Planning Noise Assessment

Harefield Academy

Harefield, Uxbridge

UB9 6ET

Stroma Built Environment Ltd.

SBE Ref: OPP-105283 – AC - 1v1

Stroma Built Environment Ltd. 6 Silkwood Business Park, Fryers Way, Wakefield, Ossett WF5 9TJ
www.stroma.com/built-environment | email: BEnfo@stroma.com
Registered Number 04507219 – VAT No. 154 765 781

I. Revision History

Revision	Date	Description	
1v1	07/08/2023	1v1 – First Issue	
		Compiled By	**Authorised By**
		Ben Reed MIOA Senior Acoustic Consultant	Andrew Gibson MIOA Principal Acoustic Consultant

II. Contents

1. Introduction

1.1 Stroma Built Environment (SBE) has been appointed by ISG Ltd (the client) to undertake acoustic consultancy services for a new build SEN school at the existing Harefield Academy site, Northwood Way, Harefield, Uxbridge.

1.2 The proposed scheme includes the construction of a new two storey teaching block containing classrooms, flexible space (dining space + bleacher seating), staff rooms / offices and ancillary spaces. A site plan showing the proposed development is provided in Appendix I.

1.3 The purpose of this assessment is to consider the existing and future noise climate around the proposed development site in order to determine suitability of the development proposals. The assessment will also consider potential noise impacts at nearby noise sensitive receptors (NSR) due to the proposed scheme.

1.4 This document has been prepared for the sole use, benefit and information of the client for the purposes set out. The liability of SBE In respect of any information contained herein shall not extend to any third party.

1.5 Whilst every effort has been made to ensure this report is easy to understand, it is technical in nature. A glossary of acoustic terms is included as Appendix IIIAppendix III.

2. Noise Assessment Guidance and Criteria

National Planning Policy Framework (2021) (NPPF)

2.1 Initially published in March 2012 and most recently updated in July 2021, this document sets out the Government's overall planning policies for England. In relation to noise, the following paragraphs in the document are relevant.

2.2 Paragraph 174, which states

"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."

2.3 The main reference to noise within the NPPF is at paragraph 185, which is reproduced in full below:

"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
c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation"

IEMA Guidelines for Environmental Noise Assessments (2014)

2.4 The IEMA guidelines address the key principles of assessing noise effects and are applicable to all development proposals where noise effects may occur.

2.5 The guidance provides advice with regard to the collection of baseline noise data, prediction of noise levels and how noise should be assessed. The guidance recognises that the impact associated with a particular noise source will be dependent on a number of factors including, but not limited to the sensitivity of the receptor, the frequency and duration of the noise source and the time of day at which it occurs.

2.6 However, it stops short of providing specific assessment criteria which developments should achieve but instead suggests that the methodology adopted should be selected on a site by site basis with reference to relevant national and local standards.

Part E Building Regulations – BB93 Acoustic Performance Standard for Teaching Spaces

2.7 Section 8 of Approved Document E states that the normal way of satisfying Requirement E4 of Part E to Schedule 1 of the Building Regulations 2010 for new school buildings is to meet the performance standards set out in Building Bulletin 93 *'Acoustic design of schools: performance standards'* (BB93).

2.8 Section 1.1 of BB93 presents Indoor Ambient Noise Level (IANL) upper limit criteria for various types of teaching, study, and ancillary spaces. Secondary school teaching spaces are to achieve a maximum IANL of 35 dB $L_{Aeq,30min}$ and more stringent criteria for SEN spaces applies where IANL should not exceed 30 dB $L_{Aeq,30min}$.. Additionally, BB93 states that the IANL should not regularly exceed 60 dB $L_{A1,30min}$, however this is achieved by default for spaces with IANLs up to 40 dB $L_{Aeq,30min}$.

2.9 Note that the BB93 IANL criteria include contributions from external sources outside the school premises and building services noise but excludes contributions from teaching activity/equipment, staff, and students within the school premises.

Hillingdon local plan

2.10 The Hillingdon local plan sets out the local authority requirements for development within the local area. Policy EM1 is referenced in relation to the control of noise, however Policy EM1 does not set out any specific control measures or requirements in terms of directly controlling noise.

2.11 The local plan does reference the need for quiet or 'tranquil' areas in development generally and references the Mayor's London's Ambient Noise Strategy and intentions in the London Plan, however again, without any prescriptive requirements or control measures to be adopted. The local plan generally highlights noise with regards to primary noise sources in the area namely Heathrow airport and the major road network.

2.12 Reference is given to the NPPF, full details of which are presented above with the local plan stating the following:

"8.138 Noise: Guidance has already been set out at the national level by the NPPF. This guidance sets out a clear rationale as to where sensitive development should be located in relation to existing noise/ pollution sources, and also provides guidance on where potentially noise polluting development should be located."

2.13 Policy EM8: Land, Water, Air and Noise states the following with regards to noise:

"Noise

The Council will investigate Hillingdon's target areas identified in the Defra Noise Action Plans, promote the maximum possible reduction in noise levels and will minimise the number of people potentially affected.

The Council will seek to identify and protect Quiet Areas in accordance with Government Policy on sustainable development and other Local Plan policies.

The Council will seek to ensure that noise sensitive development and noise generating development are only permitted if noise impacts can be adequately controlled and mitigated."

The London Plan 2021 - Greater London Authority (GLA)

2.14 The GLA London Plan 2021 sets out the economic, environmental, transport and social framework for development in London. The plan contains various planning policies for London, with Policy D14 relating to noise, which is repeated below:

"Policy D14 Noise

A In order to reduce, manage and mitigate noise to improve health and quality of life, residential and other non-aviation development proposals should manage noise by:

1) avoiding significant adverse noise impacts on health and quality of life

2) reflecting the Agent of Change principle as set out in Policy D13 Agent of Change

3) mitigating and minimising the existing and potential adverse impacts of noise on, from, within, as a result of, or in the vicinity of new development without placing unreasonable restrictions on existing noise-generating uses

4) improving and enhancing the acoustic environment and promoting appropriate soundscapes (including Quiet Areas and spaces of relative tranquillity)

5) separating new noise-sensitive development from major noise sources (such as road, rail, air transport and some types of industrial use) through the use of distance, screening, layout, orientation, uses and materials – in preference to sole reliance on sound insulation

6) where it is not possible to achieve separation of noise-sensitive development and noise sources without undue impact on other sustainable development objectives, then any potential adverse effects should be controlled and mitigated through applying good acoustic design principles

7) promoting new technologies and improved practices to reduce noise at source, and on the transmission path from source to receiver.

B Boroughs, and others with relevant responsibilities, should identify and nominate new Quiet Areas and protect existing Quiet Areas in line with the procedure in Defra's Noise Action Plan for Agglomerations."

2.15 Regarding the management of noise, paragraph 3.14.3, references BS 8233:2014, the Pro:PG Planning and Noise (May 2017) and BS 4142:2014 as being suitable guidance to aid acoustic design.

2.16 Guidance within BS 8233:2014 and the Pro:PG typically contains guidance to aid the design of residential development, as such is not considered applicable to this development. However, guidance contained within BS4142:2014 has been followed with regards to noise impacts.

BS 4142:2014 *Methods for rating and assessing industrial and commercial sound*

2.17 BS 4142 describes a method for assessing the adverse impact from noise sources that are of an industrial nature (e.g. fans, pumps, chillers, air handling units etc). The assessment methodology is based upon determining a 'rating level' for the equipment being assessed, which is the level of noise from the item of items of plant being assessed (measured as an $L_{Aeq,T}$)

- 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 +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 of a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

2.18 BS 4142 states that a penalty should be added for any plant which gives rise to noise features that may increase disturbance such as tonal, impulsive or intermittent characteristics. With respect to the acoustic feature correction, BS 4142 states:

"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, add a character correction to the specific sound level to obtain the rating level."

2.19 A rating penalty for a sound may be based on a subjective assessment of its characteristics or using objective methods to determine tonality.

3. Baseline Conditions

Site Description

3.1 The site is located within the grounds of the existing Harefield Academy on Northwood Way, Harefield, Uxbridge. The existing Harefield Academy building is located immediately to the northwest with existing outdoor sports use immediately to the north and parking to the south. Beyond the existing school grounds is residential properties on Northwood Road to the south, and on Newdigate Road to the west. To the north of the site is generally greenfield, with a single property located approximately 90m northeast of the school boundary.

Noise Surveys

3.2 A baseline noise survey has been undertaken at the site previously by a third-party consultant Sharps Redmore (SR) as summarised in their report '*Northwood Road School Harefield Planning Assessment*' Report Date; 5th May 2022 Project Number: 2220958.

3.3 An extract from the Sharps Redmore report showing the measured noise levels is provided in Appendix II.

3.4 An additional noise survey has also been undertaken by Stroma on Wednesday 19th April 2023 for an hour at each of the measurement positions as shown in Figure 1.

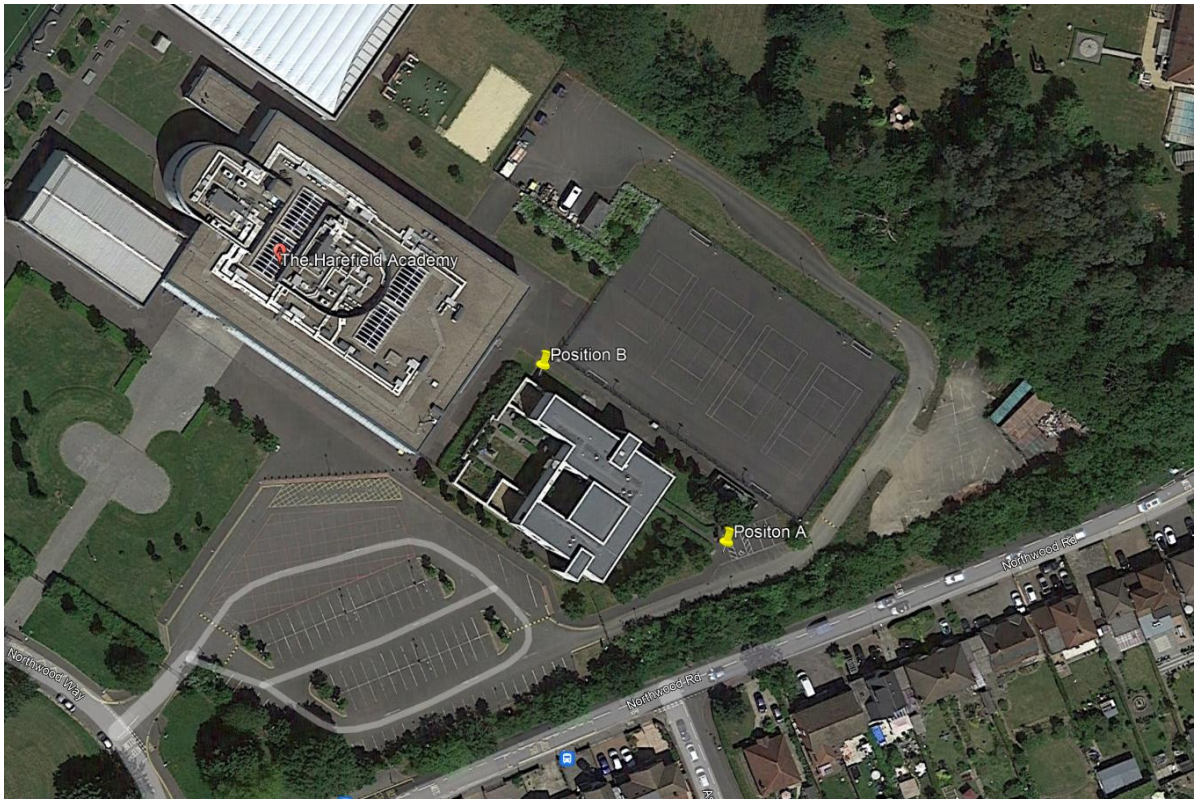


Figure 1: Survey measurement position

3.5 A photograph of the measurements in progress is shown in Figure 2 and Figure 3 for measurement Position A and Measurement Position B respectively. The dominant noise sources were vehicle movements and bird song.

Figure 2: Measurement in progress at Position A

Figure 3: Measurement in progress at Position B

3.6 The measured noise level at each position is shown in Table 1.

Table 1: Measured free-field noise levels at each measurement position

Start time	Position	$L_{Aeq,T}$ (dB)	Octave band $L_{Aeq,T}$ (dB)							
			63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
08:32	A	55	35	42	44	44	52	51	39	29
09:36	B	49	29	33	40	41	46	42	37	29

Noise Sensitive Receptors

3.7 The closest noise sensitive receptors (NSR) have been identified to be the existing residential dwellings to the south on Northwood Road.

4. Site Suitability Assessment

Façade Noise Exposure

4.1 Based on the results of the baseline noise survey, noise levels incident on the new building façades are predicted to be circa 55 dB $L_{Aeq,30mins}$, controlled by road traffic noise.

4.2 Indoor Ambient Noise Level (IANL) criteria are defined in BB93 for different spaces; Teaching space intended specifically for students with special hearing or communication needs should not exceed 30 dB $L_{Aeq,30min}$. In addition, to protect students from regular discrete events such as aircraft or trains IANL should not regularly exceed 60 dB $L_{A1,30min}$. BB93 does state however that this is achieved by default for spaces with IANLs up to 40 dB $L_{Aeq,30min}$. As such, the $L_{A1,30min}$ noise level requirement is considered to be met by default in this assessment given the requirement for IANLs of 30 dB $L_{Aeq,30min}$.

4.3 The building envelope is required to provide adequate sound reduction of external noise levels to achieve the internal design criteria. Based on measured noise survey data, minimum façade construction sound insulation performances outlined in Table 2 are calculated to provide BB93 compliant internal noise levels with windows closed.

Table 2: Minimum building façade sound insulation requirements

Building Element	Minimum Airborne Sound Insulation Performance
Façade glazing	27 dB $R_w + C_{tr}$
Walls	31 dB $R_w + C_{tr}$
Roof	29 dB $R_w + C_{tr}$

4.4 For all spaces, glazing rated 27 dB $R_w + C_{tr}$ (or higher) is calculated to provide BB93 compliant internal noise levels with windows closed. This rating is typically provided with 'standard' double glazed units, as is typically required for thermal purposes, e.g. 6 mm panes separated by a 12 mm cavity.

Normal Ventilation Strategy

4.5 Ventilation to teaching spaces shall need to be provided with a system which allows windows to remain closed such as mechanical ventilation or hybrid heat recovery ventilation units.

4.6 Section 1.1.3 of BB93 addresses natural and hybrid ventilation in schools and states that a 5 dB relaxation of BB93 Indoor Ambient Noise Levels is applicable in teaching spaces when the proposed ventilation systems are operating in their normal condition. Section 1.1.3 of BB93 defines the normal condition for a natural or hybrid ventilation system as follows:

"The normal condition for a ventilation system in natural or hybrid mode is defined as when the system is operating to limit the daily average carbon dioxide concentration to no more than 1,500ppm with the maximum concentration not exceeding 2,000ppm for more than 20 consecutive minutes on any day. This would normally equate to a minimum ventilation rate of approximately 5l/s per person."

4.7 Based on the above it is not possible to achieve IANL requirements with a natural ventilation strategy, therefore the use of open windows cannot be relied upon for normal ventilation for teaching spaces, though façade ducted ventilation units or mechanical ventilation system is suitable.

Boost Ventilation and Control of Summertime Overheating

4.8 BB93 permits elevated IANLs of up to 55 dB $L_{Aeq,30mins}$ for short periods to provide intermittent boost ventilation, e.g. to expel fumes during practical activities, or to mitigate summertime overheating (allowable during the hottest 200 hours of the year including the August holiday period). This does not apply however to classrooms intended specifically for students with special hearing and communication needs, or to speech therapy rooms (i.e. SEN spaces).

4.9 Assessment indicates that all spaces are suitable to use open windows to provide short term intermittent boost / purge ventilation under the control of the teacher.

4.10 Open windows may be used in non-SEN teaching spaces to control overheating during the hottest 200 hours of the year including the August holiday period only.

5. Noise Impact Assessment

Control of Building Services External Noise

5.1 Measured background noise levels for daytime and night-time periods taken from the Sharps Redmore environmental noise survey have been used to set limits for new sources of building services plant noise.

5.2 It is recommended that noise limits for new sources of building services plant are controlled such that they are 5 dB below the representative background noise level, both in line with BREEAM Pol 05 requirements and also such that assessment indicates a low noise impact based on BS 4142 guidance at the closest noise sensitive premises. On this basis, provisional plant noise limits are provided in Table 3 below.

5.3 It is recommended that mechanical engineers are made aware of the proposed plant noise limits in order to inform plant unit specification and selection. The rating level should be assessed in accordance with BS 4142, including appropriate consideration of any tonal or impulsive characteristics of the proposed mechanical services plant.

Table 3: BS 4142:2014 Provisional plant noise limits

Location	Period	Representative background noise level, L_{A90} (dB)	BS4142 Rating Level, $L_{Ar,Tr}$ (dB)
Residential Properties on Northwood Road	Daytime (07:00-23:00)	43	≤ 38
	Night (23:00-07:00)	34	≤ 29

5.4 At this stage of the development details of proposed plant selections are not available for detailed assessment. A building services plant noise impact assessment will be undertaken prior to completion to confirm that the requirements will be met.

Noise emissions from the development

5.5 It is understood that there will be no change in the hours of use of the external sports area as a result of the scheme, therefore assessment of external sports use has not been carried out.

5.6 It is however understood that a new car park comprising 28 spaces is proposed to the eastern site boundary adjacent to Northwood Road, as such noise from vehicle movements from the new car park have been assessed.

Car Park Noise Assessment

5.7 Noise levels from car park movements have been predicted using CadnaA noise modelling software, which follows the methodology set out in Bavarian State Office for the Environment: Parking Area Noise – 6. Revised Edition, 2007, as considered the most appropriate calculation method. The model has been based on the number of vehicle movements for the worst-case hour and the parking area type has been set to 'Park & Ride', and asphalt surface.

5.8 It is anticipated that the majority of vehicle movements in the car park will be at the start and end of the school day, with a reduced number of vehicle movements during the day. It is assumed that there will be up to 28 vehicle movements in a one-hour period at both the start and end of the day, as a worst-case, with a total of 1 vehicle movement per space throughout the day.

5.9 The noise level from the proposed car park at the nearest noise sensitive receptors, identified as the existing residential properties on Northwood Road, is calculated to be 51 dB $L_{Aeq,1hour}$ for the worst-case hour, and 37 dB $L_{Aeq,1hour}$ throughout the rest of the day (assuming 1 vehicle movement per hour as above).

5.10 The calculated level for the worst-case hour is seen to fall 4 dB below the existing ambient noise level at the nearest receptor, which is therefore not considered to result in any notable noise impact, and it is noted that this calculated noise level will be limited to the busiest two periods at the start and end of the school day. The calculated noise level throughout the rest of the day is seen to fall well below both the ambient and background noise level at the nearest receptor, which is therefore not considered to result in any notable impact. As such consideration to mitigation is not given.

6. Conclusions

6.1 A planning stage environmental noise assessment has been undertaken for the construction of a new build SEN school at the existing Harefield Academy site, Northwood Way, Harefield, Uxbridge.

6.1 A baseline noise survey has been undertaken at the site previously by a third-party consultant Sharps Redmore (SR) as summarised in their report '*Northwood Road School Harefield Planning Assessment*' Report Date; 5th May 2022 Project Number: 2220958. An additional noise survey has also been undertaken by Stroma on Wednesday 19th April 2023.

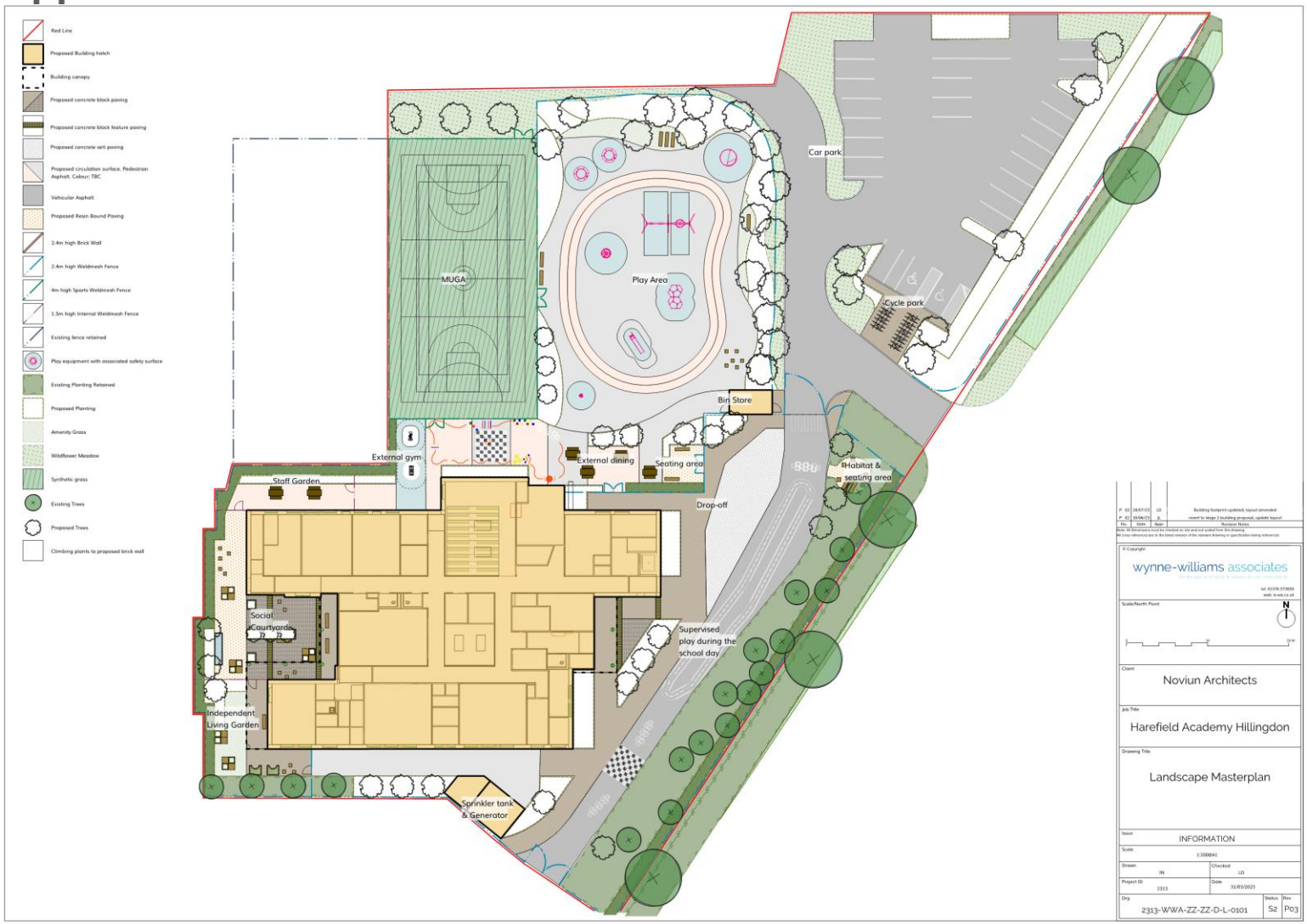
6.2 Assessment has found that based on the results of noise survey Indoor Ambient Noise Levels (IANL) for a new school building given in Building Bulletin 93 Acoustic design of schools: performance standards (BB93) can be met in all areas with appropriate specification of building envelope, glazing and ventilation strategy. Use of standard thermal double glazing providing a minimum sound insulation of 27 dB $R_w + C_{tr}$ is sufficient.

6.3 Measured site background noise levels have been used to inform noise limits proposed to control noise emissions from new sources of building services noise introduced by the scheme, in line with BREEAM Pol 05 requirements and guidance given in BS 4142:2014 '*Methods for rating and assessing industrial and commercial sound*'.

6.4 An assessment of noise from the proposed car park use has been undertaken, and it has been determined that there will be no notable impact during both the worst-case hour and throughout the remainder of the day.

6.5 It is concluded that the impact of noise on the proposed development and noise impact on existing receptors as a result of noise from the proposed development can be suitably controlled such that there is little to no impact. Additionally, assessment indicates that the requirements of the local authority and the GLA can be met with suitable specification of the façade construction and glazing, and through suitable plant selections.

Appendix I. Site Plan



Appendix II. Sharps Redmore Noise Survey

3.0 Survey Details

Environmental noise survey

3.1 Sharps Redmore visited the site on the 8th and 9th March 2022 to measure existing ambient and background sound levels in order to assess the external façade and set plant noise limits.

3.2 Existing ground-borne vibration is not considered to be a concern on the proposed site, therefore measurements of vibration were not conducted.

3.3 The measurement locations are shown ahead in Figure 3.1.

Figure 3.1: Survey Measurement Locations

3.4 Unmanned measurements to assess the external façade and to set plant noise limits were taken at locations representative of the building facade and the nearest noise sensitive receiver (MP1 and MP2). MP1 was selected as representative of the residential dwellings on Northwood Road opposite, being equidistant from the main noise source, Northwood Road. Measurements made at MP1 were made over a 24-hour period. Measurements at MP2 were made over a period between the hours 09:15-15:10.

3.5 The building façade will only be assessed during daytime hours, when it is understood that the building will be occupied. Plant noise limits will be set during day time and night time hours to provide flexibility should the plant operate 24 hours a day.

3.6 Measurements were taken using Class 1 Norsonic 118 sound level meters. The equipment was field calibrated before and after the survey and no significant drift was noted. Weather conditions were suitable for the measurement of environmental noise, with low wind speeds and dry conditions.

3.7 During the survey, the dominant noise sources were noted to be local road traffic on Northwood Road, shooting noise from a local shooting ground (at a distance of 1 mile south-east) and students using the outdoor facilities at Harefield Academy.

3.8 A summary of the noise levels measured are provided below in Table 3.1, and charted in Appendix C.

Table 3.1: Summary of Survey Results

Location	Logarithmically averaged $L_{Aeq,5\ minutes}$ dB		Typical $L_{A90,5minutes}$ dB		Typical L_{Afmax} dB
	Day (07:00-23:00)	Night (23:00-07:00)	Day (07:00-23:00)	Night (23:00-07:00)	Day (07:00-23:00)
MP1	56	50	43	34	68
MP2	52 (Between hours of 09:15-15:10)	-	43 (Between hours of 09:15-15:10)	-	65 (Between hours of 09:15-15:10)

Internal Ambient Noise Levels

3.9 A sample of the daytime internal ambient noise level on the most noise exposed façade was measured on the 8th March 2022 with windows and trickle click vents closed. The noise environment generally consisted of frequent passing road traffic on Northwood Road and occasional shooting noise from the local shooting ground.

3.10 The measurement location is shown ahead in Figure 3.2.

Figure 3.2: Survey Measurement Locations

3.11 The measurement were taken using a Class 1 Norsonic 118 sound level meter. The equipment was field calibrated before and after the survey and no significant drift was noted. Weather conditions were suitable for the measurement of environmental noise, with low wind speeds and dry conditions.

Table 3.2 Internal Ambient Noise Levels

Room	Floor level	Internal Noise Level	
		Logarithmically averaged $L_{Aeq, 5minutes}$ dB	Typical $L_{A1,5minutes}$ dB
MP3- Single Student Bedroom	1st	31	41

Appendix III. Acoustic Glossary

Sound pressure level and the decibel, dB

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. The 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 120 dB (threshold of pain).

Frequency and hertz, Hz

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. The human range of hearing is commonly accepted to be 20 Hz to 20,000 Hz. Additionally, an octave can be used to describe the interval between a frequency in Hz and either half or double that frequency.

Frequency weighting

Different weighting networks can be applied to a given sound level in each stated octave band by a specified amount, in order to better represent the response of the human ear. The most commonly used weighting network is the 'A' weighting, and the letter 'A' will be included within a descriptor to indicate that the value has been 'A' weighted, e.g. $L_{Aeq,T}$ or L_{A90}. An 'A' weighted noise level may also be written as dB(A). Other weightings less commonly used are 'C' and 'D' weighting.

Noise indices

When a noise level varies with time, the measured 'A' weighted dB level will vary as well. In this case it is therefore not possible to represent the noise climate with a simple 'A' weighted dB value. In order to describe noise where the level is continuously varying, a number of other indices, including statistical parameters, are used. The various indices used are described as below:

$\boldsymbol{L_{Aeq,T}}$	The 'A' weighted 'equivalent continuous noise level' which is an average of the total sound energy measured over a specified time period, *T*
$\boldsymbol{L_{Amax}}$	The maximum 'A' weighted noise level that was recorded during the monitoring period.
$\boldsymbol{L_{A10}}$	The 'A' weighted noise level that was recorded for at least 10% of the monitoring period.
$\boldsymbol{L_{A90}}$	The 'A' weighted noise level that was recorded for at least 90% of the monitoring period, usually taken as the underlying 'background' noise level.

Sound level difference, *D*

The sound level difference between two internal spaces, or between internal and external spaces. The '*D*' value is used to denote the differences at each third octave or octave band, with a single figure 'weighted' value to

describe an overall performance. Note that the '*D*' value will always describe an in-situ or on-site acoustic performance. All values are described using the decibel.

D_w	Single figure weighted sound level difference, simply the measured source noise level minus receiver noise level, not adjusted to reference conditions
$D_{nT,w}$	Weighted normalised sound level difference – a single, weighted sound insulation value, normalised to a reference reverberation time using the measured reverberation time in the receive room
$D_{nT,w} + C_{tr}$	As above, with a spectral adaptation term applied to account for the effects of low frequency noise, and based on urban traffic noise
$D_{nf,w}$	Overall flanking normalised level difference - A parameter that defines the flanking transmission of sound from room to room where a dividing partition or floor construction abuts a flanking building element common to both rooms, such as the building façade or ceiling

Sound reduction index, *R*

This describes the sound transmitted through a material or building element, such as a wall, door or window. It is measured in a laboratory with suppressed flanking transmission. The '*R*' value is used to denote the differences at each third octave or octave band, with a single figure 'weighted' value to describe an overall performance. All values are described using the decibel.

R_w	Weighted single figure sound reduction index
$R_w + C_{tr}$	As above, with a spectral adaptation term applied to account for the effects of low frequency noise, and based on urban traffic noise
R'_w	The 'apparent sound reduction index', a field measurement to obtain the sound reduction index of a material or element, with all effects of site installation accepted.

Standardised impact sound pressure level, $L'_{nT,w}$

$L'_{nT,w}$ is the single figure used to characterise the impact sound pressure level in a receiving room, normalised to a reference reverberation time. Impact noise can be classified as (but is not limited to) the result of footfall impact on a separating floor to a habitable space below. All values are described using the decibel.

Reverberation time, *T* and T_{mf}

The reverberation time of a space is a measure of the rate at which sound decays, measured in seconds. It is defined as the time taken for the sound pressure level to reduce by 60 dB from its original impulse level. Reverberation time is commonly quoted in terms of the mid-frequency reverberation time, T_{mf}, the arithmetic average of the reverberation times in the 500 Hz, 1 kHz and 2 kHz octave bands.

Absorption Coefficient

The acoustic absorption provided by a surface is defined as the sound absorption coefficient α, which denotes the fraction of sound energy absorbed between 0 (no absorption) and 1 (no reflection). The absorption coefficient of a material varies with the frequency of incident sound waves, therefore is considered for different frequencies.

Absorption Class

Based on the absorption coefficients, the overall sound absorption of a material is classified from Class A to Class E as defined in BS EN ISO 11654:1997, with Class A providing the highest level of acoustic absorption.

Noise rating, NR

The noise rating or NR system is commonly used in the design of noise emitted by internal building services systems. The system is frequency dependent, and was empirically derived to prevent disturbance to occupants in habitable or working areas from building services noise that exhibits 'tonal' elements, e.g. rumbles, whines, whistles etc. There is no direct relationship between the average 'A' weighted noise level in dB and the NR. However, as a guide, and assuming the absence of strong low frequency content in a given noise, the NR could generally be said to be 6 dB less than the average 'A' weighted dB value.

Privacy

Privacy is the addition of the level of sound insulation between two rooms and the background noise within a receiving room. It can be used to assess the level of privacy afforded in the 'receiving room' for speech from the 'source room'. The 'privacy factor' is a unit-less value that is the combination of the average 'A' weighted background noise level in dB and the weighted sound level difference (D_w) in dB.

Appendix IV. SBE Acoustic Credentials

SBE have specialised in providing the UK Construction Industry with a range of acoustics services since 2006. Specialising in Building Acoustics, all SBE acousticians are members of the Institute of Acoustics.

SBE is accredited for on-site acoustic testing by United Kingdom Accreditation Service (UKAS) (Testing Laboratory Number 2731).
SBE meet the relevant acoustic requirements typically required in the UK, including for sound insulation testing as defined in Approved Document E for the purposes of testing for Part E to the Building Regulations 2010.

This report has been prepared by Ben Reed, Senior Acoustic Consultant who meets the BREEAM requirements for a suitably qualified acoustician (SQA) as follows:

1. Holds a BEng(Hons) degree in Acoustics from the University of Salford
2. Has been an Acoustic Consultant for more than three year's (within the last five years). This experience includes a practical understanding of factors affecting acoustics in relation to construction and the built environment; including, acting in an advisory capacity to provide recommendations for suitable acoustic performance levels and mitigation measures.
3. Holds Membership of the Institute of Acoustics - MIOA membership.

This report has been read and reviewed and has been found to:

1. Represent sound industry practice
2. Be appropriate given the building being assessed and scope of works proposed
3. Avoid invalid, biased and exaggerated recommendations.

Appendix V. Report Conditions

This document has been prepared for the sole use, benefit and information of the Client. The liability of Stroma Built Environment Ltd. in respect of the information contained herein will not extend to any third party unless prior agreement is obtained in writing from Stroma Built Environment Ltd.

This report is limited to addressing the specific acoustic issues contained herein. Advice has been provided for acoustic reasons only and it is recommended that appropriate expert advice be sought on all the ramifications, e.g. safety, fire, structural, CDM etc., associated with any proposals contained herein.

The in-situ performance of acoustic measures is influenced to a large extent by the quality of workmanship and compliance with the specifications on-site during construction, as such, Stroma Built Environment Ltd. accepts no liability for issues with acoustic performance arising from such factors.

Acoustic survey and testing work carried out for the project is representative of the prevailing conditions at the time of the work. Conditions can vary and no warranty is given as to the possibility of changes in the environment of the site and surrounding area at differing times.

In particular, it should be noted that where calculations are carried out that are based on assumptions regarding certain aspects where information has not been supplied, these are provided for indicative purposes only and should be treated as such.