

St Stephens Court
Shieldborn Drive
Harpurhey
Manchester
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Plant Noise Impact Assessment

On behalf of



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Executive Summary

Noise Solutions Limited has been appointed to provide a noise impact assessment of an air source heat pump within the grounds of St Stephens Court, Harpurhey, Manchester.

Plant noise levels have been predicted at the nearest residential windows. The assessment shows that noise from the proposed plant will comply with the local authority's usual requirements and should therefore be acceptable.

1.0 Introduction

- 1.1. Noise Solutions Ltd (NSL) has been commissioned by Fairheat to provide a noise impact assessment of an air source heat pump to be installed within the grounds of St Stephens Court, Harpurhey, Manchester.
- 1.2. An environmental sound survey has been undertaken to establish the prevailing background sound pressure levels at a location representative of the sound levels outside the nearest noise sensitive receptors to the site.
- 1.3. Plant noise levels have been predicted at the nearest noise-sensitive premises and assessed against the local authority's usual requirements and other recognised standards and guidance.
- 1.4. To assist with the understanding of this report a glossary of acoustic terms can be found in [Appendix A](#). An in-depth glossary of acoustic terms can be viewed online at www.acoustic-glossary.co.uk.

2.0 Details of development proposals

- 2.1. It is proposed to install one air source heat pump (ASHP) within the grounds of St Stephens Court, Harpurhey, Manchester. This will be fitted with an attenuation package and contained within a decorative timber screen.
- 2.2. A site plan showing the site and surrounding area and the noise monitoring location used in this assessment is presented in [Appendix B](#).
- 2.3. The proposed plant location is shown in [Appendix D](#). Plant noise data is given in [Appendix E](#). The plant will operate at all times, with a night-time set-back to 75% of its nominal operating duty.

3.0 Nearest noise-sensitive receptors

- 3.1. The nearest noise-sensitive receptors to the proposed ASHP are within St Stephens Court (Receptor R1) and are shown in the photograph in [Appendix F](#).
- 3.2. A concrete plank wall approximately 1.5m high surrounds the grounds of St Stephens Court. The nearest houses neighbouring St Stephens Court are approximately 55m from the plant location and will be screened from all plant locations by the boundary wall.
- 3.3. Harpurhey Community Church is immediately to the north of the site. There are understood to be no opening windows on the elevation closest to St Stephens Court.

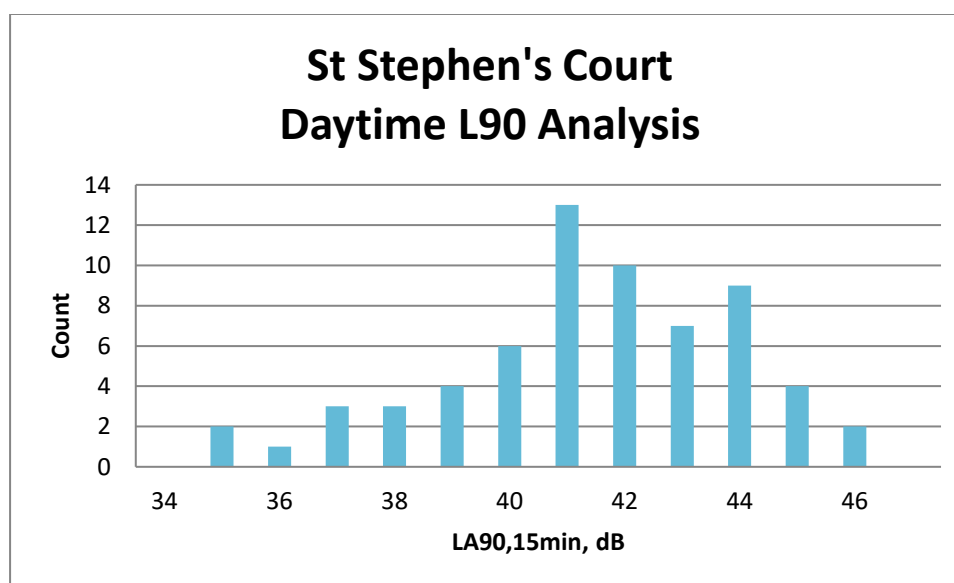
4.0 Existing noise climate

- 4.1. An environmental noise survey was undertaken to establish the typical background sound levels at a location representative of the noise climate outside the façades of the nearest noise sensitive receptors to the proposed plant area during the quietest times at which the plant will operate.
- 4.2. The results of the environmental sound survey are summarised in Table 1 below. The full set of measurement results and details of the survey methodology are presented in [Appendix C](#).

Table 1 Summary of survey results

Measurement period	Range of recorded sound pressure levels (dB)			
	L _{Aeq} (15mins)	L _{Amax} (15mins)	L _{A10} (15mins)	L _{A90} (15mins)
Daytime (07.00 – 23.00 hours)	40-61	55-91	43-55	35-46
Night-time (23.00 – 07.00 hours)	32-70	39-95	34-53	29-40

Figure 1 Histogram of daytime L_{A90} background sound pressure levels



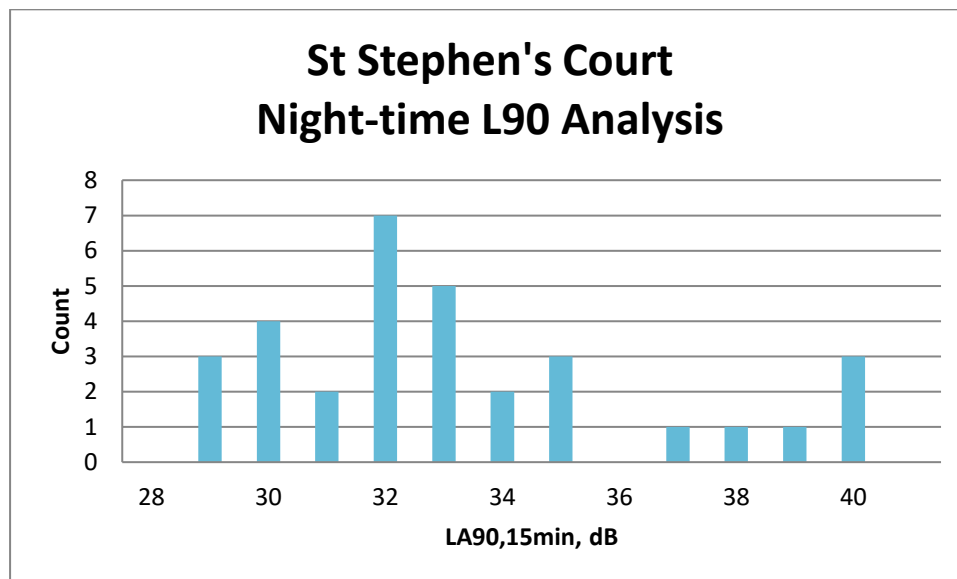
- 4.3. Further statistical analysis has been carried out on the data; the mean, modal and median values are shown in Table 2 below.

Table 2 Statistical analysis of L_{A90,15min} levels during the daytime period

dB, L _{A90} daytime period	
mean	41
modal	41
median	41

- 4.4. From the histogram analysis, 39dB has been selected to be a robust representation of the background noise level during the daytime period.

Figure 2 Histogram of night-time L_{A90} background sound pressure levels



- 4.5. Further statistical analysis has been carried out on the data; the mean, modal and median values are shown in Table 2 below .

Table 3 Statistical analysis of $L_{A90,15min}$ levels during the night-time period

dB, L_{A90} night-time period	
mean	33
modal	32
median	32

- 4.6. Again, from the histogram analysis, 32dB has been selected to be a robust representation of the background sound level during the night-time period.
- 4.7. Therefore, the following values are considered representative of the existing background sound pressure levels at nearby noise sensitive premises:
- 39dB L_{A90} during the daytime period; and
 - 32dB L_{A90} during the night-time period.

Covid-19

- 4.8. It should be noted that the environmental noise survey discussed in this report was undertaken in June-July 2021, at a time when the coronavirus pandemic was causing a disruption to typical working patterns and other activity. It is therefore likely that recorded sound levels are slightly lower than would otherwise be expected where dominated by road or air traffic. While the data should therefore be treated with an element of caution, where it has been used to establish background sound levels it is likely to understate the more-usual background sound levels and therefore result in a robust assessment.

5.0 Plant noise design criteria

Manchester City Council

- 5.1. For similar plant installations, Manchester City Council usually requires that a noise impact assessment is undertaken using the methodology described in BS 4142:2014 "Methods for rating and assessing industrial and commercial sound", with the plant sound level at the most-affected residential window being at least 5dB below the existing representative background sound level.

BS4142:2014 'Methods for Rating and Measuring Industrial and Commercial Sound'

- 5.2. British Standard (BS) 4142:2014 describes a method for rating and assessing sound of an industrial or commercial nature, which includes sound from fixed installations which comprise mechanical and electrical plant and equipment.
- 5.3. The industrial or commercial sound is assessed outside a dwelling or premises used for residential purposes, upon which sound is incident.
- 5.4. The procedure contained in BS 4142 is to quantify the "specific sound level", which is the measured or predicted level of sound from the source in question over a one-hour period for the daytime and a 15-minute period for the night-time. Daytime is defined in the standard as 07:00 to 23:00 hours, and night-time as 23:00 to 07:00 hours.
- 5.5. The specific sound level is converted to a rating level by adding penalties on a sliding scale to account for either potentially tonal or impulsive elements. The standard sets out objective methods for determining the presence of tones or impulsive elements, but notes that it is acceptable to subjectively determine these effects.
- 5.6. The penalty for tonal elements is between 0dB and 6dB, and the standard notes: "Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible."
- 5.7. The penalty for impulsive elements is between 0dB and 9dB, and the standard notes: "Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible."
- 5.8. The background sound level should be established in terms of the L_{A90} noise index. The standard states that the background sound level should be measured over a period of sufficient length to obtain a representative value. This should not normally be less than 15-minute intervals. The standard states that: *"A representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either the minimum or modal value."*

- 5.9. The assessment outcome results from a comparison of the rating level with the background sound level. The standard states:

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.

Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact."

- 5.10. The standard goes on to note that: "Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night."

- 5.11. In addition to the margin by which the Rating Level of the specific sound source exceeds the Background Sound Level, the 2014 edition places emphasis upon an appreciation of the context, as follows:

"An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context."

- 5.12. BS 4142 requires uncertainties in the assessment to be considered, and where the uncertainty is likely to affect the outcome of the assessment, steps should be taken to reduce the uncertainty.

Low background sound levels

- 5.13. In view of the low night-time background sound levels, and as described in BS 4142:2014, it is proposed that noise from the new plant is limited to a rating level of 30 dB outside the nearest residential windows at night. This would typically result in an internal noise level of around

15 dB(A) with windows open, a level below that produced by refrigerators and similar items within the nearest premises.

Summary of criteria

- 5.14. As noted previously, the local authority usually requires that the sound level of new plant at the nearest residential receptor is at least 5dBA below the representative background sound level, the latter having a lower limit of 30dBA. The proposed plant limits are therefore as shown in Table 4.

Table 4 Proposed plant noise emissions level limits at nearest residential receptors

Period	Plant sound level limit
	Residential dB L _{Ar,Tr}
Daytime (07.00 – 23.00 hours)	34
Night-time (23.00 – 07.00 hours)	30

- 5.15. These limits will result in a plant noise rating level below that at which a “low impact” would be expected, according to the method described in BS 4142:2014.

6.0 Plant noise impact assessment

- 6.1. Plant noise levels have been predicted at the nearest and most affected receptors. Calculations include corrections for distance and surface directivity.
- 6.2. Table 5 summarises the results of the plant noise impact assessment. Full calculations for the night-time period can be found in [Appendix G](#).

Table 5 Plant noise impact assessment

Receptor	Period	Predicted noise sound level at receptor window, L _{Aeq} (dB)	Plant noise criterion at receptor window (dB)	Difference (dB)
R1	Daytime (07.00 - 23.00 hours)	33	34	-1
	Night-time (23.00 - 07.00 hours)	29	30	-1

- 6.3. The assessment shows that noise from the proposed plant will comply with the local authority's usual requirements.

Context and uncertainties

- 6.4. As BS 4142:2014 advises, the impact must be considered within the context of the site and the surrounding acoustic environment. The following must, therefore, also be taken into consideration when determining the potential impact that may be experienced:
- The assessment is undertaken at the most-affected residential windows. The impact on all other nearby residential windows will be lower due to screening and distance attenuation.
 - The assessment has been made with all plant operating at maximum capacity, as this is not always the case, the assessment is an absolute worst-case scenario.
- 6.5. Where possible uncertainty in this assessment has been minimised by taking the following steps:
- The measurement of the background sound levels was undertaken over a period including the quietest times of the day and night.
 - The sound level meter and calibrator used have a traceable laboratory calibration and the meter was field calibrated before and after the measurements.
 - Uncertainty in the calculated impact has been reduced by the use of a well-established calculation method.
 - Care was taken to ensure that the measurement position was representative of the noise climate outside the nearby residential dwellings and not at a position where higher noise levels are present.

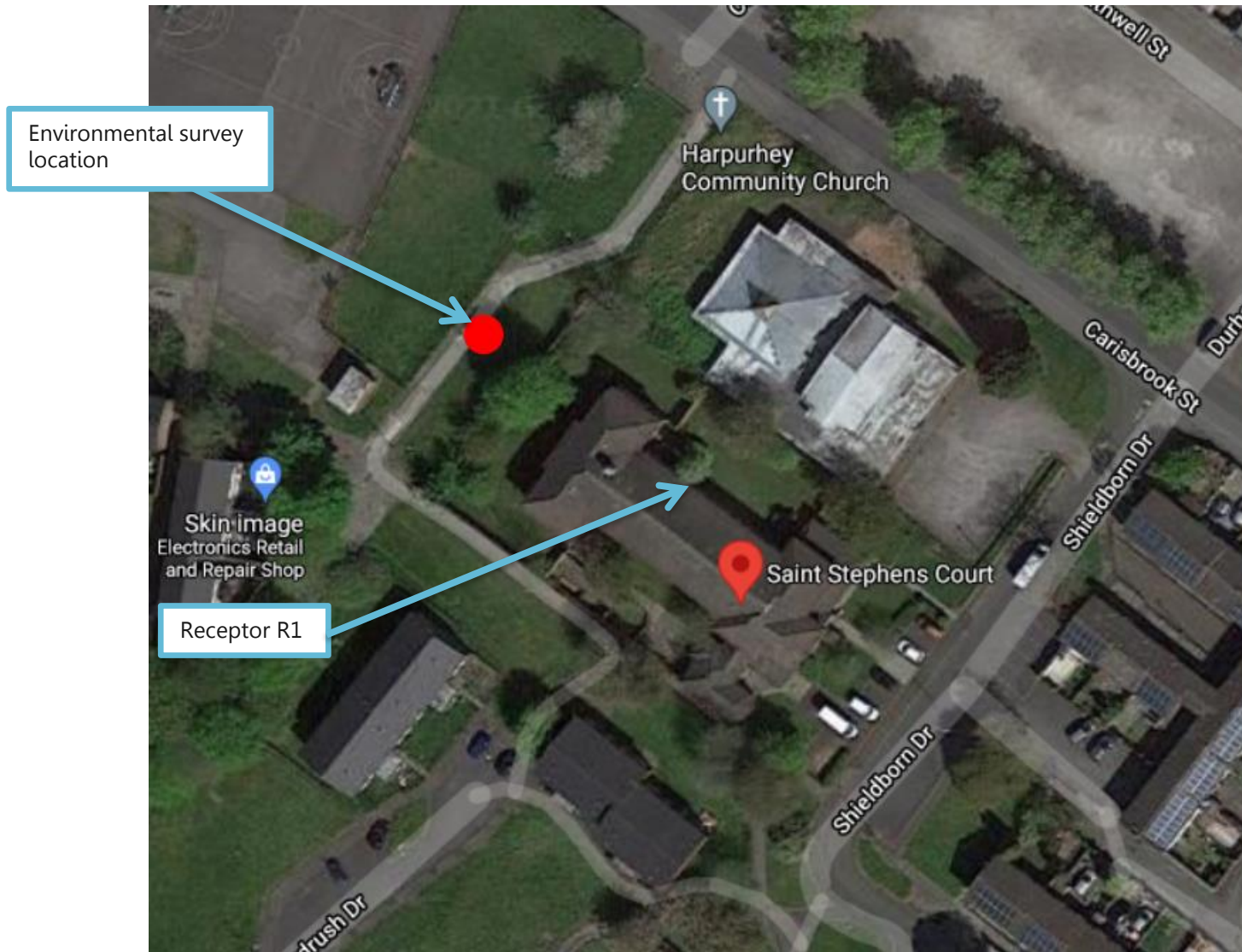
7.0 Summary

- 7.1. Noise Solutions Ltd has been commissioned by Fairheat to provide a noise impact assessment of an air source heat pump within the grounds of St Stephens Court, Harpurhey, Manchester.
- 7.2. An environmental noise survey has been undertaken to establish the existing prevailing noise levels at a location representative of the noise climate affecting the area.
- 7.3. The assessment shows that noise from the proposed plant will comply with the local authority's usual requirements and should therefore be acceptable to them.

Appendix A Acoustic terminology

Parameter	Description
Ambient Noise Level	The totally encompassing sound in a given situation at a given time, usually composed of a sound from many sources both distant and near ($L_{Aeq,T}$).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s_1 and s_2 is given by $20 \log_{10} (s_1/s_2)$. The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is $20\mu\text{Pa}$. The threshold of normal hearing is in the region of 0 dB and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.
dB(A), L_{Ax}	Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. 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. The background noise in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).
Fast Time Weighting	Setting on sound level meter, denoted by a subscript F, that determines the speed at which the instrument responds to changes in the amplitude of any measured signal. The fast time weighting can lead to higher values than the slow time weighting when rapidly changing signals are measured. The average time constant for the fast response setting is 0.125 (1/8) seconds.
Free-field	Sound pressure level measured outside, far away from reflecting surfaces (except the ground), usually taken to mean at least 3.5 metres
Façade	Sound pressure level measured at a distance of 1 metre in front of a large sound reflecting object such as a building façade.
$L_{Aeq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level recorded during a noise event with a period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise. $L_{A10,18h}$ is the A-weighted arithmetic average of the 18 hourly $L_{A10,1h}$ values from 06:00-24:00.
$L_{90,T}$	A noise level index. The noise level exceeded for 90% of the time over the period T. Generally used to describe background noise level.

Appendix B Photograph of site showing areas of interest



Appendix C Environmental sound survey

Details of environmental sound survey

- C.1 Measurements of the existing background sound levels were undertaken from 12.00 hours on Wednesday 30th June to 12.00 hours on Thursday 1st July 2021.
- C.2 The sound level meter was programmed to record the A-weighted L_{eq} , L_{90} , L_{10} and L_{max} noise levels for consecutive fifteen-minute sample periods for the duration of the survey.

Measurement position

- C.3 The sound level meter was positioned on a lamppost on the public footpath to the west of St Stephens Court. The approximate location of the microphone is indicated on the plan in [Appendix B](#).
- C.4 In accordance with BS 7445-2:1991 '*Description and measurement of environmental noise – Part 2: Guide to the acquisition of data pertinent to land use*', the measurements were undertaken under free-field conditions.

Equipment

- C.5 Details of the equipment used during the survey are provided in the table below. The sound level meter was calibrated before and after the survey; no significant change (+/-0.2 dB) in the calibration level was noted.

Environmental noise survey

Description	Model / serial no.	Calibration date	Calibration certificate no.
Class 1 Sound level meter	Rion NL-52 / 00654035	07/06/2021	1500431
Condenser microphone	Rion UC-59 /08290		
Preamplifier	Rion NH-25 / 54080		
Calibrator	Rion NC-74 /34235932	20/08/2020	TCRT20/1469

Weather conditions

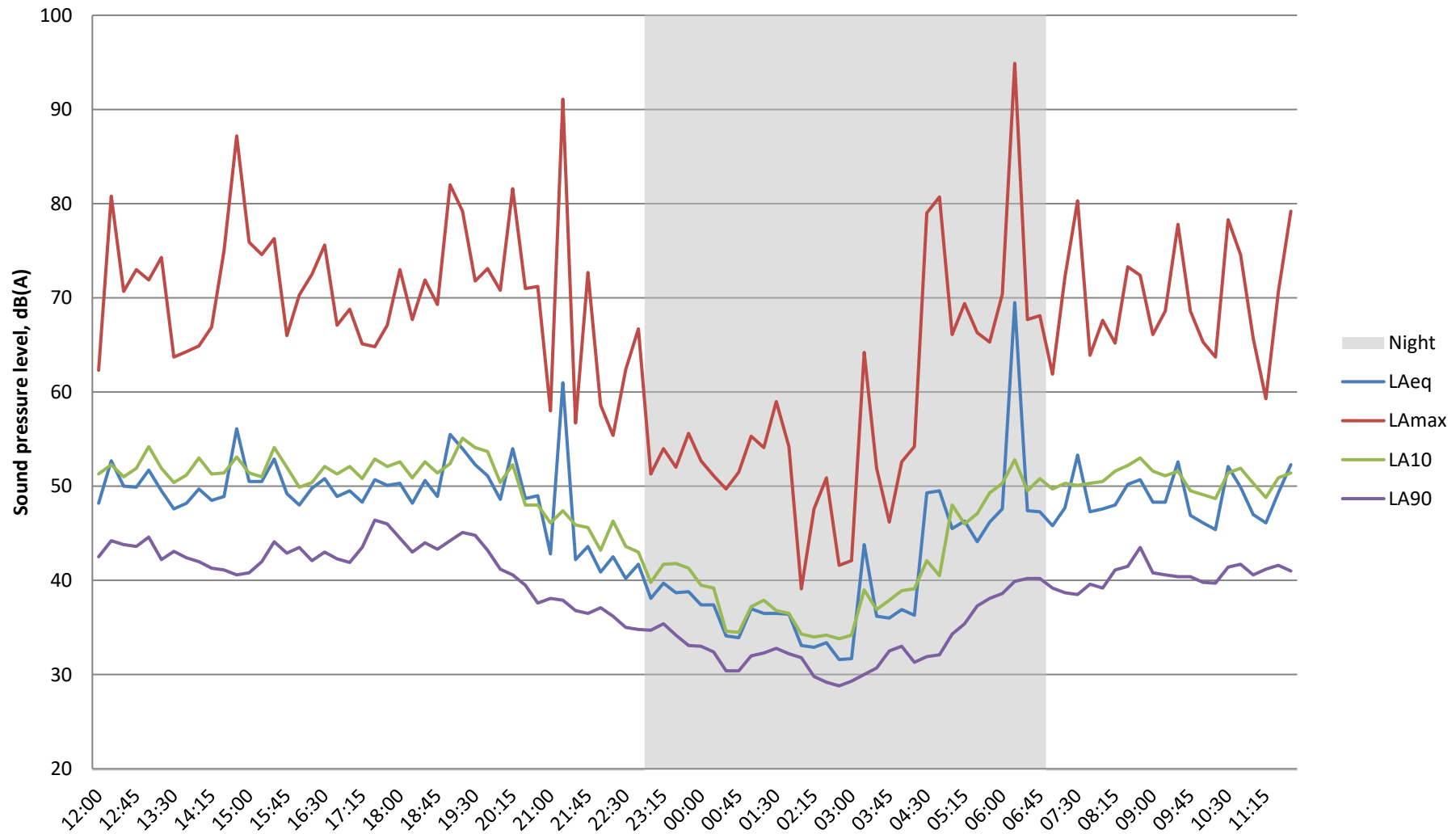
- C.6 Weather conditions were determined both at the start and on completion of the survey. It is considered that the meteorological conditions were appropriate for environmental noise measurements. The table below presents the weather conditions recorded on site at the beginning and end of the survey.

Weather Conditions				
Measurement Location	Date/Time	Description	Beginning of Survey	End of Survey
As indicated on Appendix B	12.00 30 Jun to 12.00 1 Jul 2021	Temperature (°C)	18	20
Cloud Cover Symbol Scale in oktas (eighths) 0 Sky completely clear 1 2 3 4 Sky half cloudy 5 6 7 8 Sky completely cloudy (9) Sky obstructed from view		Precipitation:	No	No
		Cloud cover (oktas - see guide)	7	3
		Presence of fog/snow/ice	No	No
		Presence of damp roads/wet ground	No	No
		Wind Speed (m/s)	-	<1
		Wind Direction	-	NE
		Conditions that may cause temperature inversion (i.e. calm nights with no cloud)	No	No

Results

- C.7 The results of the environmental survey are considered to be representative of the background sound pressure levels at the façades of the nearest noise sensitive receptors during the quietest times at which the plant will operate. The main noise source affecting the area was birdsong, with some noise from people and occasional aircraft noise. The results of the survey are presented in a time history graph overleaf.

St Stephen's Court Wednesday 30 Jun - Thursday 01 Jul 2021



Appendix D Aerial view showing proposed plant location



Appendix E Plant noise data

Plant item	Make/Model	Quantity	Period	Sound Powel Level
Air source heat pump	Mitsubishi CAHV-P500YA-HPB	1	Day	71 dBA
			Night	67 dBA

Appendix F Nearest windows to each potential plant location

Nearest windows (viewed from proposed plant location)



Appendix G Plant noise calculations

Receptor R1

Period	Source sound power level L_{WA} (dB)	Distance correction		Surface Reflections dB	Attenuation, dBA *	Plant sound level at receptor, dB L_{Aeq}
		Distance to receptor (m)	Correction (dB)			
Day	71	9	-27	+3	-14	33
Night	67	9	-27	+3	-14	29

**Allaway Acoustics AA303S attenuation package*