Woodlands Meed College

Noise Impact Assessment

Woodlands Meed College

11 December 2020

2020/DEC/10

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1. Introduction

Woodlands Meed is a Foundation Special School for pupils with a wide range of special needs who live in Mid-Sussex. Woodlands Meed operates on two shared school sites. The school site educates pupils aged 2 to 14 and the college site pupils aged 14 to 19. The college site is located at Birchwood Grove Road, Burgess Hill, West Sussex, RH15 0DP, and is shared with Birchwood Grove Primary School. The project proposes to demolish the existing facility at the college site and construct a new college building.

Woodlands Meed College has approximately 100 students forming 10 class groups. The project will see an expansion in the size of the college by approximately 30 students plus a post-19 unit for 6 students. Students in Key Stage 4 (14-16 years old) and Key Stage 5 (16-19 years old) attend the college, where the aim is to prepare them for moving on to adult life, whether this be to the workplace, to further education or supportive adult provision.

It is proposed that the new college building will be constructed within the existing outdoor PE area. The existing MUGA (multi-use games area) is to be relocated to the south part of the site, and a new all-weather pitch to be constructed to the east of the new building.

The project is currently at RIBA Stage 3. Atkins has been commissioned to carry out a noise impact assessment with regards to proposed building services and external MUGA / all-weather pitch to support a planning application for the proposed development.

This report provides a detailed assessment of the potential noise impacts arising from usage of the outdoor sports areas and building services plant. A glossary of technical terms is provided in Appendix A.

2. Technical guidance

2.1. Local guidance

It is understood that the Local Authority was contacted by the project team during November 2020 to establish whether there are any specific acoustic criteria that should be considered in the design of the building services plant and the outdoor sports areas. At the time of writing, a response has not been received. In lieu of any specific guidance or design criteria provided by the Local Authority, this report has undertaken an assessment following current best practice and guidance, with reference to the documents detailed in the following subsections.

2.2. National Planning Policy Framework, 2019

The National Planning Policy Framework (NPPF) defines the national policy toward developments which are sensitive to noise and vibration. Specifically, on the subject of noise, paragraph 170, 180 and 182 state that:

'170. 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;'

'180. 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;'

'182. 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.'

NPPF refers to the Noise Policy Statement for England (NPSE), discussed in the subsequent section.

2.3. Noise Policy Statement for England, 2010

The long-term vision of Government noise policy is set out in the Noise Policy Statement for England (NPSE) published in March 2010. Through effective management and control of environmental noise within the context of Government policy on sustainable development, the NPSE aims to:

- *'Avoid significant adverse impacts on health and quality of life;*
- *Mitigate and minimise other adverse impacts on health and quality of life; and*
- *Contribute to improvements to health and quality of life, where possible.'*

The Explanatory Note to the NPSE assists in the definition of significant adverse and adverse with reference to No Observed Effect Level (NOEL), Lowest Observed Adverse Effect Level (LOAEL) and Significant Observed Adverse Effect Level (SOAEL) values:

- NOEL: the level of noise exposure below which no effect at all on health or quality of life can be detected;

- LOAEL: the level of noise exposure above which adverse effects on health and quality of life can be detected; and
- SOAEL: The level of noise exposure above which significant adverse effects on health and quality of life occur.

The Government policy and guidance do not state values for the NOEL, LOAEL and SOAEL, rather, it considers that they are different for different noise sources, for different receptors and at different times and should be defined on a strategic or project basis taking into account the specific features of that area, source or project.

2.4. Sports England Artificial Grass Pitch Acoustics – Planning Implications, 2015

2.4.1. Criteria for outdoor noise levels

This Design Guidance Note from Sport England aims to increase awareness of good design practices for sports facilities and to encourage implementation of these practices to improve the quality of sports facilities and how there are perceived by the local community.

It refers to the use of Community Noise Guidelines (1999)[1] published by the World Health Organisation, which recommends the following noise limits:

- 35 dB $L_{Aeq,16hour}$ – daytime noise limit inside dwellings; and
- 50 dB $L_{Aeq,16hour}$ – daytime noise limit in outdoor living areas (e.g. gardens), which is referred to as a threshold level for the onset of ‘moderate annoyance’.

The above limits are defined for steady sound sources without a specific character, such as road traffic. The Sports England guide suggest that these limits can also be applied to artificial grass pitch noise, with a noise assessment period of 1 hour to reflect the typical duration of use (i.e. classes). The above limits should therefore be observed in terms of the $L_{Aeq,1hour}$ values.

The Sport England guidance acknowledges that exceedance of 50 dB $L_{Aeq,1h}$ at 1m from a building façade of a sensitive receptor does not automatically mean that a significant impact will occur, as higher levels of noise exposure may be required to adversely affect nearby properties.

2.4.2. Criteria for noise levels inside dwellings

Further guidance on noise levels inside dwellings and within outdoor living areas is provided by BS 8233:2014 *Guidance on Sound Insulation and Noise Reduction for Buildings,* as mentioned in the Sports England guidance. BS 8233 is a code of practice for acoustic design of buildings. Table 4 in Section 7.7.2 of the standard shows the recommended noise levels inside the dwellings, which are based on WHO guidelines. Note 7 under the table in the standard states that where development is necessary and desirable, the internal noise targets may be relaxed by up to 5 dB and reasonable internal conditions can still be achieved. The table and the relevant note are reproduced below.

Table 2-1 – BS 8233 recommended internal ambient noise levels

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16h}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16h}$	-
Sleeping / resting	Bedroom	35 dB $L_{Aeq,16h}$	30 dB $L_{Aeq,8h}$

Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal L_{Aeq} target levels listed in above may be relaxed by up to 5 dB and reasonable internal conditions still achieved.

[1] Now partially replaced by WHO *Environmental Noise Guidelines for the European Region* (2018)

In terms of noise limits in the outdoor living areas, Paragraph 7.7.3.2 of BS 8233 indicates that in external amenity spaces it is desirable that the steady noise levels should not exceed 50 dB $L_{Aeq,T}$, and 55 dB $L_{Aeq,T}$ should be regarded as an upper guideline value.

2.4.3. Activity noise levels

The Sports England guidance also provided information on typical noise levels from artificial grass pitches when in use. Vocal noise from sports participants and impact noise were noted to be the noise sources generating the highest noise levels. Based on measurements taken at artificial grass pitches during a number of sports activities (football, hockey, rugby), the Sport England guidance states that 58 dB $L_{Aeq\ (1h)}$ is a 'typical' free-field noise level at 10m from the sideline halfway line marking.

2.4.4. Change to noise levels following introduction of a new artificial grass pitch

The Sport England guidance also considers how noise levels may change as a result of the introduction of a new artificial grass pitch. The guidance aligns with "moderate" impacts defined in the Institute of Environmental Management and Assessment (IEMA) Guidelines (2014), where a new artificial grass pitch should not increase noise levels by more than 3dB(A).

The IEMA best practice guidelines for Noise Impact Assessments is specifically intended to cover all aspects of noise impact assessment, including scoping, baseline studies, noise prediction, assessment, mitigation and reporting, in order to facilitate greater consistency and transparency between assessments.

Although there are no "standard" definitions to describe the magnitude and significance of noise level changes at residential properties, this document provides examples for the categorisation of noise change impacts. The guidance within this document has been used as the basis for the terms detailed in Table 2-2 below, which will be used to describe the impacts of the proposed outdoor sports areas within this assessment.

Table 2-2 – IEMA noise impact criteria

Magnitude (nature of impact)		Description of Effect Significance (on a specific sensitive receptor)	Significance (as required within EIA)	Change in Noise Level
Substantial	Beneficial	**Receptor perception = Marked change** Causes a material change in behaviour and/or attitude. e.g. individuals begin to engage in activities previously avoided due to preceding environmental noise conditions. Quality of life enhanced due to change in character of the area.	**More Likely to be Significant** (Greater justification needed - based on impact magnitude and receptor sensitivities - to justify a non-significant effect)	Decrease by 5dB or more
Moderate	Beneficial	**Receptor perception = Noticeable improvement** Improved noise climate resulting in small changes in behaviour and/or attitude, e.g. turning down volume of television; speaking more quietly: opening windows. Affects the character of the area such that there is a perceived change in the quality of life.		-3dB to -5dB
Slight	Beneficial	**Receptor perception = Just noticeable improvement** Noise impact can be heard, but does not result in any change in behaviour or attitude. Can slightly affect the character of the area but not such that there is a perceived change in the quality of life.	(Greater justification needed based on impact magnitude and receptor sensitivities - to justify a significant effect). **Less Likely to be Significant**	-1dB to -3dB
Negligible		N/A = No discernible effect on the receptor	**Not Significant**	-1dB to 1dB
Slight	Adverse	**Receptor perception = Non-intrusive** Noise impact can be heard, but does not cause any change in behaviour or attitude, e.g. turning up volume of television; speaking more loudly; closing windows. Can slightly affect the character of the area but not such that there is a perceived change in the quality of life.	**Less Likely to be Significant** (Greater justification needed - based on impact magnitude and receptor sensitivities - to justify a significant effect)	1dB to 3dB
Moderate	Adverse	**Receptor perception = Intrusive** Noise impact can be heard and causes small changes in behaviour and/attitude, e.g. turning up volume of television; speaking more loudly; closing windows. Potential for non-awakening sleep disturbance. Affects the character of the area such that there is a perceived change in the quality of life.		3dB to 5dB
Substantial	Adverse	**Receptor perception = Disruptive** Causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion. 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 character of the area.	(Greater justification needed based on impact magnitude and receptor sensitivities - to justify a non-significant effect) **More Likely to be Significant**	5dB to 10dB
Severe	Adverse	**Receptor perception = Physically Harmful** Significant 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.	**Significant**	Increase by 10dB or more

2.5. BS 4142:2014 + A1:2019: Methods for rating industrial and commercial sound

BS 4142:2014+A1:2019 (hereafter referred to as BS 4142) describes methods for rating and assessing sound of an industrial and/or commercial nature. The methods described in the standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

The standard is used to determine the rating levels for sources of sound of an industrial and/or commercial nature and the ambient, background and residual sound levels at outdoor locations. These levels could be used for the purposes of investigating complaints; assessing sound from proposed new or modified sound sources; and assessing sound at proposed new dwellings or premises used for residential purposes. However, the determination of sound amounting to a nuisance is beyond the scope of the standard.

The procedure contained in BS 4142 provides a framework for assessing the significance of sound. The initial significance depends upon the margin by which the rating level ($L_{Ar,T}$) of the sound sources exceeds the background sound level ($L_{A90,T}$) and the context in which the sound occurs.

The reference time interval for the specific sound source 'Tr' is 60 minutes during the daytime and 15 minutes during the night. The reduced reference time at night reflects the increased sensitivity to sound during this period. The relevant time periods for daytime and night-time are as follows:

- Daytime – 07:00 to 23:00 hours; and
- Night-time – 23:00 to 07:00 hours.

An initial estimate of the impact of the sound source is obtained by subtracting the measured background sound level from the rating level and considering the following:

- Typically, the greater this difference, the greater the magnitude of the impact.
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
- 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.

Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location and have the potential to increase disturbances, the standard adds acoustic penalties to the specific sound level to obtain the rating level. Character corrections can be included for tonality, impulsivity, other sound characteristics that make it "readily distinctive", and intermittency.

The Standard also provides guidance on scenarios where low background sound levels are present at the sensitive receptors under consideration. Specifically, it states the following:

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

3. Existing acoustic conditions

3.1. Site description

Woodlands Meed College is located in a land parcel enclosed by Birchwood Grove Primary School to the east, Birchwood Grove Road to the north and west, and Ryeland Road to the south west. Several residential buildings are located in proximity to Woodlands Meed College, including those on Birchwood Grove Road (notably Appletree Cottage and Conifers which overlook the site), Ryeland Road, Shearing Drive, Chilcomb, Bough Beeches and The Ridings.

The nearest sensitive receptors to Woodlands Meed College are shown in Figure 3-1, which also depicts the current layout of the college.

Figure 3-1 – Woodlands Meed College site and its surroundings

3.2. Acoustic survey

3.2.1. Survey methodology and locations

An acoustic survey was undertaken to ascertain the existing acoustic conditions at Woodlands Meed College site to aid the design of the proposed new college building and to estimate ambient conditions at nearby residential properties. The acoustic survey included unattended measurements over a period of approximately four days, between 13:18 on Friday 18th September 2020 and 15:30 on Tuesday 22nd September 2020. A series of shorter attended measurements were also carried out over the duration of a school day, between approximately 09:45 and 15:30 on Tuesday 22nd September 2020. All measurements were undertaken during term time, with pupils of Woodlands Meed College and Birchwood Grove Primary School in full attendance.

The survey locations are shown in Figure 3-2 with reference to the current and proposed site layouts. Attended measurement positions 1-4 and 6 were selected to represent key locations along the proposed building outline, with their primary aim to establish the ambient noise levels at the building façades due to the existing sound sources. Location 5 was used to measure noise from the existing college MUGA (multi-use game area), at a distance similar to that between the proposed MUGA and the closest façade of the new building. Unattended measurement position 7 was located towards the south west of the site, close to the boundary with residential properties, with the purpose of establishing typical background noise levels occurring at different times of day outside these properties.

All measurements were undertaken at a height of approximately 1.5 m above ground, under free-field conditions (at least 3.5 m away from any reflective surfaces other than the ground).

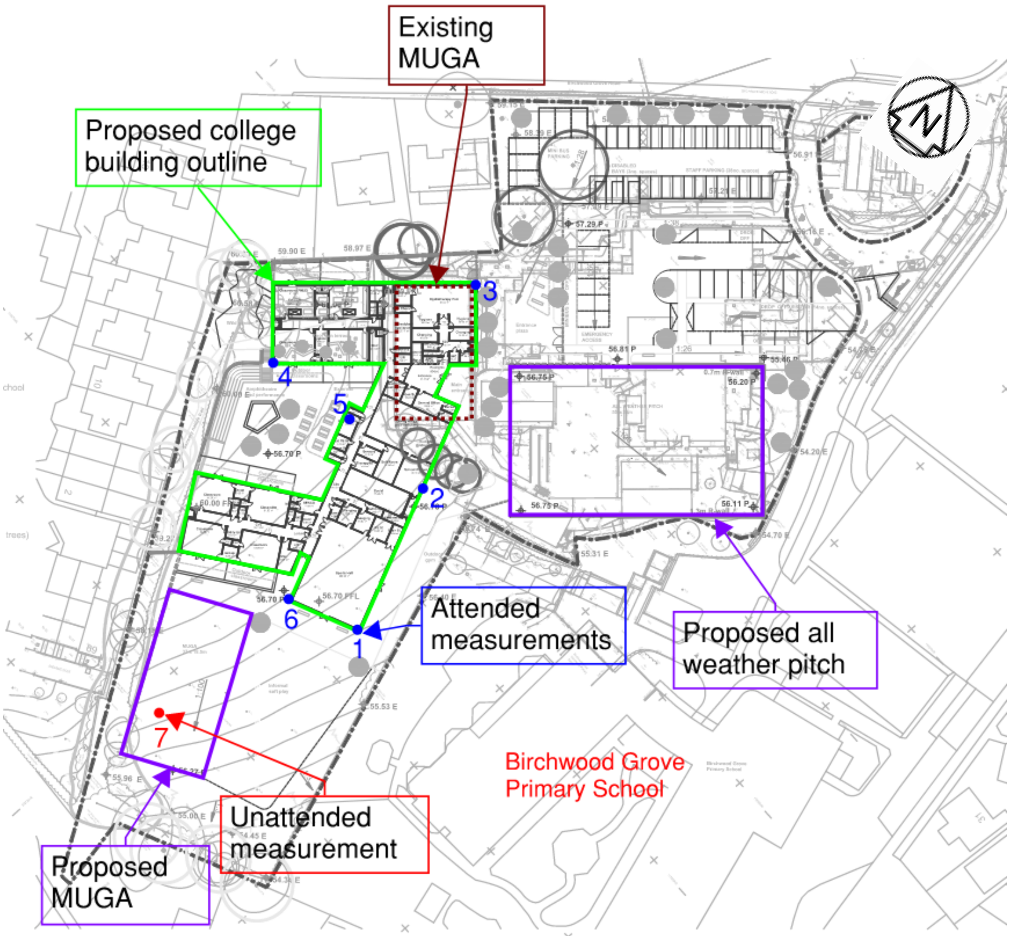


Figure 3-2 – Acoustic survey locations

Based on the locations of the measurement positions, the following positions are considered relevant to the noise impact assessment of building services noise and MUGA usage:

- Position 3, to represent Conifers and Appletree Cottage;
- Position 4, to represent properties on Ryeland Road;
- Position 5, to confirm existing noise levels from MUGA usage; and
- Position 7, to represent 69 Shearing Drive.

The data collected from all measurement locations is reported to provide a complete understanding of the existing acoustic conditions in and around Woodlands Meed College.

All sound level monitoring equipment has Class 1 accuracy and holds the current manufacturer's or UKAS calibration certificates, available on request. All microphones were used with windshields. Acoustic calibrators were applied before and after the measurements to calibrate the sound level meters, with no significant differences noted in levels. Details relating to the survey instrumentation are provided in Appendix B. Calibration certificate can be made available on request.

3.2.2. Weather conditions

The weather conditions during the measurements were monitored locally on site using a data logging weather station. The conditions were suitable for outdoor sound level measurements during the attended survey and for most of the unattended survey duration: there was no rain and the wind speeds were below the windshield limits (below 5 m/s). Periods of strong persistent wind gusts with speeds above 5 m/s occurred during the unattended measurements during the following periods:

- Between approximately 13:00-18:00 on Friday 18th September;
- Between approximately 08:00-15:00 on Saturday 19th September; and
- Between approximately 15:45-18:15 on Sunday 20th September.

The sound level data measured during these periods was excluded from survey result analysis.

A history of local wind speed conditions during the survey is shown in a graph in Appendix B (maximum wind speeds recorded in 5-minute periods).

3.3. Survey results

Data associated a with range of sound level indices was recorded during the survey, with the key ones reported below:

- $L_{Aeq,T}$, representing ambient sound levels;
- $L_{A90,T}$, representing background sound levels; and
- $L_{Amax,T}$, representing maximum sound levels.

Full definitions of the above indices are provided in Appendix A.

3.3.1. Attended measurements

The attended measurement results are shown in Table 3-1.

The results from Positions 1-4 and 6 are considered representative of sound levels to occur at the proposed college building façades during a typical school day, in locations corresponding with the measurement positions. The exception is a measurement between 13:11-13:39 at Position 4 which was dominated by noise from existing college MUGA, which will not occur at the corresponding façade section of the new building. The results from Position 5 represent sound levels from the existing college MUGA at the distance of approximately 10 m. These results can be used to predict noise from the new relocated MUGA at the new building façades.

Measurements at Positions 1, 2 and 6 were dominated by playtime activity noise from the adjacent outdoor play areas at Birchwood Grove Primary School. Other sources included birdsong, foliage rustle, remote traffic (mainly from the south direction), occasional remote air traffic. Measurements at Position 3 and Position 4 (without MUGA noise) did not have a clearly dominant source, with all sources listed above being present, in addition to occasional remote college pupils chatter and occasional remote construction activity. Measurements at Position 5 were dominated by college MUGA noise.

Table 3-1 – Attended measurement results

Measurement Position	Measurement time	Measurement duration (minutes)	$L_{Aeq,T}$, dB	$L_{Amax,T}$, dB	$L_{A90,T}$, dB	Comment
1	09:45-10:15	30	62	80	53	-
	11:36-12:06	30	61	82	52	-
2	10:19-10:49	30	55	72	47	-
	14:34-14:44	10	52	66	47	Measurements representing primary school children pick-up time noise
3	10:54-11:16	22	46	69	36	Position further from existing school position and less
	15:02-15:28	26	44	66	38	

Measurement Position	Measurement time	Measurement duration (minutes)	$L_{Aeq,T}$, dB	$L_{Amax,T}$, dB	$L_{A90,T}$, dB	Comment
						influenced by noise from children
4	13:11-13:39	18	50	66	44	Measurement dominated by noise from college MUGA
	13:54-14:24	30	46	61	40	-
5	11:20-11:26	6	55	70	46	Measurements representing college MUGA noise at distance of approximately. 10 m
	14:48-15:01	13	58	79	46	
6	12:10-12:35	25	51	67	45	-

3.3.2. Unattended measurement

A summary of the unattended measurement results at position 7, is shown in Table 3-2.

The background sound levels are reported as minimum and most frequently occurring (mode) 15-minute period values in a given measurement period. A graph showing the full history of sound levels measured at position 7, in consecutive 15-minute periods, is shown in Appendix B.

The reported background noise levels are considered representative of the conditions occurring outside the neighbouring residential properties at Chilcomb, 69 Shearing Drive and 2 Ryeland Road.

The most noticeable sound source during break times was playtime activity at Birchwood Grove Primary School. Other sources included birdsong, foliage rustle, remote traffic from the south direction, occasional remote air traffic.

Table 3-2 – Unattended measurement results (Position 7)

Date	Day	Period	$L_{Aeq,T}$, dB	$L_{Amax,T}$, dB	$L_{A90,15min}$, dB (min.)	$L_{A90,15min}$, dB (mode)
18/09/2020	Friday	Evening (19:00-23:00)	41	63	32	36
18-19/09/2020	Fri/Sat	Night (23:00-07:00)	39	71	20	28
19/09/2020	Saturday	Day (07:00-19:00)[1]	46	72	38	41
19/09/2020	Saturday	Evening (19:00-23:00)	41	74	30	34
19-20/09/2020	Sat/Sun	Night (23:00-07:00)	34	63	20	24
20/09/2020	Sunday	Day (07:00-19:00)[2]	46	75	34	41
20/09/2020	Sunday	Evening (19:00-23:00)	38	57	23	33
20-21/09/2020	Sun/Mon	Night (23:00-07:00)	38	64	19	19
21/09/2020	Monday	Day (07:00-19:00)	51	75	38	40
21/09/2020	Monday	Evening (19:00-23:00)	46	74	27	31
21-22/09/2020	Mon/Tue	Night (23:00-07:00)	44	73	20	21
22/09/2020	Tuesday	Day (07:00-15:30)	52	76	39	43

[1] Results exclude sound level data from the period between 08:00-15:00 (excluded due to high wind speeds)

[2] Results exclude sound level data from the period between 15:45-18:15 (excluded due to high wind speeds)

3.3.3. Summary of measured sound levels

A summary of the measured sound levels and the values that the outdoor sports area and building services plant assessment will be based on, is provided in Table 3-3.

Table 3-3 – Selected sound levels representing existing acoustic conditions

Sensitive receptor	Measurement location	Representative sound levels		Justification
		L_{Aeq} dB	L_{A90} dB	
Birchwood Grove Road (Conifers, Appletree Cottage)	3 (short-term monitoring location)	44	36	Lowest measured ambient and background sound levels
10-18 Ryeland Road	4 (short-term monitoring location)	46	40	Lowest measured ambient and background sound levels
2 Ryeland Road, 69 Shearing Drive	7 (long-term monitoring location)	51	40	Lowest ambient and model background sound levels from the weekday daytime measurements
8 Chilcomb	7 (long-term monitoring location)	51	40	Lowest ambient and model background sound levels from the weekday daytime measurements

4. Assessment methodology

4.1. Approach to assessment

Due to the different types of sound sources involved in the proposed development, two separate assessments have been undertaken:

1. Assessment of sound from MUGA usage based on Sports England guidance;, and
2. Assessment of building services sound in accordance with BS 4142.

In order to predict sound emissions from these sources, a 3D acoustic model was built of the proposed new college building and separate calculations were undertaken for each type of sound source. The resultant sound levels at the nearest sensitive receptors were then used to assess each sound source based on the standards and guidance detailed in Section 2.

The following sections provide information on how the acoustic modelling was undertaken, assumptions made, and the sound sources considered in the assessment.

4.2. Acoustic modelling

4.2.1. Ground model and site layout

The 3D acoustic model of the site and surrounding area was built using SoundPlan v8.2 software. The acoustic model included the ground topography, ground absorption, buildings and sound sources associated with the proposed development, namely building service plant and the MUGA/all-weather pitch. The acoustic model predicted the sound levels for each source type at the identified sound sensitive receptors in accordance with ISO 9613:1996 Part 2 '*Attenuation of sound during propagation – Engineering method for the prediction of sound pressure levels outdoors*'.

The acoustic model was developed using the following data sources:

- 1m Lidar Digital Terrain Model (Environment Agency, obtained November 2020);
- Ordnance Survey Base Mapping (obtained November 2020);
- Product specifications for proposed plant and equipment;
- Aerial imagery from Google Maps;
- Plan view and elevation view drawings for the proposed development, including:
  - The RIBA Stage 3 Landscape chapter;
  - General Arrangement (GA) Ground Floor Plan (Level 00), drawing reference 1191-HAV-ZZ-00-DR-A-1500;
  - GA First Floor Plan (Level 01), drawing reference 1191-HAV-ZZ-00-DR-A-1501;
  - GA Roof Floor Plan (Level 02), drawing reference 1191-HAV-ZZ-00-DR-A-1502;
  - Proposed GA Elevations, drawing reference 1191-HAV-ZZ-00-DR-A-2500;
  - Proposed GA Sections, drawing reference 1191-HAV-ZZ-00-DR-A-2501; and
- Measured sound levels from children using the existing MUGA at Woodlands Meed College.

The heights of residential buildings surrounding the site were set to 6m representing a typical two-storey building and the height and layout of the college building was modelled based on the plan view and elevation drawings. Receiver heights at residential buildings were set to 1.5m and 4m above ground level to represent the ground floor and first floor of these buildings.

Ground absorption was modelled as mixed hard and soft ground, using an absorption coefficient of 0.6, which is considered representative of prevailing ground characteristics in the area. The areas occupied by the proposed outdoor sports areas were modelled as hard ground with an absorption coefficient of zero.

The proposed college building was modelled with a maximum height of 7.1m at roof level, and 3.4m at the first floor level for patio areas and an external plant compound located at the north elevation of the building. The northern and eastern walls of the compound were modelled as a noise barrier, aligning with the top height of the brickwork for classrooms on the first floor of the building as shown in the elevation view drawings. A roof parapet of 0.8m height was also modelled as a noise barrier along the edge of the roof.

A weather louvre is located in the wall of the plant compound on the northern elevation. The dimensions of the louvre are 10m x 1.5m. For the purposes of this assessment, it is assumed that the louvre has a typical free area of 60%, which has been modelled by including an opening in the plant compound wall of the same surface area as the free area of the louvre (9m^2, with dimensions 10m x 0.9m). Figure 4-1 shows how the wall on the northern elevation of the external plant compound was modelled.

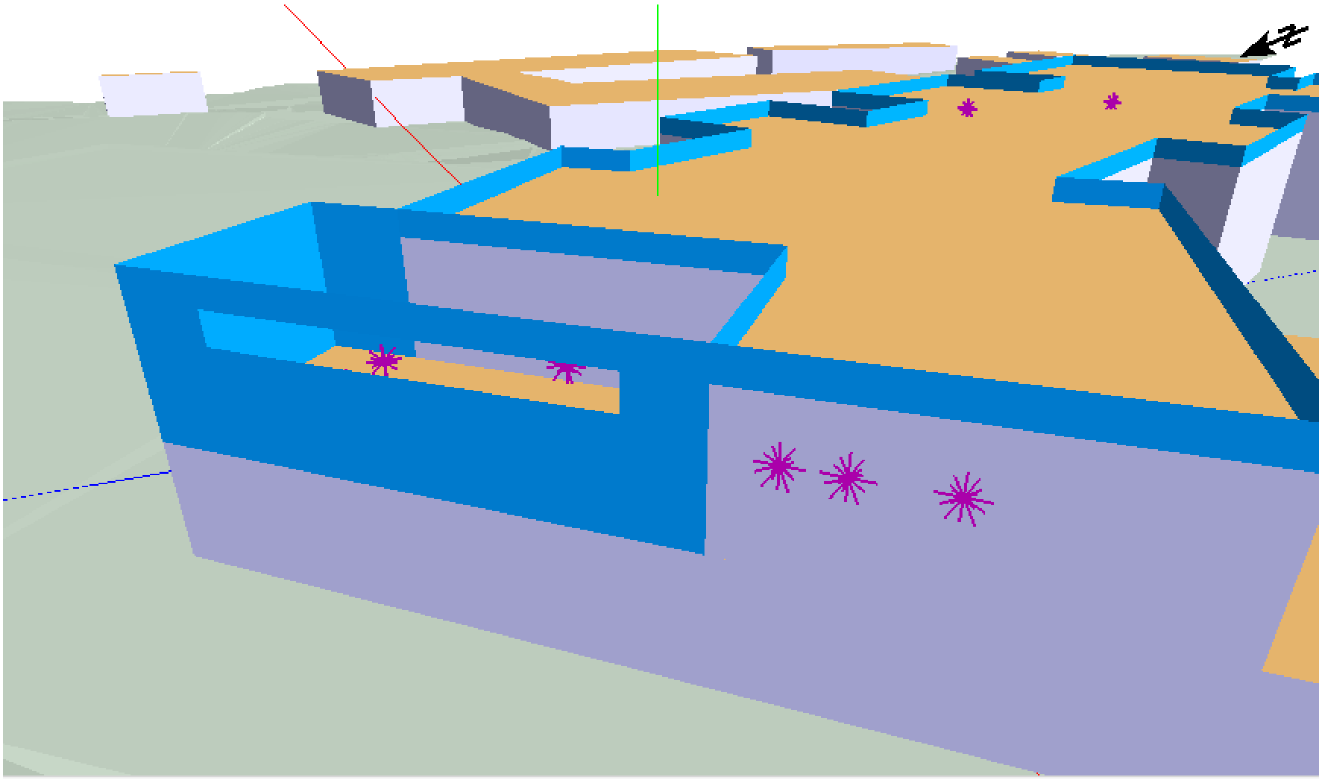


Figure 4-1 – Modelled louvre on the northern wall of the external plant compound

A solid timber fence is located at the southern boundary of properties on Birchwood Grove Road. This has been included in the acoustic model as a timber noise barrier of 1.8m height.

4.2.2. Sound sources

The proposed outdoor sports areas were modelled as area sources with the dimensions of the pitch area. The area source was modelled at 1.5m above ground as the majority of sports noise from sports pitches is from participants communicating with each other.

Each item of building services plant was modelled as a point source, which is considered appropriate given relatively large distances to the assessment locations. The air source heat pump was modelled at a height of 2.1m above the floor level in the external plant compound on the first floor. All other items of plant located in this compound or on the roof were modelled at approximately 0.6m above floor or roof level. Three of the mechanical ventilation heat recovery units (MVHRs 4, 5 and 12) are located inside the first floor plant room and interface with the atmosphere via a 4m x 1m louvre. The point sources for these items were positioned at the approximate location of the louvre, at an estimated height of 4.5m above ground level.

4.3. Source data

4.3.1. Outdoor sports area

The proposals for Woodlands Meed College include spaces for outdoor sports provision, namely:

- An all-weather sports pitch located east of the new college building that will be used for several sports, including cricket; and
- A MUGA located south of the new college building that will be used for netball and basketball.

It is understood that no sports that generate impact sounds such as football will be played on the MUGA, although some such sports will be played at the all-weather sports pitch. Hockey will not be played in any of the outdoor sports areas. The proposed outdoor sports areas are for school use only and it is expected to be limited to daytime hours.

In line with Sports England guidance, the outdoor sports areas were modelled so that the sound level would equal 58 dB L_{Aeq} at 10m from the halfway sideline. This source sound level takes into account communication and impact sounds.

The level of usage of the outdoor sports areas during a typical one-hour period during college opening hours is not known. The assessment assumes that both outdoor sports areas are in use at the same time, with sports activity taking place for the entire one-hour period, which represents the worst-case scenario.

4.3.2. Building services plant

The building service plant items considered in this assessment are described in Table 4-1. Detailed acoustic data for the plant, as provided by equipment manufacturers, is included in Appendix C.

Table 4-1 – Building services plant information

Item model	Item type	Location	Quantity	Sound power level (dBA)	Usage
Nuaire Xboxer XBC15	Mechanical ventilation heat recovery unit (MVHR)	Roof (MVHR 2, 3)	2	66.6	75% duty
Nuaire Xboxer XBC25	MVHR	First floor plant room (MVHR 12), roof (MVHR 1)	2	75.7	75% duty
Nuaire Xboxer XBC45	MVHR	First floor plant room (MVHRs 4 and 5)	2	74.4	75% duty
Nuaire ESBHS4-L	Air handling unit (AHU) (kitchen supply)	First floor external plant compound	1	81.8	81.5% duty
Dantherm DANX 2/4 XKS	AHU serving the hydrotherapy pool	First floor external plant compound	1	73.7	Not provided
Nuaire SQFA44-AE-WP	Kitchen ventilation extract fan	First floor external plant compound	1	84.8	79.5% duty
Lochinvar Amicus LAHP1602LT	Air source heat pump	First floor external plant compound	1	87	Not provided

All building services plant will be operational during college opening hours and on-times of 100% were set for all items to reflect typical usage when the college is open. The air source heat pump is the only item that is likely to be operational outside of opening hours, where it may become active from 05:00 at the earliest.

4.4. BS 4142 rating level for building services plant

In order to complete the BS 4142 assessment for building services plant, acoustic feature corrections were applied to the predicted specific sound level to determine the rating level. As mentioned in Section 2.5, acoustic features may include tonal components, intermittency, distinct impulses or impact sounds, or any other readily distinguishable feature.

The product datasheets for each item of plant included spectral data in octave bands. The octave band data for the Dantherm AHU and Nuaire kitchen ventilation extract fan suggest that each item may have tonal components within the 125 Hz octave band, however, third octave band data and a tonality assessment would be required to confirm if any distinct tones are present. For a precautionary approach, a +2 dB correction has been applied for tonality to the specific sound level predicted at each sensitive receptor, which in accordance with BS 4142 represents tones that are 'just perceptible'.

As the building service plant would be in continuous use, no corrections were applied for intermittency. The building services plant is not expected to produce impulsive or any other readily distinctive sounds, so no further acoustic corrections were applied.

5. Sound from outdoor sports areas

5.1. Predicted sound levels

The predicted sound levels at nearby residential properties resulting from usage of the outdoor sports areas are provided in Table 5-1. The sound levels were predicted at 1m from the building façade as required by Sports England guidance for comparison against the 50 dB $L_{Aeq,1h}$ threshold level for moderate annoyance. Values shaded in blue indicate an exceedance above this threshold level.

Assuming 15 dB sound attenuation from a partially open window, meeting the 50 dB $L_{Aeq,1h}$ threshold level at the building facades of nearby properties would achieve compliance with the requirement of 35 dB L_{Aeq} for indoor ambient noise levels stated in BS 8233:2014.

Table 5-1 – Predicted sound levels from outdoor sports areas

Location	Orientation of property	Sound level at 1m from the property's most affected building facade, ($L_{Aeq,T}$ dB)		
		All-weather sports pitch	MUGA	Both outdoor sports areas
Appletree Cottage, Birchwood Grove Road	South east	43.5	37.6	44.5
Conifers, Birchwood Grove Road	South east	49.5	36.3	49.7
2 Ryeland Road	North east	39.7	52.0	52.2
10 Ryeland Road	North east	38.5	45.7	46.5
14 Ryeland Road	North east	38.1	41.6	43.2
18 Ryeland Road	North east	37.7	40.0	42.0
69 Shearing Drive	North east	34.2	60.1	60.1
8 Chilcomb	North west	40.9	51.9	52.2

The guidance from Sports England also advises that comparisons can be made between the predicted sports sound levels at nearby sensitive receptors and existing ambient sound levels. Table 5-2 shows how the outdoor sports areas are predicted to change the overall ambient sound levels outside the nearest noise sensitive properties. The existing free-field ambient sound levels are based on the data collected from the acoustic survey (refer to Table 3-3), converted to values at 1m from building facades using a +2.5 dB correction. Values shaded in blue indicate a difference of 3 dB or more.

Table 5-2 – Predicted sound levels from outdoor sports areas

Location	Orientation of property	Baseline ambient sound level at 1m from building facades (L_{Aeq}, dB)	Activity noise (L_{Aeq}, dB)	Total noise level (baseline + activity, L_{Aeq}, dB)	Difference (L_{Aeq}, dB)
Appletree Cottage, Birchwood Grove Road	South east	46.5	44.5	49.3	1.8
Conifers, Birchwood Grove Road	South east	46.5	49.7	51.7	4.2
2 Ryeland Road	North east	53.5	52.2	55.9	2.4

Location	Orientation of property	Baseline ambient sound level at 1m from building facades (L_{Aeq}, dB)	Activity noise (L_{Aeq}, dB)	Total noise level (baseline + activity, L_{Aeq}, dB)	Difference (L_{Aeq}, dB)
10 Ryeland Road	North east	46.5	46.5	49.5	3.0
14 Ryeland Road	North east	46.5	43.2	48.2	1.7
18 Ryeland Road	North east	46.5	42.0	47.8	1.3
69 Shearing Drive	North east	53.5	60.1	61.0	7.5
8 Chilcomb	North west	53.5	52.2	55.9	2.4

5.2. Appraisal of impacts

The data presented in Table 6-1 and Table 6-2 shows that the predicted sound levels from the outdoor sports areas at Appletree Cottage and 14-18 Ryeland Road were below 50 dB L_{Aeq} and that the overall ambient sound level at these properties would change by less than 3 dB L_{Aeq}. According to IEMA (2014) guidance, a change in noise level less than 1 dB L_{Aeq} is considered 'negligible' and an increase of 1 to 2.9 dB is classified as 'slight adverse'. Therefore the impact of the outdoor sports areas at these properties is slight adverse. Taking into account the predicted sound level and magnitude of change, the impact of the outdoor sports areas at these properties is not significant.

At 2 Ryeland Road and 8 Chilcomb, the predicted sound levels exceeded 50 dB L_{Aeq} by 2 dB, but the predicted change to existing sound levels was 2.4 dB L_{Aeq} at both properties. According to IEMA (2014) guidance, a change of this magnitude would cause a 'slight adverse' impact at these locations. As the ambient sound levels were predicted to change by less than 3 dB L_{Aeq}, which is the minimum change in sound levels for perceptibility, the impact of the outdoor sports areas at 2 Ryeland Road and 8 Chilcomb is not significant.

At Conifers, the predicted sound level with the contribution from the outdoor sports areas was 4.2 dB L_{Aeq} higher than the existing ambient sound level. According to IEMA (2014) guidance, an increase of 3 to 4.9 dB is considered a 'moderate adverse' impact. The exceedance is attributed to the all-weather sports pitch, which is located approximately 50m east of the property. However, the total predicted sound level from both outdoor sports areas being used at the same time was below the 50 dB L_{Aeq} threshold level for moderate annoyance. As the proposed outdoor sports areas are located further away from this property than the existing MUGA (which is approximately 20m south of the property), the overall sound levels are likely to be lower than the existing ones when the outdoor sports areas are in use. Taking into account the predicted sound level, magnitude of change and the established use of school sports facilities influencing sound levels at this receptor, the impact of the outdoor sports areas at Conifers is not considered to be significant or more detrimental than existing conditions.

At 10 Ryeland Road, the predicted sound level with the contribution from the outdoor sports areas was 3 dB L_{Aeq} higher than the existing ambient sound level, which is considered a moderate adverse impact according to IEMA (2014) guidance. The exceedance is attributed to the MUGA, which is located approximately 25m east of the property. However, the total predicted sound level from both outdoor sports areas being used at the same time was below the 50 dB L_{Aeq} threshold level for moderate annoyance. On this basis, the impact of the outdoor sports areas at 10 Ryeland Road is not considered to be significant or more detrimental than existing conditions.

At 69 Shearing Drive, the predicted sound level exceeded the 50 dB L_{Aeq} threshold level for moderate annoyance and increased the existing ambient sound levels by 7.5 dB L_{Aeq}, which constitutes a 'substantial adverse' impact according to IEMA (2014) criteria. This property is located within 10m of the western edge of the MUGA, which is predicted to be the main contributor to the sound levels. The proposed MUGA is located on an existing area of grassland that is used by Woodlands Meed College, and 69 Shearing Drive is already exposed to some sound from sports and recreation when the field is in use, and from playtime at Birchwood Grove Primary School. The sound levels from the all-weather pitch were below 50 dB L_{Aeq} and lower than the existing ambient and background sound levels due to significant distance to this property. Taking into account the predicted sound level, magnitude of change and context, the usage of the MUGA would result in a significant impact at 69 Shearing Drive.

Mitigation measures are required to reduce the noise impact at 69 Shearing Drive. This is discussed further in Section 7.

6. Sound from building services plant

6.1. Specific sound level

The predicted specific sound levels for the daytime usage of building services plant are shown in Table 6-1, where all items are operating simultaneously and continuously throughout the reference time period. The values shown are the highest specific sound levels predicted for each property, which is at the first floor of the building. The specific sound levels presented are free-field values in this case for comparison with free-field measured background sound levels, and are presented as integers as required by BS 4142.

Table 6-1 – Predicted specific sound levels from building services plant

Location	Orientation of property	Specific sound level, free-field ($L_{Aeq,T}$ dB)
Appletree Cottage, Birchwood Grove Road	South east	51
Conifers, Birchwood Grove Road	South east	50
2 Ryeland Road	North east	36
10 Ryeland Road	North east	36
14 Ryeland Road	North east	38
18 Ryeland Road	North east	43
69 Shearing Drive	North east	32
8 Chilcomb	North west	27

The predicted specific sound levels indicated that the highest sound levels would occur at Appletree Cottage and Conifers, which directly overlook the northern elevation of the proposed college building. The main sound sources affecting the specific sound levels at these locations are listed below along with their highest sound contributions:

- Air source heat pump (48 dB L_{Aeq});
- Kitchen ventilation extract AHU (42 dB L_{Aeq});
- MVHR 12 (43 dB L_{Aeq});
- MVHR 4 (41 dB L_{Aeq});
- Kitchen supply AHU (38 dB L_{Aeq}); and
- MVHR 5 (42 dB L_{Aeq}).

The lowest specific sound levels were predicted at 8 Chilcomb and 69 Shearing Drive, which are located the furthest away from the proposed building services plant.

6.2. Rating level

6.2.1. Daytime impacts

The BS 4142 rating levels and impact significance for daytime usage of building services plant are shown in Table 6-2.

Table 6-2 – Daytime rating level and significance of building services plant noise

Location	Background sound level (L_{A90}, dB)	Specific sound level ($L_{Aeq,T}$ dB)	Rating level ($L_{Ar,T}$ dB)	Difference compared to background sound level (dB)	BS 4142 impact classification
Appletree Cottage,	36	51	53	17	Significant adverse impact

Location	Background sound level (L_{A90}, dB)	Specific sound level ($L_{Aeq,T}$ dB)	Rating level ($L_{Ar,T}$ dB)	Difference compared to background sound level (dB)	BS 4142 impact classification
Birchwood Grove Road					
Conifers, Birchwood Grove Road	36	50	52	16	Significant adverse impact
2 Ryeland Road	40	36	38	-2	Low impact
10 Ryeland Road	40	36	38	-2	Low impact
14 Ryeland Road	40	38	40	0	Low impact
18 Ryeland Road	40	43	45	5	Adverse impact
69 Shearing Drive	40	32	34	-6	Low impact
8 Chilcomb	40	27	29	-11	Low impact

Table 6-2 shows that significant adverse impacts are predicted to occur at properties on Birchwood Grove Road, with several items exceeding the background sound level individually as described in Section 6.1. Adverse impacts are predicted to occur at 18 Ryeland Road as a result of the same sound sources contributing the most to the specific sound levels at Birchwood Grove Road.

Low impacts were predicted at 69 Shearing Drive, 8 Chilcomb, and all other properties on Ryeland Road. At these properties, the greatest sound contributions from the building services plant were from the air source heat pump and MVHR 1.

Since the predictions have indicated that sound emissions may give rise to significant and adverse impacts, depending on context, it is recommended that the mitigation measures specified in Section 7 of this report are implemented to avoid significant impacts from occurring in line with national noise policy.

6.2.2. Night-time impacts

In addition to daytime usage of building service plant, it is possible that the heat pump may be operational on weekday mornings from 05:00 at the earliest. According to BS 4142, the night-time period is defined as 23:00 to 07:00, so operation of building services plant early in the morning has been considered separately.

The properties on Birchwood Grove Road would be most affected by the operation of the heat pump between 05:00-07:00. Although no background noise data was collected during these hours near the properties, the continuous noise monitoring data from measurement position 7 (towards the south west of the college site) can be used to provide an indication of the background sound levels in the area at those times. This data is included in Appendix B.

The data shows that the background sound level varies considerably between 05:00 and 07:00. At 05:00, the measured background sound levels on weekdays were 20-25 dB L_{A90}, which are very low levels. By 07:00, the measured background sound level had increased to approximately 38-43 dB L_{A90}, which is similar to those measured during the daytime.

As the specific sound level of the heat pump is 48 dB at Birchwood Grove Road (Conifers and Appletree Cottage), a significant adverse effect is likely to occur between 05:00 and 07:00 if it is operational during these hours. Mitigation measures are recommended in Section 7 of this report to avoid significant impacts occurring as far as practicable given the existing low background sound levels at Woodland Meed College.

6.3. Uncertainty

There is some uncertainty in the assessment arising from the following items:

- The measured existing background sound levels;
- The accuracy of the acoustic data and how it was modelled;
- The accuracy of the sound propagation methodology used by the acoustic software; and
- The acoustic character correction applied to the specific sound level.

The uncertainty relating to each of these items is discussed in the subsections below.

6.3.1. Appraisal of baseline conditions

The baseline acoustic survey was undertaken during term time in September 2020 by a professional acoustician who is a Member of the Institute of Acoustics, using class 1 calibrated equipment. Although the survey was completed during the coronavirus pandemic, the measured sound levels are considered to be representative of typical conditions as Woodlands Meed College and Birchwood Grove Primary School were both open and attended by pupils during the survey. Although low background sound levels were measured in the early hours of the morning, it is unlikely that the movement restrictions associated with the pandemic lowered sound levels during these hours considering the college is located in a quiet residential area away from major sound sources. Therefore, the uncertainty associated with the baseline acoustic survey is considered to be low.

6.3.2. Acoustic data and modelling assumptions features

Acoustic data for all of the building services sound sources were provided in octave band frequencies by recognised manufacturers. This allowed for frequency dependant modelling of sound propagation, which is considered to have sufficient accuracy. The impact of sound source data inaccuracy on the results of this assessment is therefore considered low.

As discussed in Section 4.4, the rating included a +2dB acoustic correction to allow for the possibility of 'just perceptible' tones from the proposed building services plant at all of the nearby residential properties. It is unclear from the provided acoustic data whether the proposed plant exhibit any distinct tonal features. Therefore, the presence of distinct tones from the plant and the degree to which they would be perceptible at the nearby properties may differ from the assumptions stated in this assessment. The impact of the uncertainty of distinct tones is considered low provided that mitigation measures are incorporated in the design of the building service plant to reduce their level of impact.

There is potential for uncertainty to arise from simplifications made to model the proposed building services plant using acoustic modelling software with the data available. This includes how the louvre on the northern plant compound wall was modelled (discussed in Section 4.2), and the use of omnidirectional point sources to represent the building services plant. This means that the sound attenuation provided by the louvre and the directivity of point sources interfacing with the louvre were not fully considered. The impact of this is considered low to moderate.

6.3.3. Acoustic modelling software

The specific sound levels were calculated using the sound propagation methodology presented in ISO 9613-2:1996 [2] and incorporated in the SoundPlan V8.2 acoustic software. Whilst ISO 9613-2:1996 provides a prediction methodology for environmental noise propagation, uncertainties and inaccuracies may arise due to the simplification of a complex natural process. Some of the uncertainties are highlighted below:

- ISO 9613-2:1996 uses a simplistic method for evaluating the ground effect by using a long-term average value inclusive of all meteorological conditions. This may account for small differences between measured data and predicted noise levels.
- ISO 9613-2:1996 uses a generic weather correction Cmet that accounts for weather conditions favourable and unfavourable for propagation, based on meteorological statistics. Where this information is unavailable, the Standard assumes that conditions favourable to propagation are occurring. Both of these conditions may account for small discrepancies between measured data (where a specific set of meteorological conditions are observed) and predicted noise levels.

[2] International Organisation for Standardisation (1993). ISO 9613:1996 Part 2 *Attenuation of sound during propagation outdoors*.

- The overall A-weighted prediction using ISO 9613-2:1996 has an accuracy of +/- 3dB when source heights are less than 5m above ground level and receivers are within 1km of the noise source. Accuracy is improved when source heights exceed 5m and receivers are within 100m of the source.

As the sensitive receptors were generally within 100m of the building services plant and the modelled sound sources were mostly 5m above ground level, the sound propagation is considered to be reasonably accurate. For sensitive receptors located further than 100m from a sound source or sound sources less than 5m above ground level, the predicted sound levels could vary by up to +/-3dB.

The uncertainties regarding the accuracy of the software are considered to have a potentially low impact on the assessment's results. The model follows standard calculation methodologies, and as such is considered to be an appropriate means of calculating the scheme's plant noise levels.

SoundPlan v8.2 has implemented ISO 9613-2 to reduce uncertainty by incorporating updates from ISO 17534 to manage ambiguities with ISO 9613. This includes standardisation of settings relating to the speed of sound at certain temperatures and diffraction if the line of sight is blocked to avoid calculation differences between software packages. The uncertainty related to how SoundPlan computes sound levels is therefore considered to be low.

7. Mitigation measures

7.1. Outdoor sports areas

Sport England (2015) provides advice for mitigating noise from MUGAs and improving their design as a whole. It suggests the following best practice measures to reduce noise:

- Weldmesh fencing is commonly used to enclose MUGAs and the panels should be securely clamped with resilient fixings to avoid vibrations;
- Sheet metal advertising signs should be avoided in proximity to the playing surface or replaced with vinyl signs;
- The entrance and access route should be located away from nearby housing as much as possible to avoid noise from people congregating around the entrance to the MUGA;
- A management or monitoring plan if users are found to act in an unreasonable manner that results in higher noise levels; and
- Placement of any acoustic barriers outside of the MUGA's perimeter fencing.

One of the most relevant of the suggested mitigation measures above is the positioning of entrance and access routes to the outdoor sports areas. The proposed layout of Woodland Meed College has been designed to minimise noise impacts by positioning the outdoor sports areas relatively close to the new college building and by aligning footpaths and access points away from the nearby residential buildings. The new college building shields properties on Birchwood Grove Road from the MUGA, and properties on Ryeland Road from the proposed all-weather sports pitch.

Some of the measures listed are not suitable for a school, namely the use of a monitoring or management plan to prevent unreasonable behaviour that could result in higher noise levels. As the school children will be supervised by a teacher when the outdoor sports areas are in use, this is not considered applicable.

The installation of a timber noise barrier of 3m height close to the western edge of the MUGA's weldmesh fencing is would result in a significant improvement to noise impacts predicted at 69 Shearing Drive. The noise barrier would need a density of 15-20 kg/m^3 to sufficiently reduce transmission through the noise barrier. Supposing that a noise barrier could be installed in place of the current mesh fencing along the western edge of the MUGA, the acoustic model predicts that the sound levels would reduce to approximately 53 dB L_{Aeq} at the closest façade of 69 Shearing Drive and increase existing ambient sound levels by 2.8 dB L_{Aeq}. The impact magnitude of the change to existing ambient noise levels at this property would change from substantial adverse to slight adverse according to IEMA criteria. Therefore, installation of a noise barrier would improve compliance with Sports England (2015) guidance and avoid a significant impact from occurring.

If installation of a noise barrier is not feasible, relocating the MUGA should be considered. As the MUGA and an informal play area are located adjacent to each other, it is suggested that their positions could be swapped over so that the MUGA is situated further away from 69 Shearing Drive and closer to Birchwood Primary School. It is understood that this kind of design change may not be possible and would require discussion with all stakeholders to determine whether it is viable.

7.2. Building services plant

Sound from the proposed building services plant has been shown to have the potential to give rise to significant and adverse impacts at residential properties close to the Woodland Meed College. In accordance with BS 4142, sound rating levels equal to or below the background sound level indicate a low impact. Table 7-1 shows the estimated sound reductions required to reduce the cumulative plant sound rating level to equal the background sound level.

Table 7-1 – Required minimum sound emission reductions to indicate a low impact

Building services plant	Minimum reduction required
Air source heat pump (Lochinvar Amicus LAHP1602LT)	25 dB
Kitchen ventilation extract fan (Nuaire SQFA44-AE-WP)	23 dB
Kitchen supply AHU (Nuaire ESBHS4-L)	20 dB
MVHR 12 (Nuaire Xboxer XBC25)	20 dB

Building services plant	Minimum reduction required
MVHR 4 (Nuaire Xboxer XBC45)	18 dB
MVHR 5 (Nuaire Xboxer XBC45)	20 dB
MVHR 1 (Nuaire Xboxer XBC25)	5 dB
Hydrotherapy pool AHU (Dantherm DANX 2/4 XKS)	5 dB
MVHRs 2 and 3 (both Nuaire Xboxer XBC15)	No reduction required

The sound reductions shown in Table 7-1 can be achieved by using a combination of the mitigation measures listed below:

- Selection of quieter products than those specified in this assessment;
- Addition of attenuators to the MVHR and AHU plant;
- Using an acoustic enclosure for the air source heat pump;
- Substituting the 10m x 1.5m weatherproof louvre at the external plant compound wall for an acoustic louvre, or selection of a louvre with a smaller free area than assumed in this assessment; and
- Resizing and repositioning the weatherproof louvre at the external plant compound.

Provided that these mitigation measures are implemented and the sound reductions stated in Table 7-1 can be achieved, then use of building services plant is predicted to have a low impact during daytime opening hours, in accordance with BS 4142.

With the mitigation measures listed above, it is possible that early morning usage of the air source heat pump between 05:00 and 07:00 may result in an adverse impact. This is due to the very low background sound levels during this time period, which can be as low as 20-25 dB L_{A90}. It may not be feasible to reduce sound emissions from the air source heat pump to these levels to ensure a low impact at all times that it may be operational. However, it is likely that the required internal ambient levels stated in BS 8233 can be achieved allowing 15 dB attenuation for a partially open window.

8. Conclusion

Atkins has undertaken a noise impact assessment of the proposed outdoor sports areas and building services plant at Woodland Meed College. The assessments of each type of sound source were completed in general accordance with Sports England guidance (2015) and BS 4142:2014+A1:2019 to determine whether nearby residential properties would be affected.

The sound levels from the outdoor sports areas and building services plant were calculated using acoustic modelling software. The predictions for outdoor sports areas showed that no significant impacts would occur at the majority of properties based on the magnitude of the predicted sound level, how much existing ambient conditions would change, and context. However, significant impacts were predicted at 69 Shearing Drive, which is located within 10m from the western edge of the proposed MUGA. A number of mitigation measures have been suggested to reduce the level of impact at this property, including best practice measures, installation of a 3m noise barrier and consideration of relocating the MUGA.

The assessment of sound from building services plant showed that significant impacts were likely at properties on Birchwood Grove Road (Appletree Cottage and Conifers), which is mostly attributed to plant installed on the first floor external plant compound on the northern elevation. The level of impact was exacerbated by low background sound levels measured in this area. Mitigation measures are required to achieve as low an impact as reasonably practicable, including the use of alterative quieter products, attenuators, enclosures or screening, and modifications to the louvre currently proposed on the northern wall of the external plant compound.

Appendices

Appendix A. Glossary of Acoustic Terms

Decibel (dB)

The unit of measurement used for sound pressure levels. The scale is logarithmic rather than linear. The threshold of hearing is 0 dB and the threshold of pain is 120 dB. In practical terms these limits are seldom experienced and typical levels lie within the range 30 dB (a quiet night-time level in a bedroom) to 90 dB (at the kerbside of a busy city street).

A-weighting:

An electrical frequency weighting used to represent the response of the human hearing mechanism to sound. A-weighted sound level is indicated either by placing the capital letter A after the letters dB to get dB(A) or it may be added as a subscript to the sound level parameter as in $L_{Aeq,T}$.

Percentile Level (Statistical Sound Level Indices, L_{AN}, L_{A10}, L_{A90})

L_{AN} is the dB(A) level exceeded N% of the time measured on a sound level meter with Fast (F) time weighting, e.g. L_{A90} the dB(A) level exceeded for 90% of the time, is commonly used to estimate background sound level. L_{A10}, the level exceeded for 10% of the time, is commonly used in the assessment of road traffic noise.

Research has shown that the arithmetic average of the 18, 1-hour L_{A10} levels (depicted as $L_{A10,18h}$) between 0600 and 2400 hours shows a reasonably good correlation with community responses to traffic noise. This unit is used in the UK for the assessment of road traffic noise.

Equivalent Continuous A-Weighted Sound Pressure Level ($L_{Aeq,T}$):

Equivalent continuous A-weighted sound pressure level is the steady sound level that has the same sound energy as the fluctuating A-weighted sound pressure level occurring over the same time period and at the same location.

Ambient Sound Level ($L_{Aeq,T}$):

Totally encompassing sound in a given situation at a given time usually composed of sound from many sources near and far.

Background Sound level ($L_{AF90,T}$):

The A-weighted sound pressure level of the existing ambient sound level that is exceed for 90% of a given time period, T, measured using time weighting ‘Fast’.

Free-Field (acoustical):

Free-field means a position far away from any reflecting surfaces other than the ground. Several standards and guidelines recommend that to achieve free-field conditions the microphone should be positioned at least 3.5 metres from any reflecting surfaces.

Facade position:

A façade position is located one metre from a building façade or large vertical structure.

Appendix B. Baseline Noise Survey

B.1. Instrumentation details

Table B-1 – Survey instrumentation

Measurement location	Equipment item	Type	Serial number	Date of calibration	Calibration certificate
Attended measurements (Positions 1-6)	Sound level meter	01dB FUSION	11200	31/10/2018	04017/4
	Microphone	GRAS 40CE	226400	31/10/2018	04017/4
	Pre-amplifier	01dB Pre No22	1605098	31/10/2018	04017/4
	Calibrator	Brüel & Kjær 4231	2385276	05/11/2019	UCRT19/2226
Unattended measurements (Position 7)	Sound level meter	01dB FUSION	11195	01/11/2018	4017/6
	Microphone	GRAS 40CE	233226	01/11/2018	4017/6
	Pre-amplifier	01dB Pre No22	1605094	01/11/2018	4017/6
	Calibrator	01dB CAL21	34565045	05/11/2019	UCRT19/2224
	Weather station	Davies Vantage Pro 2	1920853	N/A	N/A

B.2. Wind conditions

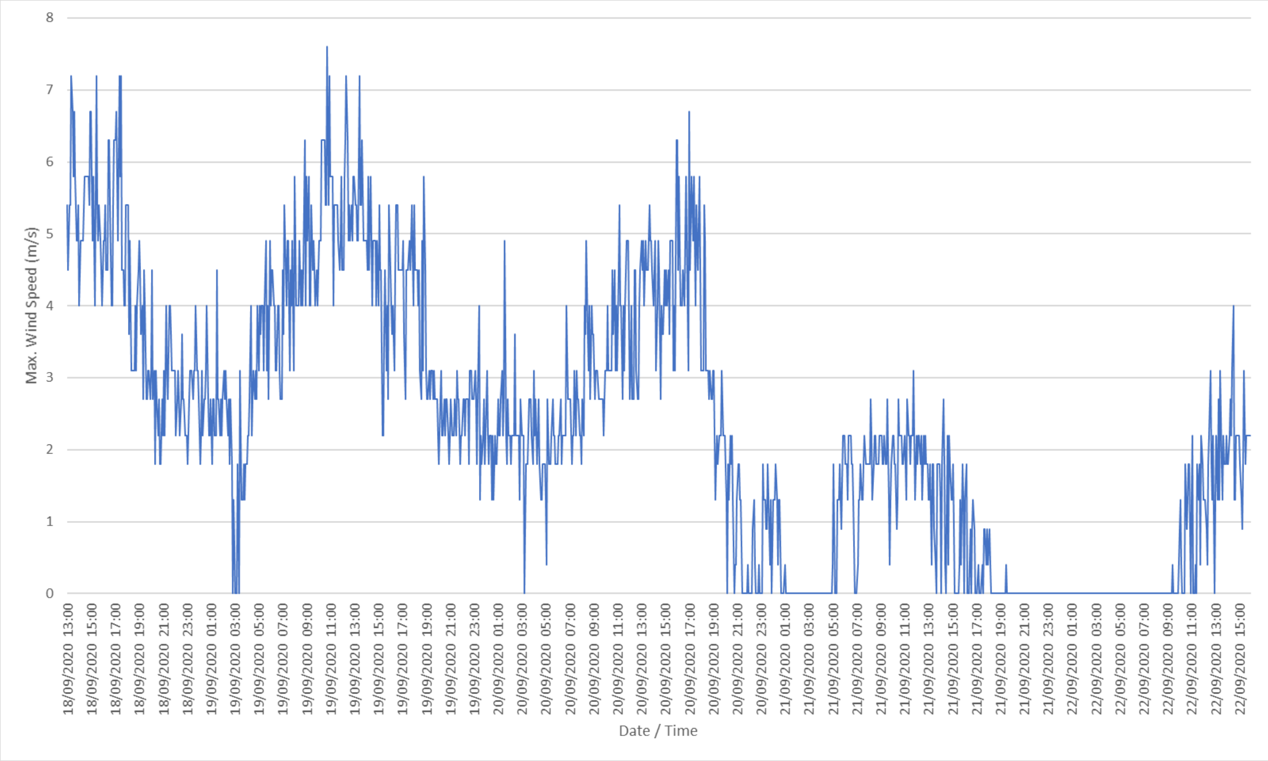


Figure B-1 – Maximum wind speeds recorded on site (5 minute periods)

B.3. Continuous noise measurements at location 7

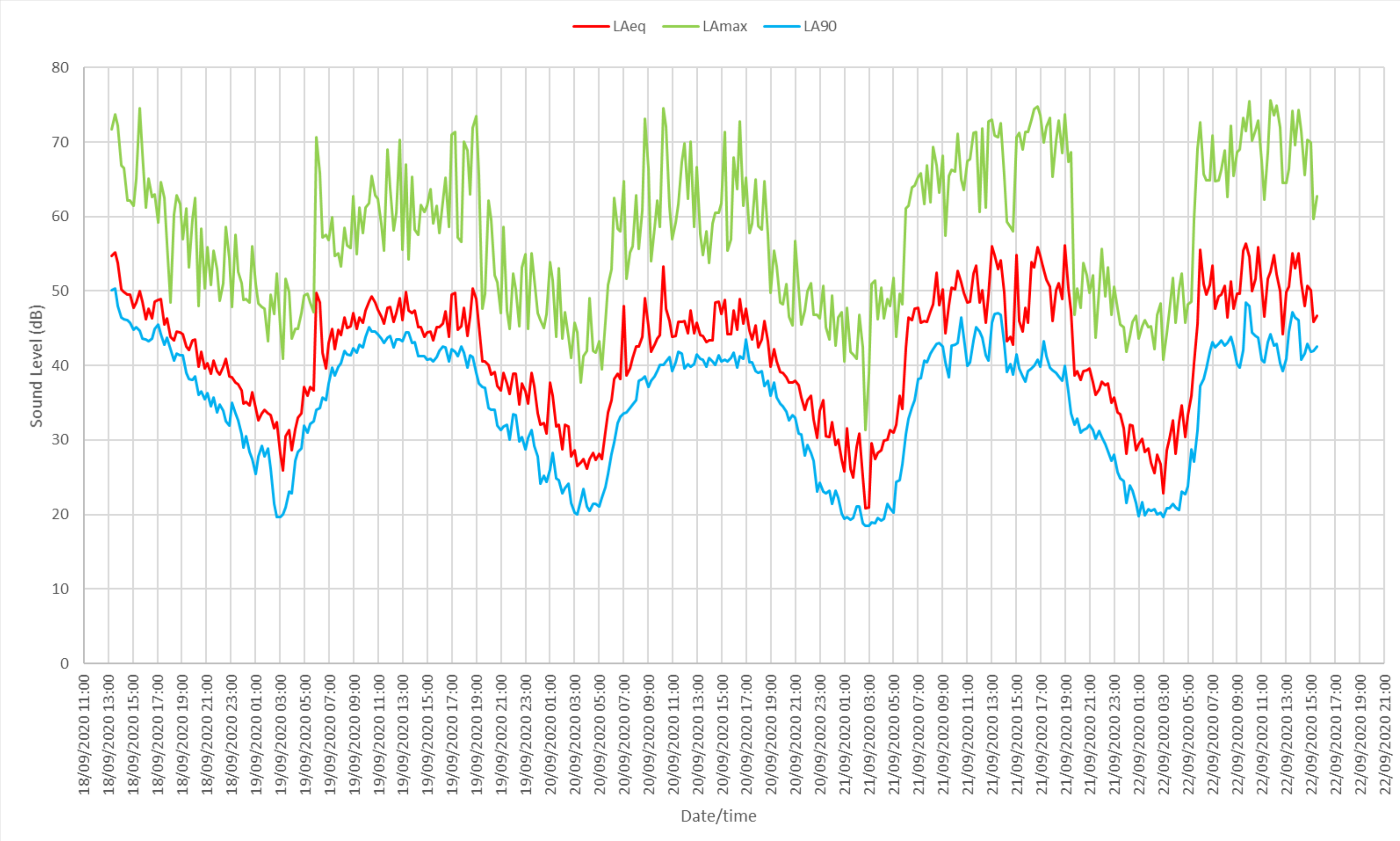


Figure B-2 – History of sound levels measured at Position 7

Appendix C. Source data

C.1. Lochinvar Amicus LAHP1602LT

Table C-1 – Lochinvar Amicus acoustic data

Item description	Sound power level at octave band centre frequencies, dB							
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Air source heat pump	100.1	91.3	85.2	83.7	82.6	77.2	73.8	64.7

C.2. Nuaire Xboxer XBC15

Table C-2 – Nuaire Xboxer XBC15 acoustic data

Fan speed	Item description	Sound power level at octave band centre frequencies, dB							
		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
100%	Induct intake	70	60	55	56	62	55	47	43
	Induct supply	75	72	65	66	68	64	59	57
	Induct discharge	75	73	65	67	68	65	60	58
	Induct extract	69	59	55	55	61	55	45	41
	Casing radiated	61	57	42	43	41	37	34	23
75%	Induct intake	64	54	49	50	56	49	41	37
	Induct supply	69	66	59	60	62	58	53	51
	Induct discharge	69	67	59	61	62	59	54	52
	Induct extract	63	53	49	49	55	49	39	35
	Casing radiated	55	51	36	37	35	61	28	< 20
50%	Induct intake	55	45	40	41	47	40	32	28
	Induct supply	60	57	50	51	53	49	44	42
	Induct discharge	60	58	50	52	53	50	45	43
	Induct extract	54	44	40	40	46	40	30	26
	Casing radiated	46	42	27	28	26	22	>20	>20
25%	Induct intake	40	30	25	26	32	25	17	13
	Induct supply	45	42	35	36	38	34	29	27
	Induct discharge	45	43	35	37	38	35	30	28
	Induct extract	39	29	25	25	31	25	< 20	< 20
	Casing radiated	31	27	< 20	< 20	< 20	< 20	< 20	< 20

C.3. Nuaire Xboxer XBC25

Table C-3 – Nuaire Xboxer XBC25 acoustic data

Fan speed	Item description	Sound power level at octave band centre frequencies, dB							
		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
100%	Induct intake	77	71	69	71	66	62	54	53
	Induct supply	82	83	78	82	72	72	68	70
	Induct discharge	83	84	78	81	72	72	70	71
	Induct extract	76	70	68	71	65	62	54	54
	Casing radiated	69	68	55	58	45	44	44	36
75%	Induct intake	71	65	63	65	60	56	48	47
	Induct supply	76	77	72	76	66	66	62	64
	Induct discharge	77	78	72	75	66	66	64	65
	Induct extract	70	64	62	65	59	56	48	48
	Casing radiated	63	62	49	52	39	38	38	30
50%	Induct intake	63	57	55	57	52	48	40	39
	Induct supply	68	69	61	68	58	58	54	56
	Induct discharge	69	70	64	67	58	58	56	57
	Induct extract	62	56	54	57	51	48	40	40
	Casing radiated	55	54	41	44	31	30	30	22
25%	Induct intake	48	42	40	42	37	33	25	24
	Induct supply	53	54	49	53	43	43	39	41
	Induct discharge	54	55	49	52	43	43	41	42
	Induct extract	47	41	39	42	36	33	25	25
	Casing radiated	40	39	26	29	< 20	< 20	< 20	< 20

C.4. Nuaire Xboxer XBC45

Table C-4 – Nuaire Xboxer XBC45 acoustic data

Fan speed	Item description	Sound power level at octave band centre frequencies, dB							
		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
100%	Induct intake	83	75	75	64	64	62	54	45
	Induct supply	87	80	85	71	72	71	66	62
	Induct discharge	88	81	85	71	72	72	66	64
	Induct extract	84	75	76	63	64	63	53	44
	Casing radiated	74	65	62	47	45	44	40	29
75%	Induct intake	77	69	69	587	58	56	48	39
	Induct supply	81	74	79	65	66	65	60	56

Fan speed	Item description	Sound power level at octave band centre frequencies, dB							
		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
	Induct discharge	82	75	79	65	66	66	60	58
	Induct extract	78	69	70	57	58	57	47	38
	Casing radiated	68	59	56	41	39	38	34	23
50%	Induct intake	68	60	60	49	49	47	39	30
	Induct supply	72	65	70	56	57	56	51	47
	Induct discharge	73	66	70	56	57	57	51	49
	Induct extract	69	60	61	48	49	48	38	29
	Casing radiated	59	50	47	32	30	29	25	< 20
25%	Induct intake	53	45	45	34	34	32	34	< 20
	Induct supply	57	50	55	41	42	41	36	32
	Induct discharge	58	51	55	41	42	42	36	34
	Induct extract	54	45	46	33	34	33	23	< 20
	Casing radiated	44	35	32	< 20	< 20	< 20	< 20	< 20

C.5. Dantherm DANX 2-4 XKS

Table C-5 – Dantherm AHU acoustic information

Item description	In duct sound power level (at duct connections), dB							
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 Hz	4 kHz	8 kHz
Fresh air (inlet)	58	58	64	58	49	47	41	36
Supply air (discharge)	64	66	73	70	71	68	63	58
Extract air (inlet)	59	61	67	64	56	54	49	45
Exhaust air (discharge)	61	62	69	65	65	61	55	51
Breakout to surroundings	49	48	50	40	32	35	29	23

C.6. Nuaire SQFA44-AE-WP

SUMMARY FAN DATA SHEET

Nuaire, Western Industrial Estate, Caerphilly, CF83 1NA, United Kingdom. email:info@nuaire.co.uk
UK Commercial enquiries T:029 2085 8200 UK Residential enquiries T:029 2085 8500 International enquiries T:+44.29 2085 8497
Whilst the information given on this data sheet is fan specific, it is in summary and reference to the product selection catalogue and installation & maintenance documents is recommended
This data sheet produced on 27 Oct 2020 13:49 using software version 4.5.3680.0

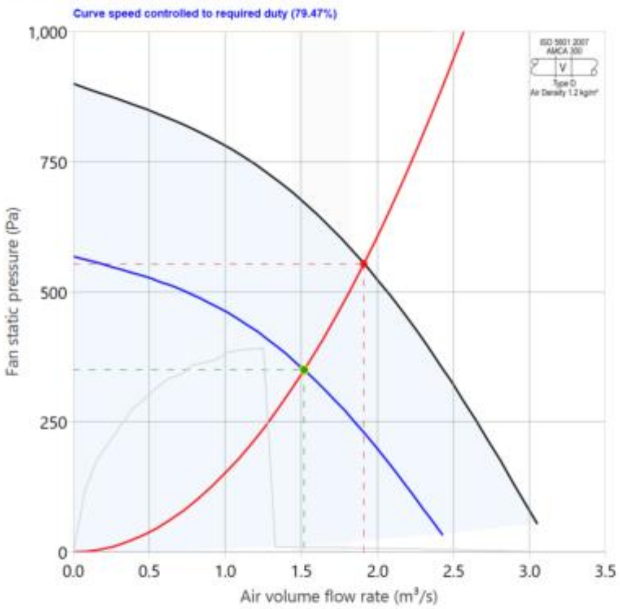
Technical Data

SQFAE-WP - SQF Single in-line fan, acoustic enclosure and weatherproof

Fan Code:	**SQFA44-AE-WP**
Installation Manual Links:	671175
Required duty:	1.52 m³/s at 350 Pa
Actual duty:	1.91 m³/s at 554 Pa
Actual at required flow:	1.52 m³/s at 671 Pa
When speed controlled to required duty (79.47%):	
Fan Input Power:	**1.087 kW**
Motor Input Power:	**1.393 kW**
Specific Fan Power:	**0.9 W/(l/s)**
Velocity at required duty:	2.714 m/s
Fan Total Efficiency:	50%
At full speed:	
Fan Input Power:	2.166 kW
Maximum Fan Input Power:	2.17 kW
Motor Input Power:	2.722 kW
Specific Fan Power:	1.4 W/(l/s)
Fan Total Efficiency:	31%
Maximum Fan Speed:	4 pole, 1,450 RPM
Electrical Supply:	400V 3 Phase 50 Hz
Nominal Motor Rating:	2.2 kW
Motor current (flc):	4.6 A
Motor starting current (sc):	28.8 A
Motor Efficiency:	IE2 / High Efficiency
Max. operating temp:	90°C
Weight:	373 kg

Starting currents are nominal for D.O.L. starting.

Performance Chart



Sound Data

Acoustic perfomance to ISO 13347 and AMCA 300.

Noise calculated speed controlled to required duty (79.47%)

Sound Power Levels re 1 pWatts (Hz):

Hz	63	125	250	500	1k	2k	4k	8k	dBA
Induct Inlet	81	91	86	78	72	75	75	66	
Induct Outlet	82	85	83	83	76	77	77	63	
Breakout	65	71	61	52	41	43	38	19	37
For 100% speed:	+2	+2	+3	+4	+5	+5	+5	+5	

dBA is spherical at 3 metres. For hemi-spherical add 3 dBA.
Values shown are for inlet Lw, outlet Lw sound power & breakout levels for: Installation Type D: ducted inlet, ducted outlet. Ratings include the effects of duct end correction.

Please note that the noise data stated on this data sheet for the unit and/or silencer is tested in accordance with UK, European and International industry laboratory standards. However onsite conditions may vary and we would recommend that this information is verified by an acoustic specialist in order to ensure its suitability for the intended application.

Specification

In-line centrifugal fan suitable for both vertical & horizontal mounting, for external applications.
In-line centrifugal fan suitable for horizontal air flow. The unit casing shall be heavy gauge galvanised steel. The fans shall be of high efficiency backward curved centrifugal design, manufactured in galvanised steel. Fans shall be direct drive with IE2 high efficiency motors to BS5000 as standard, where appropriate. The unit motor shall be positioned outside the ventilation airflow path. The unit shall be capable of continuous operation at 90°C.

The acoustic enclosure is supplied complete with a SQFA unit (as specified above) and is for external applications. The enclosure casing shall be Aluzinc, 50mm panels with an acoustic lining. The enclosure is fitted with two fans to keep the motor cool. Access is from either side. The top is also removable for access to fan/motor. For ambient conditions only.

C.7. Nuaire ESBHS4-L

nuaire **SUMMARY FAN DATA SHEET**

Nuaire, Western Industrial Estate, Caerphilly, CF83 1NA, United Kingdom. email:info@nuaire.co.uk
UK Commercial enquiries T:029 2085 8200 UK Residential enquiries T:029 2085 8500 International enquiries T:+44.29 2085 8497
Whilst the information given on this data sheet is fan specific, it is in summary and reference to the product selection catalogue and installation & maintenance documents is recommended.
This data sheet produced on 27 Oct 2020 13:33 using software version 4.5.3680.0

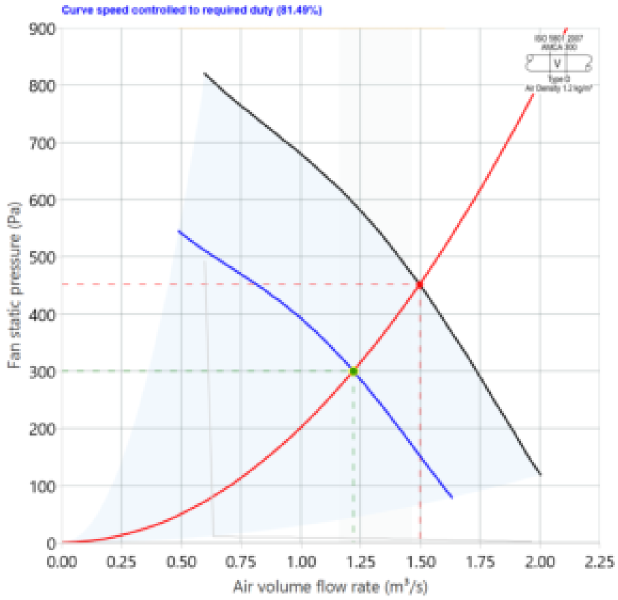
Technical Data

ESBHS - Ecosmart Boxer Supply AHU

Fan Code:	**ESBHS4-L**
Installation Manual Links:	671188
Required duty:	1.22 m³/s at 300 Pa
Actual duty:	1.5 m³/s at 452 Pa
Actual at required flow:	1.22 m³/s at 594 Pa
When speed controlled to required duty (81.49%):	
Fan Input Power:	**1.177 kW**
Motor Input Power:	**1.393 kW**
Specific Fan Power:	**1.1 W/(l/s)**
Velocity at required duty:	1.754 m/s
Fan Total Efficiency:	31%
At full speed:	
Fan Input Power:	2.174 kW
Maximum Fan Input Power:	2.393 kW
Motor Input Power:	2.573 kW
Specific Fan Power:	1.7 W/(l/s)
Fan Total Efficiency:	21%
Maximum Fan Speed:	2 pole, 2,160 RPM
Electrical Supply:	400V 3 Phase 50 Hz
Nominal Motor Rating:	3 kW
Motor current (flc):	7 A
Motor starting current (sc):	7 A
Motor Efficiency:	IE2 / High Efficiency
Max. operating temp:	40°C
Weight:	442 kg

All Ecosmart fans feature soft-starting and stepless variable speed control. A switch disconnector is required to isolate the fan from the electrical supply.

Performance Chart



Sound Data

Acoustic perfomance to ISO 13347 and AMCA 300.

Noise calculated speed controlled to required duty (81.49%)

Sound Power Levels re 1 pWatts (Hz):

Hz	63	125	250	500	1k	2k	4k	8k	dBA
Induct Inlet	90	85	81	82	74	71	65	60	
Induct Outlet	93	88	82	81	73	69	64	60	
Breakout	79	70	68	54	40	37	38	29	41
For 100% speed:	+2	+2	+3	+3	+5	+5	+5	+5	

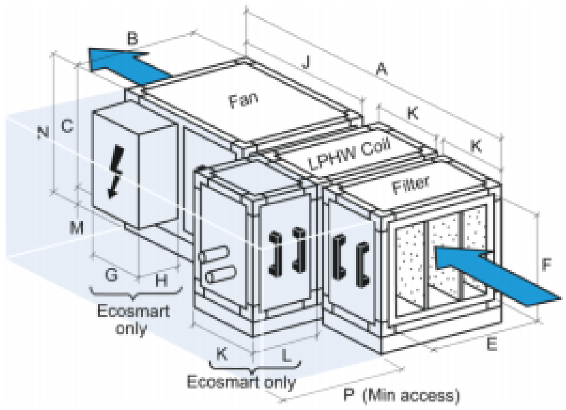
dBA is spherical at 3 metres. For hemi-spherical add 3 dBA.
Values shown are for inlet Lw, outlet Lw sound power & breakout levels for: Installation Type D: ducted inlet, ducted outlet. Ratings include the effects of duct end correction.

Please note that the noise data stated on this data sheet for the unit and/or silencer is tested in accordance with UK, European and International industry laboratory standards. However onsite conditions may vary and we would recommend that this information is verified by an acoustic specialist in order to ensure its suitability for the intended application.

Specification

Air handling unit shall consist of fan, G4 filter and LPHW heating coil. Air handling unit shall be constructed with double skinned aluzinc panels on an aluminium Pentapost frame. Air handling unit shall incorporate full Ecosmart control package.
Units will be supplied in modular sections for on site assembly by the installer, this will also necessitate completion of the wiring between modules.
LPHW: -3 to 30°C @ 1.7m³/s, 68 kW, water flow rate 1.47 l/s, water pd 13 kPa, connection 1.5 in BSP.

Fan Dimensions



A	B	C	E	F	G	H	J	K
2400	1000	800	940	740	460	260	1200	600
L	**M**	**N**	**P**	**kg**				
450	80	880	800	442				

Length:	Width:	Height:
2400	1260	880

Drawing is for dimensional purposes only. Dimensions in mm.