Trent Court

Lomas Street
Edgeley
Stockport
SK3 9DJ

Plant Noise Impact Assessment

On behalf of

FairHeat

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For and on behalf of Noise Solutions Ltd				

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01	30 Apr 21	Plant and acoustic screen arrangement confirmed	NAC	JS

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Appendices

Executive Summary

Noise Solutions Limited has been appointed to undertake a noise impact assessment of an air source heat pump to be installed at Trent Court, Edgeley, Stockport.

The assessment shows that, with the mitigation specified in this report, the proposed plant meets the local authority's usual requirements and should therefore be acceptable to them.

1.0 Introduction

1.1. Noise Solutions Ltd (NSL) has been commissioned by Fairheat to provide a noise impact assessment of proposed air source heat pumps to be installed at Trent Court, Edgeley, Stockport.

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 two air source heat pumps (ASHP) on the roof of Trent Court, on Lomas Street in Edgeley, Stockport. The installation of the units will enable a significant reduction in emissions from the existing heating systems serving the building.

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. Plant noise data is given in **Appendix D**.

2.4. Each ASHP unit will be fitted with an acoustic attenuation package, and the units will be housed within a 2400mm high acoustic screen to further reduce noise to the surroundings. The general arrangement of the screen is shown in **Appendix F**. The screen is to be solid, with no holes, and with a mass of at least 7kg/m^2 (for example, close-boarded timber fence or purpose-built acoustic panel system). The bottom 300mm of the screen perimeter is to be open to provide adequate air circulation.

3.0 Nearest noise-sensitive receptors

3.1. The nearest noise-sensitive receptors to the proposed ASHP are within Trent Court.

3.2. While the closest windows of the building (Receptor R1) are screened from the plant by the building envelope, windows on the north, south west and south east wings (R2, R3, R4 respectively) potentially have a view of the plant. These windows are shown in the photographs in **Appendix B**.

4.0 Existing noise climate

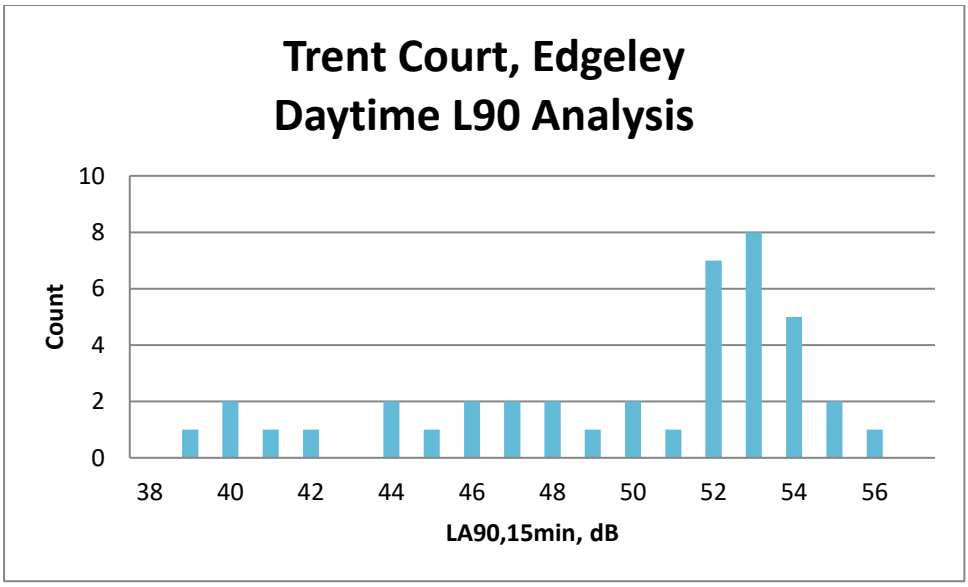
4.1. An environmental noise survey was undertaken to establish the typical background sound levels at a location representative of the noise climate outside the façades of the nearest noise sensitive receptors to the proposed plant area during the quietest times at which the plant will operate.

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)	51-62	62-88	55-64	39-56
Night-time (23.00 – 07.00 hours)	42-57	56-80	42-60	33-51

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



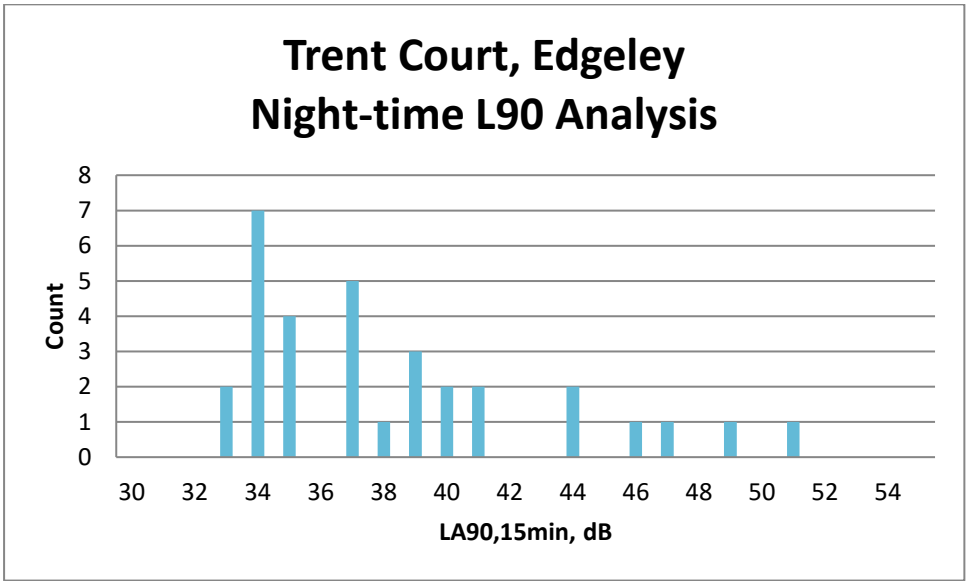
4.3. Further statistical analysis has been carried out on the data, and the mean and median values are shown in Table 2 below.

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

dB, L_{A90} daytime period	
mean	50
modal	53
median	52

4.4. From the histogram analysis, 42dB 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 and the mean and median values are shown in Table 3 below.

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

dB, L_{A90} night-time period	
mean	38
modal	34
median	37

4.6. Again, from the histogram analysis, 34dB 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:

- 42dB L_{A90} during the daytime period; and
- 34dB 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 April 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

Stockport Metropolitan Borough Council

5.1. For similar plant installations, Stockport Metropolitan Borough Council usually requires that a noise impact assessment is undertaken using the methodology described in BS 4142:2104 "Methods for rating and assessing industrial and commercial sound", with the rating noise level at the most-affected residential window being no higher than 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.

Summary of criteria

5.13. As noted previously, the local authority usually requires that the rating level of new plant, at the nearest residential receptor is no higher than the existing background sound level. 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 rating level
	Residential dB $L_{Ar,Tr}$
Daytime (07.00 – 23.00 hours)	42
Night-time (23.00 – 07.00 hours)	34

5.14. 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 assessment

6.1. Plant noise levels have been predicted at the nearest and most affected receptors. Calculations include corrections for distance, surface directivity and acoustic screening provided by the building envelope (where applicable) and the proposed 2400mm high acoustic screen.

6.2. The proposed plant will be inverter driven and therefore will gradually ramp up and down according to demand and is therefore not expected to contain any impulsive or intermittent features. In order to be robust, a penalty of 3dB as described in BS 4142:2014 may be applied for the *possible presence of "…characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment…".*

6.3. Table 5 summarises the results of the plant noise impact assessment. A series of calculations can be found in **Appendix E**.

Table 5 Plant noise impact assessment

Receptor	Period	Predicted noise rating level at receptor window, $L_{Ar,Tr}$ (dB)	Plant noise criterion at receptor window (dB)	Difference (dB)
R1	Daytime (07.00 - 23.00 hours)	29	42	-13
	Night-time (23.00 – 07.00 hours)	29	34	-5

Receptor	Period	Predicted noise rating level at receptor window, $L_{Ar,Tr}$ (dB)	Plant noise criterion at receptor window (dB)	Difference (dB)
R2	Daytime (07.00 - 23.00 hours)	34	42	-8
	Night-time (23.00 – 07.00 hours)	34	34	0
R3	Daytime (07.00 - 23.00 hours)	32	42	-10
	Night-time (23.00 – 07.00 hours)	32	34	-2
R4	Daytime (07.00 - 23.00 hours)	29	42	-13
	Night-time (23.00 – 07.00 hours)	29	34	-5

6.4. The predictions demonstrate that cumulative noise emissions from the proposed equipment will comply with the proposed limits.

Context and uncertainties

6.5. 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.

6.6. 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.

Control of vibration and structure borne noise

6.7. To limit the risk of vibration entering the structure and being re-radiated within the residential units, the ASHPs and attached pipes etc. must be isolated from the structure by suitable vibration isolators.

6.8. It is recommended that an acoustic assessment of the roof is undertaken in order to determine whether additional treatment is required to control noise to the rooms below to acceptable levels.

7.0 Summary

7.1. Noise Solutions Ltd has been commissioned by Fairheat to provide a noise impact assessment of proposed roof-mounted air source heat pumps to be installed at Trent Court, Edgeley, Stockport.

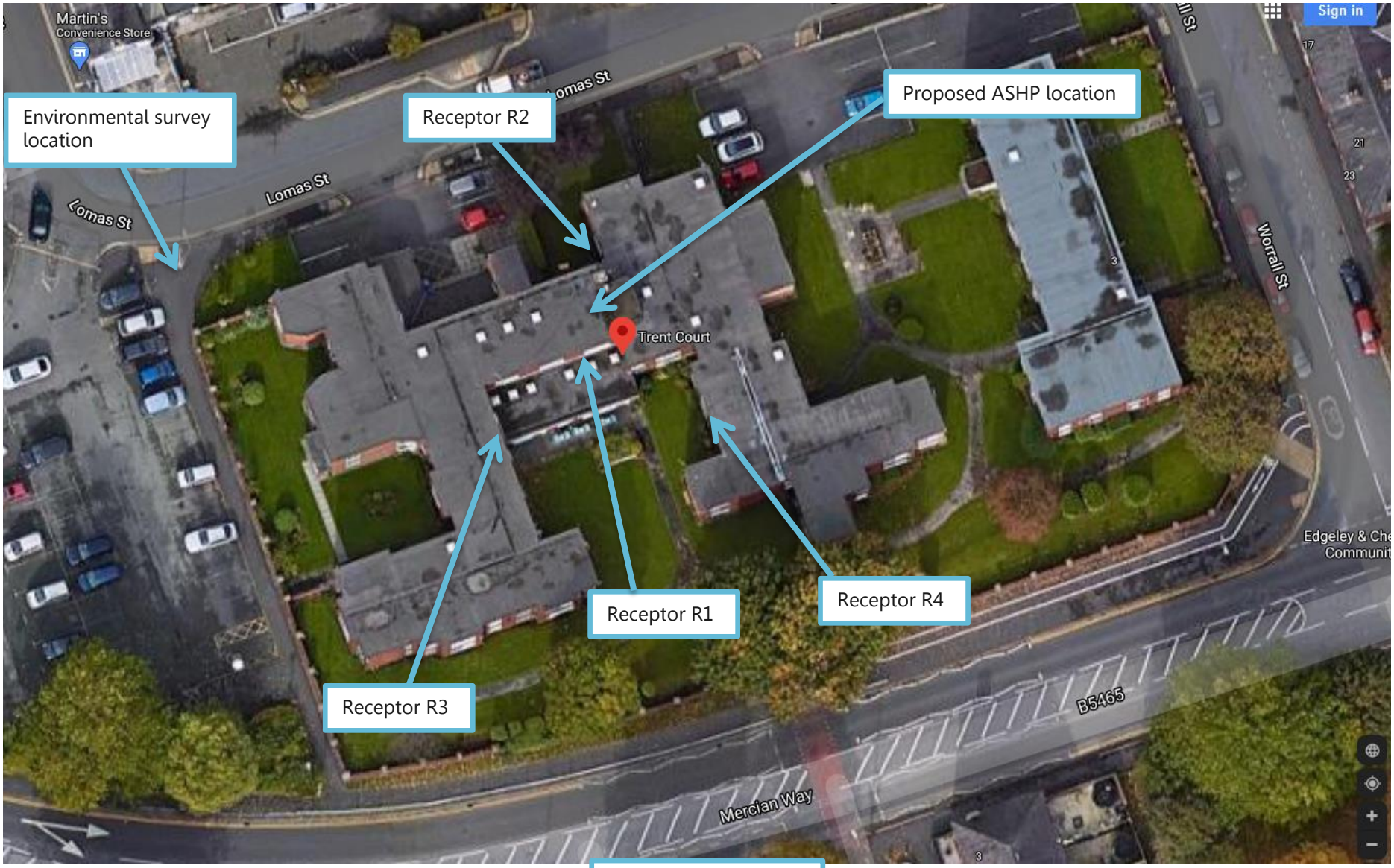
7.2. An environmental noise survey has been undertaken to establish the existing prevailing noise levels at a location representative of the noise climate outside the nearest noise sensitive receptors to the proposed site.

7.3. The assessment shows that, when attenuated as detailed in this report, noise from the proposed plant will comply with the local authority's usual requirements and other recognised standard and guidance and should therefore be acceptable.

Appendix A Acoustic terminology

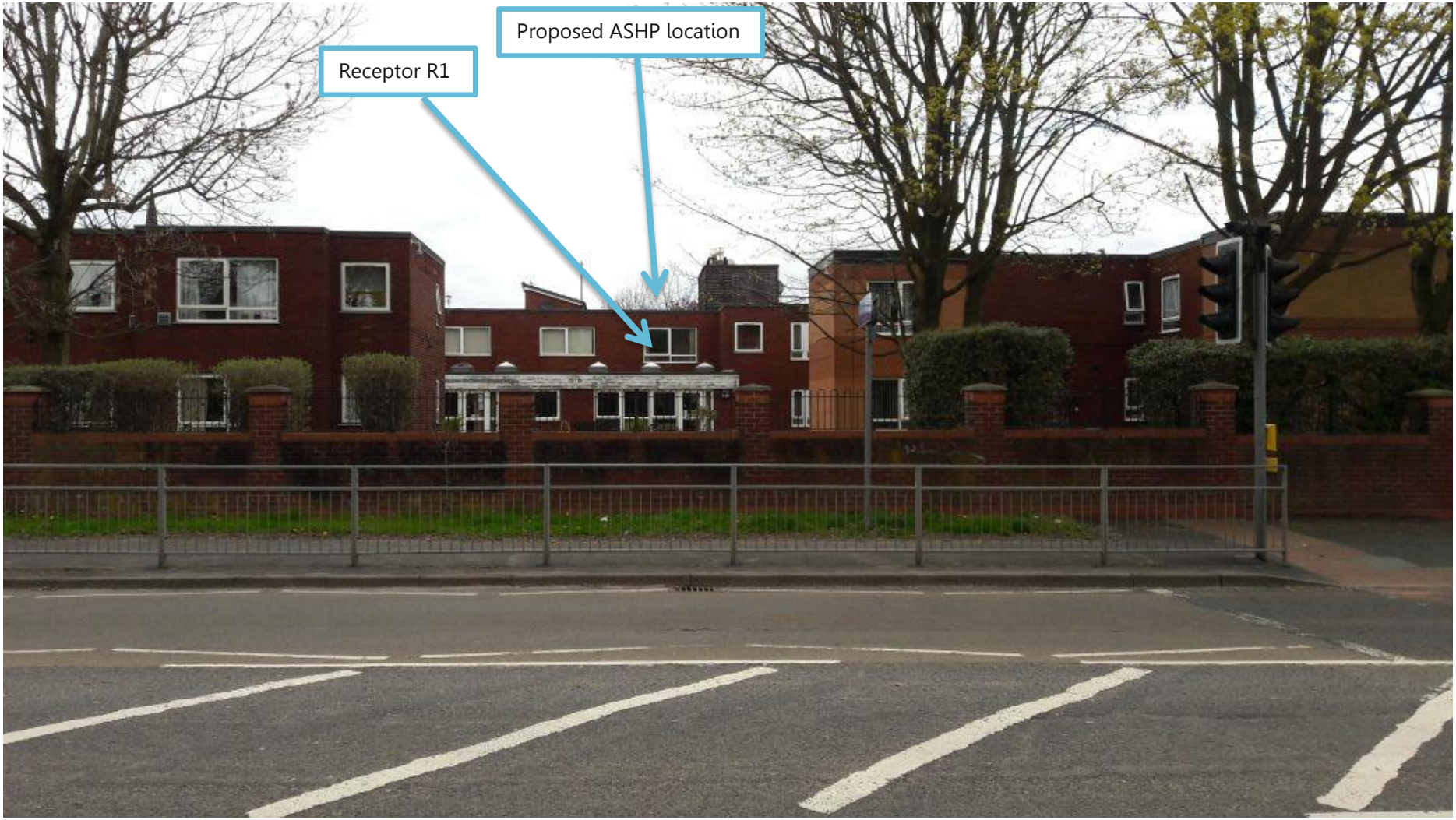
Parameter	Description
Ambient Noise Level	The totally encompassing sound in a given situation at a given time, usually composed of a sound from many sources both distant and near ($L_{Aeq,T}$).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 $\log_{10}$ (s1/s2). 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 20µPa. 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 Photographs of site showing areas of interest



View from Lomas Street

View from Mercian Way



Appendix C Environmental sound survey

Details of environmental sound survey

C.1 Measurements of the existing background sound levels were undertaken from 17.15 hours on Wednesday 7th April to 11.30 hours on Thursday 8th April 2021.

C.2 The sound level meter was programmed to record the A-weighted L_{eq}, L_{90}, L_{10} and L_{max} noise indices 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 Lomas Street. 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

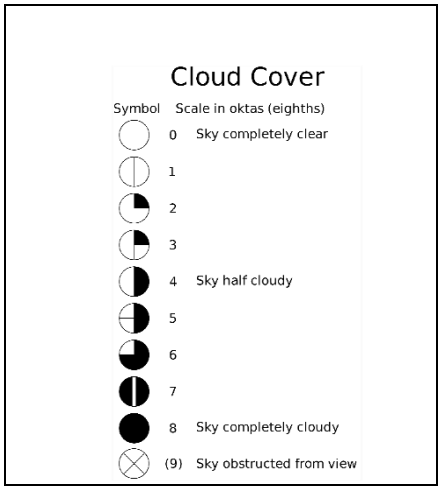
C.5 Details of the equipment used during the survey are provided in the table below. The sound level meter was calibrated before and after the survey; no significant change (+/-0.2 dB) in the calibration level was noted.

Environmental noise survey

Description	Model / serial no.	Calibration date	Calibration certificate no.
Class 1 Sound level meter	Rion NL-52 / 00876023	11/02/2021	00000924-1
Condenser microphone	Rion UC-59 /14826		
Preamplifier	Rion NH-25 / 87474		
Calibrator	Rion NC-74 /34235932	20/08/2020	TCRT20/1469

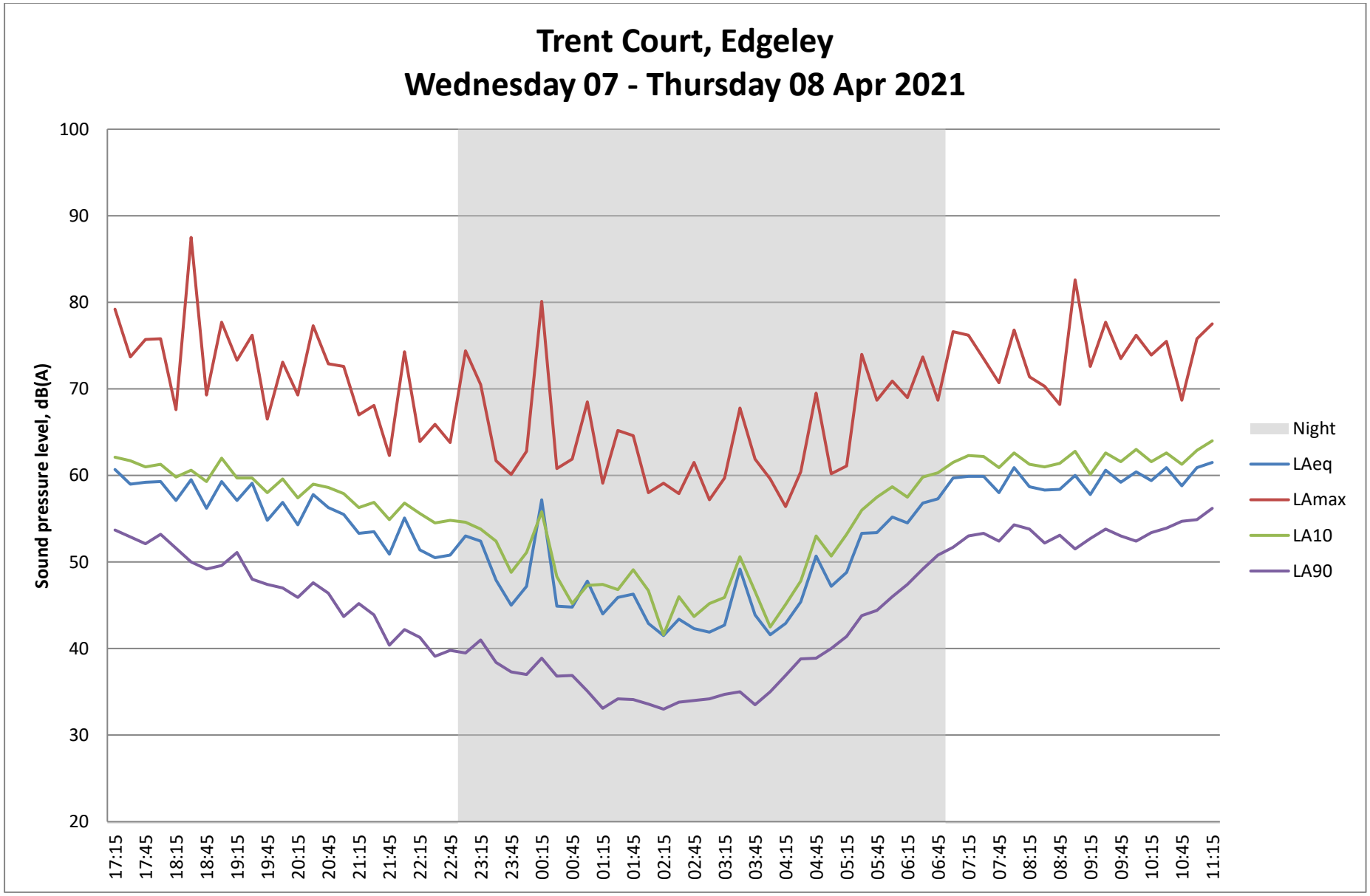
Weather conditions

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	17.15 7 Apr to 11.30 8 Apr 2021	Temperature (°C)	8	10
		Precipitation:	No	No
		Cloud cover (oktas - see guide)	7	7
		Presence of fog/snow/ice	No	No
		Presence of damp roads/wet ground	No	No
		Wind Speed (m/s)	4	4
		Wind Direction	W	SW
		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 local traffic, predominantly on Mercian Way. The results of the survey are presented in a time history graph overleaf.


Trent Court, Edgeley
Wednesday 07 - Thursday 08 Apr 2021
Sound pressure level, dB(A)
100
90
80
70
60
50
40
30
20
17:15
17:45
18:15
18:45
19:15
19:45
20:15
20:45
21:15
21:45
22:15
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04:15
04:45
05:15
05:45
06:15
06:45
07:15
07:45
08:15
08:45
09:15
09:45
10:15
10:45
11:15
Night
LAeq
LAmax
LA10
LA90

Appendix D Plant noise data

Plant item	Make/Model	Quantity	Period	Sound Powel Level
Air source heat pumps	Mitsubishi CAHV-P500YA-HPB	2	Day and night	71 dBA (each)

Each ASHP is to be fitted with an Ambient Acoustics Ltd Acoustic Kit providing 8dBA attenuation

Appendix E Plant noise calculations

R1 – Windows – central spine

Plant item	Source noise level (each) L_{wA} (dB)	Distance correction		Correction for two units	Reflections dB	Attenuation (dB)	Acoustic screening (dB)*	BS4142 correction (dB)	Resultant at receptor R1, L_{Aeq} (dB)
		Distance to receptor (m)	Correction (dB)						
ASHP	71	3.8	-20	3	0	-8	-20	3	29

R2 – Windows - north wing

Plant item	Source noise level (each) L_{wA} (dB)	Distance correction		Correction for two units	Reflections dB	Attenuation (dB)	Acoustic screening (dB)*	BS4142 correction (dB)	Resultant at receptor R1, L_{Aeq} (dB)
		Distance to receptor (m)	Correction (dB)						
ASHP	71	7.3	-25	3	0	-8	-10	3	34

R3 – Windows – south west wing

Plant item	Source noise level (each) L_{wA} (dB)	Distance correction		Correction for two units	Reflections dB	Attenuation (dB)	Acoustic screening (dB)*	BS4142 correction (dB)	Resultant at receptor R1, L_{Aeq} (dB)
		Distance to receptor (m)	Correction (dB)						
ASHP	71	9.9	-28	3	0	-8	-9	3	32

R4 – Windows – south east wing

Plant item	Source noise level (each) L_{wA} (dB)	Distance correction		Correction for two units	Reflections dB	Attenuation (dB)	Acoustic screening (dB)*	BS4142 correction (dB)	Resultant at receptor R1, L_{Aeq} (dB)
		Distance to receptor (m)	Correction (dB)						
ASHP	71	14.0	-31	3	0	-8	-9	3	29

**including effects of all noise paths, including screening by building and noise-path under the foot of the screen*

Appendix F Plan of acoustic screen