

**PROPOSED ALTERATIONS TO THE FIRWOOD BUILDING
XAVERIAN COLLEGE, RUSHOLME**

PLANT NOISE ASSESSMENT

**On behalf of:
Kilhey Consultancy Limited**

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Report prepared by:
Hepworth Acoustics Ltd
21 Little Peter Street
Manchester
M15 4PS

On behalf of:
Kilhey Consultancy Limited

Report prepared by:
James Shaw BSc AMIOA – Consultant



Report checked by:
Graham Bowland BSc MIOA – Technical Director



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1.0 INTRODUCTION

1.1 Hepworth Acoustics Ltd was commissioned by Kilhey Consultancy to carry out a noise assessment in connection with a proposed planning application for alterations to the Firwood Building at Xaverian College in Rusholme.

1.2 The original version of this report (ref: 'P20-537-R01v1') dated February 2021, provided an assessment of the potential noise impact from the proposed plant upon the nearest dwellings and provided recommendations for a cumulative plant noise limit. This report update has been prepared following planning approval and to satisfy Condition 5 of the approval which states:

5) Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5dB (L_{Aeq}) below the typical background (L_{A90}) level at the nearest noise sensitive location.

Prior to installation of any externally mounted plant or equipment the scheme shall be submitted to and approved in writing by the City Council as local planning authority in order to secure a reduction in the level of noise emanating from the site.

1.3 Xaverian is a sixth form college located in a broadly residential area in Rusholme and comprises eight buildings around the perimeter of College Green, which is a large green space to the north of the Firwood Building. The location of site is indicated in Figure 1.

1.4 The refurbishment proposals are for the relocation of the kitchen and dining hall from part of the Firwood Building to a new location on the ground floor of the building, where the existing entrance/reception and administration offices are currently sited. The offices will be relocated to the upper floors of the Firwood Building and the reception will be moved to the Birtles Building. The existing and proposed Firwood Building layouts are shown in Figure 2.

1.5 We understand that three existing air conditioning condensers are to be reused (x3 Mitsubishi SUZ-M71VA) and two new air conditioning condensers are to be installed (x1 Mitsubishi PUZ-7M71VHA & x1 Mitsubishi PUZ-M140YKA) within the courtyard area to the west of Lower Park Road some 60m from the nearest dwellings. The location of the equipment is indicated in Figure 2.

1.6 This assessment has included:

- A background noise survey outside the nearest residential properties.
- Calculation of plant noise levels outside the nearest residential properties.
- A BS 4142:2014+A1:2019 assessment of plant noise impact.

- 1.7 The various noise units and indices referred to in this report are described in Appendix I. All noise levels mentioned in the text have been rounded to the nearest decibel, as fractions of decibels are imperceptible.

2.0 GUIDANCE AND ACOUSTIC DESIGN CRITERIA

- 2.1 A baseline background and ambient noise survey has been carried out by Hepworth Acoustics at a location representative of the nearest dwellings to the new kitchen. The measurement location is indicated in Figure 1.
- 2.2 The measurements are representative of the background noise levels at the nearest dwellings to the south on Crescent Range some 50m to the south of the proposed kitchen location. Attended measurements were taken between 14:00 and 15:30 on Wednesday 6th January 2021.
- 2.3 Measurements were taken in 15-minute periods at approximately 1.4m above local ground level and in free-field conditions. The calibration of the sound level meter was checked with a field acoustic calibrator before and after each survey with no variance noted.
- 2.4 The measured 15-minute values are considered to be representative of the corresponding 1-hour values in line with BS 4142.
- 2.5 The results of the noise survey are summarised in Table 1 and the full results are shown in Appendix II. Noise levels at both locations were primarily attributed to road traffic noise and noise from construction works at a nearby dwelling on Crescent Range.

Table 1: Range of Measured Noise Levels (dB)

Location	Daytime	
	L _{Aeq,15mins}	L _{A90,15mins}
Outside dwellings on Crescent Range	48-58	41-47

- 2.6 With the current government restrictions in response to the ongoing Covid-19 pandemic, it is likely that the background noise levels measured during our survey were lower than during normal conditions. Therefore, our assessment presents a worst-case scenario.

3.0 NOISE ASSESSMENT

- 3.1 British Standard 4142:2014, *'Methods for rating and assessing industrial and commercial sound'* (referred to hereafter as BS 4142) describes methods for rating and assessing sound of an industrial nature including;
- fixed installations which compromise mechanical and electrical plant and equipment;
 - loading and unloading of goods and materials at industrial and/or commercial premises.
- 3.2 BS 4142 requires the 'rating' sound level ($L_{A,r,Tr}$) for the operation to be compared with the background sound level (L_{A90}) in the absence of the operational noise.
- 3.3 With regard to the background sound level, BS 4142 states that *"it is important to ensure that values are reliable and suitably represent both the particular circumstances and periods of interest. For this purpose, the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods."*
- 3.4 The rating level ($L_{A,r,Tr}$) is derived based on the '*specific*' ($L_{Aeq,Tr}$) sound level attributable to the operation, corrected as necessary for the '*residual*' sound level, with an '*character correction*' added for any sound sources which give rise to tonal, impulsive, intermittent, or other characteristics readily distinctive against the residual acoustic environment.
- 3.5 A '*character correction*' is added to the specific sound level where '*certain acoustic features can increase the significance of impact*' at the residential locations. BS 4142 corrections for noise characteristics are summarised in Table 2.

Table 2: Summary of BS 4142:2014 Character Corrections

Noise Character	Correction (dB)				
Tonality	Audibility	Not tonal	Just audible	Clearly perceptible	Highly perceptible
	Correction	0	+2	+4	+6
Impulsivity	Audibility	Not impulsive	Just audible	Clearly perceptible	Highly perceptible
	Correction	0	+3	+6	+9
Intermittency	Audibility	Not Intermittent	Readily distinguishable against residual acoustic environment		
	Correction	0	+3		
Other	Audibility	N/A	Readily distinguishable against residual acoustic environment		
	Correction	0	+3		

- 3.6 The potential character/feature corrections for tonality, impulsivity and intermittency shown in Table 3 are additive, and therefore significant corrections can be applicable in worst-case situations.
- 3.7 An initial estimate of the impact of the noise under consideration is determined by subtracting the background level from the rating level. BS 4142 states that:
- Typically, the greater this difference, the greater the magnitude of the impact
 - A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context
 - A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context
 - The lower the rating level is relative to the measured background level, the less likely it is that the operation 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.
- 3.8 Condition 5 of the planning approval states that plant should be designed so as to achieve a rating level of 5 dB below the typical background (L_{A90}) level at the nearest noise sensitive location.
- 3.9 Therefore, the appropriate criterion for plant noise at this development would be to control the rating level from any externally mounted plant associated with the new kitchen to 5 dB below the existing typical background noise level (L_{A90}) at the nearest dwellings. We have adopted the most regularly occurring background noise level (the mode) from the results of our noise survey at the site as the basis for determining the plant noise limit at the nearest dwellings. The mode of the measured background noise levels was 45 dB L_{A90} . The limit is therefore 40 dB $L_{A,r,Tr}$.

4.0 ASSESSMENT OF PLANT NOISE

Proposed Equipment

- 4.1 The proposals for the new equipment include two new air-conditioning condensers and the redeployment of three existing condensers to be floor mounted within the courtyard as indicated in Figure 2. A summary of the proposed equipment is shown in Table 3 along with the manufacturer's broadband noise emission data.

Table 3: Summary of Proposed Plant Noise Emissions

Model	Description of Noise Source	Cooling dB	Heating dB
Mitsubishi SUZ-M71VA	Air Conditioning Condenser	49 L_{pA} @ 1 m	51 L_{pA} @ 1 m
Mitsubishi SUZ-M71VA	Air Conditioning Condenser	49 L_{pA} @ 1 m	51 L_{pA} @ 1 m
Mitsubishi SUZ-M71VA	Air Conditioning Condenser	49 L_{pA} @ 1 m	51 L_{pA} @ 1 m
Mitsubishi PUZ-ZM71VHA	Air Conditioning Condenser	47 L_{pA} @ 1 m	49 L_{pA} @ 1 m
Mitsubishi PUZ-M140YKA	Air Conditioning Condenser	55 L_{pA} @ 1 m	57 L_{pA} @ 1 m

- 4.2 The nearest dwelling is the dwelling to the east on Lower Park Road 60m from the proposed plant location. A separation distance of 60m has therefore been taken into account in our calculations. The calculated distance attenuation to the nearest dwellings is 35 dB(A) (i.e. $20 \times \log 60$). The plant location is well screened from residential properties (both visually and acoustically) and therefore we have assumed a nominal acoustic screening correction of -5 dB(A). For a worst case scenario, we have based the assessment on all equipment running simultaneously on heating duty.

Plant Noise Levels at the Nearest Dwellings

- 4.3 The calculated noise rating level from the new equipment outside the nearest dwellings is shown in Table 4 overleaf and is compared with the background noise level.

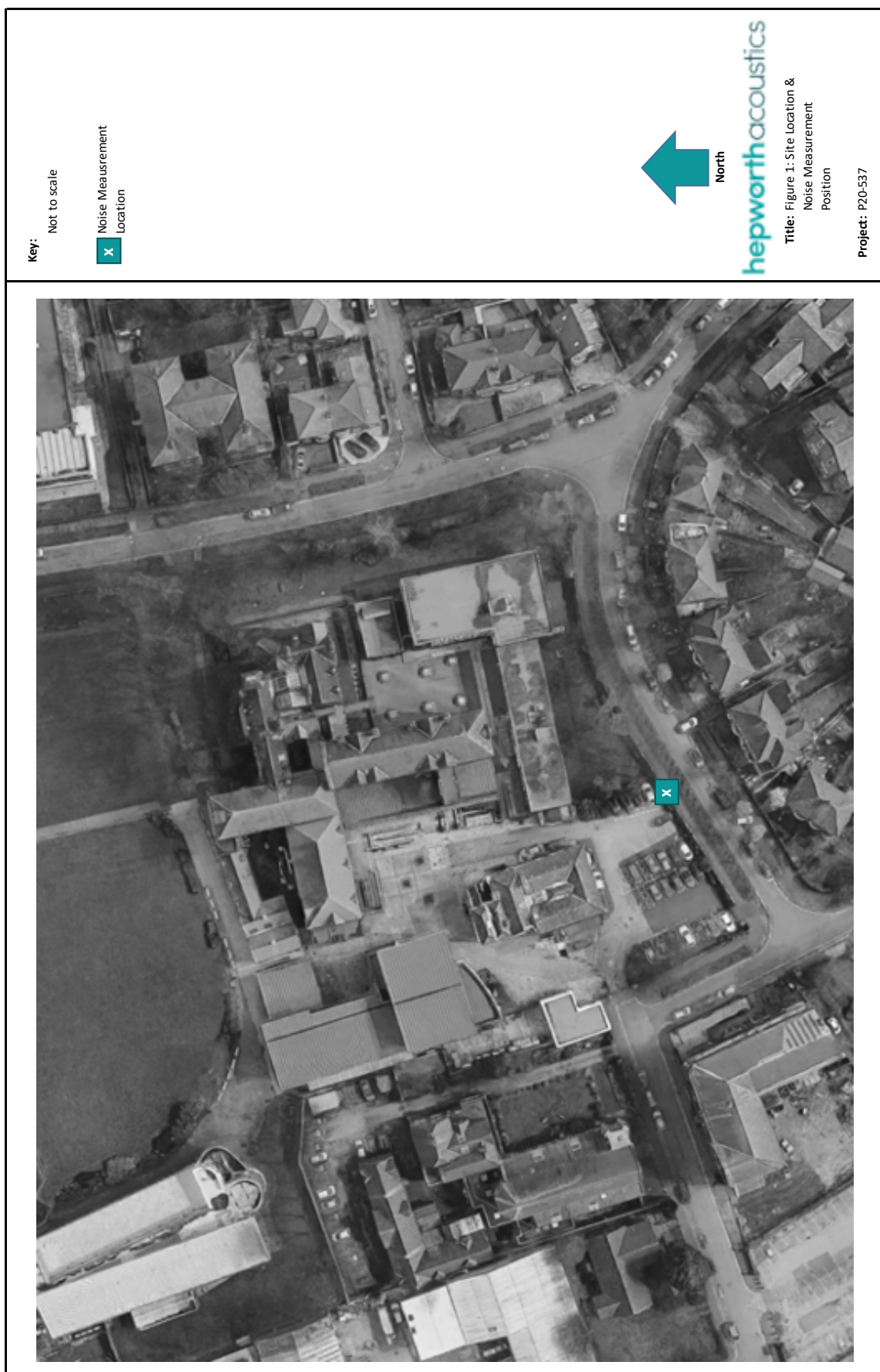
Table 4: Calculation & assessment of equipment noise outside the nearest dwelling (dB)

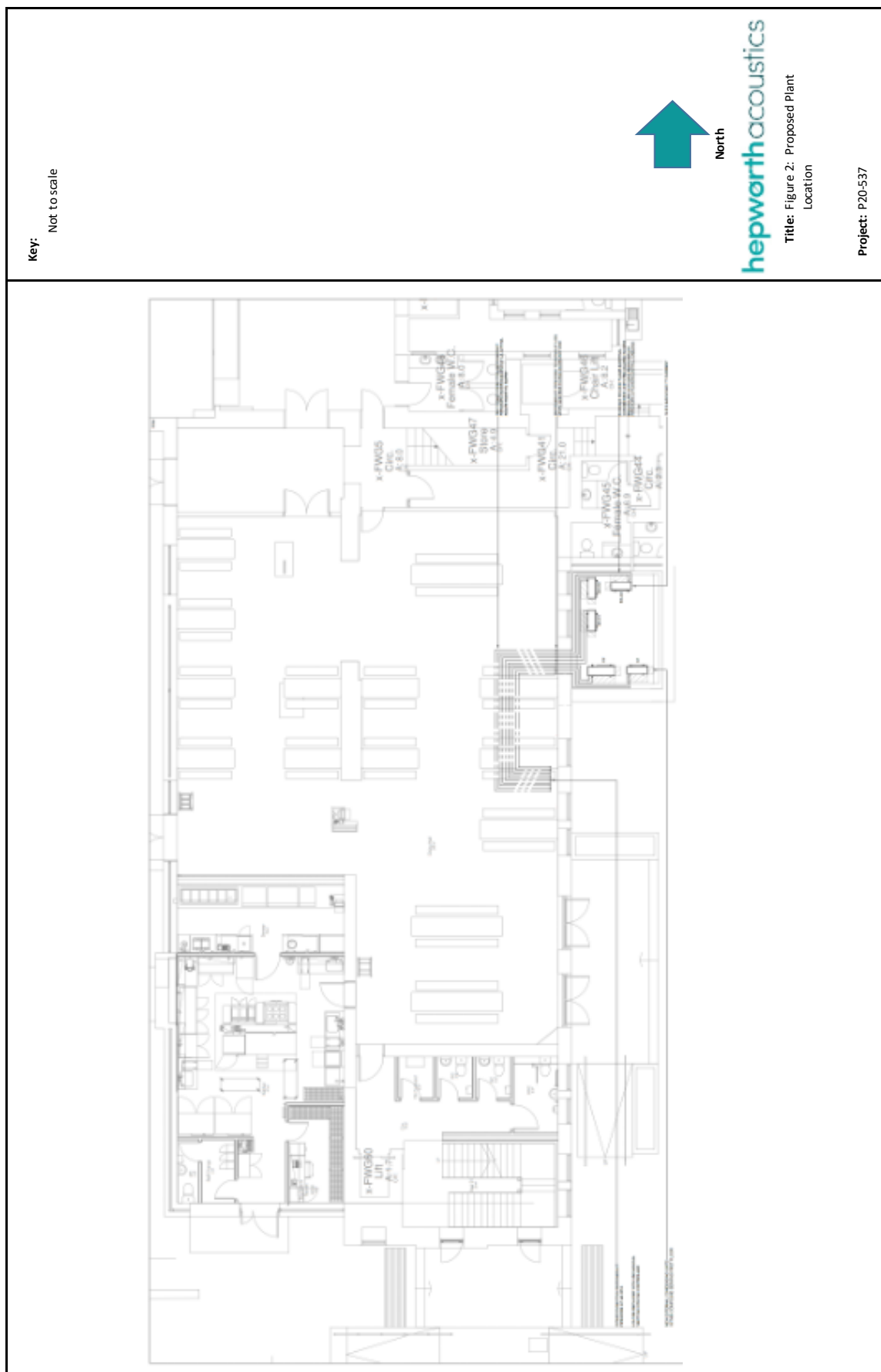
Description	Noise Level (dB)
Calculated Specific Sound Level outside dwelling ($L_{Aeq,T}$)	20
Acoustic Character Correction	+0
Rated noise level outside dwelling on Roby Road ($L_{Ar,Tr}$)	20
Lowest background measured (L_{A90})	40
Comparison	-20

- 4.4 The calculated BS 4142 sound rating level from the service yard is 20 dB below the representative daytime background noise level. Therefore, the requirements of Condition 5 of the planning approval are comfortably met.
- 4.5 In terms of BS 4142, this indicates that the impact will be 'low' i.e. there will not be any adverse noise impact at residential locations.

5.0 SUMMARY

- 5.1 Hepworth Acoustics Ltd was commissioned by Kilhey Consultancy to carry out a noise assessment in connection with a proposed planning application for relocated kitchen and ancillary office spaces at Xaverian College in Rusholme.
- 5.2 The assessment has included an inspection of the building and the surrounding area, and a background noise survey during the daytime in line with the anytime operating times of the new equipment.
- 5.3 The calculated noise level from the proposed plant is low at the nearest dwelling and 20 dB below the representative background noise level. On this basis the requirements of the Condition 5 will be met.





Appendix I: Noise Units & Indices

Sound and the decibel

A sound wave is a small fluctuation of atmospheric pressure. The human ear responds to these variations in pressure, producing the sensation of hearing. The ear can detect a very wide range of pressure variations. In order to cope with this wide range of pressure variations, a logarithmic scale is used to convert the values into manageable numbers. Although it might seem unusual to use a logarithmic scale to measure a physical phenomenon, it has been found that human hearing also responds to sound in an approximately logarithmic fashion. The dB (decibel) is the logarithmic unit used to describe sound (or noise) levels. The usual range of sound pressure levels is from 0 dB (threshold of hearing) to 120dB (threshold of pain).

Due to the logarithmic nature of decibels, when two noises of the same level are combined together, the total noise level is (under normal circumstances) 3 dB(A) higher than each of the individual noise levels e.g. 60 dB(A) plus 60 dB(A) = 63 dB(A). In terms of perceived 'loudness', a 3 dB(A) variation in noise level is a relatively small (but nevertheless just noticeable) change. An increase in noise level of 10 dB(A) generally corresponds to a doubling of perceived loudness. Likewise, a reduction in noise level of 10 dB(A) generally corresponds to a halving of perceived loudness.

The ear is not equally sensitive to sound at all frequencies. It is less sensitive to sound at low and very high frequencies, compared with the frequencies in between. Therefore, when measuring a sound made up of different frequencies, it is often useful to 'weight' each frequency appropriately, so that the measurement correlates better with what a person would actually hear. This is usually achieved by using an electronic filter called the 'A' weighting, which is built into sound level meters. Noise levels measured using the 'A' weighting are denoted dB(A) or dBA.

Frequency and Hertz (Hz)

As well as the loudness of a sound, the frequency content of a sound is also very important. Frequency is a measure of the rate of fluctuation of a sound wave. The unit used is cycles per second, or hertz (Hz). Sometimes large frequency values are written as kiloHertz (kHz), where 1 kHz = 1000 Hz.

Young people with normal hearing can hear frequencies in the range 20 Hz to 20 kHz. However, the upper frequency limit gradually reduces as a person gets older.

Glossary of Terms

When a noise level is constant and does not fluctuate, it can be described adequately by measuring the dB(A) level. However, when the noise level varies with time, the measured dB(A) level will vary as well. In this case it is therefore not possible to represent the noise climate with a simple dB(A) value. In order to describe noise where the level is continuously varying, a number of other indices can be used. The indices used in this report are described below.

- L_{Aeq} This is the A-weighted 'equivalent continuous noise level' which is an average of the total sound energy measured over a specified time period. In other words, L_{Aeq} is the level of a continuous noise which has the same total (A-weighted) energy as the real fluctuating noise, measured over the same time period. It is increasingly being used as the preferred parameter for all forms of environmental noise.
- L_{Amax} This is the maximum A-weighted noise level that was recorded during the monitoring period.
- L_{A90} This is the A-weighted noise level exceeded for 90% of the time period. L_{A90} is used as a measure of background noise.

Appendix II: Noise Survey Results

Date: Wednesday 6th January 2021
 Equipment: Brüel & Kjær 2250 'Type 1' sound analyser (serial no. 3011706) with tripod and calibrator
 Weather: Dry, cold (~3-5°C), clear skies and calm (<2 m/s)

All levels in dB(A)

Location 1:

Time		Measured Noise Levels (dB)				Comments
Start	End	L _{Amax}	L _{A10}	L _{Aeq}	L _{A90}	
14:00	14:15	67.2	58.9	55.3	47.0	Construction works at nearby house, passing road traffic and distant road traffic. Birdsong
14:15	14:30	71.6	60.2	56.5	45.4	Construction works at nearby house, passing road traffic and distant road traffic. Birdsong
14:30	14:45	73.0	62.0	58.1	44.6	Construction works at nearby house, passing road traffic and distant road traffic. Birdsong
14:45	15:00	53.6	51.5	47.9	44.6	Passing road traffic and distant road traffic. Birdsong
15:00	15:15	65.4	50.0	49.3	42.6	Passing road traffic and distant road traffic. Birdsong
15:15	15:30	64.8	48.0	49.5	44.5	Passing road traffic and distant road traffic. Birdsong
15:30	15:45	60.7	51.2	47.9	41.1	Passing road traffic and distant road traffic. Birdsong