

Report for:

Campbell Reith Hill LLP

*The Heights Primary School,
Mapledurham*

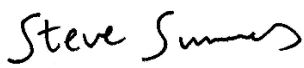
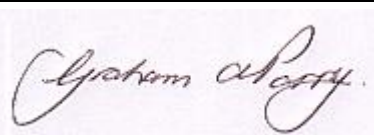
Noise Assessment

Status: Final

Date: 10.03.2017

Campbell Reith Hill LLP

The Heights Primary School, Mapledurham - Noise Assessment

Author:	David Yates
Contributor:	Rebecca Edwards
Reviewed By:	 Steve Summers Associate Director
Approved By:	 Graham Parry Managing Director
Report For:	Alice Hoy Campbell Reith Hill LLP Raven House 29 Linkfield Lane Redhill Surrey RH1 1SS
Date:	10.03.2017
Version Number:	A2958/N/001
Status:	Final

This report has been prepared by ACCON UK Limited with all reasonable care and diligence within the terms of the contract with the client. We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above. We accept no responsibility to third parties to whom this report, or any part, thereof is made available. Any such party relies upon the report at their own risk.

Table of Contents

1.	INTRODUCTION.....	4
2.	THE NATURE, MEASUREMENT AND EFFECT OF NOISE.....	6
3.	NOISE ASSESSMENT CRITERIA	7
3.1.	National Planning Policy Framework.....	7
3.2.	Noise Policy Statement England.....	7
3.3.	Planning Practice Guidance.....	8
3.4.	Reading Borough Council	8
3.5.	Noise Assessment Criteria for Schools	9
3.6.	Assessment Criteria for Noise from External School Areas.....	10
3.7.	British Standard BS 4142:2014.....	11
3.8.	Road Traffic Noise	13
4.	NOISE MEASUREMENT SURVEY	15
4.1.	Semi-Permanent Noise Measurement	15
4.2.	Satellite Noise Measurements	16
5.	BB93 ASSESSMENT	18
5.1.	Internal Noise Levels	18
5.2.	External Noise Levels	19
6.	PLANT NOISE ASSESSMENT	20
7.	ROAD TRAFFIC NOISE.....	23
7.1.	Upper Woodcote Road	23
7.2.	Mapledurham Playing Fields Access Road	23
8.	EXTERNAL ACTIVITY NOISE LEVELS	25
8.1.	Playground Noise Measurements	25
8.2.	Predicted Noise Levels	26
8.3.	Activity Noise Impact Assessment	27
9.	CONCLUSION	29

List of Appendices

Appendix 1 Glossary of Acoustic Terms.....	30
Appendix 2 Noise Monitoring Positions and Receptor Locations.....	32

List of Figures

Figure 1.1: Site Location	5
Figure 5.1: Proposed Site Plan	18
Figure 6.1: Proposed Ground Floor Plan Identifying Potential Sources of Plant Noise	20
Figure 6.2: Proposed First Floor Plan Identifying Potential Sources of Plant Noise	21
Figure 8.1: Proposed Site Plan	25

List of Tables

Table 2.1: Typical Noise Levels	6
Table 3.1: Upper Limit for the Indoor Ambient Noise Level $L_{Aeq,30min}$	9
Table 3.2: Summary of Noise Criteria: BS 8233 & WHO	11
Table 3.3: Scale of Magnitude Used in the Operational Road Traffic Noise Assessment	13
Table 4.1: Summary of Free Field Noise Levels from Semi-Permanent Noise Monitoring	15
Table 4.2: Summary of Free Field Noise Levels from Satellite Noise Monitoring	17
Table 5.1: Predicted Average Internal Noise Levels	19
Table 6.1: Total Sound Power Level of Plant Equipment	22
Table 7.1: Predicted Traffic Flows for Upper Woodcote Road	23
Table 7.2: Change in Noise Level on the Access Road	24
Table 8.1: Noise Levels from The Francis Baily School Playgrounds	26
Table 8.2: Predicted Noise Level from the playgrounds	27
Table 8.3: Noise Impact Assessment of the Playgrounds – Average Noise Levels	27
Table 8.4: Noise Impact Assessment of the Playgrounds – Highest Noise Levels	28

1. INTRODUCTION

ACCON UK Limited (ACCON) has been commissioned by Campbell Reith Hill LLP to assess the noise constraints and impacts for the proposed school, The Heights Primary School on the Mapledurham Playing Fields in Reading.

The Heights School is to be located in the northern corner of the Mapledurham Playing Fields, to the west of the existing sports pavilion and tennis courts. Access to the school will be via the playing fields' existing access road from Upper Woodcote Road.

The site is bound to the north and west by residential properties, the east by the sports pavilion, tennis courts and associated car parking, and to the south by the playing fields which include football pitches, a hardscape play area and a MUGA (multi-use games area).

The purpose of this noise assessment has been to assess, through on-site noise measurements, the current noise climate at the site in order to determine the sound insulation requirements for the external envelope of the school building based on guidance given in Building Bulletin 93 (BB93). Additionally, this report assesses, for adjacent noise sensitive receptors, noise impacts from the use of external play areas and teaching areas, mechanical plant, and changes in road traffic noise due to the development. A glossary of acoustic terms is provided in **Appendix 1** and the site location is displayed in **Figure 1.1** below.

Figure 1.1: Site Location



2. THE NATURE, MEASUREMENT AND EFFECT OF NOISE

Noise is often defined as sound that is undesired by the recipient. Whilst it is impossible to measure nuisance caused by noise directly, it is possible to characterise the loudness of that noise. 'Loudness' is related to both sound pressure and frequency, both of which can be measured. The human ear is sensitive to a wide range of sound levels. The sound pressure level of the threshold of pain is over a million times that of the quietest audible sound. In order to reduce the relative magnitudes of the numbers involved, a logarithmic scale of decibels (dB) is normally used, based on a reference level of the lowest audible sound.

The response of the human ear is not constant over all frequencies. It is therefore usual to weight the measured frequencies to approximate the human response. The resulting 'A' weighted decibel, dB (A), has been shown to correlate closely to the subjective human response.

When related to changes in noise, a change of ten decibels from say 60 dB (A) to 70 dB (A) would represent a doubling in 'loudness'. Similarly, a decrease in noise from 70 dB (A) to 60 dB (A) would represent a halving in 'loudness'. A change of 3 dB (A) is generally considered to be just perceptible¹. **Table 2.1** details typical noise levels.

Table 2.1: Typical Noise Levels

Approximate Noise Level (dB(A))	Example
0	Limit of hearing
30	Rural area at night
40	Library
50	Quiet office
60	Normal conversation at 1 m
70	In car noise without radio
80	Household vacuum cleaner at 1 m
100	Pneumatic drill at 1 m
120	Threshold of pain

¹ Institute of Environmental Management and Assessment (2014). Guidelines for environmental noise impact assessment.

3. NOISE ASSESSMENT CRITERIA

3.1. National Planning Policy Framework

The National Planning Policy Framework (NPPF) was released in March 2012 and has replaced the Planning Policy Guidance which previously covered planning and pollution control and new development in England. The purpose of the planning system is to contribute to the achievement of sustainable development. There are three dimensions to sustainable development: economic, social and environmental. The environmental role is to contribute to protecting and enhancing our natural, built and historic environment; and as part of this, helping to improve biodiversity, use natural resources prudently, minimise waste and pollution, and mitigate to adapt to climate change including moving to a low carbon economy.

One of the core planning principles is to contribute to conserving and enhancing the natural environment and reducing pollution. Allocations of land for development should prefer land of lesser value, where consistent with other policies in the Framework. The planning system should contribute to and enhance the natural and local environment by preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability.

Paragraph 123 of the NPPF states that planning policies and decisions should aim to:

- Avoid noise from giving rise to significant adverse impacts (see Explanatory Note to the Noise Policy Statement for England (DEFRA)) on health and quality of life as a result of new development;
- Mitigate and reduce to a minimum other adverse impacts (see Explanatory Note to the Noise Policy Statement for England (DEFRA)) on health and quality of life arising from noise from new development, including through the use of conditions;
- Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land use since they were established (Subject to the provisions of the Environmental Protection Act 1990 and other relevant law); and
- Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

3.2. Noise Policy Statement England

The Noise Policy Statement England (NPSE) aims to *“through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*

- *avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*

- *where possible, contribute to the improvement of health and quality of life'*

3.3. Planning Practice Guidance

The Planning Practice Guidance (PPG) was published in March 2014 and updated in December 2014. The PPG provides advice on how to determine the noise impact on development:

'Local planning authorities' plan-making and decision taking should take account of the acoustic environment and in doing so consider:

- *whether or not a significant adverse effect is occurring or likely to occur;*
- *whether or not an adverse effect is occurring or likely to occur; and*
- *whether or not a good standard of amenity can be achieved.*

In line with the Explanatory Note of the Noise Policy Statement for England, this would include identifying whether the overall effect of the noise exposure (including the impact during the construction phase wherever applicable) is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation. As noise is a complex technical issue, it may be appropriate to seek experienced specialist assistance when applying this policy.'

The document goes on to provide a definition for the levels of noise exposure at which an effect may occur:

"Significant observed adverse effect level: *this is the level of noise exposure above which significant adverse effects on health and quality of life occur.*

Lowest observed adverse effect level: *this is the level of noise exposure above which adverse effects on health and quality of life can be detected.*

No observed effect level: *this is the level of noise exposure below which no effect at all on health and quality of life can be detected."*

It is important to understand that as the PPG does not provide any advice with respect to specific noise levels/ limits for different sources of noise, it is appropriate to consider other sources of advice and guidance documents when considering whether new developments would be sensitive to the prevailing acoustic environment.

3.4. Reading Borough Council

Reading Borough Council (RBC) Environmental Protection Team have been contacted by ACCON regarding specific noise criteria which may be appropriate to this assessment; in particular, their requirements for the assessment of new plant installations. At the time of preparing this report, a response had not been received.

3.5. Noise Assessment Criteria for Schools

3.5.1. Building Bulletin 93 – Acoustic Design of Schools: Performance Standards

Building Bulletin 93 – Acoustic Design of Schools: Performance Standards (BB93) was published in 2014 and sets out minimum performance standards for the acoustics of school buildings and describes the normal means of demonstrating compliance with the Building Regulations. It also provides guidance in support of the School Premises Regulations (2012) and the Independent School Standards (2013). The document supersedes Section 1 of the previous version of BB93 which was published in 2003.

Table 1 in Section 1 of the document specifies an upper limit for indoor ambient noise levels in specified spaces. Those most relevant to primary schools are reproduced in **Table 3.1** below.

Table 3.1: Upper Limit for the Indoor Ambient Noise Level $L_{Aeq,30min}$

Type of Room	Upper limit for the indoor ambient noise level $L_{Aeq,30min}$ (dB)	
	New Build	Refurbishment
Primary school: classroom, class base, general teaching area, small group room	35	40
Open plan: teaching area, resource/breakout area	40	45
Primary music room	35	40
Teaching space intended specifically for students with special hearing and communication needs ⁽¹⁾	30	35
SEN calming room	35	35
Library	40	45
Assembly halls, multi-purpose halls (drama, PE, audio/visual presentations, assembly, occasional music)	35	40
Atrium, circulation space not intended for teaching or learning	45	50
Meeting room, interviewing/counselling room, video conference room	40	45
Dining rooms	45	50

Type of Room	Upper limit for the indoor ambient noise level $L_{Aeq,30min}$ (dB)	
	New Build	Refurbishment
Administration and Ancillary spaces		
Kitchens	50	55
Offices, medical room, staff rooms	40	45
Corridors, stairwells, coats and locker areas	45	50
Changing areas	50	55
Toilets	50	55

Note (1): Alternative performance standards (APS) are commonly required for these rooms and should be agreed by an acoustician and the school client body. See Section 0.4 of BB93.

BB93 also provides guidance on discrete noise events such as aircraft:

“In order to protect students from regular discrete noise events, e.g. aircraft or trains, indoor ambient noise levels should not exceed 60 dB $L_{A1,30mins}$. This is achieved by default for spaces with internal ambient noise levels up to 40 dB $L_{Aeq,30mins}$ but requires assessment in spaces with higher limits e.g. 45 and 50 dB.”

3.5.2. Acoustics of Schools – A Design Guide

The document Acoustics of Schools – A Design Guide was published in November 2015 and provides supporting guidance and recommendations on the acoustic design of new and refurbished schools. The document supersedes Sections 2 to 7 of the previous version of BB93 published in 2003 and supports the acoustic performance standards provided in the current version of BB93, published in 2014.

The document provides recommendations which are considered good practice for providing suitable acoustic conditions outside of school buildings. For new schools, 60 dB $L_{Aeq,30min}$ should be regarded as an upper limit for external noise at the boundary of external areas used for formal and informal outdoor teaching and recreation.

The document states that: *“playgrounds, outdoor recreation areas and playing fields are generally considered to be of relatively low sensitivity to noise, however, where they are used for teaching (e.g. sports lessons) outdoor ambient noise levels have a significant impact on communication in an environment which is already acoustically less favourable than most classrooms. Noise levels in unoccupied playgrounds, playing fields and other outdoor areas should not exceed 55 dB $L_{Aeq,30min}$ and there should be at least one area suitable for outdoor teaching activities where noise levels are below 50 dB $L_{Aeq,30min}$. Acoustic screening can be used to reduce noise levels in these areas as far as reasonably practicable.”*

3.6. Assessment Criteria for Noise from External School Areas

There are no specific noise criteria that particularly relate to the impact of noise from playgrounds and sports pitches on noise sensitive receptors. BS 8233:2014 *“Guidance on*

sound insulation and noise reduction for buildings” and the World Health Organization “Guidelines for Community Noise” both contain relevant noise criteria and set out guideline noise limits that would normally be considered acceptable for a range of noise sources. BS 8233 states that these noise levels relate to “sources without a specific character”. Whilst not strictly applicable to noise from playgrounds, which could be described as having a “specific character”, the criteria can assist in providing an indication as to the acceptability of noise from this specific source.

Noise predictions can be made of the likely anticipated noise levels arising from the playground activities at the closest residential receptors and these can be compared to guideline noise levels, in order to determine the acceptability of the proposals. Accordingly, the proposed acceptability criteria for this development are outlined in **Table 3.2** below.

Table 3.2: Summary of Noise Criteria: BS 8233 & WHO

	Criterion	Location	Ambient Noise Level $L_{Aeq,T}$
WHO	To prevent annoyance in external amenity areas	Outside dwellings	55
BS 8233	To ensure a reasonable resting condition inside living rooms	Internal	35

It should be noted that the above criteria relate to the daytime period, which is normally defined as 0700 hours to 2300 hours. Additionally, it is important to understand the extent to which noise from the proposed playgrounds would potentially intrude over and above the existing ambient noise levels. Therefore a comparison of typical playground noise with existing ambient noise levels has also been made.

3.7. British Standard BS 4142:2014

British Standard 4142:2014 “Methods for rating and assessing industrial and commercial sound” provides a method for the measurement and rating of industrial type noise sources and background noise levels outside dwellings. The rating level (defined in the BS) is used to rate the noise source outside residential dwellings.

The first step of the assessment is to obtain the specific sound level of the sound source at the receptor position by measurement or calculation. The rating level is determined by assessing the character of the noise and applying an acoustic feature correction to the specific sound level if appropriate. Corrections are applied for the tonality, impulsiveness and intermittency of the noise source which can both make noise more noticeable.

The initial assessment described in BS 4142 to determine whether an adverse impact is likely is based on establishing the difference between the rating level and the background noise level outside the residential property of interest. The British Standard states that the following points should be considered:

- 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.*

Where it is considered that the initial assessment of the impact needs to be modified due to the context in which the noise is occurring, BS 4142 suggests that all pertinent factors are taken into consideration, including:

- 1) *The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.*

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.

Where residual sound ² levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.

- 2) *The character and level of the residual sound compared to the character and level of the specific sound. Consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound, to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and/or commercial nature is likely to be perceived and how people react to it.*

² The residual sound is defined as the ambient sound level at the assessment location in the absence of the specific sound source.

3) *The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:*

- i) facade insulation treatment;*
- ii) ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and*
- iii) acoustic screening.*

3.8. Road Traffic Noise

3.8.1. Calculation of Road Traffic Noise

The Technical Memorandum *Calculation of Road Traffic Noise* (CRTN) produced by the Department of Transport in 1988, sets out standard procedures for calculating noise levels from road traffic. The calculation method uses a number of input variables, including traffic flow volume, average vehicle speed, percentage of heavy goods vehicles and type of road surface to predict the L_{A10} noise level for any receptor point at a given distance from the road.

3.8.2. Design Manual for Roads and Bridges

The Design Manual for Roads and Bridges (DMRB) provides methods for quantifying the noise and vibration impacts generated by changes in road traffic. Operational road traffic noise levels are considered using the magnitude of change criteria outlined in **Table 3.3** below. The relative levels are reproduced from the semantic scale for long-term changes in road traffic noise levels found in the DMRB guidance document.

Table 3.3: Scale of Magnitude Used in the Operational Road Traffic Noise Assessment

Magnitude of impact	Description
Large	Greater than 10 dB(A) change in sound level
Medium	5.0 dB(A) to 9.9 dB(A) change in sound level
Small	3.0 dB(A) to 4.9 dB(A) change in sound level
Negligible	2.9 dB(A) or less change in sound level

3.8.3. TRL Methodologies for Converting the UK traffic noise index $L_{A10,18hr}$ to EU noise indices for noise mapping

The report titled “*Converting the UK traffic noise index $L_{A10,18hr}$ to EU noise indices for noise mapping*” by P.G. Abbott and P.M. Nelson in 2002 provides three methods for converting the $L_{A10,18hr}$ noise index to the EU noise indices, L_{day} , $L_{evening}$ and L_{night} . The EU noise indices can then be combined to obtain the daytime period $L_{Aeq,16hr}$ and the night-time period $L_{Aeq,8hr}$ noise levels.

Method 1 of the report requires hourly traffic data in order to calculate the hourly L_{Aeq} noise levels and Method 2 requires detailed traffic data for the relevant time periods specified by

the EU in order to calculate the L_{day} , $L_{evening}$ and L_{night} indices. Where hourly traffic data or detailed traffic data is not available, Method 3 can be utilised to calculate the EU noise indices from the $L_{A10,18hr}$ calculated using the CRTN methodology.

4. NOISE MEASUREMENT SURVEY

In order to determine the current noise climate at the school, a detailed noise measurement study has been carried out during the proposed hours of opening of the school. A semi-permanent noise monitoring position and three satellite noise monitoring positions were utilised for a 3-hour noise measurement study. The noise monitoring positions are identified on a plan in **Appendix 2**.

The noise measurements utilised a Svantek 971 Class 1 Sound Level Meter and a Rion NL-52 Class 1 Sound Level Meter. Before and after the measurement period the equipment was calibrated in order to ensure that the equipment had remained within reasonable calibration limits (± 0.5 dB). All measurements were carried out with a microphone height of 1.5 m above local ground level. Measurements were carried out on Tuesday 7th March 2017 between 0940 hrs and 1240 hrs. The weather was dry and sunny with a temperature ranging from 8°C at the start of the noise measurement survey to 12°C at the end of the survey. There was a westerly wind with speeds of less than 2 m/s throughout the survey.

4.1. Semi-Permanent Noise Measurement

The semi-permanent noise measurement position was located in a free-field location (at least 3.5m from a reflective façade) to the west of the proposed school site and on the edge of the existing tree line. The noise measurements were carried out over consecutive five minute periods for the duration of the noise measurement survey. The measured noise levels are presented in **Table 4.1**.

Table 4.1: Summary of Free Field Noise Levels from Semi-Permanent Noise Monitoring

Period (hrs)	L _{Aeq} (dB) ⁽¹⁾	L _{AFmax} (dB) ⁽¹⁾	L _{A1} (dB) ⁽¹⁾	L _{A90} (dB) ⁽¹⁾
09:40-10:10	48.1	64.9	56.7	37.0
10:10-10:40	43.7	63.4	51.7	36.1
10:40-11:10	47.5	69.4	54.5	36.6
11:10-11:40	47.4	65.7	56.0	36.2
11:40-12:10	47.5	69.1	56.6	37.0
12:10-12:40	45.9	76.1	54.6	37.4
Total Period 09:40 – 12:40	46.9	68.1	55.0	36.7 (Typical L_{A90} = 37 dB)

Note (1): The average levels stated are logarithmic for L_{Aeq} and arithmetic for L_{A1}, L_{A10} and L_{A90}. The typical L_{A90} is the most common L_{A90,5min} measured during the three hour noise measurement period. The L_{AFmax} is the highest measured noise level in each 30 minute period; the total period L_{AFmax} is an average of the highest measured noise level in each 30 minute period.

The environmental noise climate at MP1 generally comprised distant road traffic and local road traffic on Hewett Avenue, frequent aircraft movements, and the sound of train horns from the Great Western Main Line railway (approximately 1.6km to the south-west of the site). Additionally, due to the Mapledurham Playing Fields being frequently utilised by dog walkers, there were occasional shouts by owners and dogs barking, mud being removed from boots by hitting them against walls, fences and the ground, and also from activities within the tennis courts.

4.2. Satellite Noise Measurements

Satellite noise monitoring was carried out at three measurement positions (MP2 to MP4, as shown on the plan in **Appendix 2**) over 15 minute periods on and around the proposed school site.

MP2 was located at a distance of 4m from the carriageway of Upper Woodcote Road at its junction with Gurney Close. The noise climate at this position was dominated by road traffic on Upper Woodcote Road which generally comprised cars, HGVs and occasional buses and motorbikes.

MP3 was located on Hewett Avenue approximately 44m to the north-west of MP1, approximately 4m from the edge of the carriageway and approximately 13m to the north of No. 29 Hewett Avenue. The noise climate at this position was similar to the noise climate at MP1. However, due to being nearer to Hewett Avenue and with line of sight towards Upper Woodcote Road, road traffic noise was perceived to be louder. During the third measurement period at this position, a lawn mower was in operation in the front garden of No. 3 Hewett Close, however, this does not appear to have significantly increased the noise levels at MP3.

MP4 was located to the north of the proposed school site, approximately 17m to the west of the existing car parking area, approximately 13m to the north of the site boundary and approximately 58m to the north-east of MP1. The noise climate at this position was similar to the noise climate at MP1. However, road traffic noise from Hewett Avenue was less audible due to the measurement position being screened from Hewett Avenue. Noise from activities in the car park and tennis courts was louder due to the measurement position being closer to these noise sources.

The measured noise levels from the free-field noise measurement positions are summarised in **Table 4.2** below. The noise measurements were carried out over consecutive five minute periods.

Table 4.2: Summary of Free Field Noise Levels from Satellite Noise Monitoring

Period (hrs)	L _{Aeq} (dB) ⁽¹⁾	L _{AFmax} (dB) ⁽¹⁾	L _{A10} (dB) ⁽¹⁾	L _{A90} (dB) ⁽¹⁾
MP2				
09:53-10:08	70.1	86.0	74.2	47.6
10:50-11:05	68.6	82.8	72.9	46.1
11:51-12:06	69.1	87.7	73.9	44.3
Average⁽²⁾	69.3	85.5	73.7	46.0
MP3				
10:14-10:29	49.5	67.6	51.3	36.8
11:10-11:25	50.2	68.9	51.5	36.7
12:13-12:28	49.6	64.2	52.8	38.7
Average⁽²⁾	49.8	66.9	51.9	37.4
MP4				
10:32-10:47	48.0	69.6	48.9	36.2
11:31-11:46	50.8	74.7	52.3	39.1
12:30-12:45	49.8	67.3	53.8	37.9
Average⁽²⁾	49.7	70.5	51.7	37.7

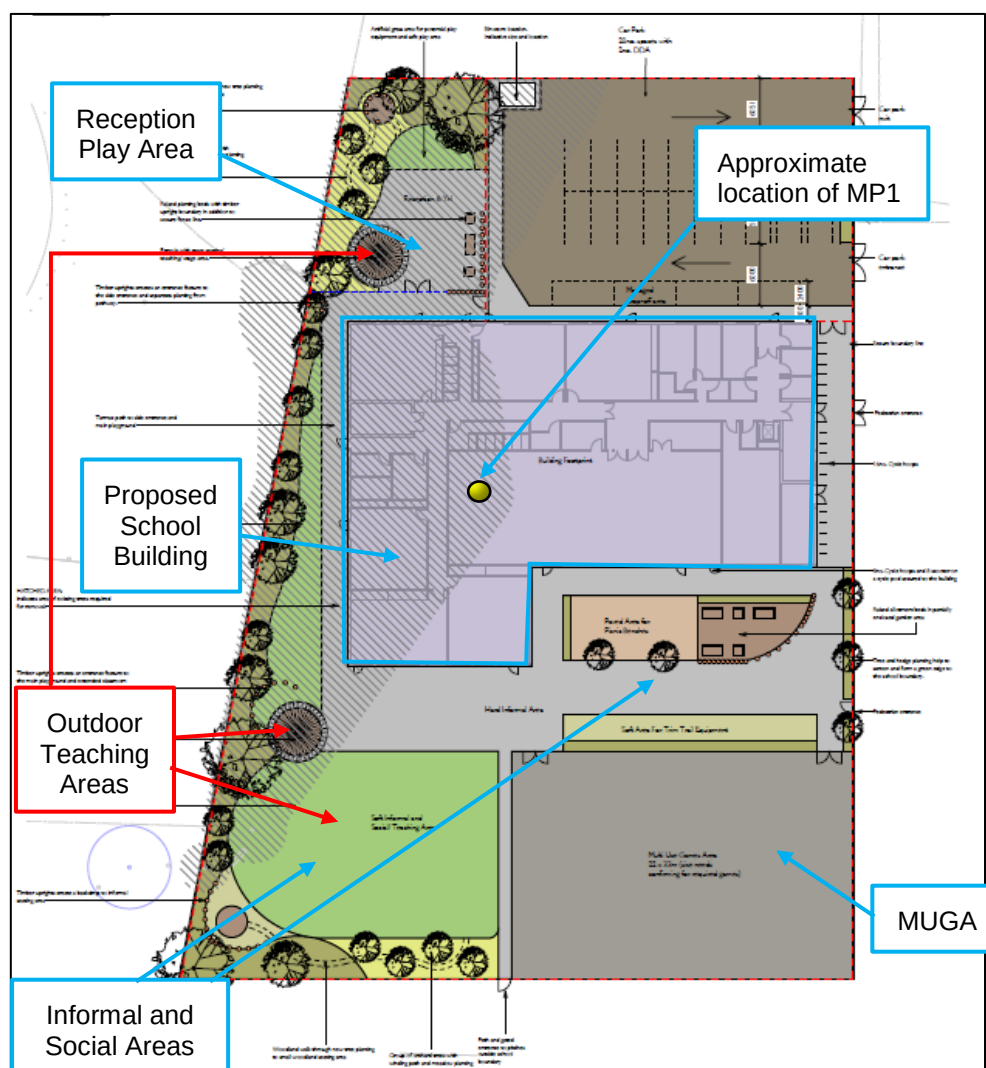
Notes (1): The average 15-minute levels stated are logarithmic for L_{Aeq} and arithmetic for L_{A10} and L_{A90}. The L_{AFmax} is the highest measured noise level in each 15 minute period.

(2): The summary average levels stated are logarithmic for the L_{Aeq} and arithmetic for the L_{AFmax}, L_{A10} and L_{A90}.

5. BB93 ASSESSMENT

The proposed plans for the new school have been provided to ACCON by David Miller Architects (DMA). The proposed site plan (drawing number PS-RYD-XX-XX-DR-L-0001 Revision I dated 02.03.2017) is reproduced as **Figure 5.1** below.

Figure 5.1: Proposed Site Plan



5.1. Internal Noise Levels

The location of MP1 during the noise measurement survey was within the area to be occupied by the school building, as indicated in **Figure 5.1** and is considered to provide a representative noise level for the future western and southern facades of the school building. The location of MP4 was to the north of the site boundary and, due to its proximity to the existing car park and tennis court noise sources, is considered to be representative of the noise levels for the future northern and eastern facades of the school building.

The most onerous internal noise level criterion for a Primary School (excluding requirements for special hearing or communications needs) is a level of 35 dB $L_{Aeq,30mins}$ to be met within the proposed classrooms.

Table 5.1 below displays the predicted internal noise levels within proposed classrooms. Those noise levels are then compared against the requirements of BB93, PSBP and the draft performance standards for schools in order to determine the required sound reduction from the indicated façade, including any windows, for each of the three performance criteria.

Table 5.1: Predicted Average Internal Noise Levels

Location	External Noise Levels (dB)	Required Sound Reduction (dBA)	Internal Noise Levels (dB)	Compliance with BB93 Criteria
	$L_{Aeq,30mins}$		$L_{Aeq,30mins}$	
All classrooms – west and south façades	47	15	32	✓
All classrooms – north and east façades	50	15	35	✓

Where the required sound reduction is 15 dBA or less, the noise criteria can be achieved with open windows. In these cases, it would therefore be unnecessary to provide additional ventilation for acoustic reasons and the level of sound reduction, as indicated in **Table 5.1**, could also be readily achieved with closed single glazed windows. In the case of the requirement to provide suitable internal noise levels for special hearing and communications needs, the provision of additional ventilation may be required to ensure that an internal noise level of 30 dB $L_{Aeq,30mins}$ is achieved in accordance with BB93, whilst maintaining the required levels of ventilation.

The measured external $L_{A1,30mins}$ at MP1 was 55 dB, whilst the criterion in BB93 is to ensure that the internal $L_{A1,30mins}$ is below 60 dB. Therefore, this criterion is satisfied by virtue of the measured external noise levels being below this internal noise level criterion despite regular aircraft movements over the site.

5.2. External Noise Levels

The results of the noise measurement survey indicate that the external areas, including outdoor teaching areas should achieve the 50 dB $L_{Aeq,30min}$ criterion recommended in the 'Acoustics of Schools – A Design Guide' document without the need for further mitigation measures.

6. PLANT NOISE ASSESSMENT

To achieve a plant noise assessment of *low impact* in accordance with BS 4142 the plant noise rating level should not exceed the typical background noise level (L_{A90}).

Figures 6.1 and 6.2 identify the potential areas which may be a source of plant noise. **Figure 6.1** is an extract of the DMA drawing number 02004 Rev P dated 23.01.2017 and **Figure 6.2** is an extract of the DMA drawing number 02005 Rev P dated 23.01.2017. **Figure 6.1** indicates a proposed plant room at ground floor level in the north-west corner of the school building. However, the precise specifications of any plant items to be installed in the plant room are unknown at this stage of the project. Additionally, there are a number of toilet facilities and a kitchen, as well as the main hall and activity studio which may require further ventilation provision such as extract ventilation. The precise specifications and locations of any ventilation inlets or outlets are also unknown at this stage of the project.

Figure 6.1: Proposed Ground Floor Plan Identifying Potential Sources of Plant Noise

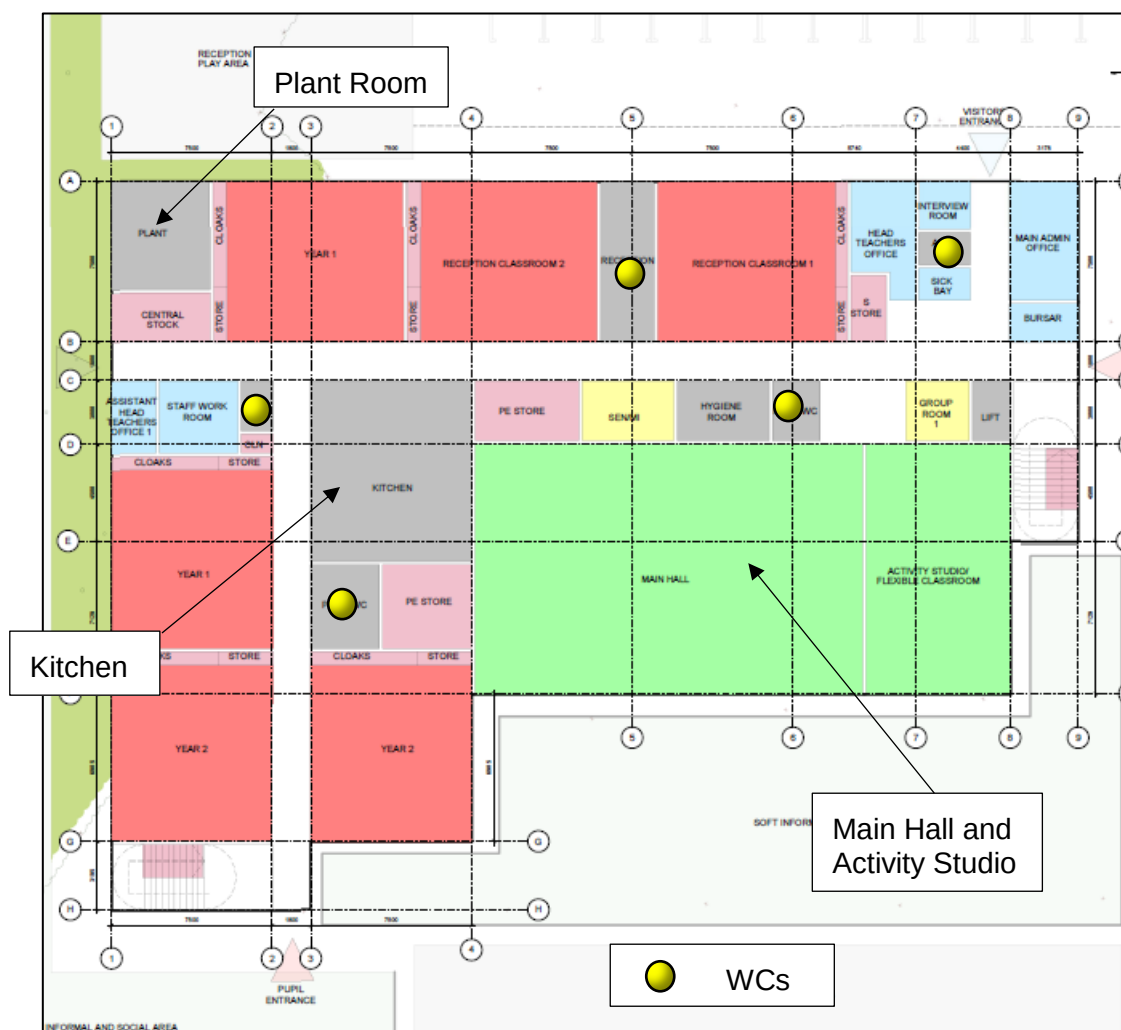
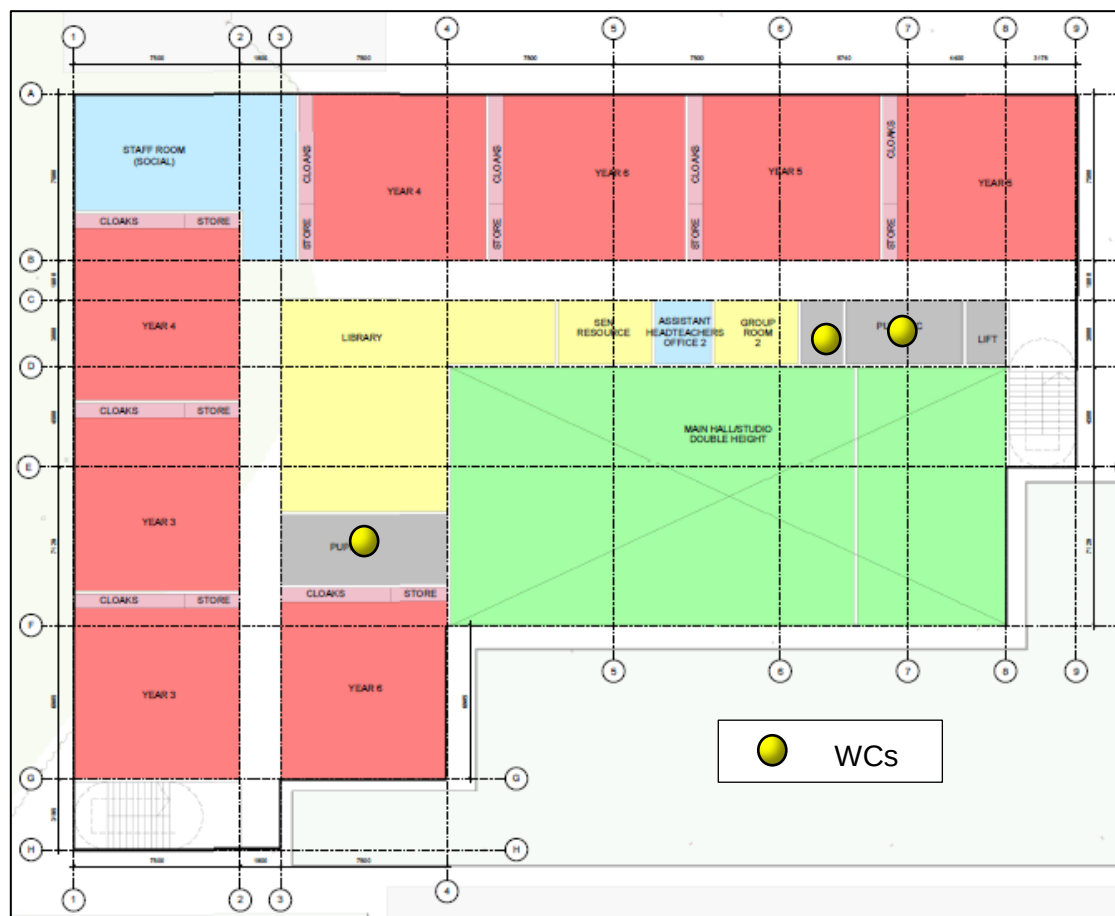


Figure 6.2: Proposed First Floor Plan Identifying Potential Sources of Plant Noise



The likely source of the greatest levels of plant noise is the plant room. The nearest noise sensitive receptors to the plant room are No. 4 Hewett Close, approximately 45m to the north of the plant room, and No. 29 Hewett Avenue, approximately 32m to the west of the plant room. The locations of these noise sensitive receptors are identified in **Appendix 2**.

A typical daytime background noise level of 37 dB L_{A90} was measured at MP1. This background noise level is considered to be representative of the background noise level at the nearest noise sensitive receptors, given that it is not significantly different to the L_{A90} noise levels measured at the satellite measurement positions MP3 and MP4.

The typical background noise level has been used to determine the cumulative plant noise level (rating level) which should not be exceeded at each noise sensitive receptor in order to achieve a low noise impact. It should be noted that the rating levels provided are the noise levels at the identified noise sensitive receptors from all proposed items of plant together and not individual items of plant. **Table 6.1** presents the typical background noise level, the corresponding cumulative plant noise rating level and specific sound level and an indication of the maximum sound power level of the plant room break-out noise. It should be noted that the sound power level has been determined without consideration of any plant which may not be located within the plant room, such as toilet extract fans which may extract to various locations around the building depending on the final ventilation strategy and design.

Table 6.1: Total Sound Power Level of Plant Equipment

Results	4 Hewett Close and 29 Hewett Avenue	Relevant Clauses of BS 4142:2014	Commentary
Typical Background Sound Level L _{A90} (dB)	37	8.1, 8.2	The typical background sound level at MP1 from Section 4.1 .
Specific Sound Level L _{Aeq,1hr} (dB)	37	7.3.7, 7.3.9, 7.3.11	Derived from the typical background sound level
Acoustic Feature Correction	Unknown	9.2	No acoustic feature correction has been applied to account for the specific acoustic features as the precise plant specifications are unknown.
Rating Level	37	9.2	(Specific Sound Level + Acoustic Feature Correction)
Difference between Rating Level and Background Sound Level	0	9.2	
BS 4142 Initial Estimate of Impact	Indication of a low impact	11	
Plant Room Break-out Noise – Maximum Sound Power Level L _{WA} (dB)	60	N/A	Indicative only.

It will be important to ensure that plant associated with the proposed school does not exceed the specific noise levels identified in this section of the report. If the plant is tonal, intermittent, or contains any other acoustic features, this would reduce the maximum specific noise level and total sound power levels identified in **Table 6.1**. Careful consideration is required as to the specification and siting of any plant. If the plant was positioned further away from the identified noise sensitive receptors, the total sound power levels identified in **Table 6.1** may be increased accordingly.

When the exact items of plant to be installed have been identified, ACCON would recommend that a further plant noise assessment is carried out in order to ensure compliance with the target noise criteria.

7. ROAD TRAFFIC NOISE

For the purpose of predicting the noise impact of The Heights Primary School, changes in predicted traffic flow on the local road network as a result of the operation of the school have been analysed for the fully occupied year, 2023 utilising the traffic data provided by MLM Consulting.

In 2023, the school is expected to be fully occupied with 420 pupils and 50 staff members. The MLM Consulting traffic data predicts that 99 pupils will arrive and depart from school by car (or by car share) and 23 members of staff will arrive and depart from school by car. It has been derived that this creates 198 two-way trips to drop off and collect pupils and 23 two-way trips for staff to arrive and depart from the school. This results in a total of 442 additional vehicle movements along the access road each day.

7.1. Upper Woodcote Road

Traffic data for Upper Woodcote Road (A4074) has been obtained from the Department for Transport (DfT) Traffic Counts website³ which reports the Average Annual Daily Flow (AADF) of traffic on the major road network. The DfT traffic data has been converted to an 18-hour traffic flow utilising a conversion factor of 0.94. The 18-hour traffic flow has then been increased using a year-on-year traffic growth factor to obtain the 18-hour traffic flow for 2023.

The changes in predicted 18-hour traffic flow and associated noise change based on the derived traffic data are shown in **Table 7.1**.

Table 7.1: Predicted Traffic Flows for Upper Woodcote Road

Location	No Development (2023)	With Development (2023)	% Change in Traffic Flow	Change in Noise Level (dB)
A4074 Upper Woodcote Road	11,518	11,960	3.8%	+0.2

It can be identified, by reference to **Table 7.1**, that there will be a 3.8% increase in traffic flow on the A4074 Upper Woodcote Road as a result of the proposed school. This will result in a 0.2 dB increase in noise levels which, when assessed in line with the methodology outlined in **Table 3.3**, will result in a negligible noise impact.

7.2. Mapledurham Playing Fields Access Road

There is no traffic data available for the Mapledurham Playing Fields Access Road. However, the noise measurement data obtained at MP4 is considered to be reasonably representative of the existing traffic movements in and out of the car park area.

³ <http://www.dft.gov.uk/traffic-counts/cp.php>

A basic noise level for a peak hour traffic flow (school traffic only) has been determined utilising the CRTN Chart 2 calculation procedure. The peak hour traffic flow assumes 221 school traffic movements: assuming a one-hour peak period in the morning and a one-hour peak period in the afternoon. In order to minimise the uncertainty in the measured data, the basic noise level has been distance corrected to the measurement position MP4. The corrected basic noise level has then been converted to a period $L_{Aeq,1hr}$ noise level using the TRL Method 1 calculation procedure and logarithmically summed with the measured L_{Aeq} noise level at MP4. A comparison is made between the predicted and existing hourly L_{Aeq} noise levels during the peak hour and between the existing and predicted daytime $L_{Aeq,16hr}$ noise levels in order to assess the impacts.

Table 7.2 presents the change in noise level on the Access Road for the fully operational school.

Table 7.2: Change in Noise Level on the Access Road

Row	Noise Level Descriptor	Noise Level (dB)
1	Measured (average) $L_{Aeq,15mins}$ at MP4 ⁽¹⁾	49.7
2	Calculated $L_{Aeq,16hr}$ at MP4 ⁽²⁾	49.9
3	Basic Noise Level for 110 vehicles per hour (CRTN Chart 2)	65.5
4	Basic Noise Level corrected for distance, speed and percentage of HGVs (CRTN Chart 4, CRTN Chart 7)	57.2
5	Corrected Basic Noise Level converted to $L_{Aeq,1hr}$ (TRL Method 1)	54.5
6	Total Predicted Noise Level $L_{Aeq,1hr}$ (Logarithmic sum of row 1 plus row 5)	55.8
7	<u>Change in noise level – 1 hour period (row 6 – row 1)</u>	<u>+6.1</u>
8	Predicted Daytime Period Noise Level $L_{Aeq,16hr}$ (logarithmic average of row 6 (2 hours) and row 1 (14 hours) over 16 hours)	51.1
9	<u>Change in daytime noise level – 16 hour period (row 8 – row 2)</u>	<u>+1.2</u>
Notes (1): Average of three 15 minute measurements (2): Calculated from the measured L_{A10} noise levels in accordance with the CRTN shortened measurement procedure and the TRL Method 3 calculation methodology.		

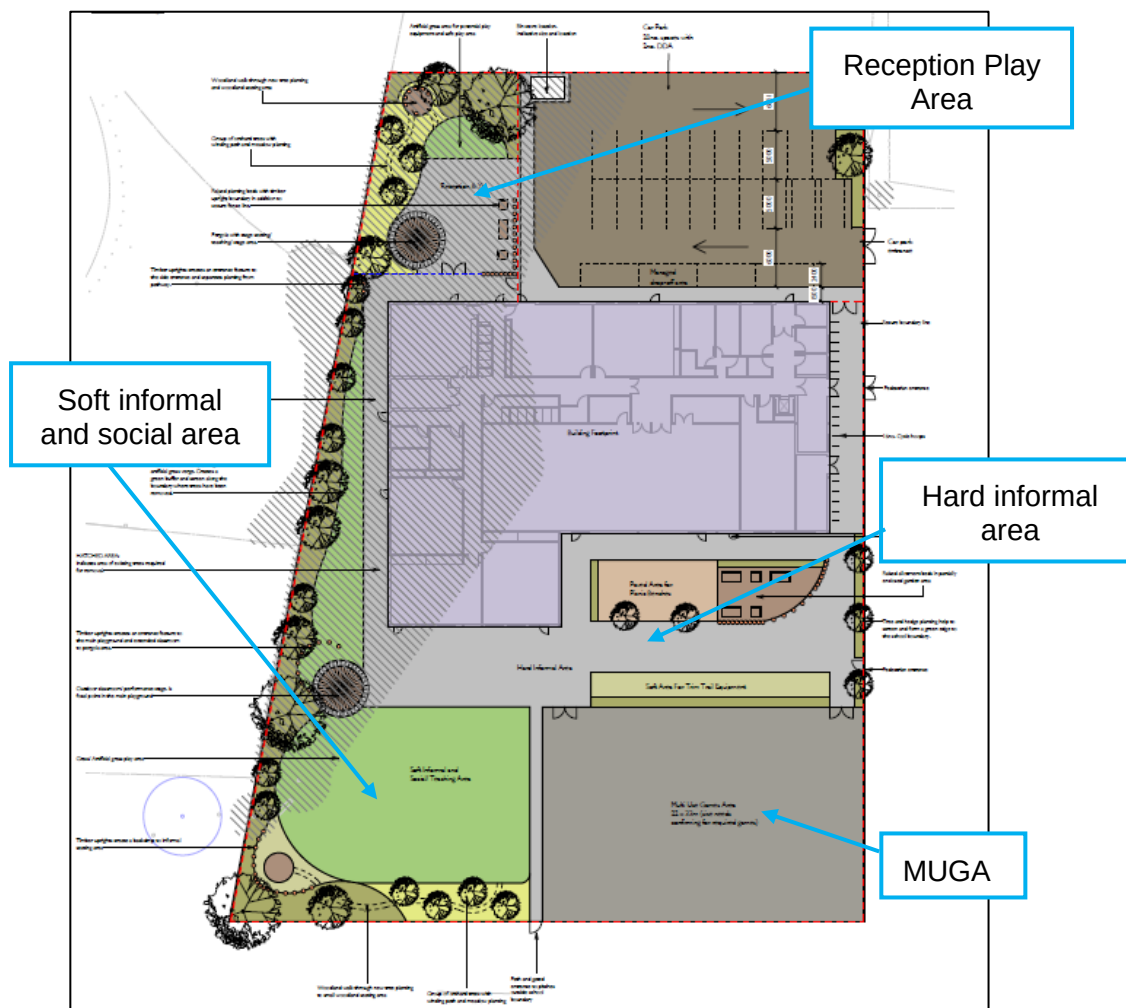
Table 7.2 indicates that, during peak school periods, there would be an increase in road traffic noise on the access road of 6.1 dB. When assessed in line with the methodology outlined in **Table 3.3**, this increase in noise level will result in a medium noise impact.

However, over the duration of a 16 hour day, as typically assessed for noise assessment purposes, the increase in road traffic noise level due to school traffic on the access road is predicted to be 1.2 dB. When assessed in line with the methodology outlined in **Table 3.3**, this increase in noise level will result in a negligible noise impact.

8. EXTERNAL ACTIVITY NOISE LEVELS

The proposed plans for the school include four main outdoor play areas, one Reception Play Area, a soft informal and social area, a hard informal area, and a MUGA as shown in **Figure 8.1** below.

Figure 8.1: Proposed Site Plan



In order to determine whether the predicted noise levels emanating from the play areas are within reasonable limits, it is necessary to predict the future noise levels when the play areas are in use.

8.1. Playground Noise Measurements

In order to provide the necessary source noise data to calculate the likely levels of noise from the use of the playground areas, ACCON have used the results of a noise measurement survey at an existing primary school.

The noise measurement survey was carried out over the lunch-time break on Tuesday 9th December 2014 between 1230 hrs and 1320 hrs at The Francis Baily School in Thatcham,

Berkshire. The noise measurements were carried out both within the playground area for years 1 and 2 pupils and within the playground area for years 3 and 4 pupils.

The acoustic characteristics of a primary school playground invariably involves small groups of children of various ages talking with occasional raised voices and occasional playful screams. In the years 3 and 4 playground area, some organised activities took place including games with bats and balls, space hoppers and climbing frames. During the noise measurements, the numbers of children in the play areas ranged from 30-40 up to around 130.

The measurements were taken as one second L_{Aeq} noise levels and a summary of the measured noise levels is provided in **Table 8.1** below.

Table 8.1: Noise Levels from The Francis Baily School Playgrounds

Measurement Location	Approximate Number of Pupils	Measurement	Noise Level Arising from the Playground $L_{Aeq,1sec}$ (dB)
Years 1-2 – Middle of playground	130	Average	77
		Highest	92
Years 1-2 – Edge of playground	130	Average	76
		Highest	93
Years 3-4 – Middle of playground	100	Average	78
		Highest	93
Years 3-4 – Edge of playground	30-40	Average	75
		Highest	84

It can be seen, by reference to **Table 8.1**, that there is not a wide range of average noise levels regardless of the age or number of children in the play area. It is appropriate for an impact assessment to consider the average and highest noise levels in order to demonstrate the range of noise impacts at the identified noise sensitive receptors. In the noise model discussed below the highest measured $L_{Aeq,1sec}$ (93 dB) has been utilised to represent the L_{Amax} noise level and the highest average $L_{Aeq,1sec}$ (78 dB) has been utilised to represent the average L_{Aeq} noise level as a worst case.

8.2. Predicted Noise Levels

The noise modelling software CadnaA has been utilised to determine the receptor noise levels using the source terms from the playground, as detailed above. CadnaA utilises the methodology in *ISO 9613: Acoustics – Attenuation of sound during propagation outdoors*. The model has assumed a worst case where all the playground areas are in use at the same time. The receptor location noise predictions are summarised in **Table 8.2** below. The receptor locations are detailed in **Appendix 2**.

Table 8.2: Predicted Noise Level from the playgrounds

Receptor	Noise Level arising from the playgrounds	
	Average (L _{Aeq})	Highest (L _{Amax})
29 Hewett Avenue	54	69
28 Hewett Avenue	55	70
3 Hewett Close	51	66
4 Hewett Close	52	67

The model was run using acoustically hard ground conditions (G=0) and with source heights modelled at 1m and receiver heights modelled at 1.5m (ground floor height) in order to represent a worst case scenario. The effect of localised fencing around gardens has been included in the noise models.

8.3. Activity Noise Impact Assessment

In order to determine the noise impact and the acceptability of the use of the playgrounds, a comparison has been carried out against the noise criteria identified in **Section 3.9**. **Table 8.3** identifies the assessment carried out to determine compliance with BS 8233 and World Health Organization Guidelines for the average noise levels and **Table 8.4** identifies the highest noise levels.

Table 8.3: Noise Impact Assessment of the Playgrounds – Average Noise Levels

Receptor	Predicted External Noise Level L _{Aeq} (dB)	Existing Ambient Noise Level L _{Aeq} (dB)	Change in External Noise Level (dB)	Predicted Internal Noise Level ⁽¹⁾ L _{Aeq} (dB)	Compliance with Criteria ⁽²⁾	
					WHO Guidelines (55 dB L _{Aeq} external)	BS 8233 (35 dB L _{Aeq} internal)
29 Hewett Avenue	54	47	+7	39	✓	X
28 Hewett Avenue	55	47	+8	40	✓	X
3 Hewett Close	51	47	+4	36	✓	X
4 Hewett Close	52	47	+5	37	✓	X

Notes: (1) Where internal noise levels are concerned we have assumed a minimum reduction of 15 dB(A) with windows open. The assessment considers the predicted noise from the playground only, and not the existing ambient noise level.
(2) The assessment against the WHO and BS8233 noise criteria considers the predicted noise from the playground only, and not the existing ambient noise level.

Table 8.4: Noise Impact Assessment of the Playgrounds – Highest Noise Levels

Receptor	Predicted External Noise Level L_{Amax} (dB)
29 Hewett Avenue	69
28 Hewett Avenue	70
3 Hewett Close	66
4 Hewett Close	67

It can be seen, by reference to **Table 8.3**, that noise levels at the identified noise sensitive receptors have the potential to be raised due to playground activities. The raised noise levels would be below the external ambient noise level recommendations of the WHO guidelines but within 5 dB of the internal noise level criteria provided within BS 8233 with windows open. The internal noise level criteria is provided within Table 4 of BS 8233 and includes the following supporting note:

“Note 7 Where development is considered necessary or desirable, despite external noise level above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.”

With reference to **Table 8.4**, the external maximum noise levels are similar to the highest L_{AFmax} noise levels measured during the noise measurement survey. At MP1 the average of the highest L_{AFmax} levels measured in each 30 minute period was 68 dB and at MP3 and MP4 the averages of the highest L_{AFmax} levels measured in each 15 minute period was 67 dB and 71 dB, respectively.

It should however be noted that the noise criteria provided within the WHO guidelines and BS 8233 are for average noise levels over a 16 hour day and the activity noise levels that have been utilised for the assessment will only occur during break and lunch times (for between one and two hours a day). The activity noise levels will therefore only occur for part of the day and will not affect the identified noise sensitive receptors continuously. It should also be noted that the activity noise will occur in the mid-morning and afternoon, and not during the early morning or evening time periods which is when residents are generally more sensitive to noise. Therefore, activity noise levels from the external play areas are not considered to result in any significant noise impacts for existing noise sensitive receptors.

9. CONCLUSION

A noise assessment has been carried out for the proposed The Heights Primary School on the Mapledurham Playing Fields in Reading. The school will comprise a purpose-built school building with associated outdoor teaching and play areas. The school will have a capacity of 420 pupils and 50 staff members.

External noise levels at the site of the proposed school are mainly due to aircraft, visitors to the Mapledurham Playing Fields who use the playing fields to walk their dogs, users of the tennis courts, and some local road traffic on Hewett Avenue.

The results of the noise measurement study have been utilised to identify the requirements for façade sound reduction of the proposed building envelope in order to achieve the requirements of BB93.

Maximum noise rating levels for plant associated with the school building have been calculated in line with BS 4142:2014. It is recommended that a further assessment is carried out once precise plant specifications have been determined.

It has been demonstrated that the additional traffic movements caused by the development of the proposed school are predicted to result in a negligible increase in noise levels for existing properties alongside the existing highway network. Along the Access Road, a negligible increase in noise levels has been predicted over the daytime assessment period, although a medium increase in noise levels may be perceived during peak hours at those properties either side of the Access Road.

The impact of noise from activity in the proposed play areas has been assessed. The assessment has demonstrated that, although the existing ambient noise levels would be raised by up to 8 dB in some gardens during school break times, the predicted noise levels would not exceed the guideline external noise criteria. The internal noise criteria, assuming the residents' windows would be open, would, however, be slightly exceeded. The L_{Amax} noise levels due to activity noise are similar to the measured L_{Amax} noise levels of the existing noise climate. It should be noted however that the activity noise would only occur for up to two hours per day and would occur during the periods of least sensitivity to noise (i.e. mid to late morning and in the afternoon). It can therefore be concluded that the activity noise levels from the external play areas are unlikely to result in any significant noise impacts for existing noise sensitive receptors.

Achievement of the target noise criteria will ensure compliance with the aims of the NPPF and the PPG in that it will avoid noise from giving rise to significant adverse impacts on health or quality of life for future occupiers of the proposed school and existing occupiers in close proximity to the proposed school.

Appendix 1

Glossary of Acoustic Terms

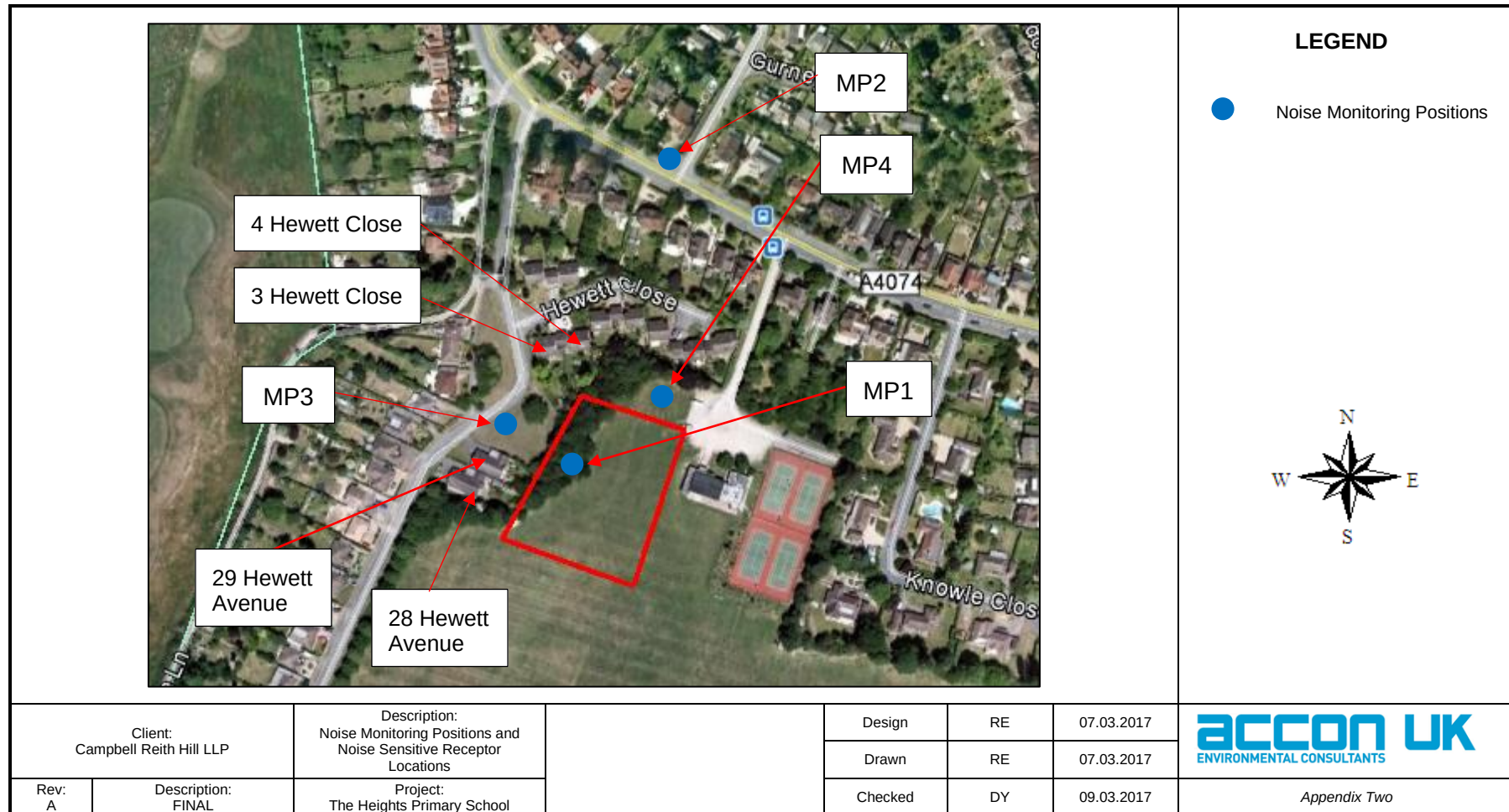
Appendix 1: Glossary of Terms

Term	Description
'A'-Weighting	<i>This is the main way of adjusting measured sound pressure levels to take into account human hearing, and our uneven frequency response.</i>
Decibel (dB)	<i>This is a tenth (deci) of a bel. The decibel can be a measure of the magnitude of sound, changes in sound level and a measure of sound insulation. Decibels are not an absolute unit of measurement but are an expression of ratio between two quantities expressed in logarithmic form.</i>
$L_{Aeq,T}$	<i>The equivalent steady sound level in dB containing the same acoustic energy as the actual fluctuating sound level over the given period, T. T may be as short as 1 second when used to describe a single event, or as long as 24 hours when used to describe the noise climate at a specified location. $L_{Aeq,T}$ can be measured directly with an integrating sound level meter.</i>
L_{A10}	<i>The 'A'-weighted sound pressure level of the residual noise in decibels exceeded for 10 per cent of a given time and is the L_{A10T}. The L_{A10} is used to describe the levels of road traffic noise at a particular location.</i>
L_{A50}	<i>The 'A'-weighted sound pressure level of the residual noise in decibels exceeded for 50 per cent of a given time and is the L_{A50T}.</i>
L_{A90}	<i>The 'A'-weighted sound pressure level of the residual noise in decibels exceeded for 90 per cent of a given time and is the L_{A90T}. The L_{A90} is used to describe the background noise levels at a particular location.</i>
L_{Amax}	<i>The 'A'-weighted maximum sound pressure level measured over a measurement period.</i>

Appendix 2

Noise Monitoring Positions and Receptor Locations

Appendix 2: Noise Monitoring Positions



10.03.2017

Page | 33

Email: enquiry@accon-uk.com • www.accon-uk.com
Unit B, Fronds Park, Frouds Lane, Aldermaston, Reading, RG7 4LH

Reading Office Tel: 0118 971 0000 Fax: 0118 971 2272
Brighton Office Tel: 01273 573 814



Email: enquiry@accon-uk.com

Reading Office:

Tel: 0118 971 0000
Fax: 0118 971 2272
Unit B, Fronds Park,
Frouds Lane, Aldermaston,
Reading, RG7 4LH

Brighton Office:

Tel: 01273 573 814
Citibase, 95 Ditchling Road,
Brighton, East Sussex, BN1 4ST

www.accon-uk.com