

SHARPS REDMORE

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Report 1

BS 4142 Assessment
of Proposed Plant
for William Hill, Radcliffe

Prepared by
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Revision Register

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This report has been prepared with all reasonable skill, care and diligence commensurate with an acoustic consultancy practice under the terms and brief agreed with our client at that time. Sharps Redmore provides no duty or responsibility whatsoever to any third party who relies upon its content, recommendations or conclusions.

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1.0 Executive Summary

- 1.1 This report presents an BS 4142:2014 assessment of the noise impact due to the proposed installation of new building services plant for the William Hill at 8 Church Street in Radcliffe.
- 1.2 The new plant includes two condensers to be located at the rear of the property. Drawings have been provided by the client and noise emission data have been provided by the building services engineer.
- 1.3 An environmental survey was undertaken to determine the background noise environment at the site and nearby noise-sensitive locations during the proposed periods of operation.
- 1.4 The nearest noise-sensitive locations have been identified as follows:
- Windows at the façades of residential properties of 6 and 14 Church Street,
 - The gardens of 6 and 14 Church Street.
- 1.5 Calculations have been undertaken to determine the specific plant noise level at the noise-sensitive locations and, where appropriate, penalties for distinguishable characteristics have been applied to calculate the noise rating level. This is then compared to the measured background sound level and an assessment of noise impact established.
- 1.6 A summary of the assessment is presented below, and includes the reference daytime background sound level ($L_{A90,T}$), the noise rating level ($L_{Ar,Tr}$) and the difference between the two.

Table 1.1 Summary of BS 4142:2014 assessment

	6 Church Street (Garden)	6 Church Street (Facade)	14 Church Street (Garden)	14 Church Street (Facade)
Rating level, $L_{Ar,Tr}$ (dB)	50	27	50	31
Background, L_{A90} (dB)	50	50	50	50
Rating relative to background (dB)	0	-13	0	-19

- 1.7 Based on the information provided within this report, the calculated plant noise rating level does not exceed the background sound level. At the façades of the nearest residential noise-sensitive receptors predicted noise levels are significantly lower than the measured background sound level.
- 1.8 As such, in accordance with the assessment procedures of BS 4142:2014, the proposed condensers would have a low impact.
- 1.9 In terms of assessment according to Planning guidance and the NPPG hierarchy, the proposed condensers would have No Observed Adverse Effects.

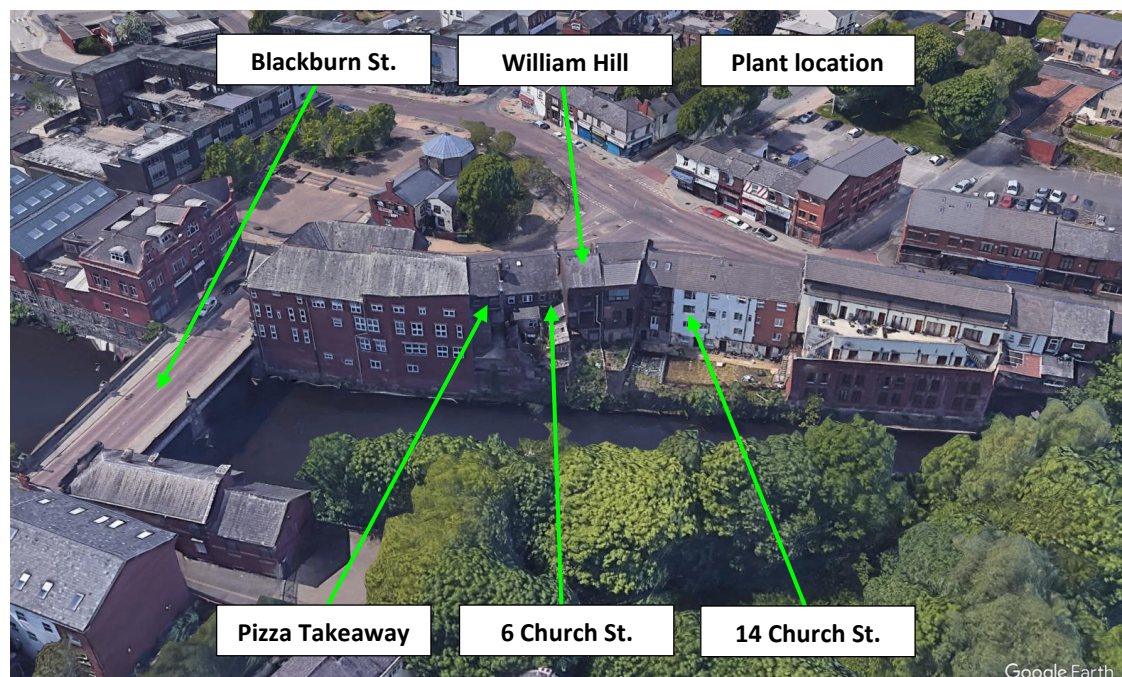
2.0 Introduction

- 2.1 Sharps Redmore has been appointed to provide a BS 4142:2014 assessment of proposed plant for William Hill at 8 Church Street, Radcliffe. This report will be submitted to the Local Planning Authority.
- 2.2 William Hill are to relocate due to the redevelopment of the town centre which comprises the construction of a new leisure centre and civic hub, as well as the refurbishment of the existing market hall and chambers on Church Street/Blackburn Street.

Site Description

- 2.3 The site is situated in the town centre of Radcliffe close to highways which are busy during the daytime. The A665 is located approximately 200 m to the south-west. The predominant land use in the neighbouring area is generally commercial with some residential, and then residential across the river to the south.
- 2.4 The site and surrounding area experience constant road traffic noise during the daytime. Further to this there is an extract fan and associated ductwork at the rear of the pizza takeaway. This is a significant noise source when it is operating, and dominant during the late evening into the night. The pizza takeaway is understood to open from 4pm every day until 11:30pm Sunday to Thursday and until 12:30am on Fridays and Saturdays.
- 2.5 The nearest noise-sensitive receptors (NNSR) are the neighbouring residences at 6 and 14 Church Street.

Figure 2.1 Site location



3.0 Standards, Guidance, Policy & Legislation

National Policy

- 3.1 The National Planning Policy Framework (NPPF) sets out the Government's economic, environmental and social planning policies for England and "these policies articulate the Government's vision of sustainable development". In respect of noise, Paragraph 123 of the NPPF states the following:

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, while recognising that many developments will create some noise; and*
- *identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.*

- 3.2 Guidance on the interpretation of the policy aims contained within the NPPF is provided by the National Planning Practice Guidance (NPPG). The NPPG introduces the concept of a noise exposure hierarchy based on likely average response. The guidance contained in the NPPG is summarised in Table 3.1 below.

Table 3.1 NPPG noise exposure hierarchy

Perception	Examples of outcomes	Increasing effect level	Action
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to	Significant Observed Adverse Effect	Avoid

Perception	Examples of outcomes	Increasing effect level	Action
	sleep. Quality of life diminished due to change in acoustic character of the area.		
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

- 3.3 The NPPF and NPPG reinforce the March 2010 DEFRA publication Noise Policy Statement for England (NPSE), which states three 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.*

- 3.4 Together, the first two aims require that no significant adverse impact should occur and that, where a noise level which falls between a level which represents the lowest observable adverse effect and a level which represents a significant observed adverse effect, then according to the explanatory notes in the statement:

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

- 3.5 Therefore, taking an overview of National policy, it is clear that when considering the impact of noise one must consider the significance of any impact. The presence of an adverse impact in itself is not sufficient to refuse permission.

Local Policy

- 3.6 It is understood that there are no policies or criteria specific to the noise emission of plant within Local Planning Policy.

- 3.7 However, a discussion with the Environmental Health Officer¹ confirmed the requirement for a BS 4142 assessment to avoid complaints from the nearest residents.

BS 4142:2014+A1:2019

- 3.8 BS 4142:2014+A1:2019 *Methods for rating and assessing industrial and commercial sound* describes a method for rating and assessing sound of industrial and/or commercial nature according, in summary, to the following process:

1. Determine the background sound level, in terms of L_{A90} , at the receptor locations of interest.

¹ Telephone call with Luca Gabrielli, 19th January 2023.

2. Determine the specific sound level of the source being assessed, in terms of $L_{Aeq,T}$. The reference period T is 1 hour during the daytime period or 15 minutes during the night-time.
 3. Apply an acoustic feature correction if the source sound has tonal, impulsive, intermittent, or other characteristic which attracts attention to determine the rating level.
 4. Compare the rating level with the background noise level; the greater the difference between the two, the higher the likelihood of complaints of the noise.
 5. A difference (rating level minus the background sound level) of around +10 dB is likely to be an indication of significant adverse impact depending on context; a difference of +5 dB is likely to be an indication of adverse impact, depending on context. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending upon context.
- 3.9 The general intent of the planning system is to ensure that a development does not result in 'significant adverse impacts on health and quality of life' (NPPF para 123). BS 4142 considers that the threshold of 'significant adverse impact' is likely to be around 10 dB or more, depending on the context.
- 3.10 The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound exceeds the background sound level and the context in which it is placed. There are several contextual considerations when assessing the impact of sound including the following:
- The absolute level of sound;
 - The character and level of the specific sound compared to the existing noise climate;
 - The sensitivity of the receptors;
 - The time and duration that the specific sound occurs;
 - The conclusions of assessments undertaken using alternative assessment methods, for example WHO guideline noise values or change in noise level;
 - The ability to mitigate the specific sound through various methods, for example by screening, the selection of quiet plant equipment, the use of attenuators, through the imposition of noise management plans and good practice, façade design and layout/orientation;
 - The form and scale and scale of a development. For example, does the proposed development involve a new industrial/commercial premises or is the proposal the installation of new plant or an extension to an existing premises?
- 3.11 It is therefore entirely possible that whilst the numerical outcome of a BS 4142 assessment is indicative of adverse or even significant adverse impact, when the proposal is considered in context the significance of the impact is reduced to an acceptable level.

4.0 Survey

- 4.1 Sharps Redmore carried out a noise survey at the proposed site on the 26th and 27th January 2023 to determine the background sound level at the NNSR.

Survey Methodology

- 4.2 A sound level meter was set up at the rear of the property at a position representative of the NNSR. The measurement location is shown in Figure 4.1.

Figure 4.1 Sound level meter measurement position



- 4.3 Measurements were carried out with a 01dB Fusion Class 1 sound level meter, which is laboratory calibrated to National standards and certificates are available on request. The meter was field calibrated before and after the survey with no significant drift observed.

Table 4.1 Survey equipment

Description	Make / model	Serial	Calibration expiry
Class 1 sound level meter	01dB Fusion	12500	March 2024
Microphone capsule	GRAS 40CD	292538	March 2024
Calibrator	Brüel & Kjær Type 4231	2586678	August 2023

- 4.4 The temperature ranged from between 0°C and 8°C with no precipitation during the survey period. Wind speeds were less than 5 m/s throughout at the measurement position and did not affect measurements.

Survey Results

- 4.5 The dominant noise source was the extract fan at the rear of the pizza takeaway when it was open, and road traffic noise during other times. Site construction noise did not significantly affect measurements.
- 4.6 There was a hand grinder being used in the adjacent property for a short period between 14:55 and 15:25, then again at 16:08. This has been excluded from the assessment.
- 4.7 A summary of the survey results is shown in Table 4.2.

Table 4.2 Summary of survey results

Measurement start date + time	$L_{Aeq,T}$ (dB)	$L_{Amin,T}$ (dB)	$L_{Amax(fast),T}$ (dB)	$L_{A90,T}$ (dB)	$L_{A10,T}$ (dB)
26/01/2023 13:00	56	46	75	50	59
26/01/2023 14:00	60	44	77	49	57
26/01/2023 15:00	68	47	81	52	74
26/01/2023 16:00	63	50	80	51	58
26/01/2023 17:00	54	49	65	51	55
26/01/2023 18:00	53	49	62	51	55
26/01/2023 19:00	54	49	71	51	55
26/01/2023 20:00	53	49	67	50	54
26/01/2023 21:00	52	49	69	50	54

- 4.8 Based on the results of the survey it is considered that a representative background sound level during the daytime is 50 dB $L_{A90,1hr}$.

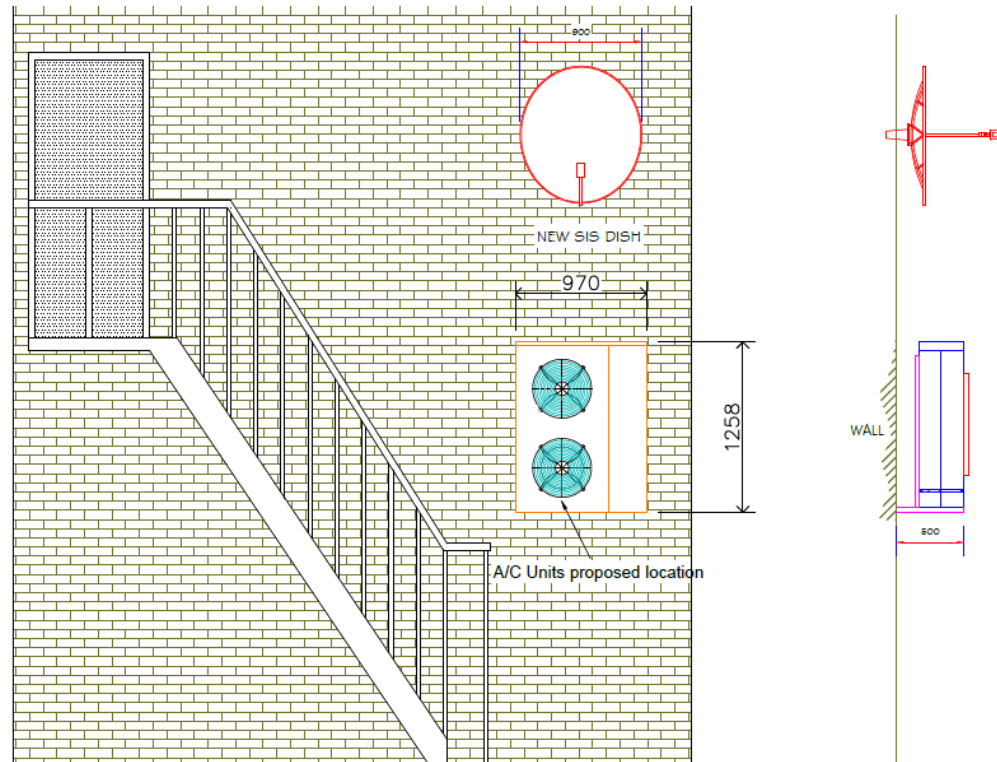
5.0 Noise Sources

5.1 The proposed sources of noise include two external condenser units, as follows:

- Mitsubishi PUHZ-ZRP100YKA
- Mitsubishi SUZ-KA35VA4

5.2 The condensers are proposed to be located at the rear of the building, as shown in Figure 5.1.

Figure 5.1 Proposed plant location



5.3 Noise emission data have been provided by the mechanical engineer and spectral data has also been sourced. These are presented in Table 5.1.

Table 5.1 Condenser noise emission

Condenser Unit	Sound pressure level at 1m (dB)							SWL (dBA)
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	
PUHZ-ZRP100YKA	54	54	53	49	46	41	36	71
SUZ-KA35VA4	49	53	49	46	43	39	33	63

5.4 The values given above and used in calculations are for when the condensers are in heating mode. Cooling mode results in slightly lower sound emission.

6.0 Assessment

- 6.1 The assessment of the proposed plant is considered for the nearest residential garden areas and at the façades of the closest residential properties, understood to be at numbers 6 and 14 Church Street.

Propagation Methodology

- 6.2 The propagation of sound is calculated according to the following formula:

$$L_p = L_w - 20 \lg(r) - 11 + DI$$

where:

L_p is the sound pressure level at the receptor,
 L_w is the sound power level of the noise source,
 r is the distance between source and receptor,
 DI is the directivity index; a correction for reflective surfaces.

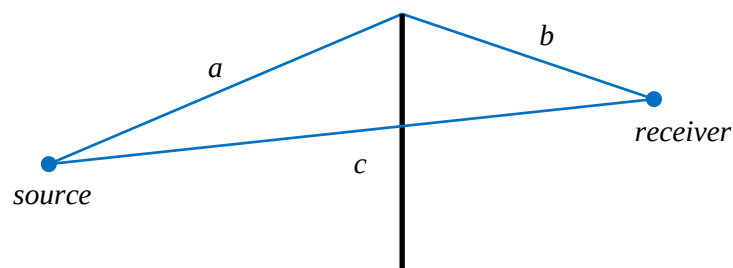
- 6.3 Barrier effects are calculated according to the following formula:

$$Attenuation = -1 \times \left[10 \lg \left\{ 3 + \left(\frac{40 \times f \times PD}{344} \right) \right\} \right]$$

where:

Attenuation is the reduction due to barrier effects,
 f is the frequency band of interest,
 PD is the barrier-receptor path difference.

- 6.4 The 'path difference' is calculated as shown below:



$$PD = a + b - c$$

BS 4142 Assessment

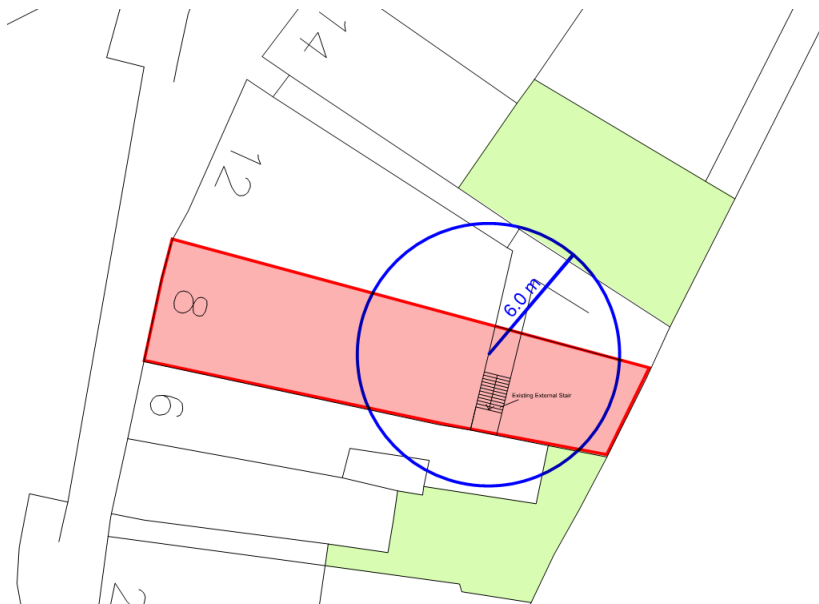
Specific Noise Level: Garden Areas

- 6.5 The nearest residential gardens areas are shown in Figure 6.1 and are 6 metres from the proposed plant at their closest points.
- 6.6 The noise levels within gardens from the proposed condensers, calculated according to the formula in Paragraph 6.2 are presented below.

Table 6.1 Calculated plant noise levels at the nearest garden point

Condenser Unit	Sound pressure level at 6m (dB)							TOTAL L_p (dBA)
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	
PUHZ-ZRP100YKA	50	50	49	45	42	37	32	48
SUZ-KA35VA4	40	44	40	37	34	30	24	40
<i>Specific sound level</i>	<i>51</i>	<i>51</i>	<i>50</i>	<i>46</i>	<i>43</i>	<i>38</i>	<i>33</i>	48

Figure 6.1 Distance to nearest point in residential gardens



- 6.7 No reductions have been applied for barrier effects or ground absorption in the above calculation.

Specific noise level: Residential Façades

- 6.8 The noise levels from the proposed condensers at each of the residential façades is calculated according to the formula in Paragraph 6.2, and then reductions for the barrier effects of the corner of buildings are also applied, as shown in Table 6.2 and Table 6.3.

Figure 6.2 Closest residential façades

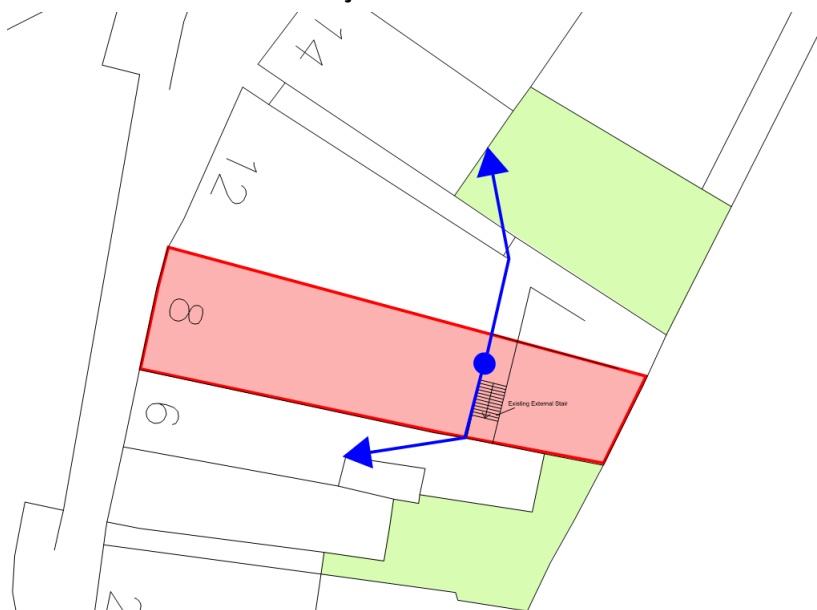


Table 6.2 Calculated plant noise levels at rear façade of No. 14

Description	Sound pressure level at rear of No. 6 Church Street (dB)							TOTAL L_p (dBA)
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	
PUHZ-ZRP100YKA	46	46	45	41	38	33	28	
SUZ-KA35VA4	36	40	36	33	30	26	20	
Barrier reductions	-7	-9	-11	-13	-16	-19	-22	
Specific sound level	39	38	35	29	23	15	7	31

Table 6.3 Calculated plant noise levels at rear façade of No. 6

Description	Sound pressure level at rear of No. 14 Church Street (dB)							TOTAL L_p (dBA)
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	
PUHZ-ZRP100YKA	48	48	47	43	40	35	30	
SUZ-KA35VA4	38	42	38	35	32	28	22	
Barrier reductions	-12	-14	-17	-20	-23	-26	-29	
Specific sound level	37	35	31	24	18	10	2	27

Penalties for Distinguishable Characteristics

- 6.9 Condenser units can exhibit tonal characteristics when running at higher fan speeds. For the gardens, it is predicted that the specific sound level would be just less than the L_{A90} background sound level and, as such, any tonal effects would only be just audible. Therefore, a penalty for tonality of +2 dB is applied for gardens.
- 6.10 At the residential facades, the specific sound level is much lower than the background sound level and consequently tonal characteristics would not be expected to be audible.

Rating Level

- 6.11 The plant noise rating level ($L_{Ar,Tr}$) is calculated by adding the penalties to the specific noise level ($L_{Aeq,Tr}$). The rating level for each noise-sensitive location is given in Table 3.1 below, along with the reference background sound level ($L_{A90,T}$).

Table 6.4 BS 4142 Results

	6 Church Street (Garden)	6 Church Street (Facade)	14 Church Street (Garden)	14 Church Street (Facade)
Specific level, $L_{Aeq,Tr}$ (dB)	48	27	48	31
Penalties (dB)	+2	-	+2	-
Rating level, $L_{Ar,Tr}$ (dB)	50	27	50	31
Background, L_{A90} (dB)	50	50	50	50
Rating relative to background (dB)	0	-13	0	-19

- 6.12 The results of the assessment show that the plant noise rating level in gardens does not exceed the background sound level. The rating level is significantly below the background sound level at the façades of nearby residences.

Contextual Considerations

- 6.13 The site and neighbouring NNSL are within the town centre of Radcliffe which is subject to the background noise environment that would be expected for this type of location, including constant road traffic noise.
- 6.14 The pizza takeaway at No. 4 Church Street has a large extract fan and ductwork exhausting externally at the rear of the building. As such fan noise is already a part of the existing noise environment.
- 6.15 The pizza extract fan is operational during the opening hours of the takeaway, which are 4pm every day until 11:30pm Sunday to Thursday and until 12:30am on Fridays and Saturdays. As such, this extract would be operational at the same time as the proposed condensers during what could be considered the more sensitive 'evening' period.
- 6.16 The proposed plant will only be operational during the daytime period and consequently would not have any implications for sleep disturbance.
- 6.17 The calculated noise levels at the façade of the buildings such that any noise ingress into bedrooms or other occupied rooms would be significantly lower than the guideline internal noise levels specified within BS 8233:2014 and by the WHO. This is 35 dB $L_{Aeq,16\text{-hour}}$ during the daytime.

Limitations and Accuracy

- 6.18 Every reasonable endeavour has been made to minimise uncertainty in measurements and calculations.
- 6.19 Survey equipment is calibrated periodically and on site to maintain measurement accuracy.
- 6.20 Plant noise levels have been calculated on a reasonable 'worst-case' basis using the published data when the plant noise is highest, i.e. during heating. In practice the condensers will vary in duty according to demand and much of the time noise emission would be lower.

Assessment of the Impacts

- 6.21 Based on the information provided within this report, the calculated plant noise rating level does not exceed the background sound level. At the façades of the nearest residential noise-sensitive receptors predicted noise levels are significantly lower than the measured background sound level.
- 6.22 As such, in accordance with the assessment procedures of BS 4142:2014, the proposed condensers would have a low impact.
- 6.23 In terms of assessment according to Planning guidance and the NPPG hierarchy, the proposed condensers would have No Observed Adverse Effects.

APPENDIX A

Survey Time History Chart

