Noise Impact Assessment
Marble Hill Stable Block Cafe
Twickenham
TW1 2NL
HRS Services Ltd.
HRS Ref: 124898 – AC - 3v6

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I. Revision History

Revision	Description	Date	Approved
3v1	Draft for Comment	23/07/2018	-
3v2	First Issue	25/07/2018	AW
3v3	Minor updates based on client comments	27/07/2018	AW
3v4	Updated noise modelling based on update to project proposals	28/08/2018	AW
3v5	Minor updates based on client comments	28/08/2018	AW
3v6	Update to opening hours	30/08/2018	AW

II. Executive Summary

HRS Services Ltd (HRS) has undertaken an environmental noise impact assessment for the proposal to redevelop the existing Marble Hill Stable Block Cafe located within Marble Hill Park, based on a site noise survey undertaken in December 2016.

During the noise survey, the daytime noise climate observed to be affecting the site was noted to be controlled by distant road traffic and regular aircraft movements associated with planes approaching and departing Heathrow airport. The noise survey was undertaken out of season when noise associated with the existing café is lower. It is anticipated that noise form the existing Stable Block café will be higher during the summer period; however it is beneficial to measure the lower end of existing ambient and background sound level ranges in order to undertake a robust assessment of noise impact from the new development.

The assessment of noise impact from the new scheme is made by comparing highest levels of anticipated operational noise from the Stable Block redevelopment with existing measured site ambient and background noise levels, with reference to the guidance documents set out in this report. The resultant increase in noise due to the proposed redevelopment can be classified in terms of a scale potential noise impact ranging from ‘no impact’ to ‘severe impact’.

This report considers the impact of noise from customers using the proposed development, building services plant equipment associated with the building, and also operation noise associated with the day to day operation of the proposed café.

A noise propagation model of the site has been developed to assess customer noise transfer from the scheme based on maximum occupancy levels. Predicted average noise levels in adjacent residential garden areas have been assessed in relation to existing site ambient noise levels with noise impact predicted to range from ‘no impact’ in more screened garden areas, to ‘slight impact’ in more exposed garden areas. Noise impact would be expected to reduce when the café is below maximum occupancy levels.

Noise levels within garden areas of adjacent residential properties are predicted to be below the guidance levels outlined in BS 8233:2014, as referenced in ‘*London Borough of Richmond upon Thames: Supplementary Planning Document - Noise Generating and Noise Sensitive Development (SPD)’*.

Maximum noise levels have been considered due to single maximum noise events associated with use of the proposed café such as furniture movements, raised voices and waste disposal. Maximum noise levels within gardens and at the facades of identified Noise Sensitive Receptors (NSR) are predicted to be of the order of existing site maximum noise levels, which are currently controlled by regular airplane movements. Given the

current site context of regular audible aircraft movements, and the expected regularity and duration of maximum noise events due to café operation, a significant impact is not expected.

HRS has proposed building services noise limits at identified NSR most exposed to the proposed scheme, in line with guidance outlined in '*London Borough of Richmond upon Thames: SPD'*. It is recommended that external noise from new building services plant does not exceed 5 dB below the existing representative background noise level when assessed at the nearest noise sensitive receptors in line with BS 4142:2014 '*Methods for rating and assessing industrial and commercial sound'*. BS 4142:2014 states that this is an indication of the specific sound source having a low impact.

An overview of proposed building services plant has been undertaken based on information available at the time of writing, with commentary on expected noise levels and mitigation requirements.

Based on HRS' environmental noise assessment included within this report, HRS concludes that the new development is expected to result in a 'low' to 'slight' noise impact upon identified noise sensitive properties.

III. Contents

1. Introduction

1.1 HRS Services Ltd (HRS) has been appointed by English Heritage to provide acoustic consultancy services for the proposed redevelopment of Marble Hill Stable Block Cafe located within Marble Hill Park, Twickenham.

1.2 The project proposals involve redevelopment of the existing Marble Hill Stable Block café. The internal area of the building is to be remodelled creating a new café area to the south of the building and an overflow café area in the northern wing of the existing building. Internal dining areas are proposed to cater for 60 covers. An external seating area is proposed to the east and south of the existing stable block building with space to incorporate a further 100 diners. The existing kitchen and WC area are to be retained and remodelled. Proposed building plans are appended to this report.

1.3 The purpose of this report is to assess the existing site noise climate and consider noise impact from the proposed scheme on nearby Noise Sensitive Receptors (NSR) in terms of both fixed building services plant and operational noise.

1.4 This document has been prepared for the sole use, benefit and information of English Heritage for the purposes set out in the document or instructions commissioning the works. The liability of HRS in respect of the information contained herein will not extend to any third party.

1.5 This report is limited to addressing the specific acoustic issues contained herein and is based on information and drawings provided by the client.

1.6 Whilst every effort has been made to ensure that this report is easy to understand, it is technical in nature; to assist the reader, a glossary of terminology is included in Appendix IV.

2. Site Description

2.1 The development site is located within Marble Hill Park in the London Borough of Richmond upon Thames. The existing stable block is located towards the western boundary of the park, adjacent to Montpellier Row.

2.2 Figure 1 shows the roof plan and layout of the proposed scheme.

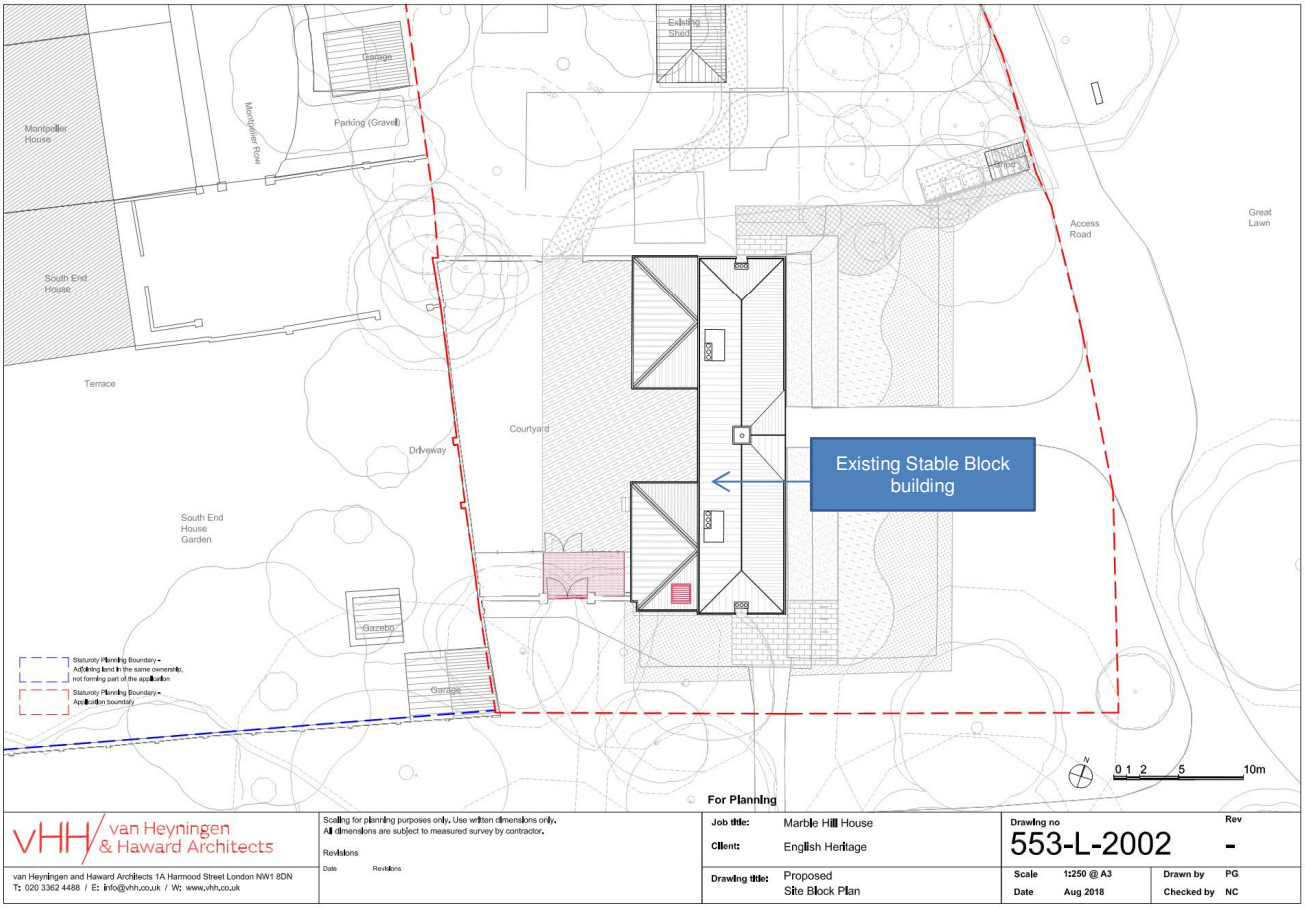


Figure 1: Site plan

2.3 The daytime noise climate at the site is noted to be controlled by distant road traffic noise from local roads, as well as regular aircraft movements associated with planes approaching and departing Heathrow airport. Additional noise sources were noted to be activity within Marble Hill park and visitors to the existing Stable Block café, occasional vehicle movements on Montpellier Row and birdsong. It was noted during HRS' time on site that daytime maximum noise levels are controlled by aircraft movements, occurring at approximately 15 minute intervals during the daytime.

2.4 The nearest identified NSR are residential houses located on Montpellier Row to the west of the proposed development site. The closest is Southend House, a four storey residential dwelling with

garden / external amenity areas located to the south of the main house bordering onto the proposed Stable Block development.

2.5 An existing gazebo building is located within the grounds of Southend House, approximately 20m west of the Stable Block building, as indicated in Figure 1. HRS understands that this building does not currently have a residential use, however there is a possibility of future residential use of this building.

Development Proposals

2.6 The internal area of the building is to be remodelled creating a new café area to the south of the building and an overflow café area in the northern wing of the building. Internal dining areas are proposed to cater for 60 covers. The existing kitchen to the south of the building is to be remodelled, and the existing Male WC to the west of the building is to be remodelled to form unisex WC facilities.

2.7 Additional external seating area is proposed to the east and south of the existing stable block building with space to incorporate a further 100 diners.

2.8 Building services plant is primarily to be contained within a newly formed internal plant room with ventilation provided by a louvred door facing into the yard to the east of the Stable Block.

2.9 The remodelled café areas are proposed to be naturally ventilated via existing east facing windows. The newly formed kitchen and toilets are to be ventilated by mechanical air supply and extract. An Air Handling Unit (AHU) serving the kitchen is to be contained within external compound to west of kitchen.

2.10 An existing shed to the north of the Stable Block is to be repurposed as a store for the Kitchen / Café, including dry goods and a cold store.

2.11 HRS understands that proposed opening times will be 09:00 – 18:00 seven days a week within the summer months, or 09:00 to 16:00 in the winter.

2.12 Current scheme drawings indicating the proposed alterations to the Stable Block building are provided for reference in Appendix II.

2.13 The remodelled café areas are proposed to be naturally ventilated via existing east facing windows. The newly formed kitchen and toilets are to be ventilated by mechanical air supply and extract.

3. Noise Assessment Guidance and Criteria

Planning Guidance

3.1 The current planning guidance for the assessment of the potential environmental noise impact is outlined in the National Planning Policy Framework (NPPF). Whilst the NPPF does not set criteria that must be achieved, the NPPF states the following in relation to the appropriate control of potential noise impacts (paragraph 109):

3.2 *'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…'*

3.3 Therefore the policy requires that new developments are not affected to an unacceptable degree by environmental noise.

Noise Policy Statement for England

3.4 The Noise Policy Statement for England (NPSE) provides further guidance on the Government's policy with regard to the potential impacts of noise. The NPSE states the aims of Government policy relating to noise are:

3.5 *'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'*

Table 1: Noise Policy Statement for England (NPSE) Effect Levels

NOEL	**No Observed Effect Level**	Level below which no detectable effect on health and quality of life due to noise
LOAEL	**Lowest Observed Adverse Effect Level**	Level above which adverse effects on health and quality of life due to noise
SOAEL	**Significant Observed Adverse Effect Level**	Level above which significant adverse effects on health and quality of life due to noise

3.6 The NPSE considers that the noise levels above the SOAEL would be seen to have, by definition, significant adverse effects and would be considered unacceptable. Where the assessed noise levels fall between the LOAEL and the SOAEL noise levels, the policy required that:

3.7 *'…all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development…This does not mean that such adverse effects cannot occur.'*

Planning Practice Guidance – Noise (PPGN)

3.8 The Noise section of the Planning Practice Guidance states that:

3.9 '*Noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment.'*

3.10 In order to determine the noise impact the document states that planning authorities' plan-making and decision taking should take account of the acoustic environment and in doing so consider the following:

- *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.*

3.11 In identifying the overall effect of noise exposure PPGN is in line with the three noise levels given in the NPSE effect levels (as shown in the table above).

3.12 PPGN expands on the NPSE effect levels by providing a table summarising the noise exposure hierarchy:

Table 2: Planning Practice Guidance – Noise (PPGN) Exposure Hierarchy

Perception	Increasing Effect Level	Action
Not noticeable	No Observed Effect	No specific measures required
Noticeable and not Intrusive	No Observed Adverse Effect	No specific measures required
	Lowest Observed Adverse Effect Level	
Noticeable and Intrusive	Observed Adverse Effect	Mitigate and reduce to a minimum
	Significant Observed Adverse Effect Level	
Noticeable and disruptive	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Unacceptable Adverse Effect	Prevent

London Borough of Richmond upon Thames: Supplementary Planning Document - Noise Generating and Noise Sensitive Development

3.13 '*Development Control for Noise Generating and Noise Sensitive Development'* issued by London Boroughs of Hillingdon, Hounslow and Richmond Upon Thames in July 2014 provides planning guidance on acoustic design and requirements applicable to new noise sensitive and noise generating developments.

3.14 The guidance considers appropriate noise levels for new and existing noise sensitive residential properties, suggesting appropriate internal and external noise levels in line with those proposed within BS 8233:2014 '*Sound Insulation and Noise Reduction for Buildings*'.

3.15 With reference to new noise generating commercial developments, the guidance references assessment in line with BS 4142:2014 *'Methods for rating and assessing industrial and commercial sound'*, and states that noise impact from relevant proposed industrial or commercial premises or plant with a BS 4142:2014 rating level $L_{Ar,Tr}$ at least 5 dB(A) below the background sound level would be "normally acceptable".

3.16 Details of BS 4142:2014 and its limitations of scope are outlined in section 3.27 below.

British Standard 8233:2014 – Sound Insulation and Noise Reduction for Buildings

3.17 HRS' suggested internal ambient noise level design criterion for the purposes of this assessment is based on BS8233. This standard is commonly used as the basis for assessing the potential noise impact of the ambient noise climate on proposed residential development. Hence, if a development meets the recommendations of BS 8233:2014, HRS recommends that it could be considered as meeting the requirements of potential noise related planning conditions, subject to relevant authorities' agreement.

3.18 The BS8233 recommended criteria for internal ambient noise levels are shown in Table 3 below:

Table 3: BS8233 Indoor Ambient Noise Design Criteria

Activity	Location	Design Range $L_{Aeq,T}$ dB	
		07:00 - 23:00	23:00 - 07:00
Resting	Living room	35	-
Dining	Dining room/area	40	-
Sleeping (daytime resting)	Bedroom	35	30

3.19 For the purposes of this assessment, and based on the above, HRS propose the following noise criteria for control of external noise:

- Living rooms (07:00-23:00 hours): 35 dB $L_{Aeq,T}$
- Bedrooms (23:00-07:00 hours): 30 dB $L_{Aeq,T}$

3.20 In addition, World Health Organisation (WHO) guidelines recommend *'general daytime outdoor noise levels of less than 55 dB $L_{Aeq(16hour)}$ are desirable'*. Whilst acknowledging these outdoor limits, BS 8233:2014 also states:

3.21 *'For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. '*

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

3.22 British Standard BS 4142, 'Methods for rating and assessing industrial and commercial sound', 2014 describes a method for assessing the likelihood of complaints from noise sources that are of an industrial nature (e.g. fans, pumps, chillers, air handling units etc.). The assessment methodology is based upon determining a 'rating level' for the equipment being assessed, which is the level of noise from the item or items of plant being assessed (measured as $L_{Aeq,T}$).

3.23 The rating level is then compared with the underlying background noise level (measured as a L_{A90}) in the absence of noise from the item or items of plant being assessed.

- 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.

3.24 BS 4142:2014 states that a penalty should be added for any plant which gives rise to noise features that may increase disturbance such as tonal, impulsive or intermittent characteristics. With respect to the acoustic feature correction, BS 4142 states:

3.25 "*Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location, add a character correction to the specific sound level to obtain the rating level.*"

3.26 Generally a rating penalty for a sound should be based on a subjective assessment of its characteristics.

3.27 It should be noted that BS 4142:2014 is not intended to be applied to the rating and assessment of sound from:

- recreational activities, including all forms of motorsport;
- music and other entertainment;
- construction and demolition;
- people;
- public address systems for speech

Operational Noise Impact

3.28 Consideration will need to be given to the potential for an adverse impact on the noise climate due to the operation of the new café. Similarly to a plant noise impact assessment, the noise impact of a development is considered relative to the existing noise climate and with particular reference to noise sensitive receptors.

3.29 The consultation draft '*Guidelines for Noise Impact Assessment*' published by the Institute of Environmental Management and Assessment and the Institute of Acoustics (2002) provides guidance on assessing the impact due to a change in environmental noise level, as outlined in Table 4.

Table 4: Typical interpretation of impact from a change in sound level

Noise Change (dB)	Impact Category
0	No Impact
0 - 3	Slight Impact
3 – 5	Moderate Impact
5 – 10	Substantial Impact
10 and more	Severe Impact

3.30 In addition, the glossary of '*Planning Policy Guidance 24: Planning and Noise'* (PPG 1994) states:

3.31 *"A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound."*

4. Noise Survey

4.1 Noise monitoring was undertaken by HRS in order to assess the existing site noise climate and background sound level. Noise monitoring equipment was located to the west of the existing Stable Block building, at the boundary wall separating Mable Hill Park from Southend House. The microphone was mounted on a pole above the boundary wall at a height of approximately 3.5m, therefore measurements are considered to be free field.

4.2 A site plan indicating the noise measurement location is shown in Figure 2.

4.3 Noise survey results are summarised in Table 5. The full noise survey methodology and detailed results are included in Appendix I of this report.

Figure 2: Location of noise monitoring equipment

Table 5: Summary of HRS measured noise levels

Date	Time Period	dB $L_{Aeq,16\ hour}$	dB $L_{Aeq,15min}$	dB $L_{AFmax,15min}$	dB $L_{AF90,15min}$
16.12.2016	Daytime 15:00 – 23:00 hours	-	42 – 59	60 - 79	34 - 42
17.12.2016	Daytime 07:00 – 23:00 hours	51	38 – 66	50 – 79	31 – 43
18.12.2016	Daytime 07:00 – 23:00 hours	48	39 – 53	55 – 74	30 - 43
19.12.2016	Daytime 07:00 – 23:00 hours	54	41 – 60	54 – 84	35 - 46
20.12.2016	Daytime 07:00 – 14:00 hours	-	51 - 62	68 - 79	38 - 46

4.4 It is seen that the lowest daytime ambient level of 48 dB $L_{Aeq,16\ hours}$ was measured on Sunday 18th December. Analysis of 15 minute measurement periods also indicates that daytime noise levels during proposed café operational hours vary between 42 dB and 66 dB $L_{Aeq,15\ mins}$. Table 6 outlines average daytime $L_{Aeq,T}$ noise levels for standard café operational hours, taken to be 08:00 – 18:00, as well as the range of $L_{Aeq,15min}$ and $L_{AFmax,15\ min}$ noise levels measured during these periods. Noise levels for the evening periods 18:00 – 23:00 have been assessed in the same manor.

Table 6: Summary of HRS measured daytime and evening noise levels

Date	Time Period	dB $L_{Aeq,T}$	dB $L_{Aeq,15min}$	dB $L_{AFmax,\ 15min}$
16.12.2016	Daytime 15:00 – 18:00 hours	54	47 - 59	66 – 77
	Evening 18:00 – 23:00 hours	53	42 - 58	60 - 78
17.12.2016	Daytime 08:00 – 18:00 hours	52	42 - 66	59 – 79
	Evening 18:00 – 23:00 hours	49	38 - 55	50 - 70
18.12.2016	Daytime 08:00 – 18:00 hours	47	43 - 51	55 – 74
	Evening 18:00 – 23:00 hours	49	39 - 53	60 - 69
19.12.2016	Daytime 08:00 – 18:00 hours	53	45 - 60	57 – 84
	Evening 18:00 – 23:00 hours	55	41 – 60	54 - 78
20.12.2016	Daytime 08:00 – 14:00 hours	57	52 - 62	68 - 79

4.5 The representative daytime background sound level has been assessed in line with guidance outlined in BS4142:2014 as 37 dB $L_{A90,15mins.}$

5. Noise Impact Assessment

Customer Activity Noise

5.1 It is anticipated that the main noise source associated with the proposed Stable Block refurbishment will be from customers, predominantly those seated externally.

5.2 In order to assess average noise impact a three dimensional noise propagation model of the scheme has been created using SoundPLAN software (SoundPLAN essential version 3.0).

5.3 The model calculates noise transfer from sources associated with use of the new café and calculates the noise propagation in accordance with ISO 9613-2:1996 '*Attenuation of sound during propagation outdoors'*. Facade reflections (up to third order) from modelled buildings have been included within the assessment.

5.4 The geometry of the model is outlined in Figure 3 below.

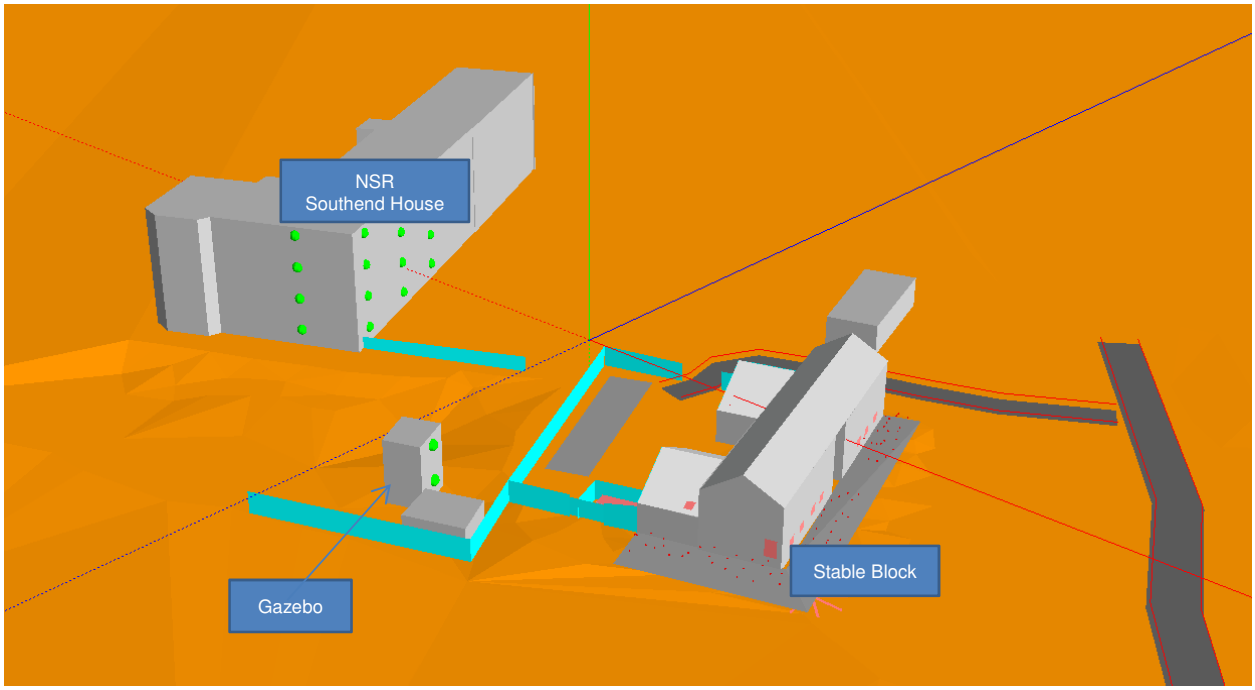


Figure 3: 3D view from noise propagation model

5.5 Typical noise levels for a human voice have been taken from '*ANSI 3.5-1997. American National Standard – Methods for Calculation of the Speech Intelligibility Index, (1997).*', and are summarised in Table 7.

Table 7: ANSI 3.5-1997 sound power level for one speaker

	Octave Band Sound Power Level Hz, dB								dB(A)
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	
Normal voice	45.0	55.0	65.3	69.0	63	55.8	49.8	44.5	68.4
Shouted	52.0	63.0	73.1	84.0	89.3	82.4	74.9	64.1	91.0

5.7 The model has been based on the worst case summer condition assuming maximum café occupancy of 160 customers, 60 seated internally and 100 seated externally. For internal customers a total internal reverberant noise level has been predicted based on 75% of the internal customers talking simultaneously with a 'normal voice' sound power level outlined in Table 7. The internal noise level within the internal café areas is predicted to be 69 dB $L_{Aeq,T}$, which HRS considers typical for a busy daytime café.

5.8 The café areas are to be ventilated by open windows on the eastern façade of the existing building. Noise break out from the café has been considered by assuming that 50% area of the windows to the eastern building elevations are open to assess the worst case summertime noise break out condition.

5.9 External noise has been modelled by treating external customers as point noise sources with a 'normal voice' sound power level as outlined in Table 7. HRS understands that the café kitchen is sized to serve 100 externally seated customers. Predicted noise levels are based on 75% of the external café customers talking simultaneously.

- 60 people on terrace area to east of Stable Block
- 40 people seated in terrace area to south of existing Stable Block

5.10 The entrance to public WCs is located to the west of the Stable Block accessed through the central archway. Existing WCs are currently accessed in the same manor, however the noise model accounts for 10 people standing in the yard to the west of the building adjacent to the WC entrance.

5.11 Figure 4 below shows the output from the noise propagation model in terms of predicted noise contours based on maximum occupancy of the Stable Block, assuming all windows required for ventilation are open. Assessment of predicted noise impact is made against the lowest daytime noise level (08:00 – 18:00) of 47 dB $L_{Aeq,10\ hours}$ measured on Sunday 18th December 2016.

5.12 Table 8 classifies the predicted noise levels incident upon NSRs in terms of a noise impact category following the methodology in Table 4, in relation to the lowest daytime measured ambient noise level.

Table 8: Interpretation of noise impact due to customer activity noise

Predicted Noise Level dB $L_{Aeq,T}$	Noise Change (dB)	Impact Category
≤ 37	0	No Impact
37 – 47	0 - 3	Slight Impact
47 - 51	3 – 5	Moderate Impact
51 - 57	5 – 10	Substantial Impact

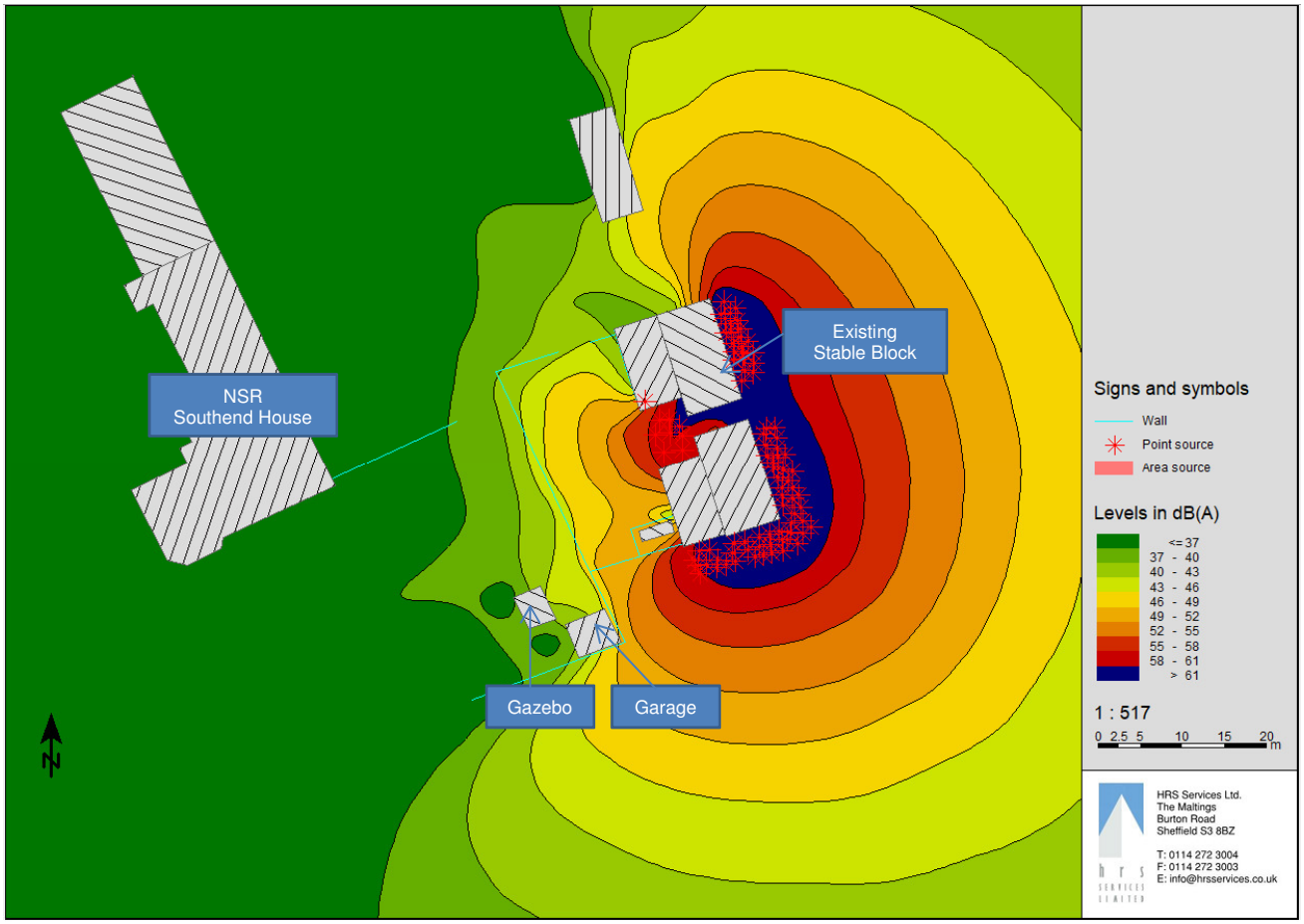


Figure 4: Activity noise contour output for maximum café occupancy (2m above ground level)

5.13 It is seen that predicted highest average noise levels to garden areas of identified NSRs is below the BS 8233:2014 and London Borough of Richmond upon Thames recommendation of ≤ 50 dB $L_{Aeq,T}$.

5.14 The main Southend House garden area is located to the south of the main building, where predicted noise levels are ≤ 37 dB $L_{Aeq,T}$, corresponding to an impact category of 'no impact'. Garden areas to the south east adjacent to the Gazebo are classified as a slight noise impact.

5.15 Noise levels at the façade of residential properties predicted to be a maximum of 37 dB $L_{Aeq,T}$, corresponding to an indication of no noise impact.

5.16 HRS understands that the Gazebo building within the grounds of Southend House currently has no residential use. Predicted maximum noise levels at the first floor window is predicted to be up to 48 dB $L_{Aeq,T}$. BS8233:2014 states that the sound insulation due to a partially open window is approximately 15 dB, therefore if this property were to be converted to future residential use daytime internal noise levels would not be expected to exceed the BS8233:2014 good practice criteria outlined in Table 3.

5.17 Assessment of customer noise has been undertaken assuming 'normal' speech noise levels. Calculations have been undertaken to assess the impact of occasional raised voices using the 'shouted' noise level outlined in Table 7, taken to be a maximum noise level for short duration events. Calculations assume 5 customers with a 'shouting' noise level located within the external terrace area to the east and south of the café, and one person within the courtyard adjacent to the WC entrance.

5.18 Maximum noise levels due to the activity associated with the operation of the Stable Block can be considered in relation to maximum levels prevailing in the absence of activity. If noise event levels do not exceed existing levels, the impact is likely to be low. If the maximum noise levels due to the activity frequently exceed existing levels then a significant impact may be considered to occur, depending on the level of exceedance and the expected frequency of occurrence.

5.19 Calculations indicate that maximum noise levels within garden areas due to occasional customer raised voices or shouts will range up to 61 dB L_{AFmax}. Existing measured maximum noise levels ranged between 55 dB and 84 dB L_{AFmax}, typically attributed to aircraft movements, therefore maximum noise events due to customer activities are predicted to be at the lower range of the existing site maximum noise levels.

Operational Activity Noise

5.20 HRS understands that external dining furniture selection is to consider control of noise generation from movements such as chair scrapes, dragging of tables or stacking, for example. It is anticipated that noise levels due to furniture movements would not normally exceed the noise levels used for the raised voice assessment above.

5.21 The existing yard to the west of the Stable Block is currently used for staff parking, which will continue under the new scheme with no significant change to parking us or resultant noise levels anticipated.

5.22 Bin stores are to be located to the east of the Stable Block adjacent to the access road, approximately 65m from the closest residential property on Montpellier Row. Kitchen bin sacks are taken from the kitchen directly to the new bin store. Maximum noise levels due to activities such as loading bottle bins can typically have maximum noise levels of up to 100 dB L_{AFmax} at 1m from source. Based on this noise

level, maximum noise levels at the most exposed façade areas of the identified NSRs is calculated to be ≤ 63 dB L_{AFmax}. This is in within the order of existing site measured maximum noise levels attributable to aircraft movements.

5.23 It is anticipated that activities such as waste handling will be of a limited duration. Given the relatively short duration and frequency of these events it is considered that overall noise impact will be limited. This can be further mitigated by appropriate operational management and staff awareness.

5.24 Bins collections are to be undertaken from the existing access road to the north east of the Stable Block, approximately 65m away from the closest NSR. As such noise impact from bin collections is anticipated to be minimal.

5.25 HRS understands that café / kitchen delivery vans will stop on the access road, approximately 65m away from the nearest NSR. Goods will then be transported to the goods store to the north of the Stable Block or directly to the kitchen using a trolley. As such noise impact is anticipated to be minimal. Goods trolleys are to be provided with rubber tyres and are to be wheeled from along a hard paved path to minimise noise.

Building Services External Noise

5.26 In line with guidance outlined in *'London Borough of Richmond upon Thames: Supplementary Planning Document - Noise Generating and Noise Sensitive Development'* it is recommended that external noise from new building services plant does not exceed 5 dB below the existing representative background noise level when assessed at the nearest noise sensitive receptor in line with BS 4142:2014 '*Methods for rating and assessing industrial and commercial sound*'. BS 4142:2014 states that this is an indication of the specific sound source having a low impact.

5.27 Based on HRS measured background noise survey data, assessment in accordance with BS 4142:2014 indicates that total emission levels for plant noise, including acoustic feature corrections where applicable, should not exceed the maximum Rating Level value provided in Table 9.

5.28 The Rating Level described will be assessed in accordance with BS 4142:2014, including appropriate consideration of any tonal or impulsive characteristics of the proposed building services plant. It is prudent to ensure that building services noise is designed to be sufficiently below the recommended plant noise limit criteria such that the cumulative noise level from all sources does not exceed the stated target level.

Table 9: BS 4142 Recommended maximum plant noise limits

Location	Daytime (07:00 – 23:00)	
	Representative background noise level range $L_{AF90,T}$ (dB)	BS 4142:2014 Rating Level $L_{Ar,Tr}$ (dB)
Residential Dwellings on Montpellier Row including gardens	37	32

5.29 At the time of writing plant selections, layouts and ducting arrangements have not been finalised. Table 10 below presents an initial overview of plant noise levels and attenuation requirements. A detailed assessment will be undertaken based on final selections to confirm the limits proposed above are met.

5.30 Data has been supplied to HRS for the external kitchen supply AHU, and an assessment of noise transfer and attenuation requirements has been undertaken. The AHU is to be located in an external compound adjacent to the kitchen, formed of existing masonry walls and a new timber fence, with a roof covering above, as indicated in plans appended to this report.

5.31 Calculations based on the current AHU unit selection indicate that fan noise break out through the unit casing will be sufficiently controlled to meet the limit proposed in Table 9. The air intake will require attenuation meeting or exceeding the minimum insertion loss values in Table 11 below.

5.32 Atmosphere side attenuator selections for the toilet ventilation fan and kitchen extract fan will be specified once unit selections, ducting arrangements, termination locations and sizes are finalised. Maximum source noise levels are provided in Table 10.

5.33 The boiler and pumps serving the Stable Block are to be contained within an internal plant room with ventilation provided by a louvred door facing into the yard to the east of the Stable Block.

5.34 The plant room boiler has been assessed based on manufacturer's noise data, with a standard non-acoustic ventilation louvre assumed to the plant room. Calculations indicate that noise transfer from the boiler at the boundary of the closest NSR will be < 20 dB $L_{Ar,Tr}$; below the proposed noise limit. At the time of writing noise data for pump equipment within the plant room is not available, however based on typical levels for similar units, noise levels are predicted to be significantly below the proposed noise limit. Manufacturer's data for final unit selections will be reviewed to ensure external noise limits are met.

Table 10: Provisional assessment of building services plant noise

Plant	Location	Predicted Noise Level at closest NSR	Attenuation Requirements
Condenser unit serving cold store	Externally located adjacent to shed to the north of the Stable Block building	< 28 dB $L_{Ar,Tr}$	No attenuation requirement
An air supply and extract fan serving the toilets within the Stable Block – Vent Axia Sentinel Kinetic High Flow or equivalent	Fan located within the building envelope. Atmosphere air supply and exhaust though termination is the roof eaves adjacent to the plant room	Attenuation provided to meet a level of < 27 dB $L_{Ar,Tr}$	Atmosphere side attenuators required to both air intake and exhaust duct to achieve a maximum level of 52 dB $L_{Aeq,T}$ at 1m from duct terminations
Supply Air AHU serving kitchen Air Design Air Handing Unit	Within external compound to west of kitchen	< 25 dB $L_{Ar,Tr}$	Atmosphere side attenuator required to air intake as indicated in Table 11 below
Kitchen Extract fan – Systemair MUB/T 042 450EC or equivalent	Fan contained within ceiling void above the kitchen discharging to vent located in roof eaves	Attenuation provided to meet a level of < 27 dB $L_{Ar,Tr}$	Atmosphere side attenuator required to exhaust duct to achieve a maximum level of 54 dB $L_{Aeq,T}$ at 1m from duct termination
Plant Room: Quinta Pro 115 Boiler 3 no. LTHW pumps Single hot water pump	Located in internal plant room with louvred door facing to west of Stable Block.	< 20 dB $L_{Ar,Tr}$	No attenuation requirement

Table 11: Attenuator Insertion loss values for kitchen supply AHU air intake

	Insertion loss, dB per octave band centre frequency, Hz							
	63	125	250	500	1000	2000	4000	8000
Atmosphere side attenuator Kitchen Supply AHU	0	2	18	22	22	18	10	0

6. Conclusions

6.1 HRS Services Ltd. has completed an environmental noise assessment for the proposed new Marble Hill Stable Block Cafe, based on HRS' noise survey carried out at the site during December 2016.

6.2 During the noise survey, the daytime noise climate observed to be affecting the site was noted to be controlled by distant road traffic noise from local roads, and regular aircraft movements associated with planes approaching and departing Heathrow airport. It was noted during HRS' time on site that daytime maximum noise levels are controlled by aircraft movements, occurring at approximately 15 minute intervals.

6.3 The predominant noise source associated with the proposed Stable Block redevelopment is expected to be noise from customers seated externally. A noise propagation model of the site has been developed to assess noise transfer from the scheme based on maximum occupancy levels and the all windows to the building open, representing a 'worst case' assessment.

6.4 Predicted noise levels in adjacent residential garden areas have been assessed in relation to existing site ambient noise levels with noise impact predicted to range from 'no impact' in screened garden areas, to 'slight impact' in more exposed garden areas. Noise levels within garden areas are predicted to be below the guidance levels outlined in BS 8233:2014, as referenced in '*London Borough of Richmond upon Thames: Supplementary Planning Document - Noise Generating and Noise Sensitive Development (SPD)'*.

6.5 Maximum noise levels have been considered due to single events such as customer shouts, waste handling and furniture movements. Maximum noise levels within gardens and at the facades of identified NSRs are predicted to be within the range of existing site maximum noise levels, currently controlled by regular airplane movements. Given the current noise climate, with regular airplane movements audible, and the expected regularity and duration of maximum noise events due to café operation, a significant noise impact is not expected.

6.6 HRS has proposed building services noise limits at identified noise sensitive receptors (NSRs) most exposed to the proposed scheme in line with guidance outlined in *'London Borough of Richmond upon Thames: Supplementary Planning Document - Noise Generating and Noise Sensitive Development'* which related to a 'low' noise impact in line with BS 4142:2014 *'Methods for rating and assessing industrial and commercial sound'*.

6.7 Based on HRS' environmental noise assessment included within this report, HRS concludes that for the new development is expected to result in a 'low' to 'slight' noise impact upon identified noise sensitive properties.

Appendix I. Noise Survey

Noise monitoring was carried out in order to assess the existing noise climate during the daytime and night-time periods. Measurements were taken between 16th and 20th December 2016.

Noise levels were measured using a UKAS calibrated 01dB Cube precision integrating sound level meter equipped with audio recording facility. Calibration checks were carried out both before and after the measurements with no significant variance observed, calibration certificates are available on request. Noise was measured in terms of broadband A-weighted indices and spectral terms to assist with the design of noise control measures.

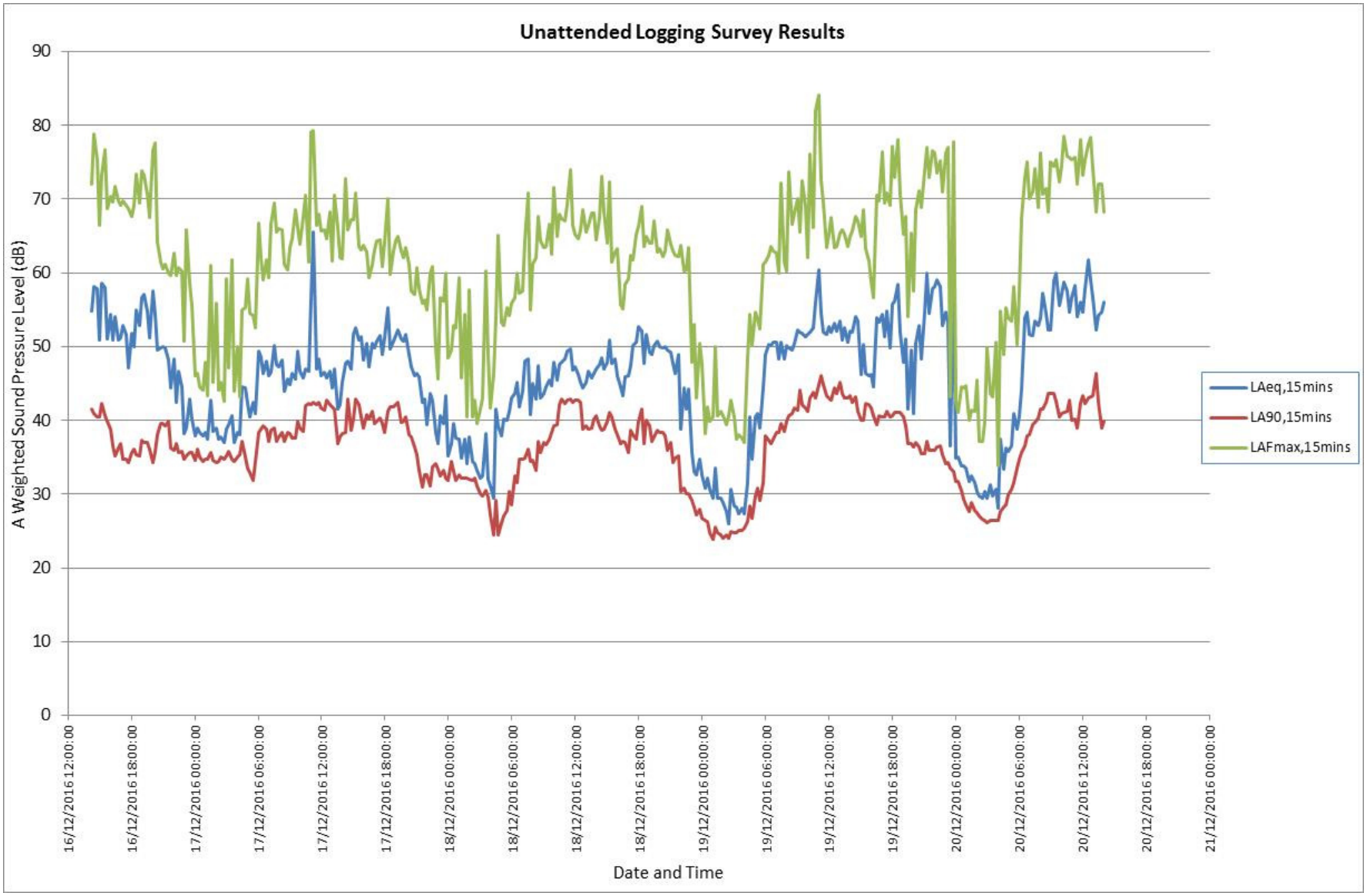
Weather conditions during HRS' site attendance on 16th and 20th December 2016 were dry and calm with wind speeds less than 5 m/s. HRS understands that weather during the unattended survey was predominantly dry, with average and maximum wind speed less than 5 m/s. A weather summary for the nearest weather station located at Heathrow airport is summarised below, taken from www.wunderground.com.

Date	Mean Temperature (°C)	Average Wind Speed (m/s)	Max Wind Speed (m/s)	Precipitation (mm)
16.12.16	8	1.9	3.6	0
17.12.16	6	1.1	3.6	0
18.12.16	6	1.4	3.6	0
19.12.16	5	1.7	3.1	0.8
20.12.16	6	2.8	4.7	0

Noise monitoring equipment was located to the west of the existing Stable Block building, at the boundary wall separating Mable Hill park from Southend House. The microphone was mounted on a pole above to boundary wall at a height of approximately 3.5m, therefore measurements are considered to be free field. A photo of the location is included in Figure A1.

Noise monitoring equipment was set to measure all typical broadband noise indices in 15 minute logging periods, as well 1/3 octave spectral data. The noise monitor was installed on Friday 16th December 2016, and continued monitoring until Tuesday 20th December 2016.

Figure A1: Noise monitoring equipment


Unattended Logging Survey Results
A Weighted Sound Pressure Level (dB)
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80
70
60
50
40
30
20
10
0
16/12/2016 12:00:00
16/12/2016 18:00:00
17/12/2016 00:00:00
17/12/2016 06:00:00
17/12/2016 12:00:00
17/12/2016 18:00:00
18/12/2016 00:00:00
18/12/2016 06:00:00
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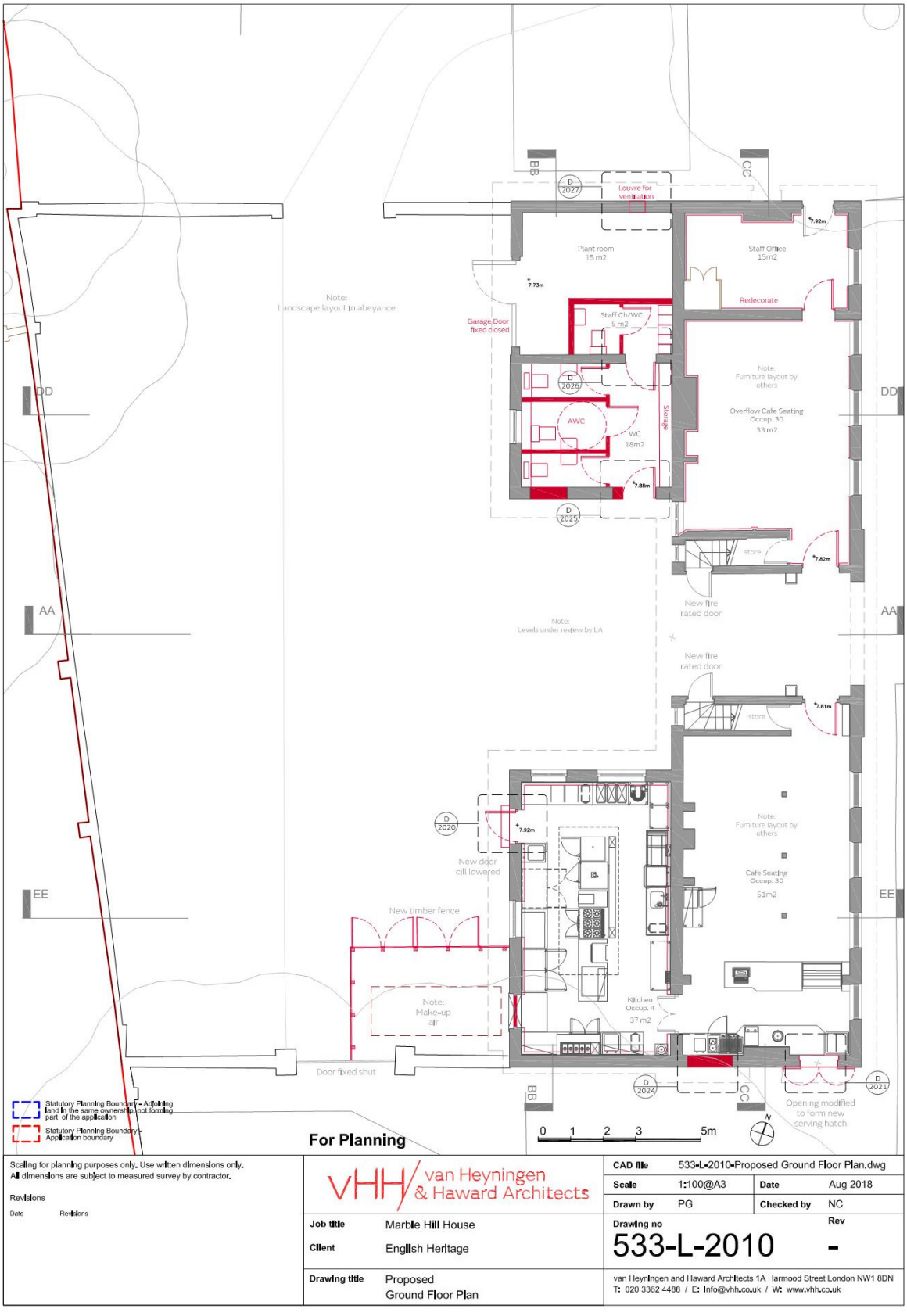
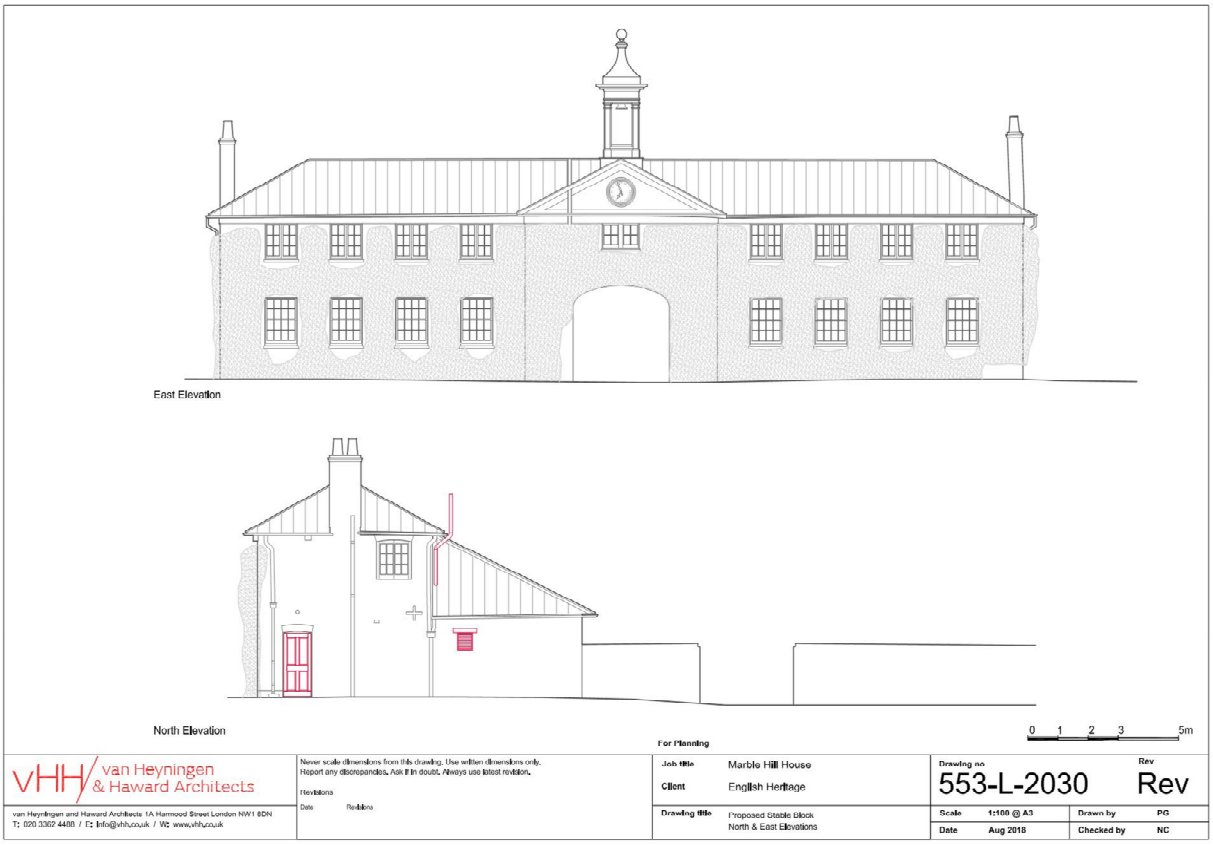
19/12/2016 12:00:00
19/12/2016 18:00:00
20/12/2016 00:00:00
20/12/2016 06:00:00
20/12/2016 12:00:00
20/12/2016 18:00:00
21/12/2016 00:00:00
Date and Time
LAeq,15mins
LA90,15mins
LAFmax,15mins

Appendix II. Proposed Building Plans




East Elevation
North Elevation
0 1 2 3 5m
For Planning
van Heyningen & Haward Architects
van Heyningen and Haward Architects 1A Harmood Street London NW1 8DN
T: 020 3362 4488 / E: info@vhh.co.uk / W: www.vhh.co.uk
Never scale dimensions from this drawing. Use written dimensions only.
Report any discrepancies. Ask if in doubt. Always use latest revision.
Revisions
Date Revisions
Job title Marble Hill House
Client English Heritage
Drawing title Proposed Stable Block
North & East Elevations
Drawing no 553-L-2030
Rev Rev
Scale 1:100 @ A3
Date Aug 2018
Drawn by PG
Checked by NC

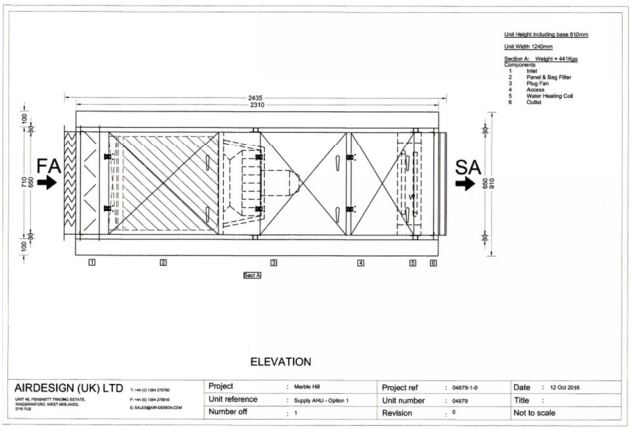

Boiler flue
Garage Door fixed closed
New door c/l lowered
Kitchen AHU
Door fixed shut
Opening bricked up c/l removed
Opening bricked up to low level to form new serving hatch
0 1 2 3 5m
For Planning
van Heyningen & Haward Architects
van Heyningen and Haward Architects 1A Harmood Street London NW1 8DN
T: 020 3362 4488 / E: info@vhh.co.uk / W: www.vhh.co.uk
Never scale dimensions from this drawing. Use written dimensions only.
Report any discrepancies. Ask if in doubt. Always use latest revision.
Revisions
Date Revisions
Job title Marble Hill House
Client English Heritage
Drawing title Proposed
Elevation 01
Drawing no 533-L-2031
Rev -
Scale 1:100 @ A3
Date Aug 2018
Drawn by PG
Checked by NC

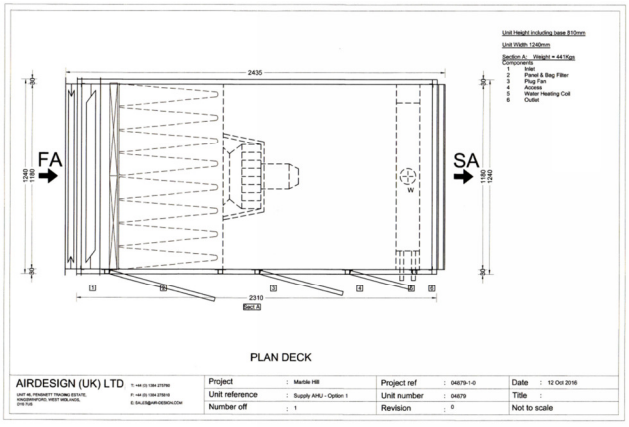
Appendix III. Kitchen Supply AHU Data

Project:	Marble Hill
Quotation Reference:	Q04879
Date:	12 Oct 2016

Customer Unit Reference	**AHU-1**		**Serving**		**Supply AHU - Option 1**			
Unit Reference	Q04879-01-0							
Model Reference	AD31260							
AHU Acoustic Data:								
Acoustic Data (Supply Fan Sound Power Level):								
Frequency(Hz)	63	125	250	500	1K	2K	4K	8K
Supply Fan Inlet Lw (dB):	71	72	76	74	67	62	60	58
Supply Fan Outlet Lw (dB):	71	73	78	78	77	70	66	60
Acoustic Data (Supply AHU Sound Resultant Level):								
Frequency(Hz)	63	125	250	500	1K	2K	4K	8K
Supply AHU Inlet Lw (dB)	68	68	72	69	61	54	49	46
Supply AHU Outlet Lw (dB)	69	71	76	76	74	65	56	50
Resultant AHU Breakout								
Frequency (Hz)	63	125	250	500	1K	2K	4K	8K
Supply Lw (dB)	63	64	64	51	49	42	39	34
Resultant AHU Level @ 3m	45	46	46	33	31	24	21	16
Overall AHU "A" weighted Breakout @ 3m	39							

The In-duct Sound Power Level Spectra are in dB re-1pW.
The overall A-weighted sound pressure level is at a distance of 3m with spherical free-field propagation. It is expressed in dB re-20 µPa and is presented for comparative purposes only.
Resultant sound pressure includes all selected AHU component losses within the above calculation.





Appendix IV. Acoustic Glossary

Sound pressure level and the decibel, dB

A sound wave is a small fluctuation of atmospheric pressure. The human ear responds to these variations in pressure, producing the sensation of hearing. The ear can detect a very wide range of pressure variations. In order to cope with this wide range of pressure variations, a logarithmic scale is used to convert the values into manageable numbers. The decibel is the logarithmic unit used to describe sound (or noise) levels. The usual range of sound pressure levels is from 0 dB (threshold of hearing) to 120 dB (threshold of pain).

Frequency and hertz, Hz

Frequency is a measure of the rate of fluctuation of a sound wave. The unit used is cycles per second, or hertz (Hz). Sometimes large frequency values are written as kilohertz (kHz), where 1 kHz = 1000 Hz. The human range of hearing is commonly accepted to be 20 Hz to 20,000 Hz. Additionally, an octave can be used to describe the interval between a frequency in Hz and either half or double that frequency.

Frequency weighting

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

Noise indices

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

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

Sound reduction index, *R*

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

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

Reverberation time, *T* and T_{mf}

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

Noise rating, NR

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

Privacy

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

Appendix V. HRS Acoustic Credentials

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

HRS has been accredited for on-site acoustic testing by United Kingdom Accreditation Service (UKAS) since 2006 (Testing Laboratory Number 2587).
HRS meet the relevant acoustic requirements typically required in the UK, including for sound insulation testing as defined in Approved Document E for the purposes of testing for Part E to the Building Regulations 2010.

This report has been authorised by Alun Williams, Senior Acoustic Consultant who meets the BREEAM requirements for a suitably qualified acoustician (SQA) as follows;

1. Holds an MEng Civil Engineering (Hons) and a PgDip in Acoustics and Noise Control.
2. Has been an Acoustic Consultant with HRS since December 2013, and previously worked within an industrial noise control company for 3 years and therefore has more than three year's relevant experience (within the last five years). This experience includes a practical understanding of factors affecting acoustics in relation to construction and the built environment; including, acting in an advisory capacity to provide recommendations for suitable acoustic performance levels and mitigation measures.
3. Holds Corporate Membership of the Institute of Acoustics - MIOA membership.

This report has been read and reviewed by Alun Williams and has been found to;

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

Appendix VI. Report Conditions

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

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

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

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

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