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Handsworth Seventh-Day Adventist Church
93 Hutton Road
Birmingham

Environmental Noise Report for Planning

Reference: 5973/DO/pw **March 2015**

Handsworth Seventh-Day Adventist Church
Environmental Noise Report

Client	Handsworth Seventh-Day Adventist Church 98 Hutton Road Handsworth Birmingham B20 3RD
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Issue Number **1st Issue**	**Date** **27th March 2015**

Handsworth Seventh-Day Adventist Church
Environmental Noise Report

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1.0 INTRODUCTION

Handsworth Seventh-Day Adventist Church appointed Acoustic Consultants Limited to provide advice on the noise and acoustic aspects of the proposed new church building at 93 Hutton Road in Handsworth, Birmingham.

The proposal is to demolish existing vacant industrial units on the site and for the construction of a place of worship comprising a worship space with balcony and choir stalls, vestry, multi-purpose rooms, toilets, kitchen and entrance lobby. The existing place of worship at 98 Hutton Road will be retained and used for pastoral and community use but not as a place of worship for the congregation.

The comments are made in relation to the schemes noted on the following Architect's drawings:

Table 1: Mike Coleman Architectural Design Service's Drawings

Drawing Number	Drawing Title	Date
MC/2220/03D	Proposed Balcony Floor Plan	22.10.2014
MC/2220/06	Proposed Site Plan	-
MC/2220/02D	Proposed Ground Floor Plan	22.10.2014
MC/2220/04D	Proposed Elevations A & C	22.10.2014
MC/2220/05D	Proposed Elevations B & D	22.10.2014

The report addresses environmental noise emission from the main auditorium and provides advice in order to control the noise impact of the amplified music, person's voices and plant noise in environmental noise terms to nearby residential property. The scheme aims to optimise the building fabric construction to minimise sound emission to sensitive residential property.

This report addresses the following elements:

A) Environmental noise emission from the Auditorium.
B) Performance criteria for the building services elements.

This report limits itself to reporting solely on the noise control and acoustics aspects as noted in the report. It is recommended that appropriate expert advice is sought on all the ramifications (e.g., CDM, structural, condensation, fire, legal etc.) of any proposals in this report or associated with it.

2.0 THE SITE

The site is located on land at 98 Hutton Road in Handsworth, Birmingham. The site is in a residential area although the site currently comprises vacant industrial units with a Mosque and community centre directly to the east.

The proposal is to demolish existing vacant industrial units on the site and for the construction of a place of worship comprising a worship space with balcony and choir stalls, vestry, multi-purpose rooms, toilets, kitchen and entrance lobby.

The Church's existing place of worship is at 98 Hutton Road directly to the west of the site in a former community building. This building is to be retained and used for pastoral and community use but not as a place of worship for the congregation.

In terms of noise emission from the development the most noise sensitive residential properties are those to the South on Hutton Road. Further away are residential properties to the West on Chalfont Road, to the North on Grosvenor Road and the East on Hutton Road.

The main source of noise affecting the site and surrounding residential properties is local and distant road traffic.

The nearest noise sensitive properties are approximately 18 metres from the façade of the proposed building.

3.0 CRITERIA

3.1 National Planning Policy Framework

The National Planning Policy Framework was published in March 2012. Section 11 entitled 'Conserving and enhancing the natural environment' addresses noise as a requirement of planning.

Paragraph 109 states:

"109. 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 states:

"123. Planning policies and decisions should aim to:

- *avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
- *mitigate and reduce to a minimum other adverse impacts 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 uses since they were established; 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."*

The document does not prescribe any assessment methodology or criteria to assess the adverse affect of noise. It is our opinion that the following assessment methods are the most relevant for this submitted scheme.

3.2 Noise Policy Statement for England

The NPPF refers to the Noise Policy Statement for England (NPSE). This was published in March 2010 and aims to provide clarity regarding current policies and practices to enable noise management decisions to be made within the wider context, at the most appropriate level, in a cost-effective manner and in a timely fashion and applies to all forms of noise including environmental noise, neighbour noise and neighbourhood noise.

The NPSE sets out the long term vision of Government noise policy. This long term vision is supported by three noise policy aims as follows:

"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."*

The NPSE introduces the concept of "Significant adverse" and "Adverse" impacts of noise which relate to the noise policy aims. These are applied as follows:

NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur.

The NPSE does not provide any assessment criteria for the noted effect levels.

3.3 National Planning Practice Guidance, Noise (NPPG)

The National Planning Practice Guidance on noise referred to here is based on that dated 6th March 2014 as provided on the Planning Guidance Website. The chapter on noise advises on how planning can manage potential noise impacts in new development. It states:

"Noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment. When preparing local or neighbourhood plans, or taking decisions about new development, there may also be opportunities to consider improvements to the acoustic environment."

The NPPG goes on to outline the factors which should be taken into account by Local Planning Authorities when determining an application. It states:

"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.*

The NPPG also provides guidance on how noise can be mitigated. It states:

"This will depend on the type of development being considered and the character of the proposed location. In general, for noise making developments, there are four broad types of mitigation:

- *engineering: reducing the noise generated at source and/or containing the noise generated;*
- *layout: where possible, optimising the distance between the source and noise-sensitive receptors and/or incorporating good design to minimise noise transmission through the use of screening by natural or purpose built barriers, or other buildings;*
- *using planning conditions/obligations to restrict activities allowed on the site at certain times and/or specifying permissible noise levels differentiating as appropriate between different times of day, such as evenings and late at night, and;*
- *mitigating the impact on areas likely to be affected by noise including through noise insulation when the impact is on a building.*

3.4 Noise from Auditorium

The building is to be designed to address amplified sounds as far as is practical in order to control the noise impact of the hall to nearby residential property. This includes building fabric construction advice and noise limiting proposals.

There is no generally accepted standard in relation to the noise emission from Worship Halls or Community Centre venues with amplified music.

The Institute of Acoustics document "Good Practice Guide on the Control of Noise from Pubs and Clubs" was published in March 2003. This provides current standard advice on noise emission from pubs and clubs, which does not fully apply to this development.

In this development we are working on the basis that the design noise emission levels from the use at the closest dwelling does not exceed the pre-existing background noise level (L90) at any octave band. It is usually the low frequency component of amplified sound which is of most concern and which this concept addresses. This is a criterion we have used successfully over the years in this type of development.

3.5 Noise from Plant and Building Services

The British Standard 4142:2014 entitled "Method for rating and assessing industrial and commercial sound" was published on the 31st October 2014 and replaced British Standard 4142:1997. British Standard 4142:2014 describes methods for rating and assessing sound of an industrial and/or commercial nature.

The methods described in the British Standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon. The principle is that of establishing the "difference" between the “rating level” and the “background noise level”.

The “Rating Level” is the “specific noise level” of the source over a period of 1 hour during the day (07:00 to 23:00 hours) and over a period of 15 minutes during the night (23:00 to 07:00 hours). Section 9 entitled “Rating Level” states:

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

An acoustic character correction should be added to the “specific noise level” if the “specific noise level” exhibits any tonality, impulsivity, other specific characteristics and/or intermittency at the assessment location. The value of the character correction varies dependant on the prominence of the character of the noise source at the assessment location.

In Section 11 of the Standard, under "Assessment of the Impacts", it states:

*"Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level (see Clause **8**) from the rating level (see Clause **9**), and consider the following.*

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

As such where assessments differences of 0 dB or less the impact is likely to be low depending on the context.

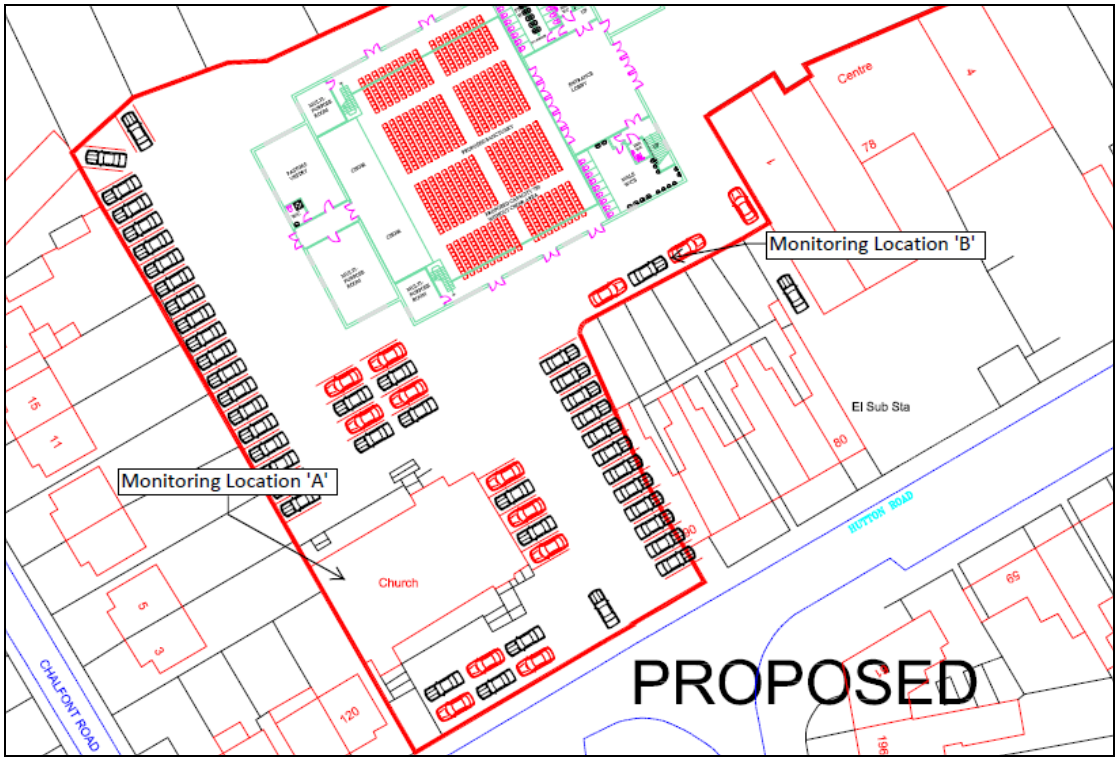
4.0 NOISE MEASUREMENT PROCEDURES

A noise monitoring exercise was carried out on the 7th March 2015 between 08:45 and 13:05 hours. The purpose of the survey was to measure existing background noise levels on a Saturday morning when the loudest and busiest church services will take place. Additionally noise levels were measured within the existing worship space during the service to determine noise levels for noise emission predictions. We were informed by the church that the services taking place on the day of measurement were typical and include the louder services that take place in the church.

Measurements were undertaken within the worship space of the existing building. The sound level meter was located towards the rear of the worship space. During the measurements the main noise sources were the congregation singing, amplified and unamplified music and amplified speech.

Measurements were undertaken at monitoring location 'B' in a facade position at a height of 1.5 metres above the ground towards the rear of the gardens of the residential properties on Hutton Road. The main source of noise affecting the monitoring location was distance road traffic. There were occasional car movements in the car park and birdsong although these are not expected to have had a significant impact on the measured noise levels. The monitoring location is provided in Figure 1.

Figure 1: Monitoring Location



The Sound Pressure Levels were measured using two Cirrus Optimus Green Type 1 sound level meters, both with a half-inch condenser microphone. The equipment information and calibration status is as follows:

Table 2: Measurement Equipment Information

Equipment Description / Manufacturer / Type	Serial number	Date of expiration of calibration	Calibration Certification Number
Sound Level Meter, Cirrus Research, CR:171C	G066500	25/09/14	222113
Calibrator, Cirrus Research, CR:515	72878	21/08/14	100253
Microphone, Cirrus Research, MK224	203245A	25/09/14	222113
Sound Level Meter, Cirrus Research, CR:171C	G066555	21/01/15	225131
Microphone, Cirrus Research, MK224	20046641	n/a	n/a
Calibrator, Cirrus Research, CR:515	65544	21/01/15	101004

The measurement system was checked before and after use with the calibrator and no drift greater than 0.1 decibels was detected.

5.0 EXISTING BACKGROUND NOISE LEVELS

From the measured noise levels the following one hour background noise level spectrum $L_{90(1\ hour)}$ has been determined as representative.

Table 3: Measured Background noise levels

Frequency (hertz)	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**dB(A)**
$L_{90,1\ hour}$ (decibels)	49	43	41	40	41	35	28	44

The full measurement data is provided in Appendix 2.

6.0 DESIGN MUSIC LEVELS

The measured noise levels within the worship space have been used to determine design noise levels for the purposes of noise breakout predictions.

It is normal to assess environmental noise from a specific source during the daytime over a one hour period and as such the highest measured one hour period has been determined.

The highest measured noise levels are as follows:

Table 4: Measured Internal Music Noise Levels

Frequency (hertz)	63	125	250	500	1k	2k	4k	dB(A)
$L_{eq,1\ hour}$ (decibels)	64	71	74	77	75	70	64	78

7.0 NOISE CONTROL PROPOSALS

The following building construction and noise mitigation measures are proposed to address amplified music in the auditorium which is considered the loudest proposed use of the space. Supplementary uses such as singing and speaking will therefore also be controlled by the proposed measures.

The measures aim to address the noise emission from activities within the worship space and in particular at the low frequencies (63 Hertz to 250 Hertz) to nearby noise sensitive residential property.

The following building constructions are proposed as the best performing, cost effective, options within practical limitations. This applies to the Sanctuary space only. The other spaces are not expected to generate any significant levels of noise.

7.1 External Walls

The external walls could comprise either masonry or a lightweight solution incorporating twin studs and layers of board. The two constructions are expected to provide a similar level of sound insulation performance.

A cavity masonry construction could two skins of brick or block both with a minimum density of at least 160 kilograms per metre squared, separated by a 100 millimetre cavity with mineral fibre in the cavity and resilient 'Part E Type' wall ties.

A stud construction could comprise two independent metal or timber stud frames with board to the outer faces. Each face would have a surface density of 25 kilograms per metre squared. The cavity would be at least 140 millimetres with 50 millimetre mineral fibre in the cavity.

These constructions are expected to achieve the following minimum sound reduction indices:

Table 5: Minimum external wall sound reduction indices

Frequency (hertz)	63	125	250	500	1k	2k	4k
Sound Reduction Index	31	44	55	66	73	76	76

7.2 Roof

We provide two possible options for the roof build up. One is when there is a roof space above the sanctuary and the other is where the ceiling of the sanctuary follows the pitch of the ceiling. The roof tiles should have a surface density of at least 25 kilograms per metre squared. Where this is not achieved additional board should be placed underneath the tiles.

Where there is a roof space the Sanctuary ceiling will be installed under the horizontal ceiling joists. The ceiling should comprise two layers of 15 millimetre thick Soundbloc Plasterboard or equivalent with a minimum total surface density of 25 kilograms per metre squared. A layer of mineral fibre, at least 50 millimetre thick should be placed above the plasterboard ceiling.

Where the ceiling follows the line of the roof the ceiling should be fixed to the underside of the rafters on an MF system supported on resilient GAH hangers. The ceiling should comprise two layers of 15 millimetre thick Soundbloc plasterboard or equivalent with a minimum total surface density of 25 kilograms per metre squared. The cavity between the roof and plasterboard ceiling should be at least 140 millimetre with a layer of mineral fibre, at least 50 millimetre thick, in the cavity.

These constructions are expected to achieve the following minimum sound reduction indices:

Table 6: Minimum external wall sound reduction indices

Frequency (hertz)	63	125	250	500	1k	2k	4k
Sound Reduction Index	31	44	55	66	73	76	76

7.3 Glazing

The auditorium has glazed windows and doors facing the nearby residential properties.

The windows are required to achieve the minimum sound reduction indices:

Table 7: Minimum window sound reduction indices with Moveable Partition

Frequency (hertz)	63	125	250	500	1k	2k	4k
Sound Reduction Index	21	26	27	34	40	38	46

This could be achieved with a double glazed unit comprising a 10 millimetre glass pane and a 6.4 millimetre laminated glass pane separated by a 12 millimetre air gap.

The windows should all remain closed during use with loud amplified music. The windows may be opened during quieter use. This can be established by user experience.

The doors should have appropriate acoustic seals which have a sound reduction rating of at least 35 Rw decibels.

Door and window frames should be of high quality sturdy and solid construction so as not to adversely affect the sound insulation performance.

7.4 Ventilation Provisions

The building fabric of the spaces will need to be sealed in order to provide the required degree of sound insulation. As such all doors, windows and openings need to be sealed or kept closed, with the result that an adequate mechanical ventilation system will be required.

The ventilation system will need to be provided with the necessary sound attenuation in order that the emission of noise via the ductwork systems is controlled to be commensurate with the building fabric. Ductwork should be of galvanised sheet metal with the attenuators located as close as possible to the inlets and outlets. It is recommended that the inlets and outlets are located as far away from the noise sensitive residential properties as possible.

The ventilation system fans may also require sound attenuation. This is addressed further in Section 9.0.

The ventilation system is required to achieve a sound level difference (from inside the auditorium to one metre from the external inlet and outlet of the system) as follows:

Table 8: Minimum ventilation sound level difference

Frequency (hertz)	63	125	250	500	1k	2k	4k
Sound Level Difference	35	48	53	57	54	55	56

7.5 Access

Access to the main hall is via an entrance lobby. There is the potential for noise to transfer to the outside through the access routes.

During church services it is recommended that external doors and doors to the Sanctuary are kept closed.

It is advised that external doors and doors to the Sanctuary are specified to achieve a sound reduction rating of at least 30 Rw decibels including appropriate seals. It is also advised that the ceiling to the entrance lobby is lined with a sound absorbent tile with sound absorption class A, B or C.

8.0 BREAKOUT NOISE ASSESSMENT

Calculations have been undertaken to determine the breakout noise level from the Sanctuary worship space at the nearby residential properties. The predictions have been undertaken for the houses to the South of the proposed building on Hutton Road. These houses are approximately 18 metres from the proposed building. All other residential properties are further away and therefore will experience lower noise levels.

The predictions are based on the measured internal noise level and the sound reduction of the proposed building elements.

The following tables show the difference between predicted breakout noise level and measured background noise level for daytime and evening; and night time use. Where breakout noise levels are at least 10 decibels below the Background noise level in each octave band we would consider that it would typically be inaudible.

The difference between the breakout level and Background noise level is as follows:

Table 9: Predicted difference between breakout noise level and Background noise level

Octave Band (Hertz)	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Difference	-20	-16	-14	-17	-25	-25	-34	-26

The predicted noise levels at the nearest noise sensitive residential properties are at least 10 decibels below the measured Background noise level in each octave band.

On the basis of the assessment noise is adequately controlled and the proposals are considered acceptable in environmental noise terms. Noise from the development is not expected to adversely affect the amenity of nearby residential properties.

9.0 PLANT NOISE ASSESSMENT

There is likely to be noise generating plant associated with the proposed development including ventilation, heating and cooling plant. To minimise impact on nearby noise sensitive residential development limits on noise emission are proposed based on British Standard 4142:2014.

The British Standard states that 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.

Therefore it is proposed that the Rating level of noise from fixed plant does not exceed the pre-existing background sound level including any applicable corrections for context, tonality or other characteristics.

From the measurement data we have selected a typical Background Noise Levels for daytime operation of 44 $L_{A90(1\ hour)}$ decibels (façade level).

Therefore the cumulative plant rating noise level should be designed not to exceed a Rating Level of 44 $L_{Aeq(1\ hour)}$ decibels (façade level).

10.0 DETAILING

The external building fabric will need to provide a homogeneous barrier throughout.

Small weaknesses in the fabric design and/or installation are likely to significantly reduce the predicted noise control performance.

Generally, there is no precise non-empirical method of determining the noise control performance or reverberation time other than by empirical means (i.e. building and testing it). In practical terms a plus or minus 5 decibel tolerance can be expected. Noise control predictions have been based on the constructions as listed in this report with no allowance made for weak points.

Small weaknesses in the fabric design and/or installation are likely to significantly reduce the predicted noise control performance. Predictions are based upon the best available information with regards to the performance of the building materials and systems.

It is therefore necessary to ensure that all detailing is carefully designed so that there are no weak points present. All brick and blockwork joints should be completely in-filled with mortar. It is also necessary to provide comprehensive site construction checks to ensure that the installation matches the design intent.

All systems should be installed in accordance with the manufacturer's recommendations.

In general terms it should also be noted that there should be no gaps in the constructions and that all components should be carefully sealed airtight using suitable mastics (NOT FOAM) where appropriate.

11.0 LIMITATIONS

The report limits itself to addressing solely on the environmental noise aspects as included in this report. We provide advice only in relation to noise and acoustics. It is recommended that appropriate expert advice is sought on all the ramifications (e.g., CDM, structural, condensation, fire, legal, etc.) associated with any proposals in this report or as advised and concerning the appointment.

The report has been prepared in good faith, with all reasonable skill and care, based on information provided or available at the time of its preparation and within the scope of work agreement with the client. We disclaim any responsibility to the Client and others in respect of any matters outside the scope of the above.

The report is provided for the sole use of the named Client. No responsibility is accepted to other parties.

It should be noted that noise predictions are based on the current information as we understand it and on the performances noted in this report. Any modification to these parameters can alter the predicted level.

There is no precise non-empirical method of determining the noise control performance, or reverberation times other than by empirical means (i.e., building and testing it). In practical terms a plus or minus 3 decibel tolerance can be expected on sound insulation performances.

If this tolerance is not acceptable, then it would be necessary to consider further measures.

12.0 SUMMARY AND CONCLUSIONS

Handsworth Seventh-Day Adventist Church appointed Acoustic Consultants Limited to provide advice on the noise and acoustic aspects of the proposed new church building at 93 Hutton Road in Handsworth Birmingham.

The proposal is to demolish existing vacant industrial units on the site and for the construction of a place of worship comprising a worship space with balcony and choir stalls, vestry, multi-purpose rooms, toilets, kitchen and entrance lobby. The existing place of worship at 98 Hutton Road will be retained and used for pastoral and community use but not as a place of worship for the congregation.

In terms of noise emission from the development the most noise sensitive residential properties are those to the South on Hutton Road. Further away are residential properties to the West on Chalfont Road, to the North on Grosvenor Road and the East on Hutton Road.

There is no generally accepted standard in relation to the noise emission from Worship Halls or Community Centre venues with amplified music.

In this development we are working on the basis that the design noise emission levels from the use at the closest dwelling does not exceed the pre-existing background noise level (L90) at any octave band. It is usually the low frequency component of amplified sound which is of most concern and which this concept addresses. This is a criterion we have used successfully over the years in this type of development.

The assessment includes the measurement of noise generated within the existing worship space during a typical service and measurements of the existing noise climate at the development site. Advice has been provided on the building construction, ventilation provisions and access arrangements to control noise breakout to acceptable levels.

On the basis of the assessment noise is adequately controlled and the proposals are considered acceptable in environmental noise terms. Noise from the development is not expected to adversely affect the amenity of nearby residential properties.

Noise limiting criteria has also been provided for building services plant based on the measured site data and the assessment methodology of British Standard 4142:2014.

Appendix 1: Measured Noise Levels at Location 'A'

Start Time	$L_{Aeq,5\ minutes}$ dB	$L_{Amax,fast}$ dB	$L_{Ae10,5\ minutes}$ dB	$L_{A90,5\ minutes}$ dB
07/03/2015 08:45:00	55.57	74.2	58.4	44.8
07/03/2015 08:50:00	55.36	73.12	57.6	45.5
07/03/2015 08:55:00	54.91	71.18	58.5	43.1
07/03/2015 09:00:00	52.51	66.79	55.7	43.4
07/03/2015 09:05:00	54.88	70.85	58.7	47.4
07/03/2015 09:10:00	60.71	72.77	64.7	48.4
07/03/2015 09:15:00	67.17	82.44	72.3	44.5
07/03/2015 09:20:00	74.34	88.53	78.2	59.6
07/03/2015 09:25:00	80.04	89.78	83.9	61.9
07/03/2015 09:30:00	77.56	90.05	81.4	51.9
07/03/2015 09:35:00	48.84	67.69	51.3	41.1
07/03/2015 09:40:00	58.54	77.47	61.6	46.6
07/03/2015 09:45:00	61.25	73.27	64	56.1
07/03/2015 09:50:00	63.02	76.46	65.7	58.1
07/03/2015 09:55:00	62.07	70.6	65.1	56.9
07/03/2015 10:00:00	61.47	73.04	64	56.6
07/03/2015 10:05:00	61.83	74.43	64.6	56.6
07/03/2015 10:10:00	62.61	72.7	65.4	57.6
07/03/2015 10:15:00	63.54	80.17	65.9	58.4
07/03/2015 10:20:00	64.59	79.92	67	60
07/03/2015 10:25:00	64.93	76.38	67.5	60.1
07/03/2015 10:30:00	65.7	78.32	68.4	59.8
07/03/2015 10:35:00	69.61	82.85	74	54.8
07/03/2015 10:40:00	71.39	85.41	75.5	52.3
07/03/2015 10:45:00	63.07	76.87	67.2	49.2
07/03/2015 10:50:00	58.03	73.1	61.3	47.6
07/03/2015 10:55:00	77.25	88.48	82	52.9
07/03/2015 11:00:00	73.22	89.42	78.3	51.6
07/03/2015 11:05:00	73.19	86.34	78.9	51.2
07/03/2015 11:10:00	64.01	79.73	67.8	50.6
07/03/2015 11:15:00	76.2	88.17	82.1	51.3
07/03/2015 11:20:00	82.13	93.31	86.6	53.4
07/03/2015 11:25:00	83.29	91.01	86.2	71.3
07/03/2015 11:30:00	83.04	92.85	86.4	67
07/03/2015 11:35:00	77.48	88.04	82.1	59.1
07/03/2015 11:40:00	71.9	85.88	77.1	50.6
07/03/2015 11:45:00	78.69	92.36	83.3	56.8
07/03/2015 11:50:00	72.03	89.17	75	46.7
07/03/2015 11:55:00	67.65	85.29	69	47.3

07/03/2015 12:00:00	75.29	88.87	80.4	52.5
07/03/2015 12:05:00	64.43	79.33	68.1	51.6
07/03/2015 12:10:00	63.89	79.17	67.3	51.3
07/03/2015 12:15:00	65.76	83.88	69.5	51.8
07/03/2015 12:20:00	65.89	81.69	69.7	50.7
07/03/2015 12:25:00	66.88	80.34	70.6	52.7
07/03/2015 12:30:00	65.13	79.86	68.7	52.4
07/03/2015 12:35:00	67.47	81.13	71.4	53.6
07/03/2015 12:40:00	76.56	85.91	80.6	53.6
07/03/2015 12:45:00	81.07	90.36	84.2	68.4
07/03/2015 12:50:00	69.35	86.42	72.7	56.3
07/03/2015 12:55:00	54.7	71.97	57.9	47.6

Appendix 2: Measured Noise Levels at Location 'B'

Start Time	$L_{Aeq,5\ minutes}$ dB	$L_{Amax,fast}$ dB	$L_{Ae10,5\ minutes}$ dB	$L_{A90,5\ minutes}$ dB
07/03/2015 09:00:00	50.41	67.54	48.8	44.3
07/03/2015 09:05:00	48.01	58.95	51	44
07/03/2015 09:10:00	47.46	66.13	49.7	44.3
07/03/2015 09:15:00	45.23	51	46.4	43.9
07/03/2015 09:20:00	51.01	66.62	53.3	45.3
07/03/2015 09:25:00	51.25	65.2	53.9	46.4
07/03/2015 09:30:00	51.39	67.53	53.1	45.7
07/03/2015 09:35:00	48.37	65.71	48.9	44.2
07/03/2015 09:40:00	50.12	67.63	52.3	44.3
07/03/2015 09:45:00	50.62	65.37	53.5	44.2
07/03/2015 09:50:00	50.14	72.42	51.8	44.3
07/03/2015 09:55:00	48.24	64.91	51.1	43.4
07/03/2015 10:00:00	50.98	66.96	53.4	43.7
07/03/2015 10:05:00	50.51	65.79	53.7	43.5
07/03/2015 10:10:00	50.11	65.41	52.2	42.8
07/03/2015 10:15:00	52.38	69.87	55.8	44
07/03/2015 10:20:00	51.93	69.32	54.7	43.7
07/03/2015 10:25:00	54.33	76.65	56	47.9
07/03/2015 10:30:00	48.84	67.92	51	45.3
07/03/2015 10:35:00	49.97	66.76	51.6	46.1
07/03/2015 10:40:00	50.27	68.21	51.7	46.4
07/03/2015 10:45:00	51.48	69.91	52.2	45.1
07/03/2015 10:50:00	49.85	60.81	51.7	45.8
07/03/2015 10:55:00	51.99	62.25	54.3	49.1
07/03/2015 11:00:00	50.5	60.83	53.7	44.8
07/03/2015 11:05:00	51.16	60.79	53.5	47.1
07/03/2015 11:10:00	51.58	61.43	53.6	48.9
07/03/2015 11:15:00	50.78	61.73	53.2	45.4
07/03/2015 11:20:00	51.21	74.99	54	44.1
07/03/2015 11:25:00	52.02	59.97	54.5	46.7
07/03/2015 11:30:00	52.45	58.89	55.2	46.3
07/03/2015 11:35:00	50.08	60.88	53.6	45
07/03/2015 11:40:00	49.03	69.09	51.5	44.6
07/03/2015 11:45:00	50.98	69.76	53.8	44.4
07/03/2015 11:50:00	55.3	70.24	58.7	46.2
07/03/2015 11:55:00	47.69	63.13	49.6	44.6
07/03/2015 12:00:00	48.92	60.24	52.2	43.4
07/03/2015 12:05:00	47.16	61.81	49.2	43.5
07/03/2015 12:10:00	51.95	76.93	49.6	43.5
07/03/2015 12:15:00	49.32	64.92	51.1	44.8
07/03/2015 12:20:00	45.12	57.08	46.7	42.9

07/03/2015 12:25:00	47.1	61.5	49	44
07/03/2015 12:30:00	47.25	62.73	48.8	44.4
07/03/2015 12:35:00	51.26	74.51	53.5	44.5
07/03/2015 12:40:00	51.69	73.67	54	45.9