

North Campus Energy Centre University of Manchester

Plant Sound
Assessment Report
1200/PSA1
Revision 1

29 October 2024

For:

Wilson Mason LLP
Upland House
Spring Lane
Samlesbury
PR5 0UX



2nd Floor 3 Hardman Square
Spinningfields Manchester M3 3EB

☎ 0161 457 0515 ■ 07415 151 901
✉ Enquiry@LighthouseAcoustics.co.uk
🌐 www.LighthouseAcoustics.co.uk

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1200/PSA1 Revision 1

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Time History Graph 1200/THG1

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Registered Office: 2nd Floor 3 Hardman Square Spinningfields Manchester M3 3EB
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1.0 Introduction

Lighthouse Acoustics has been appointed by Wilson Mason LLP to undertake an environmental sound survey at the site of the proposed Northern Campus Energy Centre, University of Manchester and to assess atmospheric sound emissions from the proposed 4No. air source heat pump units.

The survey methodology, results and assessments are presented in this report.

2.0 Objectives

To establish the Local Authority's acoustic requirements for the proposed 4No. air source heat pump units.

To visit site to undertake a detailed environmental sound survey in order to establish existing environmental sound levels at the site.

To undertake an assessment of atmospheric sound emissions from the proposed 4No. air source heat pump units upon the nearest noise sensitive receptor and to propose mitigation measures where required in order to achieve the requirements of the Local Authority.

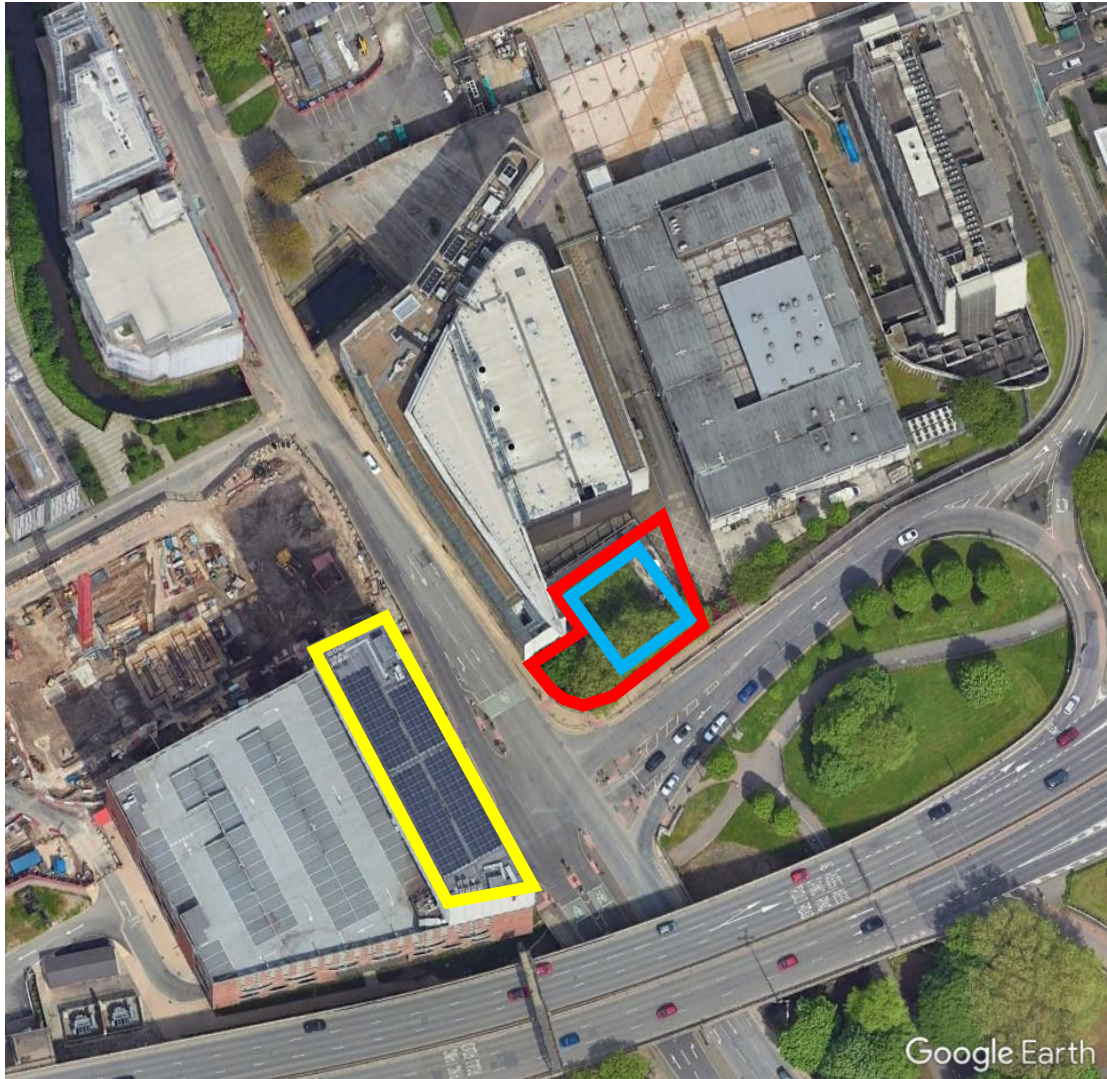
3.0 Site Description

The proposed Northern Campus Energy Centre is situated on vacant land adjacent to the existing John Garside Building at the University of Manchester. The proposed 4No. air source heat pump units are to be located at 3rd floor roof level of the new building.

The site is bound by the George Begg Building to the north east, Sackville Street to the south east, Princess Street (A34) to the south west and the John Garside Building to the north west.

A Premier Inn hotel is situated to the south west of the site opposite Princess Street above the NCP multistorey car park whilst the Mancunian Way (A57M) is situated approximately 50m to the south of the site.

The site plan below indicates the extent of the site (red line), location of the proposed 4No. air source heat pump units (blue line), the nearest noise sensitive receptor (yellow line) and the surrounding environment.



Site plan indicating the extent of the site and the surrounding environment

4.0 Local Authority Requirements

With regard to noise and vibration from fixed plant/equipment, Section 3.7.1.5 of the Planning & Noise Technical Guidance document (dated October 2022) produced by Manchester City Council states the following:

"The noise assessment should be based on BS 4142: 2014 and any application for fixed plant, equipment or machinery must demonstrate that:

Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5dB (L_{Aeq}) below the typical background (L_{A90}) level at the nearest noise sensitive location."

5.0 Environmental Sound Survey

5.1 Measurements

Automated environmental sound measurements were undertaken from 11:00 hours on Wednesday 29 May 2024 to 11:00 hours on Thursday 30 May 2024. During this period the L_{Amax} , L_{Aeq} and L_{A90} sound pressure levels were measured continuously over 15 minute periods.

5.2 Weather Conditions

At the start of the survey period there was a gentle westerly breeze (<5m/s) and the sky was overcast. There was no rainfall and road surfaces were dry. The temperature was approximately 14°C.

At the end of the survey period there was a gentle north westerly breeze (<5m/s) and the sky was overcast. There was no rainfall and road surfaces were dry. The temperature was approximately 15°C.

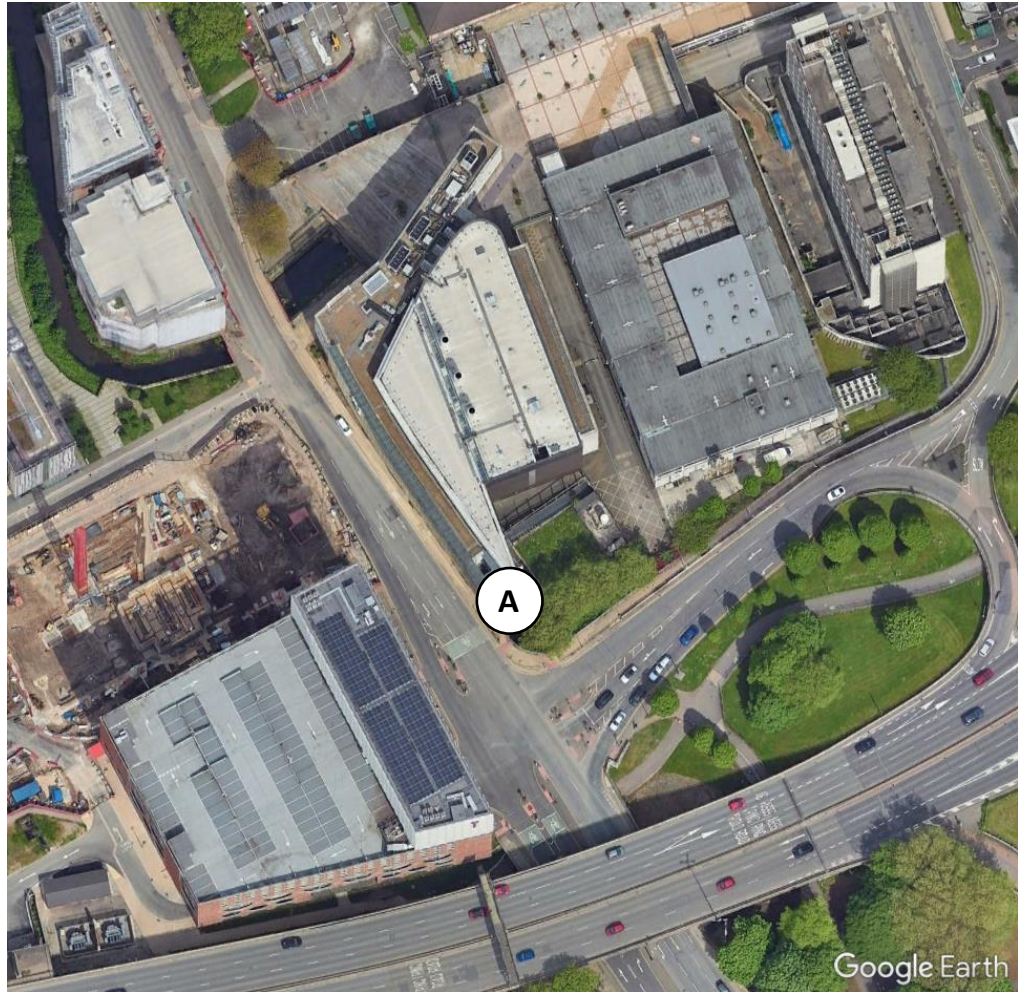
Based on publicly available weather data for the survey period it is understood that weather conditions remained similar for the duration of the survey with no periods of significant rainfall or strong breezes. The weather conditions during the survey period are therefore considered to be suitable for undertaking measurements of sound levels.

5.3 Measurement Position

Environmental sound levels were measured at a single position on-site as described in the table below.

Position	Description
A	Microphone situated on the southern elevation of the external fire escape at 4 th floor level overlooking Princess Street, Sackville Street and the Mancunian Way and in free field conditions.

The measurement position is shown on the site plan below.



Site plan showing measurement position

Measurement Position A was selected in order to assess typical environmental sound levels representative of those at the nearest noise sensitive receptor.

5.4 Equipment

The following equipment was used to undertake the environmental sound survey.

Equipment	Manufacturer	Model	Serial No.	Calibration Date
Class 1 Sound Level Meter	Casella	633C	0721320	07/11/2023
Preamplifier	Casella	495	001414	07/11/2023
Microphone	Casella	251	1025	07/11/2023
Class 1 Sound Calibrator	Casella	120/1	3864878	01/11/2023
Environmental Noise Kit	Casella	6847	-	-
Microphone Extension Cable	Casella	C6717/5	-	-
Weather Protection System	Casella	6737	-	-

Field calibration checks were performed on the sound level meter prior to and on completion of the survey and were found to be within acceptable tolerance limits.

5.5 Results

5.5.1 Time History Graph

The results of the environmental sound survey are presented on Time History Graph 1196/THG1 enclosed at the rear of the report.

5.5.2 L_{A90} Background Sound Levels

The lowest representative $L_{A90,15min}$ background sound levels measured for the daytime and night-time periods during the survey period are detailed in the table below.

Position	Lowest Representative $L_{A90,15min}$ Background Sound Levels (dB)	
	Daytime (07:00–23:00)	Night-time (23:00–07:00)
A	69	57

5.5.3 Discussion of Sound Climate

At the start and end of the survey period the dominant sound source at Position A was noted to be road traffic along the surrounding road network.

Whilst we are unable to comment on dominant sound sources or individual sound events during the survey period, based on the surrounding environment it is likely that road traffic remained the dominant sound source.

6.0 BS 4142:2014+A1:2019

BS 4142:2014+A1:2019 “Methods for rating and assessing industrial and commercial sound”, describes methods for rating and assessing sound of an industrial and/or commercial nature, which includes:

- sound from industrial and manufacturing processes;
- sound from fixed installations which comprise mechanical and electrical plant and equipment;
- sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and
- sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

Sound of an industrial and/or commercial nature does not include sound from the passage of vehicles on public roads and railway systems.

It should be noted that the determination of noise amounting to a nuisance is beyond the scope of BS 4142.

The likely impact is indicated by subtracting the existing background sound level from the rating level of the industrial and/or commercial sound. The standard states that:

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

Note 2 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."

The industrial and/or commercial sound is expressed as the specific sound level and given as a $L_{Aeq,Tr}$ sound level. Should the specific sound level exhibit any acoustic features (i.e. tonality, irregularity or impulsiveness) a character correction is applied. The rating level is the specific sound level with character correction applied (if applicable) and is given as a $L_{Ar,Tr}$ sound level. The existing background sound level is given as a $L_{A90, T}$ sound level.

The reference time interval, T_r , is 1 hour during the daytime period (07:00 to 23:00 hours) and 15 minutes during the night-time period (23:00 to 07:00 hours).

7.0 Atmospheric Sound Emission Assessment

7.1 Plant Sound Data

Atmospheric building services sound levels have been assessed based on the manufacturers sound data received for the proposed 4No. air source heat pump units which indicates octave band sound data as detailed in the table below.

Carrier 30RQP 520R

Duty	Sound Pressure Level at 10m (dB) at Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
100%	53	59	63	61	57	55	47	47	63

Whilst it is not possible to assess plant irregularity or impulsiveness based on manufacturer's sound data, BS 4142: 2014 provides an objective method for assessing the audibility of tones in sound. The one-third octave method states that if the level of a one third octave band exceeds the level of both adjacent one third octave bands by the following amounts, then a tonal component may be identified as present:

- 15dB in the low-frequency one-third-octave bands (25Hz to 125Hz);
- 8dB in the mid-frequency one-third-octave bands (160Hz to 400Hz);
- 5dB in the high-frequency one-third-octave bands (500Hz to 10kHz).

However, one third octave band sound data (and plant irregularity or impulsiveness data) is rarely available from manufacturers as is the case in this instance.

By applying the same principal to the octave band sound data in the table above, a review indicates that these items are unlikely to exhibit a tonal component. As such, no character correction has been applied to the specific sound level for these items.

Should one third octave band sound data, plant irregularity or impulsiveness data become available from the manufacturer a revised assessment should be undertaken.

7.2 Operating Hours

It is understood that the proposed 4No. air source heat pump units have the potential to operate 24 hours a day. The number of units operating and duty of the units will vary depending on the ambient temperature as detailed in the table below.

Ambient Temperature °C	Plant Duty %	No. of Units Operational	Sound Reduction dB
-10	100	4	0
-9	91	4	0
-8	84	4	-1
-7	77	4	-1
-6	71	3	-1
-5	66	3	-2
-4	61	3	-2
-3	56	3	-2
-2	52	3	-3
-1	48	2	-3
0	45	2	-4
1	42	2	-4
2	39	2	-4
3	36	2	-5
4	34	2	-5
5	31	2	-5
6	29	2	-6
7	27	2	-6
8	25	1	-6
9	23	1	-7
10	21	1	-7
11	20	1	-7
12	18	1	-8
13	17	1	-8
14	15	1	-8
15	14	1	-9
16	13	1	-9
17	12	1	-9
18	10	1	-10
19	9	1	-10
20	8	1	-11

Based on historic weather data, the number of days per year that the heat pumps are expected to operate at the various plant duties are detailed in the table below.

Plant Duty %	No. Days Per Year	Sound Reduction dB
85-100	6	0
67-84	11	-1
53-66	22	-2
46-52	44	-3
37-45	88	-4
≤36	194	≤-5

In order to undertake a worst case assessment, it is assumed that the proposed 4No. air source heat pump units will operate for the full 1 hour daytime and 15 minute night-time assessment periods.

7.3 Plant Location

The proposed 4No. air source heat pump units are to be located at 3rd floor roof level of the new building.

7.4 Nearest Noise Sensitive Receptor

The nearest noise sensitive receptor to the proposed 4No. air source heat pump units is detailed in the table below.

Plant Location	Nearest Noise Sensitive Receptor	Approximate Distance (m)
3 rd Floor Roof Level	Premier Inn Bedrooms at approximately 6 th Floor Level to the south west of the site	40

It is understood that the bedrooms are air conditioned, feature secondary glazing and that the windows are not openable.

7.5 Assessment

The table below details the calculated L_{Ar} rating levels for the proposed 4No. air source heat pump units at the nearest noise sensitive receptor along with the lowest representative $L_{A90,15min}$ background sound levels measured throughout the daytime and night-time periods and the differences between them.

Descriptor	Time Period		
	07:00-23:00	23:00-07:00	
Plant Duty (%)	100	100	≤36
Sound Pressure Level $L_{Aeq,T}$ at 10m (dB)	63	63	58
Percentage on-time (%)	100	100	100
On time correction (dB)	0	0	0
Sound Pressure Level $L_{Aeq,T}$ at 10m (dB)	63	63	58
Number of Units (#)	4	4	4
Correction (dB)	+6	+6	+6
Distance to Receptor (m)	40	40	40
Distance Attenuation (dB)	-12	-12	-12
Screening Attenuation (dB)	0	0	0
Reflections (dB)	0	0	0
Specific Sound Level $L_{Aeq,Tr}$ at Receptor (dB)	57	57	52
Character Correction (dB)	0	0	0
Rating Level $L_{Ar,Tr}$ at Receptor (dB)	57	57	52
Lowest Representative Background Sound Level $L_{A90,Tr}$ at Receptor (dB)	69	57	57
Difference (dB)	-12	0	-5

The calculated L_{Ar} rating level for the proposed 4No. air source heat pump units at the nearest noise sensitive receptor is 12dB below the lowest representative $L_{A90,15min}$ background sound level for the daytime period at 100% duty.

The assessment therefore indicates that atmospheric plant sound emissions from the proposed 4No. air source heat pump units are likely to have a low impact at the nearest noise sensitive receptor and achieve the requirements of the Local Authority during the daytime period.

The calculated L_{Ar} rating level for the proposed 4No. air source heat pump units at the nearest noise sensitive receptor is 0dB below the lowest representative $L_{A90,15min}$ background sound level for the night-time period at 100% duty and 5dB below the lowest representative $L_{A90,15min}$ background sound level for the night-time period at $\leq 36\%$ duty.

The assessment therefore indicates that atmospheric plant sound emissions from the proposed 4No. air source heat pump units are likely to have a low impact at the nearest noise sensitive receptor and achieve the requirements of the Local Authority during the night-time period at $\leq 36\%$ duty which is expected for 194 days per year.

The table below details the full number of expected exceedances of the night-time criterion.

Plant Duty %	No. Days Per Year	Exceedance of Night-time Criterion dB
85-100	6	+5
67-84	11	+4
53-66	22	+3
46-52	44	+2
37-45	88	+1
≤ 36	194	0

Given that the nearest noise sensitive receptor is air conditioned, features secondary glazing and has windows that are not openable the above occasional minor expected exceedances of the night-time criterion may be deemed acceptable.

8.0 Conclusion

The Local Authority's acoustic requirements for the proposed 4No. air source heat pump units have been established.

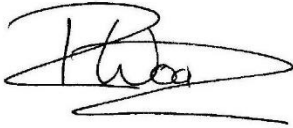
A detailed environmental sound survey has been undertaken in order to establish existing environmental sound levels at the site.

An assessment of atmospheric sound emissions from the proposed 4No. air source heat pump units upon the nearest noise sensitive receptor has been undertaken.

The assessment indicates that atmospheric plant sound emissions from the proposed 4No. air source heat pump units are likely to have a low impact at the nearest noise sensitive receptor and achieve the requirements of the Local Authority during the daytime period.

The assessment indicates that atmospheric plant sound emissions from the proposed 4No. air source heat pump units are likely to have a low impact at the nearest noise sensitive receptor and achieve the requirements of the Local Authority during the night-time period at $\leq 36\%$ duty which is expected for 194 days per year.

Given that the nearest noise sensitive receptor is air conditioned, features secondary glazing and has windows that are not openable the occasional minor expected exceedances of the night-time criterion may be deemed acceptable.

A handwritten signature in black ink, appearing to read 'Robin Wood', enclosed within a large, stylized, horizontal oval shape.

Robin Wood
LIGHTHOUSE ACOUSTICS

Air Source Heat Pumps, University of Manchester
Time History Graph - Wednesday 29 May 2024 to Thursday 30 May 2024

$L_{Amax,15min}$, $L_{Aeq,15min}$ & $L_{A90,15min}$ Noise Levels at Position A

