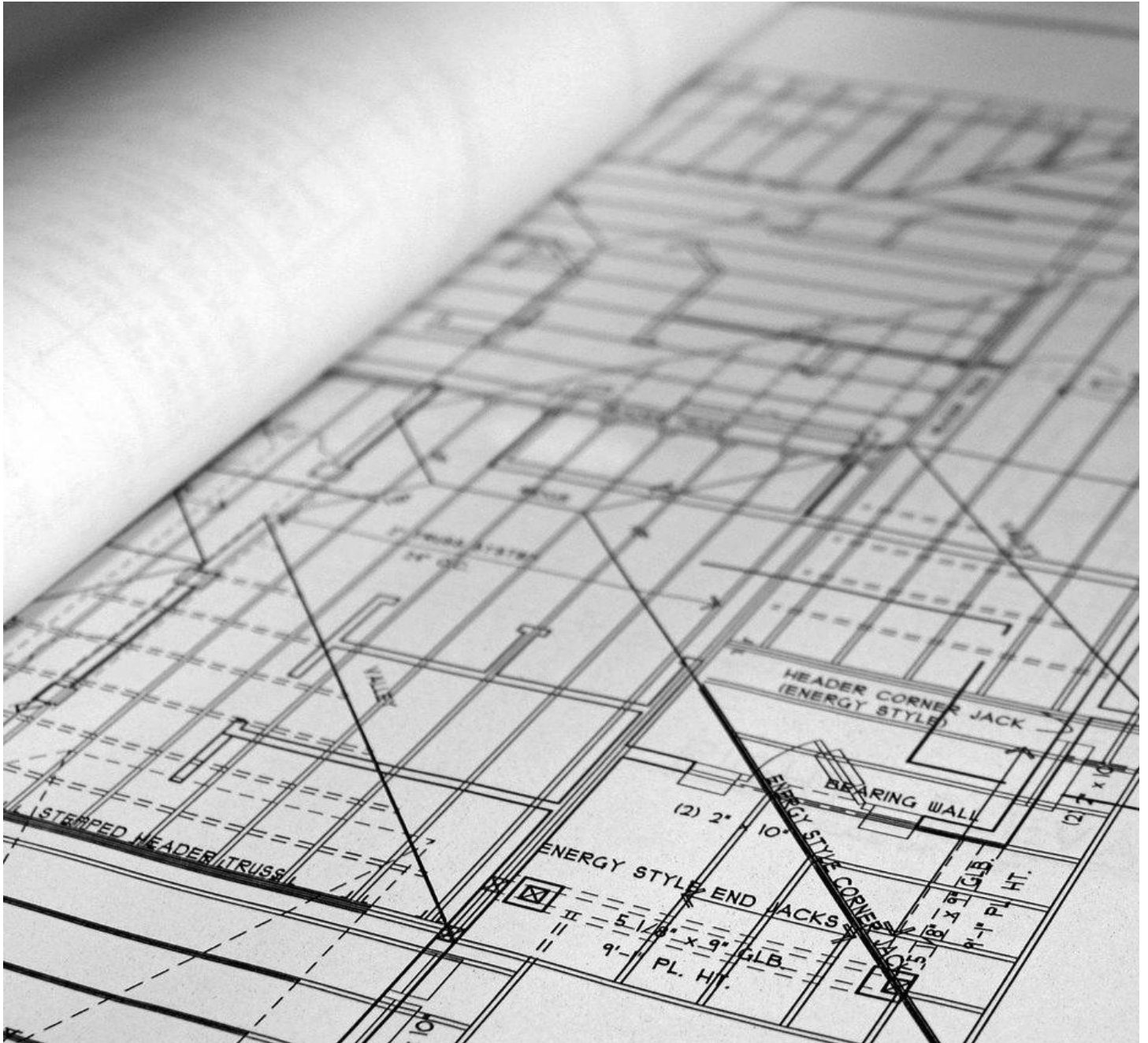




Wythenshawe Hospital, Proposed ASHP

Noise Impact Assessment

Client: Centrica Business Solutions

Project Number: 1102021

Date: 30/09/2021



REPORT ISSUE & STATUS LOG

	Revision Number		
	1	2	3
Author	Nick Adamson BSc (Hons). MIOA		
Position	Associate		
Reviewer	Jordan Mayes BSc (Hons). MIOA		
Position	Director		
Date of Issue	30/09/2021		
Comment	For Comment		

This report (including any enclosures and attachments) has been prepared by JPM Acoustics Ltd with reasonable skill and care in accordance with generally accepted acoustic principles. Any information provided by third parties and referred to herein may not have been checked or verified by JPM Acoustics Ltd unless expressly stated otherwise. This document contains confidential information, and no part of this report should be reproduced, distributed or communicated to any third party unless JPM Acoustics Ltd provide express prior written consent. We do not accept any liability if this report is used for an alternative purpose from which it is intended, nor to any third party in respect of this report.

Report Prepared By

JPM Acoustics Ltd
97 Hazelhurst Road, Worsley,
Manchester, M28 2SW

Contact Details

nick.adamson@jpmacoustics.com
www.jpmacoustics.co.uk

1 INTRODUCTION

1.1 OVERVIEW

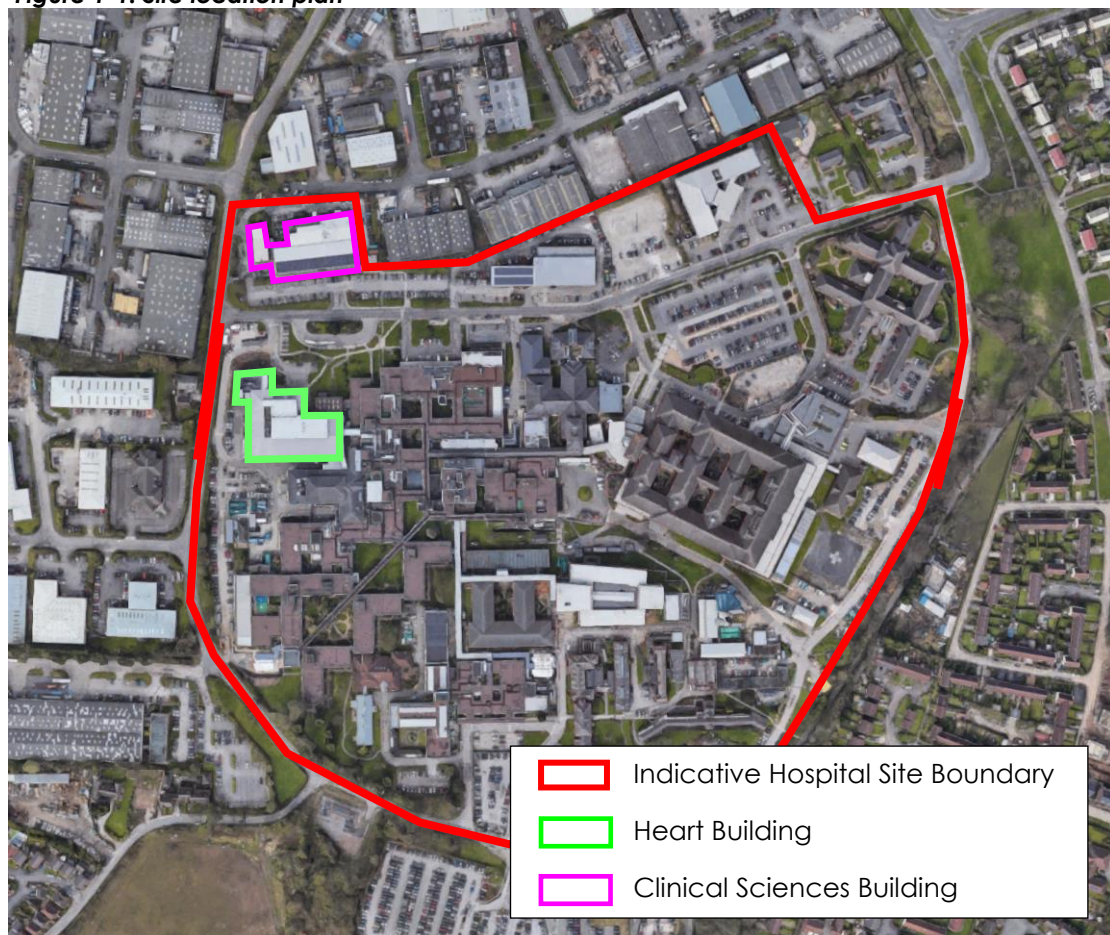
- 1.1.1 JPM Acoustics Ltd has been appointed by Centrica Business Solutions (Centrica) to undertake a noise impact assessment for the installation of two air source heat pumps at Wythenshawe Hospital (the site), for which planning permission is being sought.
- 1.1.2 The purpose of this assessment is to predict noise levels from the proposed plant items at the closest noise sensitive location(s), and to determine what, if any, mitigation measures will be required in order to demonstrate that noise associated with the proposed plant will not result in a significant adverse impact.
- 1.1.3 The assessment has been undertaken with due consideration to relevant British Standards relating to noise and to *Health Technical Memorandum 08-01: Acoustics (HTM08-01)*, which provides guidance on the acoustic environment in and around healthcare environments. This report is intended to be submitted in support of the planning application for the site.
- 1.1.4 This report is necessarily technical in nature. Therefore, to assist the reader, a glossary of acoustic terminology is provided in **Appendix A**.

1.2 SITE DESCRIPTION

- 1.2.1 Wythenshawe hospital is located on the outskirts of Wythenshawe, approximately 2km northwest of the town centre. The hospital is located directly south of, and is immediately adjacent to, the Roundthorn Industrial Estate which also borders the western side of the hospital grounds. To the east of the hospital grounds is Newall Green, which is a largely residential area, and to the south is a large hospital car park and open farmland.
- 1.2.2 The proposals for which planning permission is sought, comprise the installation of two externally located air source heat pumps (ASHP); one at the hospital's Clinical Sciences Building, and one at the hospital's Heart Building.
- 1.2.3 The Heart Building is located on the western edge of the hospital site, at the junction of Southmoor Road and Floats Road. The ASHP is proposed to be installed on the roof top equipment deck which is already used for plant and which is screened by the roof and fabric of the building itself from the nearest noise sensitive location. The closest noise sensitive location to the proposed ASHP location is a residential dwelling, Floats Cottage, approximately 55m to the west. This dwelling is a two-storey detached house located on the western side of Floats Road.
- 1.2.4 The Clinical Sciences building is located at the northwest corner of the hospital site. The ASHP is proposed to be installed externally at the northern façade of the building adjacent to the existing boiler house in a fenced compound which currently houses an existing chiller and standby generator, and is surrounded on three sides by the fabric of the existing building. There are no off-site noise sensitive locations in the vicinity of the Clinical Science building's proposed ASHP location, but there are several offices which overlook the plant area on three sides.
- 1.2.5 As these offices are part of the building for which the ASHP will serve, rather than those of a third party, consideration of the potential noise impact is not strictly necessary for the purposes of planning. Consideration has however been given to these offices in this report so that any significant mitigation identified as being required can be included in the design going forward.

- 1.2.6 The ASHP plant at both buildings will be capable of operating at any time of the day or night depending on the heating and cooling requirements of the buildings they each serve. The operational hours for the purposes of this assessment are therefore 24 hours per day.
- 1.2.7 Although the Clinical Sciences building houses a laboratory which operates 24-hour lab, and the ASHP could run at any time, the offices overlooking it are only occupied during normal daytime working hours, and the assessment of this building therefore is limited to daytime only.
- 1.2.8 The site location is shown in **Figure 1-1**, and a more detailed plan of the proposed plant layout at each individual building is shown in **Figures B1** and **B2** of **Appendix B**.

Figure 1-1: Site location plan



2 LEGISLATION AND GUIDANCE

2.1 BRITISH STANDARD 4142: 2014+A1:2019: METHODS FOR RATING AND ASSESSING INDUSTRIAL AND COMMERCIAL SOUND (BS 4142)

2.1.1 BS 4142 describes methods for rating and assessing the following:

- 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 movements on or around an industrial and/or commercial site.

2.1.2 The method uses outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

2.1.3 In accordance with the assessment methodology, the specific sound level (L_s) of the noise source being assessed is measured or predicted at a receptor location. A rating level ($L_{Ar,Tr}$) is then derived by adding a correction or penalty to the specific sound level for characteristic features, such as tonal qualities and/or distinct impulses, which make the source distinguishable against the residual noise climate. The British Standard effectively compares the difference between the rating level and the typical background sound level ($L_{A90,T}$) in the absence of the noise source being assessed.

2.1.4 It is advised that the time interval ('T') of the background sound measurement should be sufficient to obtain a representative or typical value of the background sound level at the time(s) when the noise source in question is likely to operate or is proposed to operate in the future.

2.1.5 Comparing the rating level with the background sound level, BS 4142 states:

“Typically, the greater this difference, the greater the magnitude of impact.

A difference of around +10 dB or more is likely to be an indication of a significant

adverse impact, depending on the context.

A difference of around +5 dB 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 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."

2.2 MANCHESTER CITY COUNCIL NOISE GUIDANCE

2.2.1 Manchester City Council has a published document entitled 'Planning & Noise: Technical Guidance', dated Dec 2015, which sets out the expectations in terms of noise emissions from various types of proposed developments proposed within the city.

2.2.2 With regards to noise sources of an industrial nature (such as ASHPs), the guidance states that BS 4142 should be used to assess the likely impact of noise at noise sensitive premises and the design objective should be as follows:

"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"

2.3 HTM 08-01

2.3.1 Heath Technical Memorandum 08-01 describes the acoustic design criteria that are important for healthcare premises. With regards to external noise levels it states the following provisions should apply:

"Noise outside the buildings should be controlled to allow the internal noise criteria to be achieved (with windows or trickle vents open for ventilation if the space is naturally ventilated)."

2.3.2 And:

“Open external areas should be protected. Noise from services should not exceed the existing daytime background noise level or 50 dB L_{A90} , whichever is the higher. This limit should be achieved in any areas normally occupied by staff (except maintenance staff, notwithstanding the requirements of the Control of Noise at Work Regulations 2005) or the public (for example open courtyards and accessible landscaped areas). This means that noisy plantrooms should not face normally occupied external areas unless adequate acoustic control is provided.”

3 BASELINE NOISE SURVEY

3.1 OVERVIEW

- 3.1.1 A baseline noise survey has been undertaken at locations representative of the nearest residential receptor to the Heart Building's proposed ASHP location, and representative of the Clinical Science building's offices which overlook the proposed ASHP. The survey at each location has been undertaken to determine baseline noise levels for relevant operational periods.

3.2 MEASUREMENT LOCATIONS

- 3.2.1 Two measurement locations were adopted for the purpose of the baseline noise survey, each selected to be representative of the closest noise sensitive location to the proposed plant locations. The measurement locations are described as follows:

Measurement Location 1 (ML1) Positioned within free field conditions in the front garden of Float Cottage, in line with the eastern façade of the dwellings. The microphone was located approximately 1.6m above ground level. The noise survey at ML1 was conducted between 16:30 on 23rd September 2021 and 14:30 on 22nd September 2021, during which time continuous unattended monitoring was undertaken with short periods of attendance towards the beginning and end of the monitoring period.

Measurement Location 2 (ML2) Positioned within free field conditions in the existing plant area at the northern façade of the Clinical Sciences building, and outside the office windows. The microphone was located approximately 1.5m above ground level. The noise survey at ML2 was conducted between 09:30 and 11:30 on 10th September 2021, during which time attended monitoring was undertaken.

- 3.2.2 ML1 and ML2 are identified, together with the nearest noise sensitive locations and the location of the proposed plant in **Figures B1** and **B2** in **Appendix B** respectively.

3.3 METEOROLOGICAL CONDITIONS

- 3.3.1 Over the course of the baseline surveys, meteorological conditions remained conducive for undertaking accurate and reliable environmental noise measurements, remaining dry with negligible wind.

3.4 MEASUREMENT EQUIPMENT

- 3.4.1 The baseline noise survey was undertaken using the Class 1 specification noise measurement equipment detailed in **Table 3-1**. The measurement equipment was calibrated using a portable calibrator immediately before and after the measurements with no significant drift in calibration observed.
- 3.4.2 The sound level meter, pre-amplifier and microphone were calibrated to traceable standards within 24 months prior to the measurements. The portable calibrator was calibrated within 12 months prior to the measurements.

Table 3-1: Survey Equipment Details

Equipment	Make and Model	Serial Number	Calibration due Date
Sound Level Meter	01dB Fusion	11327	18/06/2023
Microphone	Grass 40CE	259479	
Preamplifier	01dB Pre 22	1605201	
Calibrator	01dB-Stell Cal 21	34675335	19/11/2021

3.5 RESULTS

- 3.5.1 A detailed analysis of the measured background noise levels obtained over the course of the survey at ML1 has been undertaken in accordance with BS 4142. The results of this analysis can be found in **Appendix C**, with a summary of the determined representative background and ambient sound levels at both locations presented in **Table 3-2**.

Table 3-2: Summary of residual and background sound levels measured at ML1 and ML2

Period	Residual Sound $L_{Aeq,T}$	Background Sound $L_{A90,T}$
ML1 (Heart Building)		
Daytime	64	47
Night-time	56	40
ML2 (Clinical Sciences)		
Daytime	58	58

- 3.5.2 The dominant noise source at ML1 was road traffic on Floats Road, with no other identifiable sources present. At ML2 noise from an existing chiller in the plant compound was dominant and constant, leading the background and ambient sound level to be the same.

4 ASSESSMENT

4.1 NOISE SOURCE DATA

- 4.1.1 Source noise data for the proposed air source heat pumps has been provided by the manufacturer, Trane, via Centrica. This data has been provided in terms of an A-weighted sound power levels. A summary of the data provided, a used in this assessment is shown in **Table 4-1**.

Table 4-1: Summary of source sound level data

Plant Item	Number Of.	Sound Power Level, L _w
Heart Building		
TRANE CMAC SE 175 L – R410A	1	89dB(A)
Clinical Sciences Building		
TRANE CXAX 40 SE LN	1	84dB(A)
TRANE 302 Lift Scroll WWHP	1	79dB(A)

4.2 PREDICTIONS AND ASSESSMENT

- 4.2.1 The noise source data for the proposed plant, as shown in **Table 4-1**, have been used to undertake noise predictions, the results of which have then been assessed in accordance with the assessment methodology presented within BS 4142 for the Heart Building, and against the HTM08-01 guidance for the Clinical Sciences Building.

Heart Building

- 4.2.2 Given the tonal nature of noise emissions from the air source heat pump, and the measured residual sound level at the receptor, a correction of +2 dB is considered to be an appropriate rating sound level correction. This is the correction suggested by BS 4142 in instances where there is 'a there is a tone which is just perceptible at the receptor'. No further corrections, for intermittency, impulsivity or for other sound characteristics are considered warranted when determining the rating level.
- 4.2.3 The assessment location adopted for this assessment is representative of the worst affected façade of the nearest dwelling. The assessment location has been taken to be at a height of 3.5m above ground to represent first floor bedroom windows on the eastern façade of Floats Cottage.

- 4.2.4 The predictions have assumed that the walls surrounding the roof top equipment deck will provide a degree of mitigation in the form of acoustic screening, as they will block direct line of sight between the receptor and the plant and are of substantial construction.

Clinical Sciences Building

- 4.2.5 The air source heat pump for the Clinical Sciences Building is proposed to be installed on a container in the external plant yard. Inside the container will be a water pump. The specification and sound insulation performance of the container is not known but given the relative difference between the sound power levels of the external ASHP and the internal Waste Water Heat Pump (WWHP), it has been assumed that the sound insulation performance of the contained is sufficient for noise from the WWHP to not be significant externally.
- 4.2.6 The assessment location for this assessment is the closest office window to the proposed installation location, which is approximately 3m away and approximately at the same level as the base of the ASHP/top of the container.

4.3 HEART BUILDING - BS 4142 ASSESSMENT AT RESIDENTIAL RECEPTOR

- 4.3.1 The assessment has been undertaken for a single scenario, whereby the air source heat pump is operational continuously. The results of the noise prediction exercise (predicted specific sound level, background sound levels, and the BS4142 assessment) are included in **Table 4-2**.

Table 4-2: Comparison of Predicted Sound Levels Against Background Sound Levels.

Ref	Sound Levels	Night-time	Daytime
A	Predicted specific sound level at nearest dwelling façade	31 dB(A)	
B	Tonality correction	+2 dB	
C	Rating level [A+B]	33 dB(A)	
D	Background Level ($L_{A90,T}$)	40 dB(A)	47 dB(A)
E	Difference between rating level and background level [C – D]	-7 dB	-14 dB

- 4.3.2 It can be seen from **Table 4-2** that the predicted rating level at the nearest receptor is 33 dB $L_{Ar,Tr}$.

- 4.3.3 The typical background noise levels at ML1 are 40 dB L_{A90} and 47 dB L_{A90} for night-time and daytime respectively. Therefore, the predicted rating level is between 7 dB and 14 dB below the prevailing background sound level during daytime and night-time periods, respectively.
- 4.3.4 This meets the criteria stipulated by MCC, and in accordance with BS 4142, where the rating level does not exceed the prevailing background sound level a 'low impact' is indicated.
- 4.3.5 As the assessment indicates a low impact at the nearest receptors, no further mitigation measures for the control of sound from the proposed air source heat pump at the Heart Building are warranted.

4.4 CLINICAL SCIENCES BUILDING

- 4.4.1 Based on the manufacturer provide sound power data for the ASHP it is predicted that the sound pressure level outside the closest office window will be 66 dB(A). This is some 8 dB above the current L_{Aeq} (and L_{A90}) noise level, and could lead to a 9dB increase in internal office noise levels through an open window.
- 4.4.2 To minimise the potential noise impact the proposals could have on the office users, and to comply with the recommendations from HTM08-01, mitigation measures should be included to reduce noise emissions from the new plant items to a level no greater than 58 dB L_{Aeq} (the current L_{A90}) at the closest window.

Mitigation suggestions

- 4.4.3 On the basis it is always preferable to consider treating a noise source 'at source', the first consideration for mitigation would be to assess how feasible it would be to install an alternative ASHP with a lower sound power level.
- 4.4.4 Assuming a quieter unit is not feasible, consideration should be given to an alternative location for the plant which would afford greater distance attenuation and/or acoustic screening.
- 4.4.5 If a change in plant or location is not possible, an acoustic enclosure surrounding the ASHP could be considered. Any such enclosure would need to be specified to ensure that noise levels from the proposed plant, does not exceed 58 dB L_{Aeq} at the office windows, which would require an insertion loss performance of circa. 9 dB.

- 4.4.6 The nature of the ASHP is such that a significant air flow would need to be maintained which would require careful consideration when designing the acoustic enclosure, which would need to fully enclose all the fans and be sealed at the base and across the top.
- 4.4.7 It is likely that the air flow requirements would require the enclosure to incorporate acoustic louvres and / or alternative attenuated air inlets and exhausts. Any such louvres (and access doors) should be specified such that the overall performance of the enclosure is not compromised. If possible, it is also recommended that the louvres do not face the direction of any offices.

5 CONCLUSION

- 5.1.1 JPM Acoustics Ltd has been appointed by Centrica to undertake a noise impact assessment to support a planning application for new air source heat pumps to be installed at two separate buildings of Wythenshawe Hospital.
- 5.1.2 This report presents an assessment of the potential noise impacts associated with the introduction of the plant on nearby noise sensitive receptors, and on the hospital itself. The assessment has been undertaken with due consideration to relevant British Standards relating to noise and HTM08-01 guidance.
- 5.1.3 Drawing on the results of a baseline noise survey undertaken at locations representative of the nearest noise sensitive receptors, and with consideration to noise emission data provided by the plant's manufacturer, the assessment has predicted a low impact at the nearest noise sensitive receptor to the Heart Building.
- 5.1.4 The assessment has predicted a potentially adverse impact at the closest noise sensitive locations to the proposed Clinical Sciences building's proposed ASHP. The impact is predicted to affect several of the office within the building and therefore mitigation is recommended and should be considered as the design progresses.

APPENDIX A: TECHNICAL GLOSSARY

Term	Descriptions
Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level	The sound level is the sound pressure relative to a standard reference pressure of 20 μPa (20×10^{-6} Pascals) on a decibel scale.
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 μPa .
A-weighting, dB(A)	The unit of sound level, weighted according to the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
$L_{eq,T}$	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 during the 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.
$L_{90,T}$	A noise level index. The noise level exceeded for 90% of the time over the period T . L_{90} can be considered to be the "average minimum" noise level and is often used to describe the background noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5 m.
Façade	At a distance of 1 m in front of a large sound reflecting object such as a building façade.
Fast/Slow Time Weighting	Averaging times used in sound level metres.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.

APPENDIX B: SCHEME DRAWINGS

Figure B1: Heart Building Location Plan

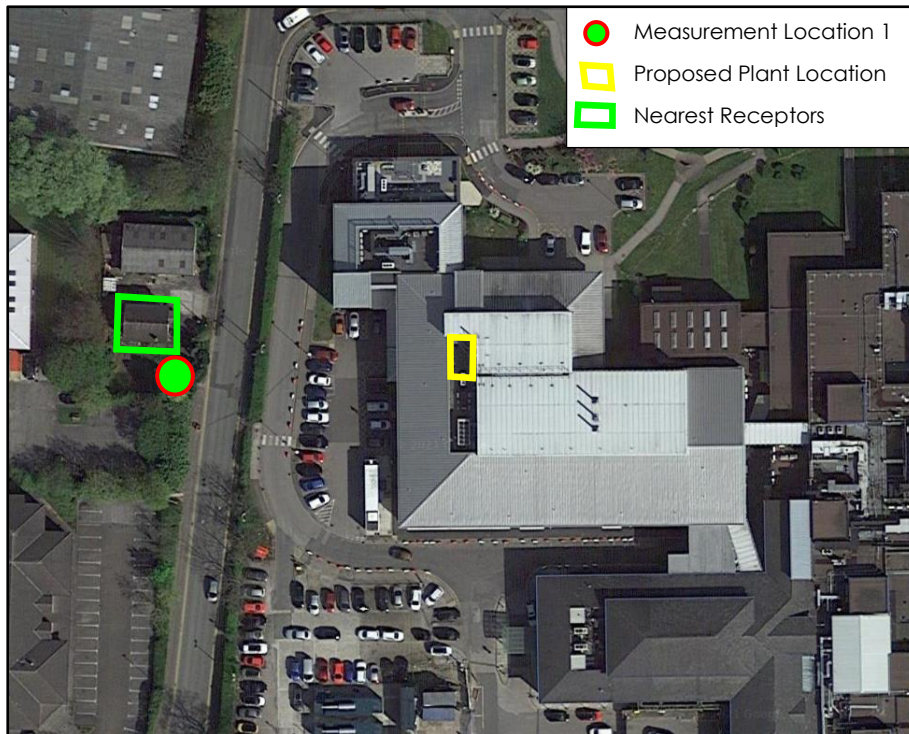
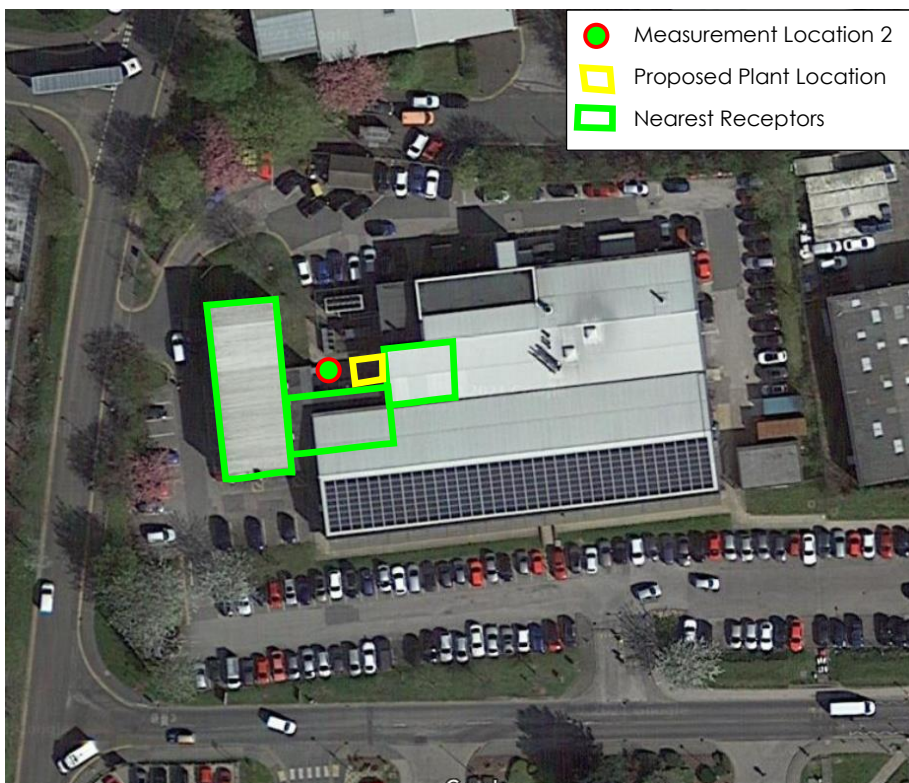


Figure B2: Clinical Sciences Building Location Plan



APPENDIX C: SUMMARY OF MEASURED SOUND LEVELS

Table C1 Summary of background $L_{A90,T}$ sound level at ML1

Period	Daytime	Night-time
Minimum $L_{A90,T}$	38	38
Maximum $L_{A90,T}$	54	53
Linear average $L_{A90,T}$	46	41
Most common $L_{A90,T}$	47	40

