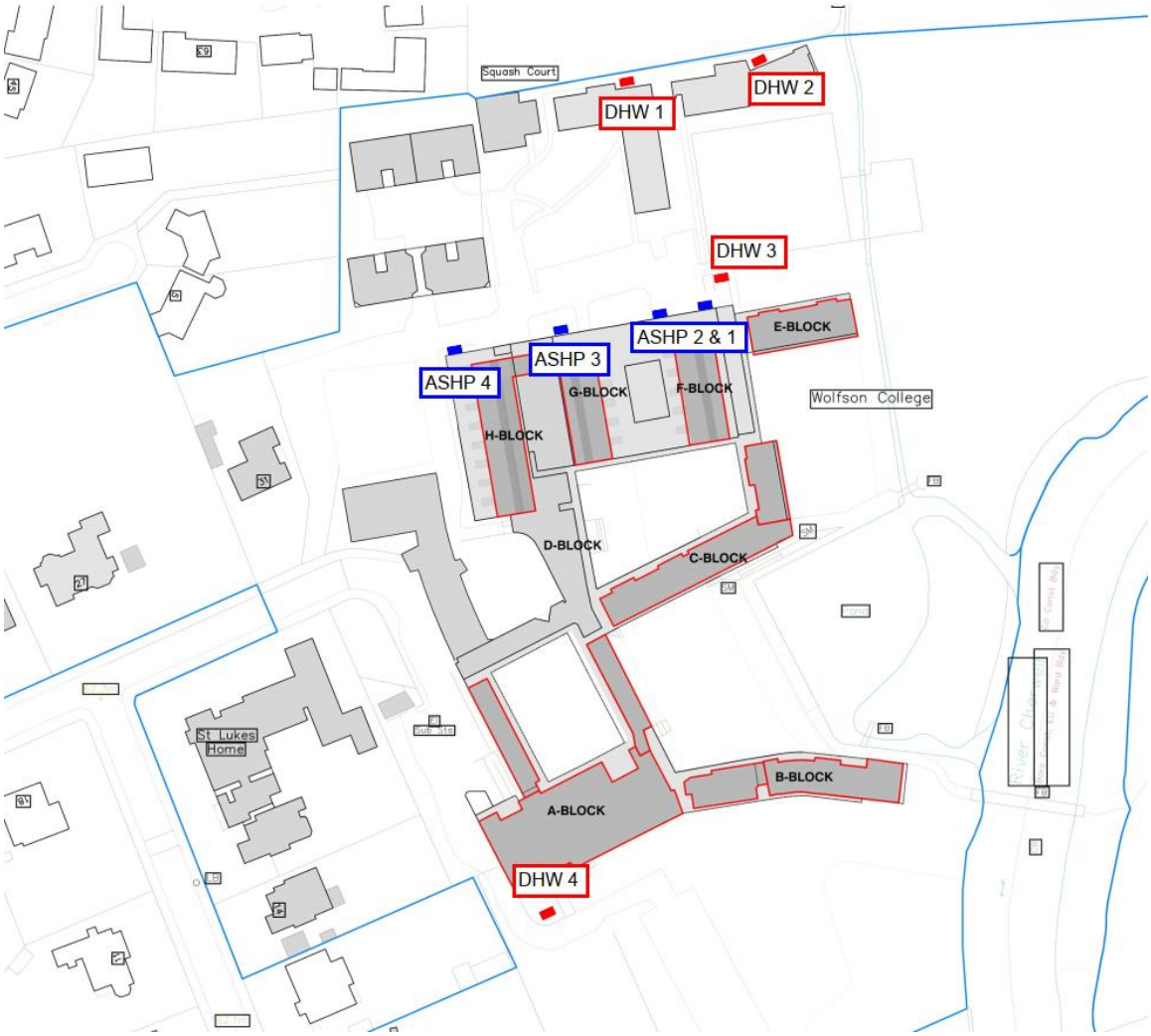

Figure 4: Map of the site showing location of proposed equipment.

5.2 Plant Noise Emission Limits

Noise predictions and noise mapping were performed using a commonly used 3D environmental noise software package, SoundPlan v8.1.

The model was built using the satellite map image from Google Maps and drawings of the proposed site. Topographical elevations were included as well as buildings. Existing building heights were estimated from images, Google Street View and Google Earth.

From the analysis of the noise propagation paths, limits for each piece of equipment has been identified. The limits are summarised in Table 3. The limits are given in terms of A-weighted sound pressure level at 1m from that item of plant (in isolation).

Table 3: Maximum noise levels at 1m from equipment to meet Target A and Target B noise limits.

Limit	DHW 1	DHW 2	DHW 3	DHW 4	ASHP 1	ASHP 2	ASHP 3	ASHP 4
LAeq at 1 metre	61 dB	63 dB	69 dB	66 dB	64 dB	64 dB	65 dB	62 dB

5.3 Plant Noise Emission Noise Map Contours

The noise limit at 1 metre on Table 3 have been inserted in the environmental noise model as a noise source. The resulting noise contour map at 2 metre height from the ground is shown on Figure 5.

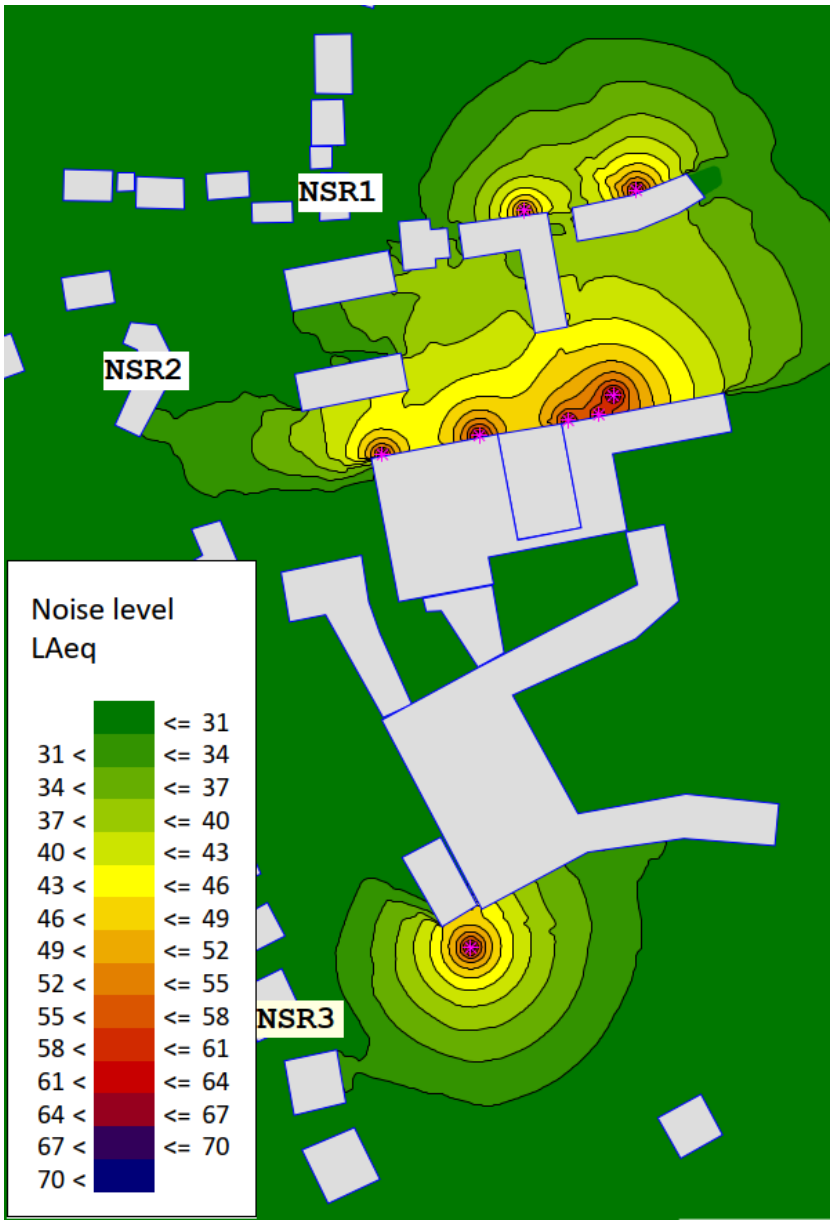

Figure 5: Noise contour map of site at 2m height with proposed plant equipment emitting Table 3 noise levels.

5.4 Plant Noise Assessment

Noise propagation predictions in Figure 5 show that, provided noise emissions from plant items are controlled to the levels described in Table 3 of this report, all noise sensitive receivers (NSRs) are expected to be within Target A night-time limit. The daytime limit is less onerous.

Thus, following BS 4142:2014 assessment the noise from the proposed plant would have a low impact or negligible impact on the residential neighbours to the college.

The noise predictions in Figure 5 indicate that around 99% of the Sports Field to the north of the college will be within the Target B daytime limit. A small area of the Sports Field very close to the DHW1 and DHW2 units may exceed the target. However, given the limited extent of the area affected, the potential for adverse impact on the use of the Sports Field is expected to be low or negligible.

6.0 APPENDIX – GLOSSARY OF ACOUSTIC TERMINOLOGY

SOUND POWER LEVEL, or L_W (decibels, dB)
The total amount of sound energy per unit of time generated by a particular sound source. This corresponds to a reference sound power of 10 pW.

SOUND PRESSURE LEVEL, SPL or L_P (decibels, dB)
A measure of the instantaneous sound pressure at a point in space. The threshold of hearing occurs at approximately L_P=0 dB (which corresponds to a reference sound pressure of 20 μPa).

A-WEIGHTED SOUND PRESSURE LEVEL, L_A (dBA)
A-weighted sound pressure level values are frequency-weighted in a way that approximates the frequency response of the human ear and allows sound levels to be expressed as a single figure value.

EQUIVALENT CONTINUOUS A-WEIGHTED SPL, $L_{Aeq,T}$ (dBA)
Energy average of the A-weighted sound pressure level over a time period, T. The level of a notional continuous sound that would deliver the same A-weighted sound energy as the actual fluctuating sound over the course of the defined time period, T.

MAXIMUM A-WEIGHTED SPL, L_{AFmax} (dBA)
Maximum A-weighted sound pressure level measured with fast time weighting.

BACKGROUND SOUND LEVEL, $L_{A90,T}$ (dBA)
The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90% of a given time interval ,T, measured using time weighting, and quoted to the nearest whole number of decibels.

NOISE RATING LEVEL, $L_{Ar,Tr}$ (dBA)
The A-weighted specific sound level plus any adjustment for characteristic features of the sound (for example if the sound features impulsive or tonal components). Used in BS 4142:2014 assessments.

SPECIFIC SOUND LEVEL, $L_s = L_{Aeq,Tr}$ (dBA)
The equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r.