ALL HALLOWS CHURCH

PLANT NOISE ASSESSMENT

Acoustics Report A1181 R01
27th July 2017

Report for:

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Contents

1 Introduction

Ion Acoustics is appointed by Eng Design to provide advice on operational noise from new plant associated with an extension of the All Hallows Church in Gospel Oak, London. The applicant is seeking to discharge a planning permission condition which was imposed on the scheme in respect of plant noise emissions. The relevant condition requires plant noise to be assessed against existing L_{A90} background noise levels. The plant is assessed against the condition which implements standard noise limits from for London Borough of Camden.

Ion Acoustics carried out a baseline noise survey in the area between 23rd and 26th June 2017 to measure existing local noise levels. These have been used to derive the noise limit applicable to the proposed plant. The proposed plant emissions have also been calculated and compared with the planning limits.

2 Scheme Details

2.1 Site Location

All Hallows Church is located on Savernake Road in Gospel Oak, London. The two items of plant (toilet and kitchen extract fans) will be located on the east and west wall of the single storey extension building, respectively. The site is in a residential area and has residential properties broadly to the south and west. North of the property is the church building itself, while to the east is the All Hallows Hall, which is a non-residential building and is associated with the church. Therefore the most affected sensitive receptors are located to the south west (56 Shirlock Road) and with additional receptors further away to the west across Shirlock Road and then to the south east (Coulthorpe Road); however these are both shielded by the All Hallows Hall and further away than those on Shirlock Road, therefore less affected.

Figure 1 indicates the location of the site in context of the surrounding area, with the plant location and measurement position indicated.

Figure 1 – Site location showing the proposed plant location and the measurement location (© Google Maps)

2.2 Plant

In total, two items of plant will be installed in the building, with grilles to the exterior at the locations indicated below in Figure 2. These are two independent extract fans; the kitchen extract being Nuaire Cyfan (wall mounted inside the grille) and the WC extract is a Vent-Axia ACM150 (located ceiling mounted within the building).

Operating hours will be associated with the churches opening hours, likely to include evenings and weekends.

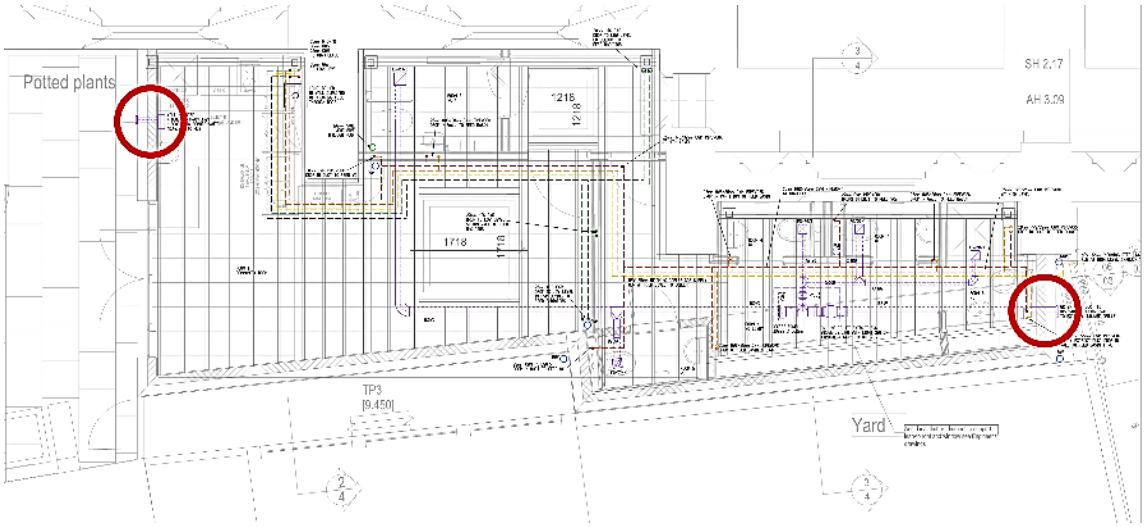

Figure 2 - Plant Location

3 Local Planning Authority Criteria

The project has been granted full planning permission by Camden Council, subject to a number of conditions. Those relevant to noise issues are reproduced below.

Condition 4
"Noise levels at a point 1 metre external to sensitive facades shall be at least 5dB(A) less than the existing background measurement (L_{A90}), expressed in dB(A) when all plant/equipment (or any part of it) is in operation unless the plant/equipment hereby permitted will have a noise that has a distinguishable, discrete continuous note (while, hiss, screech, hum) and/or if there are distinct impulses (bangs, clicks, clatters, thumps), then the noise levels from that piece of plant/equipment at any sensitive façade shall be at least 10dB(A) below the L_{A90}, expressed in dB(A)

Condition 5
"Prior to installation, full details of the proposed plant, together with an acoustic report shall be submitted to and approved by the Local Planning Authority in writing.

This condition does not refer to any British Standard, although typically BS4142:2014 would apply for such assessment.

It is noted that this condition was granted for a previous version of the scheme which had more significant plant at the time. The amount of plant has been reduced to a small kitchen extract and small WC extract. Typically, these are of a scale where a planning condition would not always be imposed in respect of noise as they are effectively similar to domestic type plant.

4 Planning Policy and Other Guidance on Noise

4.1 BS4142: 2014 – Assessment Principles

The standard method for assessing noise of an industrial nature affecting nearby housing is British Standard BS 4142 "Method for rating and assessing industrial and commercial sound". A BS 4142 assessment is made by determining the difference between the intrusive noise under consideration and the background sound level as represented by the L_{A90} parameter, determined in the absence of the intrusive noise. The L_{A90} parameter is defined as the level exceeded for 90% of the measurement time. Therefore, it represents the underlying noise in the absence of short-term events.

BS4142: 2014 states: *'In using the background sound level in the method for rating and assessing industrial and commercial sound it is important to ensure that values are reliable and suitably represent both the particular circumstances and periods of interest. For this purpose, the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods'*.

The intrusive noise under consideration is assessed in terms of the ambient noise level, L_{Aeq}, but a character correction penalty can be applied where the noise exhibits certain characteristics such

as distinguishable tones, impulsiveness or, if the noise is distinctively intermittent. The ambient noise level, L_{Aeq} is defined as the steady-state noise level with the same energy as the actual fluctuating sound over the same time period. It is effectively the average noise level during the period. The plant noise level (L_{Aeq}) with the character correction (if necessary) is known as rating level, L_{Ar}, and the difference between the background noise and the rating level is determined to make the BS 4142 assessment. The standard then states:

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

The standard outlines a number of methods for defining appropriate 'character corrections' to determine the rating levels to account for tonal qualities, impulsive qualities, other sound characteristics and/or intermittency. It is noted that the draft planning condition referred to above only mentions the plant noise level and not a rating level.

The standard also highlights the importance of considering the context in which a sound occurs. The standard indicates that factors including the absolute sound level, the character of the sound, the sensitivity of the receptor and the existing acoustic character of the area should be considered when assessing the noise impact.

5 Noise Survey

5.1 Unattended Survey

A baseline noise survey was carried out between 23rd and 26th June 2017, to inspect the site and determine the local noise climate and hence derive the plant noise limit. The measurements were made on the partly-built extension of the church which the plant will serve, attached to its south wall. A Larson Davis LD820 sound level meter with a GRAS Type 41AL windshield was used for this survey, with the microphone mounted at approximately 3.4m above local ground level in order to better represent the window locations. The sound level meter was set to log data at 15 minute intervals. The sound level meter was calibrated using a Brüel & Kjaer Type 4132 calibrator. No significant drift was found between the start and end of the survey. The measurement location is shown in Figure 3. The position was a free field location at least 3.5m away from any vertical reflecting surfaces.

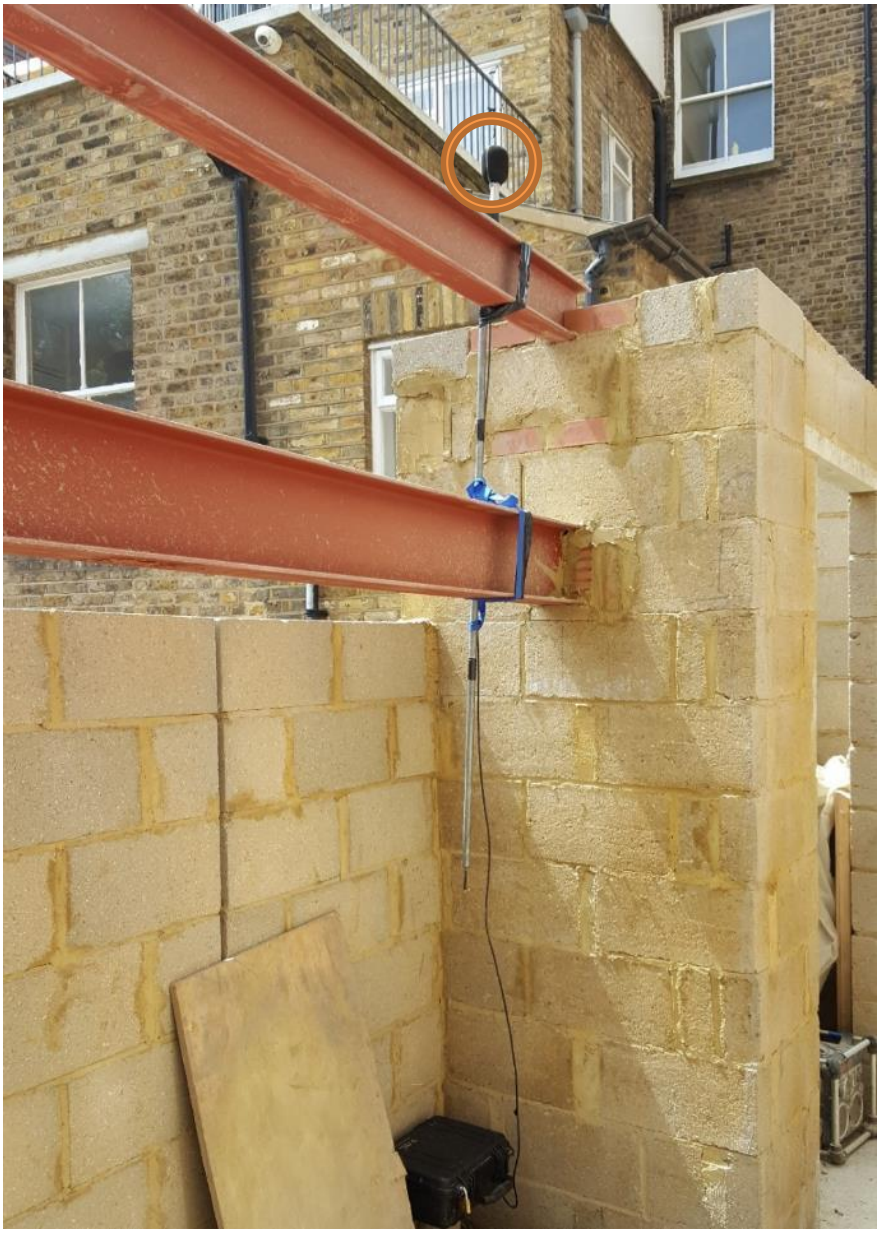

Figure 3 – Measurement location MU1, facing south-west

As the survey was unattended, detailed weather notes are not available apart from the setup and collection periods. On setup, the weather was warm and dry, with a temperature of 22˚C, a very gentle westerly breeze, and ~30% cloud cover. On collection, the temperature was 21˚C with ~20% cloud cover, and a barely perceptible westerly wind. The survey period was selected to have a forecast of dry weather with little wind and was considered suitable for such noise monitoring.

6 Survey Results

6.1 Survey Results

The measured noise data is displayed on a graph in Figures 5, 6 and 7. The L_{A90} cumulative distribution graphs for the survey period are displayed in Figures 8, 9 and 10. The full survey results are tabulated in Appendix A.

The plant will not be expected to operate continuously during a 24 hour period only when the building is operated, so only day and evening periods are considered. The typical local noise climate comprised mainly traffic noise and, to a lesser extent, local residential activity. Some construction noise occurred during the initial measurement periods on Friday and the last measurement periods on Monday, and these can be seen in the graphs, however these periods will be excluded for the assessment.

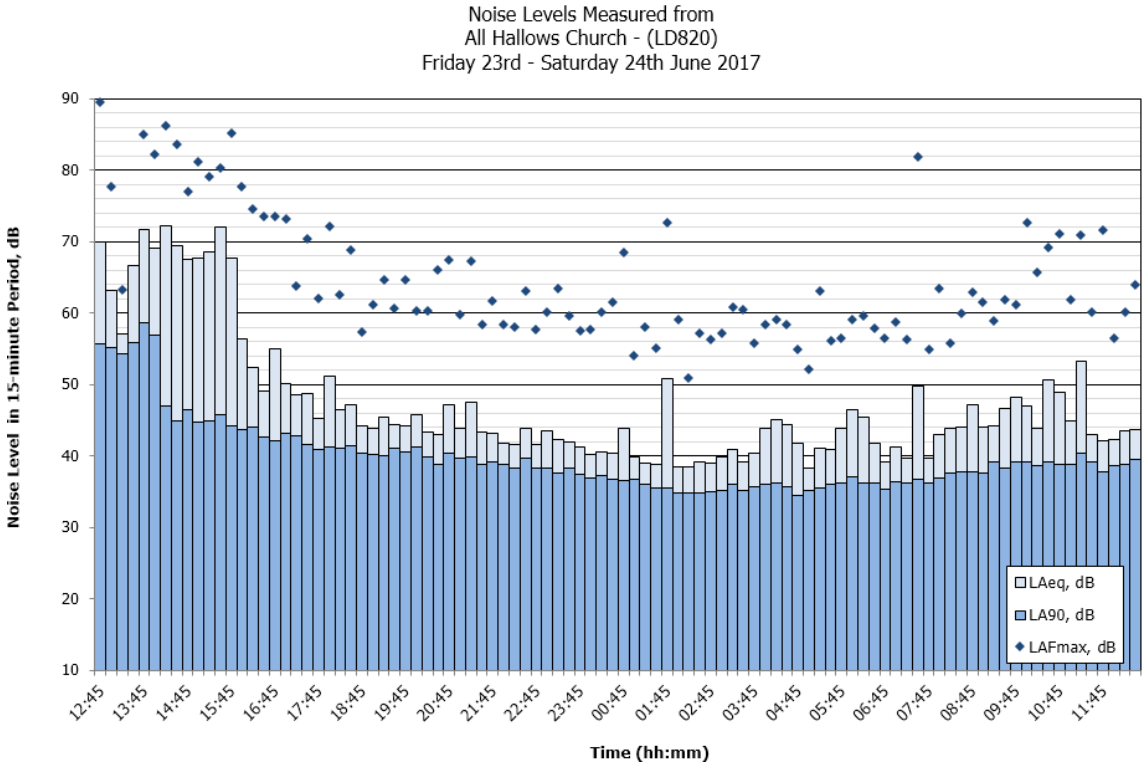

Figure 5 – Measured noise level data for Friday 23rd to Saturday 24th June 2017

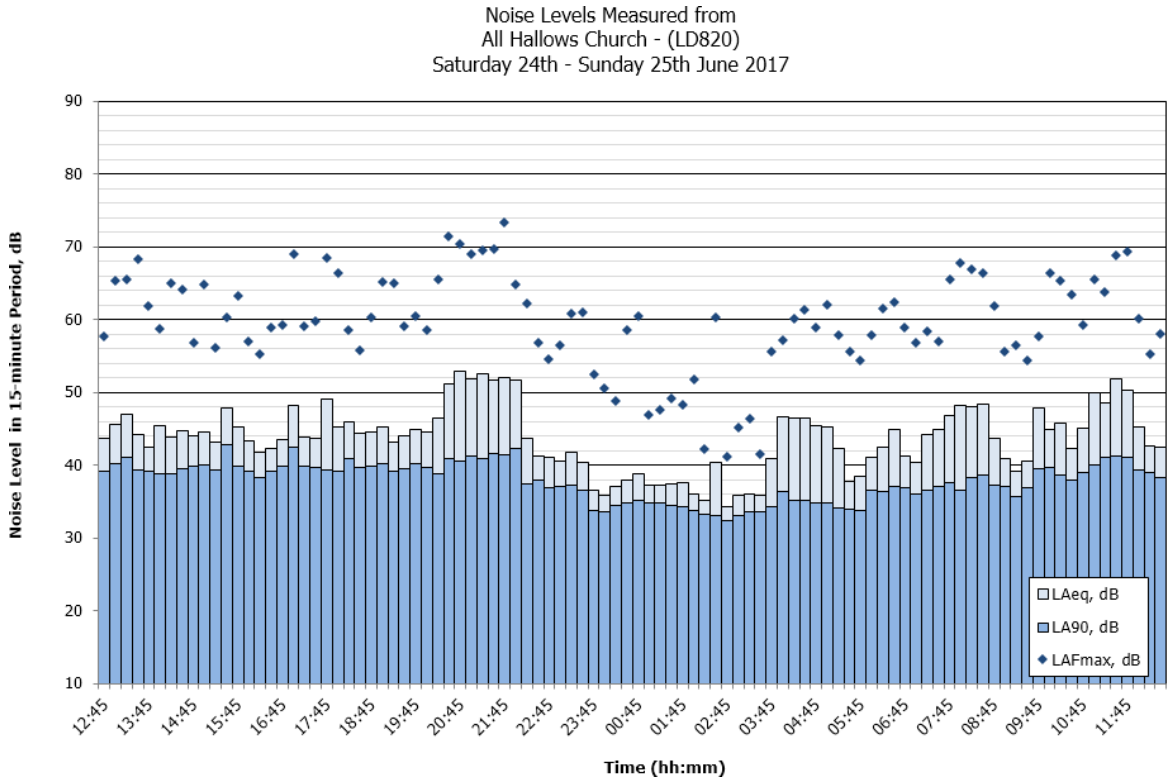

Figure 6 – Measured noise level data for Saturday 24th to Sunday 25th June 2017

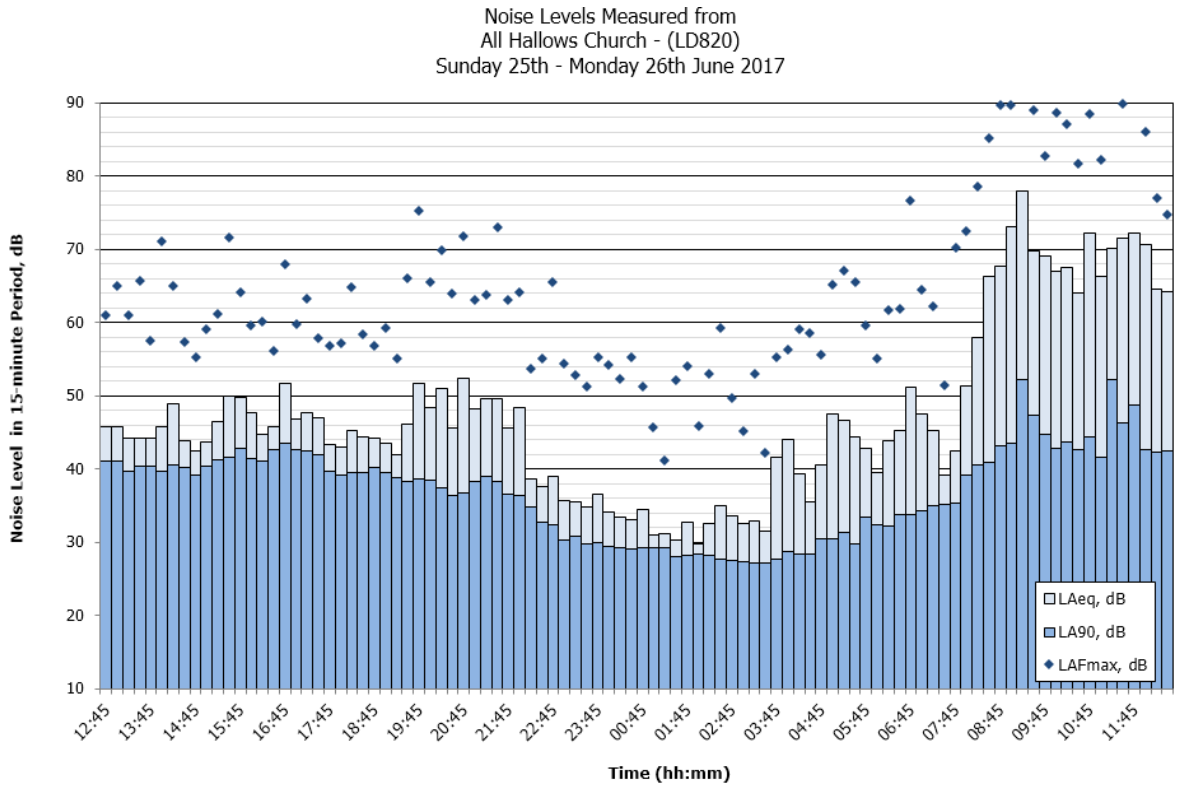

Figure 7 – Measure noise level data for Sunday 25th to Monday 26th June 2017

The graphs above show how the noise climate changes over time. It appears that the noise climate is relatively steady, normally between 35 – 40 dB L_{A90}.

6.2 Noise Limits

The plant noise limit has been derived in accordance with BS4142:2014 and Local Planning Authority guidance. The LPA specify that operational noise from plant should not exceed a level 5dB below the background level L_{A90} at 1 metre outside a window of a neighbouring residential property, or 10dB below the background level L_{A90} "if there are any distinct impulses (bangs, clicks, clatters, thumps)". The distribution of the L_{A90} values is shown in Figures 8, 9 and 10 for the day period (07:00 hrs to 19:00 hrs) and evening period (19:00 hrs to 23:00 hrs). The plant noise limit is derived in Table 1 in line with the principles of BS 4142:2014 based on a typical representative background noise level for the period.

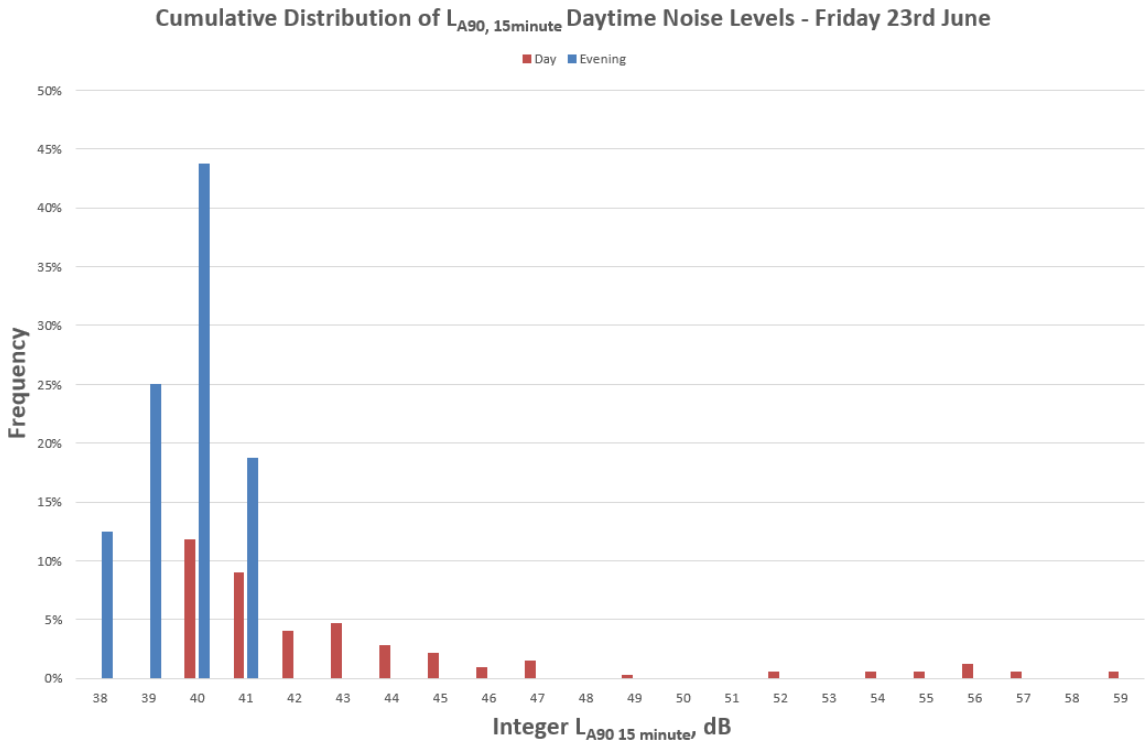

Figure 8 – Cumulative distribution of L_{A90} noise levels measured on 23th June

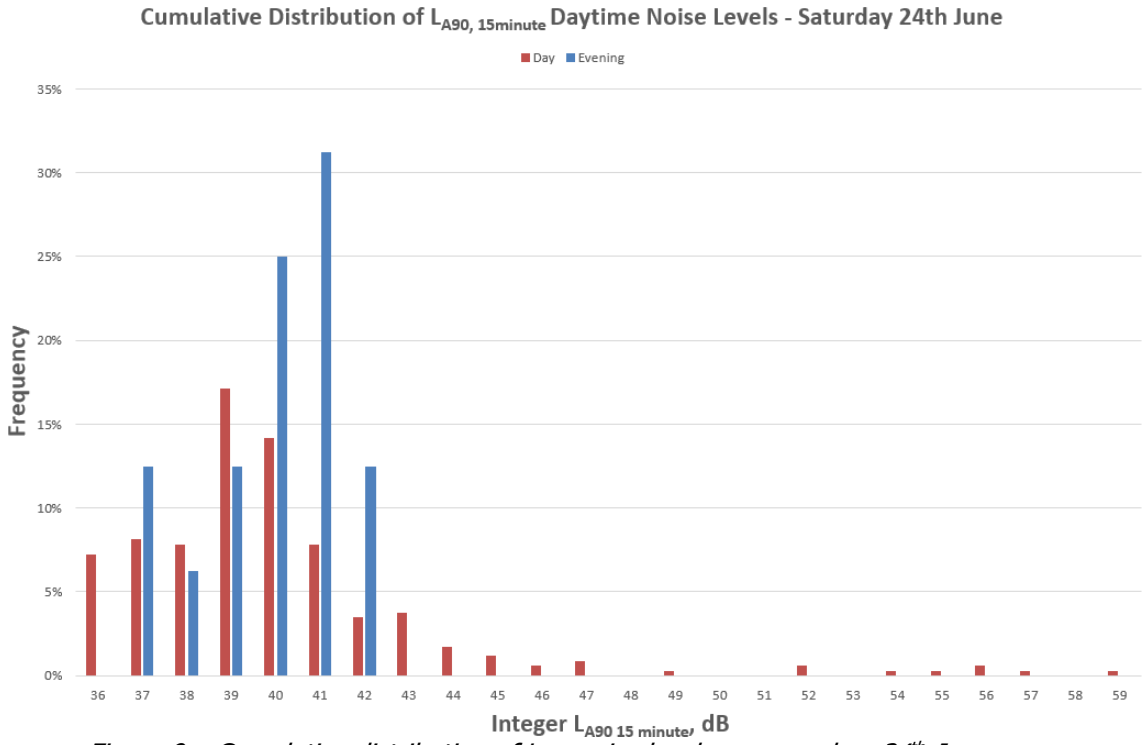

Figure 9 – Cumulative distribution of L_{A90} noise levels measured on 24th June

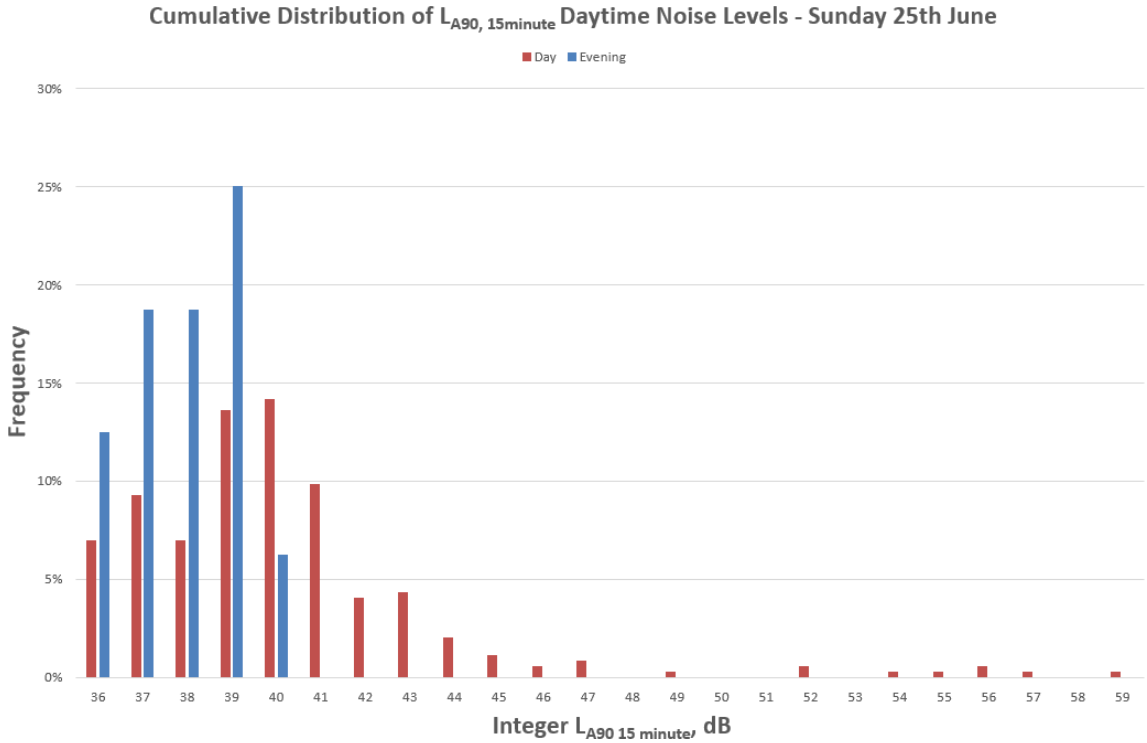

Figure 10 – Cumulative distribution of L_{A90} noise levels measured on 25th June

Table 1: Noise Limit

Period	Duration hh:mm	Typical L_{A90}, dB	Noise limit (L_{A90} -5dB)
Daytime 07:00 – 19:00	16:00	37	32
Evening 19:00 – 23:00	04:00	37	32

The location of extract fans is on the west façade for the kitchen extract, and on the east façade for the toilet extract. This limits line of sight to nearest receptors to the south thanks to shielding, as well as increasing the distance between the plant and closest residential windows.

7 Calculations

Manufacturer provided noise data is reproduced in Table 3 below. Octave band data has been provided for the WC extract only. These values are assumed to be A-weighted sound power levels (L_{WA}), which have then been corrected to linear values for calculation purposes. Data for the kitchen extract is supplied as a single figure A weighted sound pressure level (L_{PA}) at 3 metres distance from the source. This is likely to be at 3m from the internal fan rather than outside the extract grille, which may be a little lower as there would be no casing radiation there, however the same data has been used in the absence of better information.

Table 2: WC Extract Fan sound power levels

Item of plant	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	L_{WA}
	dB							
ACM150 Mixed Flow	60.7	62.6	60.1	60.2	56.0	55.3	48.5	62.1

The noise levels at the receptors from the WC extract fan have been calculated using the following formula:

$$Lp = Lw - 20\log(r) - 11 + DI - shielding$$

Where Lw is the sound power level in Table 2, r is the distance from source to receptor and DI is a directivity correction. These have been calculated for each individual item of plant, and then combined logarithmically to achieve a total level at a receptor. The results are displayed in Table 4, while the full calculations can be found in Appendix B.

Table 3: Kitchen Extract Fan sound pressure level

Item of plant	Duty	L_{PA} @3m
		dB
Nuaire Cyfan	Boost 60 l/s	45
	30 l/s	32

For the calculations, the higher boost value has been used to assess compliance in the worst case condition. Noise levels will be significantly lower under lower duty flow.

The noise levels at the receptors from the kitchen extract fan have been calculated using the following formula:

$$SPL\ @\ Receptor = Lp - 20\log\left(\frac{r2}{r1}\right) - directivity - shielding$$

Table 4: Sound Pressure Levels at Receptors, both units operating – no mitigation

Receptor	Resultant SPL (dBA)	Noise limit (dBA)	Excess (dB)
56 Shirlock Road	31	32	-1
55 Shirlock Road	26		-6

For purposes of these calculations, it has been assumed that both extract fans will be working simultaneously and on full power, as a worst-case scenario. Due to the nature of their purpose, they could sometimes operate simultaneously, and only one at a time at other times. Our calculations show that when operating simultaneously, the extract fans will meet the noise limit by a margin of 1dB at the nearest receptor, windows at the rear of 56 Shirlock Road. They would also be 5dBA below the lowest background noise level measured during the period as well as the typical level.

The absolute noise levels predicted are also low and noise levels inside dwellings would be comfortably within guidance levels even with windows open.

8 Summary

A noise assessment has been carried out for a discharge of a planning application condition regarding the installation of items of plant on the walls of an extension building of All Hallows Church in Gospel Oak, London. A noise survey was conducted between the 23rd and 26th June 2017 to establish the existing background noise level and derive a noise limit from it, in accordance with BS4142:2014.

Predictions of noise emissions from the proposed plant have been prepared and show that the noise limit and hence the planning condition are met.

Time	L_{Aeq} dB	$L_{Amax,F}$ dB	L_{AF90} dB	Time	L_{Aeq} dB	$L_{Amax,F}$ dB	L_{AF90} dB
23/06/2016 12:45	70.0	89.4	55.6	24/06/2016 00:45	43.8	68.5	36.6
23/06/2016 13:00	63.1	77.6	55.1	24/06/2016 01:00	39.8	54.0	36.7
23/06/2016 13:15	57.1	63.2	54.2	24/06/2016 01:15	39.0	58.0	36.0
23/06/2016 13:30	66.6	90.6	55.8	24/06/2016 01:30	38.8	55.1	35.5
23/06/2016 13:45	71.6	84.9	58.6	24/06/2016 01:45	50.7	72.6	35.5
23/06/2016 14:00	69.1	82.2	56.9	24/06/2016 02:00	38.5	59.1	34.8
23/06/2016 14:15	72.1	86.1	46.9	24/06/2016 02:15	38.4	50.8	34.7
23/06/2016 14:30	69.4	83.6	44.9	24/06/2016 02:30	39.1	57.1	34.7
23/06/2016 14:45	67.4	76.9	46.5	24/06/2016 02:45	39.0	56.3	34.9
23/06/2016 15:00	67.6	81.1	44.7	24/06/2016 03:00	39.8	57.1	35.2
23/06/2016 15:15	68.5	79.1	44.8	24/06/2016 03:15	40.9	60.8	36.0
23/06/2016 15:30	72.0	80.2	45.7	24/06/2016 03:30	39.2	60.5	35.1
23/06/2016 15:45	67.7	85.1	44.1	24/06/2016 03:45	40.4	55.8	35.7
23/06/2016 16:00	56.4	77.7	43.6	24/06/2016 04:00	43.9	58.3	36.0
23/06/2016 16:15	52.4	74.6	44.0	24/06/2016 04:15	45.0	59.1	36.2
23/06/2016 16:30	49.1	73.5	42.6	24/06/2016 04:30	44.3	58.4	35.6
23/06/2016 16:45	55.0	73.5	42.1	24/06/2016 04:45	41.8	54.9	34.4
23/06/2016 17:00	50.1	73.1	43.2	24/06/2016 05:00	38.2	52.1	35.1
23/06/2016 17:15	48.5	63.7	42.7	24/06/2016 05:15	41.0	63.1	35.5
23/06/2016 17:30	48.7	70.3	41.5	24/06/2016 05:30	40.9	56.1	36.0
23/06/2016 17:45	45.3	62.0	40.8	24/06/2016 05:45	43.8	56.4	36.2
23/06/2016 18:00	51.1	72.1	41.2	24/06/2016 06:00	46.4	59.1	37.0
23/06/2016 18:15	46.4	62.5	41.0	24/06/2016 06:15	45.4	59.6	36.2
23/06/2016 18:30	47.1	68.8	41.4	24/06/2016 06:30	41.7	57.8	36.2
23/06/2016 18:45	44.2	57.3	40.4	24/06/2016 06:45	39.1	56.4	35.3
23/06/2016 19:00	43.9	61.2	40.2	24/06/2016 07:00	41.3	58.7	36.4
23/06/2016 19:15	45.4	64.6	40.0	24/06/2016 07:15	39.6	56.3	36.2
23/06/2016 19:30	44.3	60.6	41.0	24/06/2016 07:30	49.7	81.8	36.7
23/06/2016 19:45	44.2	64.6	40.5	24/06/2016 07:45	39.6	54.8	36.1
23/06/2016 20:00	45.8	60.3	41.2	24/06/2016 08:00	43.0	63.4	36.9
23/06/2016 20:15	43.3	60.3	39.9	24/06/2016 08:15	43.9	55.7	37.6
23/06/2016 20:30	42.9	66.0	38.7	24/06/2016 08:30	44.0	59.9	37.7
23/06/2016 20:45	47.1	67.4	40.4	24/06/2016 08:45	47.1	62.8	37.7
23/06/2016 21:00	43.8	59.7	39.7	24/06/2016 09:00	44.0	61.4	37.5
23/06/2016 21:15	47.5	67.2	39.8	24/06/2016 09:15	44.1	58.8	39.1
23/06/2016 21:30	43.3	58.4	38.8	24/06/2016 09:30	46.6	61.9	38.3
23/06/2016 21:45	43.2	61.6	39.1	24/06/2016 09:45	48.2	61.1	39.2
23/06/2016 22:00	41.8	58.3	38.7	24/06/2016 10:00	47.0	72.6	39.1
23/06/2016 22:15	41.6	58.0	38.2	24/06/2016 10:15	43.9	65.7	38.6
23/06/2016 22:30	43.8	63.0	39.7	24/06/2016 10:30	50.6	69.1	39.1
23/06/2016 22:45	41.5	57.6	38.2	24/06/2016 10:45	48.8	71.1	38.8
23/06/2016 23:00	43.4	60.1	38.2	24/06/2016 11:00	44.9	61.9	38.7
23/06/2016 23:15	42.3	63.4	37.6	24/06/2016 11:15	53.2	70.9	40.3
23/06/2016 23:30	42.0	59.6	38.3	24/06/2016 11:30	42.9	60.0	39.2
23/06/2016 23:45	41.2	57.4	37.4	24/06/2016 11:45	42.1	71.5	37.7
24/06/2016 00:00	40.1	57.7	36.9	24/06/2016 12:00	42.3	56.5	38.6
24/06/2016 00:15	40.5	60.0	37.2	24/06/2016 12:15	43.5	60.1	38.8
24/06/2016 00:30	40.3	61.5	36.7	24/06/2016 12:30	43.7	63.9	39.5

Time	L_{Aeq} dB	$L_{Amax,F}$ dB	L_{AF90} dB	Time	L_{Aeq} dB	$L_{Amax,F}$ dB	L_{AF90} dB
24/06/2016 12:45	43.6	57.6	39.2	25/06/2016 00:45	38.7	60.5	35.2
24/06/2016 13:00	45.6	65.3	40.2	25/06/2016 01:00	37.2	46.8	34.8
24/06/2016 13:15	46.9	65.5	41.1	25/06/2016 01:15	37.2	47.5	34.7
24/06/2016 13:30	44.2	68.2	39.3	25/06/2016 01:30	37.4	49.1	34.5
24/06/2016 13:45	42.4	61.8	39.1	25/06/2016 01:45	37.5	48.3	34.3
24/06/2016 14:00	45.4	58.7	38.7	25/06/2016 02:00	36.0	51.7	33.8
24/06/2016 14:15	43.8	64.9	38.8	25/06/2016 02:15	35.2	42.1	33.2
24/06/2016 14:30	44.7	64.1	39.5	25/06/2016 02:30	40.3	60.2	33.1
24/06/2016 14:45	44.0	56.7	39.8	25/06/2016 02:45	34.2	41.1	32.4
24/06/2016 15:00	44.6	64.8	40.0	25/06/2016 03:00	35.8	45.1	33.1
24/06/2016 15:15	43.2	56.0	39.3	25/06/2016 03:15	36.0	46.4	33.5
24/06/2016 15:30	47.8	60.2	42.8	25/06/2016 03:30	35.8	41.5	33.6
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24/06/2016 16:30	42.2	58.9	39.1	25/06/2016 04:30	46.5	61.3	35.1
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24/06/2016 17:00	48.2	68.9	42.4	25/06/2016 05:00	45.3	62.0	34.8
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24/06/2016 18:30	44.3	55.7	39.7	25/06/2016 06:30	44.9	62.4	37.0
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24/06/2016 19:30	44.0	59.0	39.5	25/06/2016 07:30	44.9	56.9	37.0
24/06/2016 19:45	44.9	60.5	40.2	25/06/2016 07:45	46.7	65.5	37.5
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24/06/2016 21:00	51.8	69.0	41.2	25/06/2016 09:00	40.9	55.6	37.1
24/06/2016 21:15	52.5	69.4	40.9	25/06/2016 09:15	39.2	56.4	35.7
24/06/2016 21:30	51.6	69.6	41.5	25/06/2016 09:30	40.5	54.4	36.8
24/06/2016 21:45	52.0	73.3	41.4	25/06/2016 09:45	47.9	57.7	39.5
24/06/2016 22:00	51.6	64.8	42.3	25/06/2016 10:00	44.8	66.4	39.6
24/06/2016 22:15	43.7	62.2	37.4	25/06/2016 10:15	45.8	65.3	38.6
24/06/2016 22:30	41.3	56.7	38.0	25/06/2016 10:30	42.3	63.4	38.0
24/06/2016 22:45	41.1	54.6	36.9	25/06/2016 10:45	45.1	59.3	39.0
24/06/2016 23:00	40.5	56.4	37.0	25/06/2016 11:00	49.9	65.5	40.0
24/06/2016 23:15	41.7	60.7	37.2	25/06/2016 11:15	48.5	63.8	41.0
24/06/2016 23:30	40.3	60.9	36.6	25/06/2016 11:30	51.8	68.7	41.2
24/06/2016 23:45	36.5	52.4	33.8	25/06/2016 11:45	50.3	69.3	41.0
25/06/2016 00:00	35.9	50.6	33.6	25/06/2016 12:00	45.3	60.0	39.3
25/06/2016 00:15	37.1	48.7	34.4	25/06/2016 12:15	42.6	55.2	38.9
25/06/2016 00:30	37.9	58.5	34.8	25/06/2016 12:30	42.5	58.0	38.3

Time	L_{Aeq} dB	$L_{Amax,F}$ dB	L_{AF90} dB	Time	L_{Aeq} dB	$L_{Amax,F}$ dB	L_{AF90} dB
25/06/2016 12:45	45.8	60.9	41.1	26/06/2016 00:45	34.5	51.3	29.3
25/06/2016 13:00	45.7	64.9	41.1	26/06/2016 01:00	30.9	45.6	29.2
25/06/2016 13:15	44.2	61.0	39.6	26/06/2016 01:15	31.2	41.1	29.2
25/06/2016 13:30	44.2	65.6	40.4	26/06/2016 01:30	30.3	52.0	28.0
25/06/2016 13:45	44.1	57.4	40.4	26/06/2016 01:45	32.7	54.0	28.2
25/06/2016 14:00	45.7	71.0	39.6	26/06/2016 02:00	29.7	45.9	28.3
25/06/2016 14:15	48.8	64.9	40.6	26/06/2016 02:15	32.5	52.9	28.1
25/06/2016 14:30	43.8	57.3	40.2	26/06/2016 02:30	35.0	59.2	27.6
25/06/2016 14:45	42.5	55.3	39.2	26/06/2016 02:45	33.5	49.7	27.5
25/06/2016 15:00	43.7	59.0	40.4	26/06/2016 03:00	32.6	45.2	27.3
25/06/2016 15:15	46.4	61.1	41.3	26/06/2016 03:15	32.9	53.0	27.1
25/06/2016 15:30	50.0	71.6	41.5	26/06/2016 03:30	31.4	42.2	27.2
25/06/2016 15:45	49.7	64.1	42.7	26/06/2016 03:45	41.6	55.3	27.6
25/06/2016 16:00	47.6	59.5	41.4	26/06/2016 04:00	44.0	56.3	28.7
25/06/2016 16:15	44.7	60.0	41.0	26/06/2016 04:15	39.3	59.0	28.3
25/06/2016 16:30	45.8	56.1	42.6	26/06/2016 04:30	35.4	58.5	28.4
25/06/2016 16:45	51.6	67.9	43.5	26/06/2016 04:45	40.6	55.6	30.5
25/06/2016 17:00	46.7	59.7	42.6	26/06/2016 05:00	47.5	65.1	30.5
25/06/2016 17:15	47.7	63.3	42.4	26/06/2016 05:15	46.6	67.0	31.3
25/06/2016 17:30	46.9	57.8	41.9	26/06/2016 05:30	44.3	65.5	29.7
25/06/2016 17:45	43.3	56.7	39.7	26/06/2016 05:45	42.8	59.5	33.4
25/06/2016 18:00	43.0	57.2	39.1	26/06/2016 06:00	39.4	55.0	32.3
25/06/2016 18:15	45.3	64.7	39.5	26/06/2016 06:15	43.9	61.6	32.2
25/06/2016 18:30	44.4	58.3	39.4	26/06/2016 06:30	45.3	61.9	33.7
25/06/2016 18:45	44.1	56.8	40.1	26/06/2016 06:45	51.1	76.6	33.7
25/06/2016 19:00	43.4	59.2	39.5	26/06/2016 07:00	47.5	64.4	34.3
25/06/2016 19:15	42.0	55.1	38.8	26/06/2016 07:15	45.2	62.1	35.0
25/06/2016 19:30	46.1	66.0	38.2	26/06/2016 07:30	39.2	51.4	35.2
25/06/2016 19:45	51.6	75.3	38.6	26/06/2016 07:45	42.5	70.2	35.3
25/06/2016 20:00	48.4	65.5	38.5	26/06/2016 08:00	51.3	72.5	39.2
25/06/2016 20:15	51.0	69.8	37.4	26/06/2016 08:15	57.9	78.6	40.5
25/06/2016 20:30	45.6	63.9	36.4	26/06/2016 08:30	66.3	85.1	40.9
25/06/2016 20:45	52.3	71.8	36.7	26/06/2016 08:45	67.6	89.7	43.1
25/06/2016 21:00	48.1	63.0	38.3	26/06/2016 09:00	73.0	89.6	43.4
25/06/2016 21:15	49.5	63.7	39.0	26/06/2016 09:15	78.0	90.8	52.1
25/06/2016 21:30	49.6	72.9	38.2	26/06/2016 09:30	69.8	89.0	47.3
25/06/2016 21:45	45.5	63.0	36.5	26/06/2016 09:45	69.1	82.7	44.7
25/06/2016 22:00	48.3	64.1	36.3	26/06/2016 10:00	66.9	88.6	42.8
25/06/2016 22:15	38.6	53.6	34.7	26/06/2016 10:15	67.5	87.0	43.7
25/06/2016 22:30	37.5	55.0	32.7	26/06/2016 10:30	64.0	81.6	42.6
25/06/2016 22:45	39.0	65.4	32.3	26/06/2016 10:45	72.1	88.5	44.4
25/06/2016 23:00	35.7	54.4	30.2	26/06/2016 11:00	66.2	82.1	41.6
25/06/2016 23:15	35.4	52.7	30.7	26/06/2016 11:15	70.1	91.5	52.1
25/06/2016 23:30	34.8	51.2	29.7	26/06/2016 11:30	71.5	89.9	46.2
25/06/2016 23:45	36.6	55.2	29.9	26/06/2016 11:45	72.1	92.8	48.7
26/06/2016 00:00	34.1	54.2	29.4	26/06/2016 12:00	70.6	86.0	42.6
26/06/2016 00:15	33.4	52.3	29.2	26/06/2016 12:15	64.6	77.0	42.3
26/06/2016 00:30	33.1	55.2	29.1	26/06/2016 12:30	64.2	74.7	42.4

Plant Noise Calcs to Rear of 56 Shirlock Road				Octave Band Centre Frequency, Hz								
WC Extract				63	125	250	500	1000	2000	4000	dBA	
SWL				60.7	62.6	60.1	60.2	56.0	55.3	48.5		
circular duct, 3.4m, 160mm				0.2	0.3	0.3	0.3	0.3	0.3	0.3		
end reflection, 160mm, 160mm				16.0	11.0	6.0	2.0	0.0	0.0	0.0		
			Lw	44.5	51.3	53.8	57.9	55.7	55.0	48.2		
Atmosphere		distance	7.7m	28.7	28.7	28.7	28.7	28.7	28.7	28.7		
directivity : 30°,90°, 160mm, 160mm				3.0	3.5	3.5	2.5	1.5	-11.0	-11.0		
			Lp	18.7	26.0	28.5	31.6	28.4	15.2	8.4	31.9	dB(A)
shielding	10			8.7	16.0	18.5	21.6	18.4	5.2	-1.6	**21.9**	dB(A)
Extract Fan			boost									
60 l/s SPL @ 3m			45									
distance		6.8										
distance loss			-7.11									
directivity			-3									
shielding			-5									
SPL at receptor			**29.89**	dBA								
30 l/s SPK@ 3m			32						background noise leve			37
SPL at Receptor			16.89	dBA					**total noise levels**			diff
									boost 60 l/s		**30.5**	6.5
										30 l/s	**23.1**	13.9

Plant Noise Calcs to front of 55 Shirlock Road - opposite												
WC Extract												
SWL				60.7	62.6	60.1	60.2	56.0	55.3	48.5		
circular duct, 3.4m, 160mm				0.2	0.3	0.3	0.3	0.3	0.3	0.3		
end reflection, 160mm, 160mm				16.0	11.0	6.0	2.0	0.0	0.0	0.0		
			Lw	44.5	51.3	53.8	57.9	55.7	55.0	48.2		
Atmosphere		distance	30.0m	40.5	40.5	40.5	40.5	40.5	40.5	40.5		
directivity : 30°,90°, 160mm, 160mm				3.0	3.5	3.5	2.5	1.5	-11.0	-11.0		
			Lp	6.9	14.2	16.7	19.8	16.6	3.4	-3.4	20.1	dB(A)
shielding	10			-3.1	4.2	6.7	9.8	6.6	-6.6	-13.4	**10.1**	
Extract Fan			boost									
60 l/s SPL @ 3m			45	dBA								
distance		27		m								
distance loss			-19.1	dB								
directivity			0	dB								
shielding			0	dB								
SPL at receptor			**25.92**	dBA								
30 l/s SPK@ 3m			32						background noise leve			37
SPL at Receptor			12.92	dBA					**total noise levels**			diff
									boost 60 l/s		**26.0**	11.0
										30 l/s	**14.7**	22.3