NOISE ASSESSMENT FOR PLANNING

KESTREL WAY SEN SCHOOL

Luton Borough Council

2061563-RSKA-RP-002-(02)

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General notes

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Author(s):	Nathan Parker	Technical reviewer:	Robert Bungay
Signature:	[redacted]	Signature:	[redacted]
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1 Introduction

1.1 Instruction and Objectives

RSK Acoustics (RSKA) has been commissioned by Luton Borough Council to undertake a noise impact assessment in support of the planning application for the proposed Kestrel Way Special Educational Needs (SEN) School at Kestrel Way, Luton, LU4 0UD (Pre-application reference PREAPP/22/00131).

The development proposals include the construction of a new two storey SEN school building, for up to 112 children, including 14 general teaching spaces, additional specialist rooms, an external play area to the rear of the site, as well as respite centre with beds.

The aim of this noise assessment is as follows:

- Quantify the current noise climate across the development site, and at nearest noise sensitive receptors (NSRs) to the proposed development;
- Present appropriate noise impact assessment thresholds to inform design criteria derived from local and national guidelines;
- Assesses the potential noise impacts associated with the proposed development on the surrounding NSRs;
- Specify any outline control measures where necessary; and
- Define the appropriate acoustic performance standards for the school with regard to site suitability.

A glossary of acoustic terms used within this report is provided in Appendix A –Glossary of Acoustic Terminology.

1.2 Site Context

The proposed development site is located to the south of Kestrel Way, Luton, approximately 1.5 km south of Junction 11A M1. The site is centred on approximate national gird reference 504326E, 224140N and covers an approximate area of 1.2 hectares. The site currently contains a radio mast of approximately 20 m in height, associated anchor points, and out building.

The adjacent land uses to the application site are as follows:

- Northern boundary –Kestrel Way road.
- Eastern boundary –Existing residential properties fronting onto Kestrel Way, Goldcrest Close, and Fieldfare Green.
- Southern boundary –Existing residential properties fronting onto Fieldfare Green and Coltsfoot Green.
- Western boundary –Existing residential properties fronting onto Coltsfoot Green.

It is considered that the surrounding residential properties of the development are the NSRs for the development.

The site location plan, and proposed development plan are presented in Figures 1 and 2 respectively.

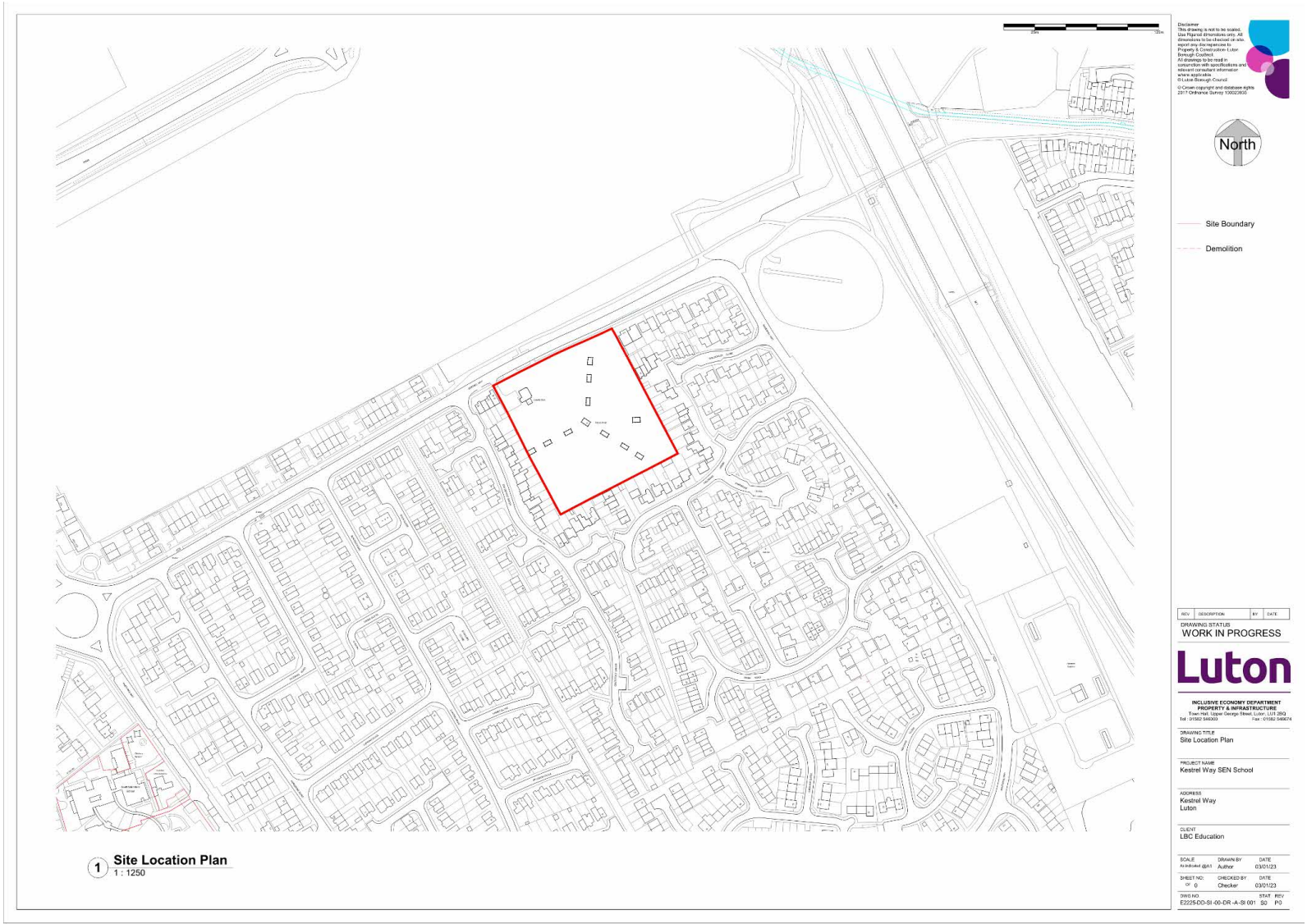

Figure 1 Site Location Plan (Drawing ref: E2225-DD-SI-00-DR-A-SE-001, dated 03/01/2023)

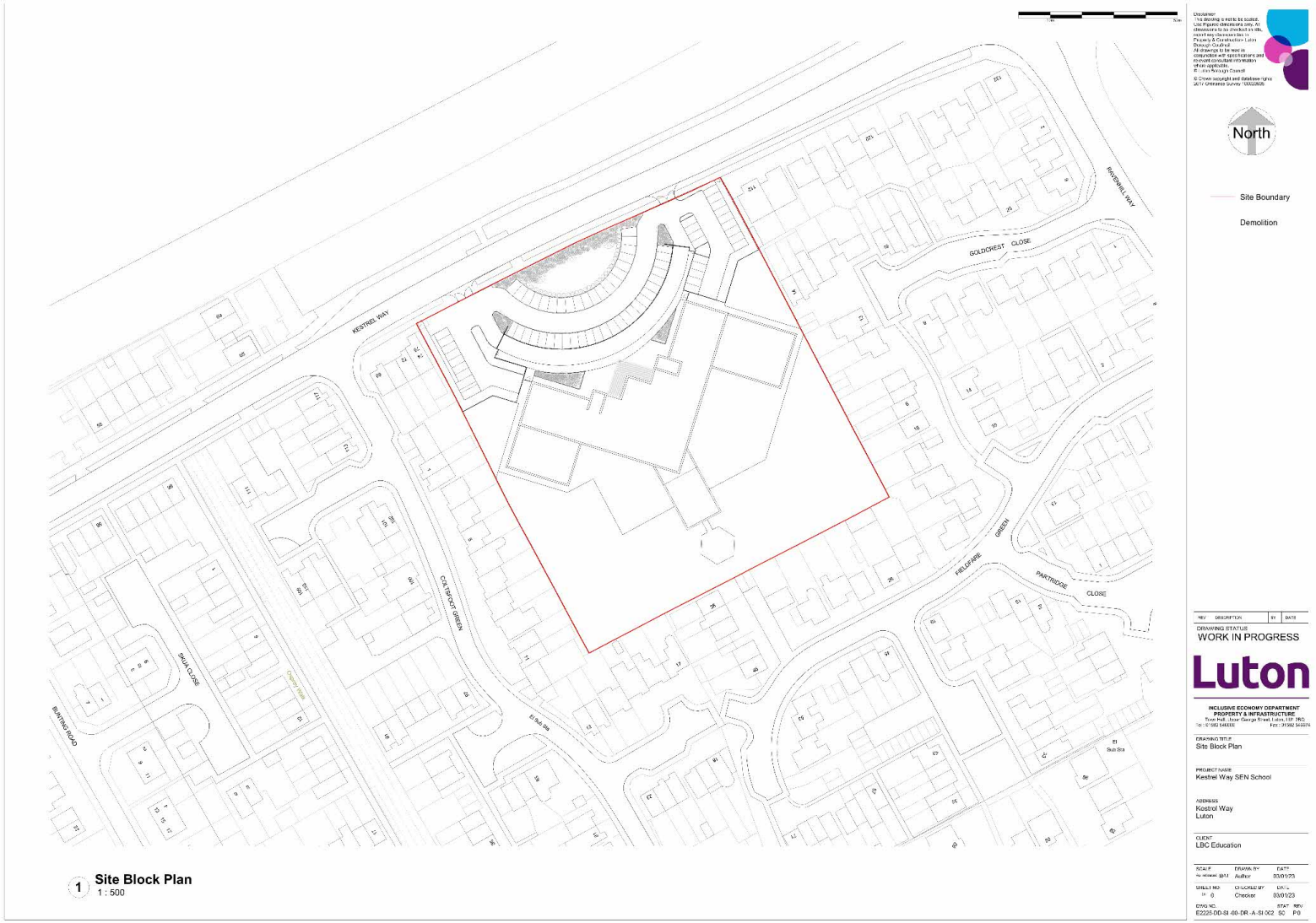

Figure 2 Proposed Development Plan (Drawing ref: E2225-DD-SI-00-DR-A-SE-002, dated 03/01/2023)

2 Methodology

2.1 Acoustic Design Criteria

2.1.1 BS 4142:2014+A1:2019

British Standard 4142:2014+A1:2019 '*Methods for rating and assessing industrial and commercial sound*' describes the methods for rating and assessing noise from industrial or commercial sources. The standard is applicable to the assessment of sound affecting residential receptors, through the determination of a specific level of an industrial or commercial noise source.

Where certain acoustic features are present at the assessment location, a character correction should be applied to the specific sound level to give the rating level to be used in the assessment. Acoustic features can include tones, impulsivity, intermittency or a type of noise that is distinct from the existing noise environment.

The assessment of the impact from a commercial or industrial sound can be carried out as follows:

- A difference of around +10 dB or more, between the rating and background noise levels, 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 adverse impact depending on the context.
- 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.

2.1.2 BREEAM UK New Construction, 2018

The BREEAM New Construction 2018 scheme can be used to assess the environmental life cycle impacts of new non-domestic buildings at the design and construction stages. 'New Construction' is defined as development that results in a new standalone structure, or new extension to an existing structure, which will come into operation or use for the first time upon completion of the works.

This BREEAM New Construction 2018 scheme version is applicable to new non-domestic buildings in the United Kingdom only.

POL 05 Reduction of noise pollution (1 Credit)

The BREEAM pollution category seeks to avoid or reduce the impact of external noise from the building by reducing the likelihood of noise arising from fixed installations on the new development affecting nearby noise-sensitive buildings.

One credit is automatically awarded when there are, or will be, no noise-sensitive areas or buildings within 800 m radius of the assessed site.

Alternatively, where there are noise-sensitive areas within the assessed building or noise-sensitive areas within 800 m radius of the assessed site, a noise impact assessment compliant with BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound' is commissioned. Noise levels must be measured or determined for:

- Existing background noise levels:

  at the nearest or most exposed noise-sensitive development to the proposed development site;

including existing plant on a building, where the assessed development is an extension to the building.

- The noise impact assessment must be carried out by a suitably qualified acoustic consultant.
- The noise level from the assessed building, as measured in the locality of the nearest or most exposed noise-sensitive development, must be at least 5 dB lower than the background noise throughout the day and night.
- If the noise sources from the assessed building are greater than the criteria, measures have to be installed to attenuate the noise to a level where it will comply with the criterion.

At the design stage of assessment, where noise-sensitive areas or buildings are present, actual measurement is unlikely to be possible due to the planned but non-existent installation. In such situations, compliance can be demonstrated through the use of acousticians' calculations or by scale model investigations.

For such cases, BS 4142 states 'Determine the specific sound level by calculation alone if measurement is not practicable, for example if the source is not yet in operation. In such cases, report the method of calculation in detail and give the reason for using it'. Where prediction methods are not possible, measurement will be necessary using either a noise source similar to that proposed or measurement of the actual noise from the installation (once installed). Compliance with the latter approach requires a written commitment to appoint a suitably qualified acoustician to carry out the required measurements post-installation, and a further commitment to attenuate the noise source in compliance with criteria (if proved necessary by the measurements).

2.1.3 BS 8233:2014

Guidance on the acceptable noise levels for living rooms and bedrooms within residential buildings is given in BS 8233:2014 '*Guidance on Sound Insulation and Noise Reduction for Buildings*' (BS 8233). Advice is given on the design range of internal noise levels, depending on the use of each room and the sensitivity to noise of the operations expected to be conducted in the rooms. An extract of the indoor ambient noise levels for dwellings is reproduced in Table 1.

Activity	Location	Time period	
		07:00 – 23:00	23:00 – 07:00
Resting	Living room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining room / area	40 dB $L_{Aeq,8hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$

Table 1 Indoor ambient noise levels for dwellngs (BS 8233 table 4)

2.1.4 World Health Organisation (WHO) Guidelines for Community Noise: 1999

The World Health Organisation (WHO) Guidelines for Community Noise was published in 2000 as a response to a need for action together with a generic need for improvements in legislation at a national level. Although not legislation, this document provides general guidance and guidelines which have been set for different health effects, using the lowest noise level that produces an adverse health effect in specific human environments. The guideline levels which are relevant to this assessment are set out in Table 2.

Environment	Critical health effect(s)	L_{eq} dB(A)	Time base (hours)	$L_{max,F}$ dB(A)
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	-
Inside bedrooms	Sleep disturbance, night-time	30	8	45 [1]
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60
Notes [1] Should not exceed 45 dB L_{AFmax} more than 10-15 times per night				

Table 2 WHO guidelines for community noise criteria

2.1.5 Acoustics Ventilation and Overheating - Residential Design Guide: 2020 and Approved Document O (2021 Edition) – The Building Regulations: 2010

Whilst the noise criteria outlined within BS 8223 provides guidance for 'normal' conditions, it is widely considered that a relaxation in acoustic criteria is permissible during peak summer months where occupants may be willing to compromise on noise ingress for purpose of thermal comfort. Suitable internal noise levels during overheating periods (i.e. when open windows or other measures are required to be implemented for the control of overheating) are provided in Acoustics Ventilation and Overheating: Residential Design Guide (AVO).

Approved Document O (AD-O), 2021 edition (under Building Regulations 2010) provides additional guidance and firms up requirements from developers for overheating scenarios. Whilst broadly in line with the AVO Guide, the AD-O (along with the recently published ANC/IOA document 'Guide to Demonstrating Compliance with the Noise Requirements of Approved Document O') provides more definition in terms of assessment categories. . Based on typical assumptions, the resulting outside-to-inside level difference for window openings necessary to satisfy the simplified method of AD-O are expected to be approximately 4 dB for 'high' risk locations and 9 dB for 'medium' risk locations.

A summary of the recommended levels for the most noise-sensitive spaces (bedrooms) are provided below in Table 3 for average ambient noise levels throughout a given time period (L_{Aeq}) and maximum noise levels (L_{max}) during the night.

Period	Normal condition (as per BS 8233)	Overheating Condition (AVO)	Overheating Condition (ADO)
Daytime (07:00 to 23:00)	35 dB $L_{Aeq,16hr}$	40 –50 dB $L_{Aeq,16hr}$	--
Night-time (23:00 to 07:00)	30 dB $L_{Aeq,8hr}$	35 – 42 dB $L_{Aeq,8hr}$	40 dB $L_{Aeq,8hr}$
	45 dB L_{AFmax}	65 dB L_{AFmax*}	55 dB L_{AFmax*}
Note – internal noise levels * L_{AFmax} refers to the level not normally exceeded, and not the 10th highest LAFmax highest level used within WHO guidelines			

Table 3 AVO and AD-O overheating condition criteria

Following an overheating analysis of the proposed building, it may be necessary to include mechanical cooling measures. Due to the varying and specific requirements of the building users (Kestrel Way School will be a Special Educational Needs School), it is necessary to have a regulated and controllable environment. Natural ventilation alone may not be sufficient to meet the requirements of the building users. Therefore, a more detailed overheating analysis will be undertaken at the detailed design stage, once a contractor is appointed, so that Part L of the building regulations will be met, as well as the needs of the building users.

2.1.6 Building Bulletin 93, Acoustic design of schools: performance standards

Much of the development will fall under compliance with BB93, which specifies a variety of criteria for:

- Indoor ambient noise levels in unoccupied spaces;
- Airborne sound insulation between spaces;
- Impact sound insulation of floors; and
- Reverberation control.

Suitable indoor ambient noise levels (IANLs) are required for clear communication of speech between teacher and student, and to minimise disturbance affecting activities requiring concentration. IANL is generally the product of external noise sources not associated with the school (such as road traffic) and internal noise from building services, measured in a space while unoccupied. Noise from teaching activities, such as speech, the use of equipment including IT equipment, projectors, or cooker hoods is considered separately. The effect of possible playground noise on children inside the school should also be considered as part of the design.

Detailed design stage compliance with the IANL targets will be assessed following a baseline survey of the development site, against the proposed ventilation approach. This will allow analysis of the proposed external facade, roof construction, and ventilation strategy. Baseline survey results will also form part of the noise impact assessment to be submitted for planning.

Separating partitions should be specified in accordance with BB93 where the activity of the source room and noise tolerance of the receiving room shown in Table 1 of BB93 are taken into account to achieve the $D_{nT,w}$ performance in Table 3a of the document. For example, a changing area would have high activity noise, but a low sensitivity to noise from other areas, while a music practice room would have both high activity noise and high sensitivity to disruptive noise from an adjacent room.

Doorsets to all teaching spaces used for SEN should be specified with a laboratory sound insulation performance of at least 35 dB R_w, which will require full threshold seals including drop-down seals. A higher performance would likely result in increased opening weight, which is considered not suitable in a building used by children or adolescents unless power-assisted opening is included. For ancillary spaces, a laboratory sound insulation performance of at least 30 dB R_w should be expected.

Reverberation control within teaching spaces allows for suitable concentration for the students and audibility of the teacher. These spaces would require a reverberation time target of ≤0.4 s averaged between octave bands 125 Hz and 4 kHz, with no octave band in this range exceeding 0.6 s. This is a significant uplift on mainstream secondary education classrooms, which are required to achieve an average reverberation time of ≤0.8 s across the octave bands between 500 Hz and 2 kHz. While every effort should be made to meet this target, it will be difficult to achieve in spaces with hard

floor finishes and limited available wall space upon which to install acoustically absorbing materials (due to windows, teaching walls, safe clearance area etc.).

In some teaching spaces it is appropriate to deviate from the general guidance for SEN spaces. BB93 permits the use of Alternative Performance Standards (APS), particularly when justified by a specific educational, environmental, or health and safety requirements. This is an acceptable approach within the framework of BB93 which notes that a relaxation is commonly required in practice for SEN teaching spaces, for example due to the functional requirement not to install carpets within certain classrooms. Use of an APS should not be considered a derogation from providing a suitable acoustic environment.

2.1.7 Approved Document E, Resistance to the passage of sound

Requirement E4 'Acoustics conditions in schools' of Approved Document E, ADE, is required for the development, which states:

"Each room or other space in a school building shall be designed and constructed in such a way that it has the acoustic conditions and the insulation against disturbance by noise appropriate to its intended use."

"In the Secretary of State's view the normal way of satisfying Requirement E4 will be to meet the values for sound insulation, reverberation time and internal ambient noise which are given in Building Bulletin 93."

It is also considered that the respite areas where bedrooms are proposed for short-term residential purposes are classed under the requirements of ADE under Sections E1, Table 0.1b, rooms for residential purposes, reproduced in Table 4 below.

	Airborne sound insulation sound insulation, $D_{nT,w} + C_{tr}$ dB (Minimum values)	Impact sound insulation $L'_{nT,w}$ dB (Maximum values)
Purpose built rooms for residential purposes		
Walls	43	-
Floors and stairs	45	62

Table 4 Reproduced Table 0.1b from ADE, rooms for residential purposes

2.1.8 Luton Borough Council Environmental Protection: Planning and Noise Guidance, 2012

This guidance document sets out the relevant noise policy and guidelines to assist developers in applying for planning permission. In relation to fixed plant sources, section 8.2 states:

> *"British Standard, BS 4142:2014 is intended to be used to assess whether noise from factories, industrial premises or fixed installations and sources of an industrial nature in commercial premises is likely to give rise to complaints from people living nearby.*
>
> *In order to ensure that complaints are unlikely, the noise level from a new source shall be at least 10dB below existing background levels at the nearest sensitive receptor. Where the new noise source contains distinguishable tones, such as a whine, hiss or hum, the noise level shall be reduced by a further 5dB.*
>
> *Where the BS 4142 assessment indicates that the above standard cannot be achieved, the planning application will normally be refused."*

As per the above, a design target of 10 dB below representative background levels, inclusive of character corrections at receptor as deemed appropriate from Luton Borough Council, which should be noted to be more stringent than the BREEAM POL 05 criteria.

2.1.9 Local Authority Consultation

Consultation was sought with of Luton Borough Council on 11 July 2023 via email, prior to site attendance to undertake the baseline noise survey, detailing RSKA's proposed approach to the survey and assessment.

A response was received on 7 August 2023, which discussed the Planning and Noise Guidance document above as well as BB93.

3 Noise Survey Methodology

A baseline noise survey has been undertaken to establish pre-development noise levels between the 12 and 14 July 2023 at the application site and surrounding area. The resulting measurement data has been used to inform the assessment of noise levels that will be experienced upon the proposed school and existing surrounding NSRs.

3.1.1 Monitoring locations

Noise measurements were undertaken at four locations, presented below in Figure 3.

Figure 3 Noise monitoring location plan

At all monitoring locations the microphone was positioned at least 3.5 m from any reflecting surfaces other than the ground (considered to be under free-field conditions), and at a height between 1.2 and 2 m above local ground level.

3.1.2 Noise Survey Equipment

The equipment used during the baseline noise survey is provided below in Table 5.

Equipment	Type	Serial number	Calibration date
Class 1 sound level meter	Rion NL-52	1276553	01/02/2023
Class 1 sound level meter	Rion NL-52	00553876	27/01/2022
Class 1 sound level meter	Rion NL-52	253698	04/04/2023
Acoustic calibrator	Rion NL-74	34615260	03/05/2023

Table 5 Monitoring equipment

The noise monitoring equipment used has a calibration history that is traceable to a certified calibration institution. Certificates of conformance can be provided on request. The calibration of the sound level meter was field checked prior to commencing measurements and prior to removing the equipment from site upon completion; no significant calibration drift was observed.

The sound level meter conforms to the requirements of BS EN 61672-1:2013 '*Electroacoustics. Sound level meter, Specifications*'. The acoustic calibrator used conforms to the requirements of BS EN IEC 60942:2018 '*Electroacoustics. Sound calibrators*'.

3.1.3 Summarised Meteorological Conditions

Summarised meteorological conditions are presented below in Table 6, and have been obtained from a locally installed weather station through Wunderground. The location ID for the weather station 'IBEDFORD19' and is situated on Jeans Way, approximately 2 km south-west of the site location.

Date, Time	Temperature range (˚C)	Total precipitation (mm)	Average wind speed (m/s)	Prevailing wind direction
12/07/2023, 12:00	15 - 20	7.6	0.4	West
13/07/2023, 00:00	13 - 18	3.1	0.6	West
13/07/2023, 12:00	15 - 21	0.5	0.6	West
14/07/2023, 00:00	13 - 16	0.0	0.2	North-west

Table 6 Meteorological conditions

Following further analysis of the measured meteorological data, the following time periods were removed from the dataset and subsequent analysis:

- 12/07/2023, 15:00-16:00 following approximately 4.6 mm of precipitation;
- 12/07/2023, 17:00-19:00 following approximately 2.0 mm of precipitation; and
- 13/07/2023, 11:00-12:00 due to approximately 2.8 mm of precipitation.

Measured wind speeds remained below 5 mm.s^{-1} for the duration of the survey. With the exception of those periods outline above, meteorological conditions were considered suitable for noise monitoring throughout the survey.

4 Baseline Noise Survey Results

The existing noise environment across the proposed development site was observed to be dominated by constant road traffic associated with the M1 motorway to the east. Other sound sources consisted of road traffic along Kestrel Way, residential noise, distant playground noise, bird song, and occasional overhead aircraft.

4.1 Long Term Noise Results

A summary of measured noise levels at the long-term, continuous measurement location UL1 is presented below in Table 7.

Date	Time	Measured noise levels (dB)[2]				
		$L_{Aeq,T}$	$L_{AFmax,1min}$ (10th highest)	$L_{A01,T}$	$L_{A10,T}$	$L_{A90,T}$
Wednesday 12/07/2023	12:30-23:00[1]	51	-	55	52	48
	23:00-07:00	46	59	50	47	43
Thursday 13/07/2023	07:00-23:00	49	-	53	50	46
	23:00-07:00	45	56	49	46	42
Friday 14/07/2023	07:00-10:30[1]	51	-	56	52	48
Averaged Noise Level	Daytime	50	-	55	51	47
	Night-time	45	59	49	46	43

[1] Measurements not taken throughout full 16 hour period

[2] Resultant $L_{Aeq,T}$ values are the logarithmic average of $L_{Aeq,15min}$ samples, and the $L_{A10,T}$ and $L_{A90,T}$ are the arithmetic average of $L_{A10,15min}$ and $L_{A90,15min}$ samples respectively. $L_{AF,max15min}$ is the highest sample within the period. All values rounded to the nearest whole number.

Table 7 Summarised long-term noise monitoring data – UL1

4.2 Short Term Noise Results

Data is presented in Table 8 for measured daytime hours at AT1 considered representative of the most exposed façade to Kestrel Way, during the period in which the school is to be occupied for teaching and learning purposes. An averaged summary of measured noise levels at the short-term, attended measurement locations are presented below in Table 9. Noise levels are rounded to the nearest whole.

Date	Time	Measured noise levels (dB)[2]		
		$L_{Aeq,30min}$ (dB)	$L_{A01,30min}$ (dB)	$L_{AFmax,15min}$ (dB)
12/07/2023	11:30	51	55	62
	12:00	52	59	69
	12:30	53	61	74
	13:00	53	58	65
	13:30	53	60	75
	14:00	54	59	74
	14:30	52	59	69
	15:00[1]	52	57	72
	15:30[1]	54	61	77
	16:00	51	56	70
[1] Data between 15:00 and 16:00 removed due to precipitation. [2] Resultant LAeq,T values are the logarithmic average of LAeq,15min samples, and the LA01,T are the arithmetic average of LA01,15min an LA90,15min samples. LAF,max15min is the highest sample within the period. All values rounded to the nearest whole number.				

Table 8 Short-term noise monitoring data – AL1

Measurement Location	Start Time (duration hh:mm)	Measured noise levels (dB)[2]				
		$L_{Aeq,T}$ (dB)	$L_{AFmax,15min}$ (dB)	$L_{A01,T}$ (dB)	$L_{A10,T}$ (dB)	$L_{A90,T}$ (dB)
AL1	11:30[1] (05:00)	52	77	59	54	49
AL2	13:45 (00:45)	48	68	56	50	44
AL3	14:45[1] (01:45)	45	73	53	46	40
	[1] Data between 15:00 and 16:00 removed due to precipitation. [2] Resultant $L_{Aeq,T}$ values are the logarithmic average of $L_{Aeq,15min}$ samples, and the $L_{A10,T}$ and $L_{A90,T}$ are the arithmetic average of $L_{A10,15min}$ and $L_{A90,15min}$ samples respectively. $L_{AF,max15min}$ is the highest sample within the period. All values rounded to the nearest whole number.					

Table 9 Summarised short-term noise monitoring data – AL1 - AL3

4.3 Derivation of Representative Background Noise Levels

Analysis of the representative background noise levels for the assessment of fixed plant noise of hourly noise levels ($L_{A90,1hr}$) measured during the daytime period (07:00 –23:00) and 15-minute noise levels ($L_{A90,15min}$) measured during the night-time period (23:00-07:00) is presented in Table 10. Such an approach is considered in line with the requirements of BS 4142 to suitably provide a representative value for the background noise in the local environment.

NSR	Adopted representative background noise level, $L_{A90, T}$ (dB)	
	Daytime (07:00 - 23:00)	Night-time (23:00 – 07:00)
Residential properties	45	41

Table 10 Adopted representative background levels

A graphical representation of the statistical analysis undertaken at unattended monitoring position UL1 are included in Figure 4 and Figure 5.

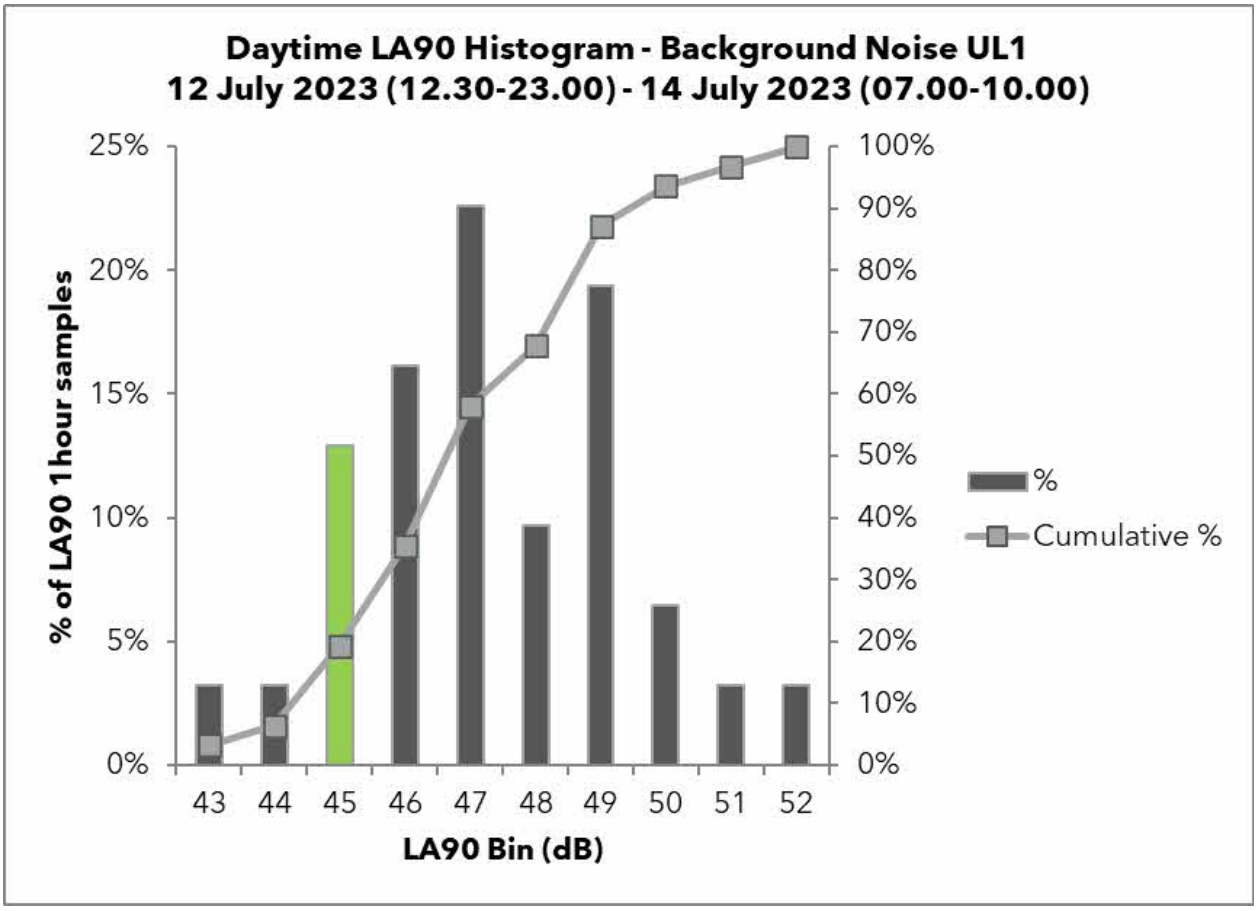

Figure 4 Daytime L_{A90} histogram

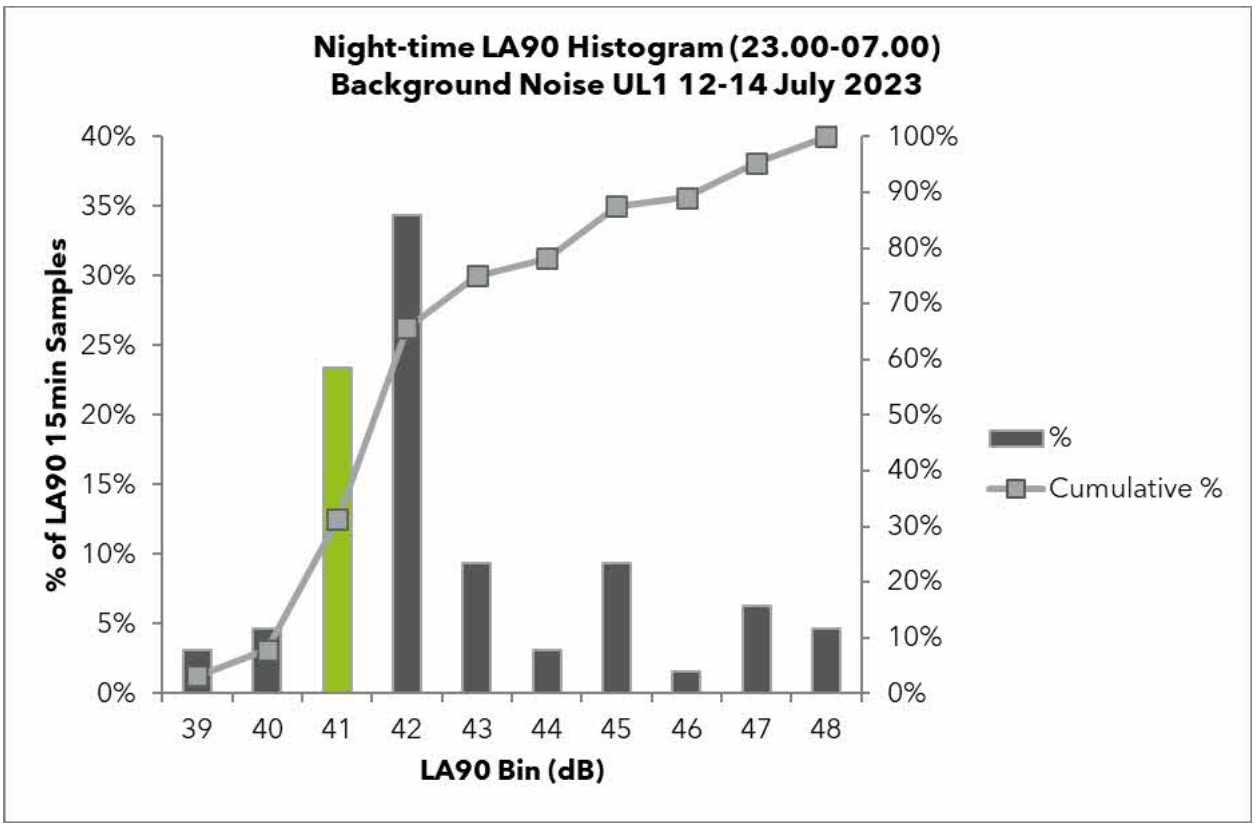

Figure 5 Night-time L_{A90} histogram

5 Noise Criteria

5.1 Target Indoor Ambient Noise Levels and Ventilation

Suitable indoor ambient noise levels (IANL) are required for clear communication of speech between teacher and student, and to ensure activities requiring concentration can be carried out undisturbed. BB93 requires the building envelope construction to be designed and constructed to ensure suitable internal noise levels are satisfied.

BB93 provides an upper limit for indoor ambient noise level in each of the different types of room found in a school. Table 11 below presents the room classifications for the proposed school, with the corresponding performance standards.

For naturally ventilated rooms, the limits are to be applied when ventilators or windows are open as required to provide adequate ventilation. If mechanically assisted ventilation is used, the internal noise limits apply to the cumulative effect of both internal mechanical services noise and external noise ingress.

The noise targets are for each type of space when unoccupied and exclude noise contributions from teaching activities and associated equipment.

Room Type	IANL Target (normal conditions)
Calm rooms	≤ 35 dB $L_{Aeq,30min}$
Changing area	≤ 50 dB $L_{Aeq,30min}$
Classrooms	≤ 30 dB $L_{Aeq,30min}$
Circulation	≤ 45 dB $L_{Aeq,30min}$
Group rooms	≤ 30 dB $L_{Aeq,30min}$
Interview room	≤ 40 dB $L_{Aeq,30min}$
Kitchen	≤ 50 dB $L_{Aeq,30min}$
Medical room	≤ 40 dB $L_{Aeq,30min}$
Meeting room	≤ 40 dB $L_{Aeq,30min}$
Multi-purpose hall	≤ 35 dB $L_{Aeq,30min}$
Music/ drama room	≤ 35 dB $L_{Aeq,30min}$
Music practice room	≤ 35 dB $L_{Aeq,30min}$
Offices	≤ 40 dB $L_{Aeq,30min}$
Sensory	≤ 30 dB $L_{Aeq,30min}$
Staff room	≤ 40 dB $L_{Aeq,30min}$
Toilets	≤ 50 dB $L_{Aeq,30min}$
Hydrotherapy pool	≤ 50 dB $L_{Aeq,30min}$
Sleep-in room	≤ 35 dB $L_{Aeq,30min}$*

Room Type	IANL Target (normal conditions)
Notes [1] Where target IANL is 40 dB $L_{Aeq,30min}$ or lower, a +5dB relaxation can be applied where a natural or hybrid ventilation strategy is implemented. This applies only to noise from external sources (not noise from building services). [2] During the hottest 200 hrs of the year, noise from external sources is permitted up to 55dB provided a natural/hybrid system is installed. Noise from mechanical systems may be relaxed by +5dB above the IANL target. This relaxation only applies where ventilation is under local control of the teacher so noise can be reduced to normal levels when needed. The relaxation does not apply to teaching spaces intended specifically for students with special hearing and communication needs. [3] The noise level from locally controlled intermittent boost mechanical ventilation may exceed the IANL by up to +5dB. If natural ventilation is utilised for this purpose, noise levels up to 55dB may be permitted. * Guidance derived from BS 8233: 2014	

Table 11 BB93 target indoor ambient noise levels

The above recommendations are based on the assumption that all classroom areas are a "teaching space intended specifically for students with special hearing and communication needs" (SHCN teaching space). Rooms meeting this classification will require an improved signal to noise ratio in respect of teacher voice to background noise than that experienced in a mainstream classroom, allowing clearer communication while also minimising the likelihood of distraction.

The British Association of Teachers of the Deaf recommend that the ambient noise level should not exceed 35dB(A) to aid in achieving a good signal to noise ratio. This is recommended as an upper limit during normal conditions for teaching spaces intended specifically for students with special hearing and communication needs.

To protect students from regular discrete noise events such as aircraft flyovers, indoor ambient noise levels should not exceed 60 dB $L_{A01,30min}$.

5.2 Internal Noise Levels - Live-in Residential Spaces

The current proposals include provision for live-in facilities, though the full details of the live-in arrangements are not fully known. Internal noise levels for these spaces shall be assessed in accordance with BS 8233:2014, Table 1 within Section 2.1.3 noise criteria.

It is anticipated that the live-in facilities will be situated towards the rear of the development, and therefore will not be situated along the most exposed façade to Kestrel Way. As such, the noise assessment will use the levels from position UL1.

5.3 External Plant Noise Criteria

The details of any proposed plant serving the proposed development, including likely noise emissions, are not fully known at this stage. The following indicative rating noise limits, based on the noise survey derivations, are proposed in accordance with the requirements discussed in Luton Borough Council's 'Planning and Noise Guidance' document.

The criteria at the NSR is defined to ensure any specific sound source associated with fixed plant having a low impact, in the current context of the site. These limits apply to the cumulative rated noise levels ($L_{Ar,Tr}$) from all proposed installations operating simultaneously as measured in free-field conditions at NSRs. The rating noise limits are inclusive of any corrections deemed appropriate for acoustic characteristics such as tonality, impulsivity and intermittency, as per BS 4142.

Daytime and night-time design targets for fixed plant at NSRs are summarised below within Table 12.

NSR	Proposed rating noise limit, $L_{Ar, Tr}$ (dB)	
	Daytime (07:00 - 23:00)	Night-time (23:00 – 07:00)
Residential properties	35	31

Table 12 Proposed rating level noise limits for NSRs

The Local Authority plant noise criteria and resultant limit of 10 dB below background noise levels is more onerous than that set out within BREEAM Pol05. Therefore, where plant is demonstrated to comply with the Local Authority requirements it will also considered to be in compliance with the BREEAM Pol05 criteria.

Upon assessment of the finalised plant details, it may be more prudent to adopt the BREEAM assessment criteria of 5 dB below measured background. Such an approach would still be in keeping with national design guidance, and would still be deemed to be an indication of the specific sound source having a low impact, depending on the context, following BS 4142. Any change in assessment criteria would be required to be agreed with the local authority.

6 Site Suitability

6.1 Indoor Ambient Noise Levels - Educational

The method of ventilation as well as the type and location of ventilation openings will affect the overall sound insulation of the building envelope. The proposed ventilation strategy is yet designed, but it is understood to be a combination of natural, hybrid and mechanical systems.

Based on measured noise levels at AT1, considered representative of the highest exposed façade to Kestrel Way, it is likely that external ambient noise levels are likely to be between 51-54 dB $L_{Aeq,30min}$ during school opening hours. For teaching and learning spaces the ventilation strategy shall be specified as such that external noise ingress will be suitably controlled so that BB93 indoor ambient noise levels can be achieved in all spaces as suitable indoor ambient noise levels are considered to not be achieved with openable windows in theses spaces. For ancillary spaces, BB93 indoor ambient noise levels are expected to be achievable with natural ventilation by means of openable windows.

Where mechanical or hybrid ventilation systems are to be installed, it should be ensured that cumulative noise from services and external sources does not exceed the target levels provided in Table 11.

6.2 Internal Ambient Noise Levels - Residential

6.2.1 Indoor Ambient Noise Assessment

Measured noise levels at monitoring location UL1 have been assessed against the adopted criteria for internal noise ambient levels for the live-in residential rooms within Table 13 below.

Period	Measured Noise Level, $L_{Aeq,T}$	BS 8233 Internal Ambient Noise Requirements, dB[1]	Attenuation Required by Building Envelope, dB
Daytime (07:00 – 23:00)	50	35	15
Night-time (23:00 – 07:00)	45	30	15
	59	45 L_{AFMax}[2]	14
NOTE – noise levels rounded to nearest whole number, bold denotes the highest level of attenuation required at boundary location [1] Daytime criteria for resting/ living rooms. Night-time criteria for bedrooms. [2] Criteria derived from WHO guidelines for community noise			

Table 13 BS 8233 Internal Noise Assessment

Based on the measured noise levels, the highest level of mitigation afforded by the building envelope is 15 dB $R_w + C_{tr}$. Noise level reduction can be provided through various façade treatment methods such as glazing or ventilation products, however the final level of mitigation would be dependent on factors such as room size and room volume. For reference, a noise reduction of circa 29 dB R_w+C_{tr} can be achieved with standard double glazing (assuming 4mm/6mm/6mm configuration).

On the basis that a partially open window typically provides in the order of 13 dB attenuation, it is apparent there is a marginal exceedance of the recommended internal acoustic design target

during a situation in which windows are partially open for ventilation purposes. However, should the residential rooms be located towards the rear of the proposed development, noise levels incident on these façades would be expected to be lower than those measured, due to the screening benefit afforded by the building and could achieve suitable attenuation with windows partially open for ventilation.

6.2.2 Residential Internal Noise Levels – Overheating (ADO)

Based on the calculation method within ISO 12354, the required window opening area within a single bedroom would correspond to approximately 9 dB reduction from outside to inside; in order to meet an internal ambient level of 40 dB $L_{Aeq,8hr}$ (and 55 dB L_{AFmax} more than 10 times) in line with the requirements of the recently published Approved Document O (AD-O), the external noise limit for night-time hours must not exceed 49 dB $L_{Aeq,8hr}$ and 64 dB L_{AFmax}. Measured noise levels at UL1 are below the criteria detailed within AD-O when accounting for 9 dB reduction from outside to inside.

It is recommended that input be sought from the wider design team to identify areas of high overheating risk and to ensure subsequent mitigation options compliment ventilation, architectural, and structural design strategies and assessments.

6.3 External Fixed Plant Installations

The proposed NSR noise limits, as set out in Table 12 are deemed to be achievable, on the basis that suitable attenuation measures can be implemented at source along with sympathetic positioning / screening to achieve adequate noise levels at any identified NSR.

Typical plant used for schools, such as air handling and cooling plant can be attenuated through in-duct attenuation, acoustic enclosures to plant, and attenuated acoustic louvres to plant/plant areas.

It is recommended that a full plant noise assessment for the scheme be carried out during the design stages of the project. As discussed, it may be prudent to adopt the less onerous BREEAM criteria of 5 dB below measured background levels, rather than the Luton Borough Council criteria of 10 dB below measured background, should this be a prohibitive factor.

6.4 External Teaching Areas/ Recreational Spaces

The current development proposals include provision for an external playground area, and informal play areas to the south of site. It is understood that the predominant use of these spaces will be for supervised free play and teacher-led educational play. These spaces will be superficially for use by the school (i.e. no out of hours community use).

Use of the play areas could give rise to potential raised voices during school operational hours, which may be audible within the surrounding garden spaces. This is likely to be an infrequent occurrence, with speech at the level of normal conversation arising from the play areas typically masked by the underlying ambient noise level from transport infrastructure. It should also be noted, that during the site survey, noise from playground activities in the surrounding area was observed to be audible. This would suggest that noise from playground activity currently contributes towards existing noise environment within the area, and therefore the proposed external teaching spaces would not change the existing noise environment of the area.

On the basis of the proposed hours of use for the external areas, and the general transient nature of activities carried out, it is considered unlikely that operational use of the proposed external teaching and recreational spaces will give rise to significant noise impacts at NSR.

7 Conclusions

RSKA has been commissioned by Luton Borough Council to undertake a noise impact assessment in support of a planning application for the Kestrel Way SEN School at Kestrel Way, Luton, LU4 0UD.

A baseline noise survey was undertaken to establish baseline conditions across the proposed development site and at the surrounding noise sensitive receptors. Noise measurements comprised of a combination of attended measurements and unattended noise measurements throughout continuous daytime and night-time periods between 12 and 14 July 2023.

The results of the survey indicate noise levels incident upon the façade of the proposed new building will typically be between 51 to 54 dB $L_{Aeq,30min}$ during school hours. On this basis, the target indoor ambient noise levels can be achieved through implementation of the ventilation strategies currently proposed.

The type, quantity and location of fixed mechanical and electrical plant associated with the proposed school has not been defined at this stage in the design and hence it is not possible to quantify the noise impact at the nearest noise sensitive receptors. Based on the outcome of the survey, suitable rating noise limits have been provided for fixed plant installations to meet the requirements of the Luton Borough Council. Appropriate mitigation measures to meet these limits will be determined as the design develops.

References

- British Standard 4142:2014+A1 2019 ‘Method for rating and assessing industrial and commercial sound.’ British Standards Institution, 2019.
- British Standard 7445-1: 2003, ‘Description and measurement of environmental noise –Part 1: Guide to quantities and procedures’. British Standards Institution, 2003.
- British Standard 8233:2014 ‘Sound insulation and noise reduction in buildings –code of practice’. British Standards Institution, 2014.
- World Health Organisation (WHO) ‘Guidelines for Community Noise’. WHO, 1999
- Building Bulletin 93 ‘Acoustic design of schools: performance standards’. Department for Education, 2015.
- BREEAM New Construction 2018 Reference: SD5078 –Issued 3.0. BRE Global Ltd., 2019
- Luton Borough Council ‘ Environmental Protection: Planning and noise guidance’. Luton Borough Council, 2012.

Appendix A – Glossary of Acoustic Terminology

Term	Definition
Ambient sound	The total sound at a given place, usually a composite of sounds from many sources near and far.
Background sound, $L_{A90,T}$	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval.
dB	Decibel. Scale for expressing sound pressure level. It is defined as 20 times the logarithm of the ratio between the root mean square pressure of the sound field and a reference pressure i.e. $2x10^{-5}$ Pascal.
dB(A)	A-weighted decibel. This provides a measure of the overall level of sound across the audible spectrum with a frequency weighting to compensate for the varying sensitivity of the human ear to sound at different frequencies. Example sound levels include: 140 dB(A) Threshold of pain 120 dB(A) Threshold of feeling 100 dB(A) Loud nightclub 80 dB(A) Traffic at busy roadside 60 dB(A) Normal speech level at 1m 40 dB(A) Quiet office 20 dB(A) Broadcasting studio 0 dB(A) Median hearing threshold (1000 Hz)
Frequency	The repetition rate of a sound wave. The subjective equivalent in music is pitch. The unit of frequency is the Hertz (Hz), which is identical to cycles per second. A thousand hertz is often denoted as kHz, e.g. 2 kHz = 2000 Hz. Human hearing ranges approximately from 20 Hz to 20kHz.
$L_{Aeq,T}$	This is defined as the notional steady sound level over a stated period of time (T), would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period.
NR	Noise rating. A set of curves based on the sensitivity of the human ear. They are used to give a single-figure rating for a range of frequencies.
Rating level	Specific sound level of a source plus any adjustment for the characteristic features of the sound.
Residual sound	Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.
Sound absorption	Process whereby sound energy is converted in to heat. Sound absorption properties is expressed as the sound absorption coefficient α or the sound absorption class (A-E).
Sound insulation	The reduction or attenuation of airborne sound by a solid element between source and receiver.
Specific sound	Sound pressure level produced by the source being assessed at the assessment location.

Table A 1 Glossary of Acoustic Terminology)

Appendix B – Noise Monitoring Results – UL1

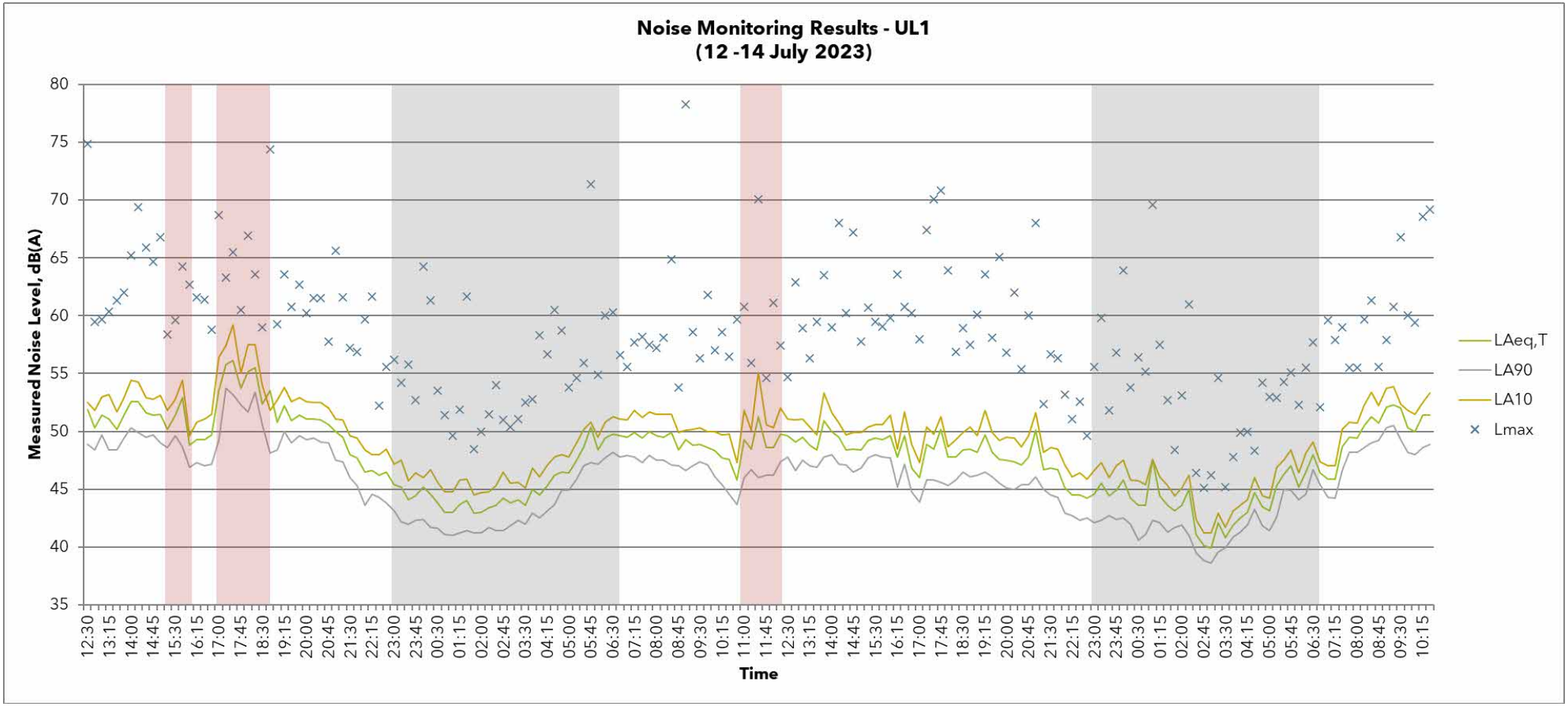

Figure 6 Noise Monitoring Results – UL1

Appendix C – Photographic Report

	
UL1 (facing north)	AT1 (facing west)
	
AT2 (facing east)	AT3 (facing west)

Table C 1 Photographic report – monitoring locations

RSK acoustics