Noise Impact Assessment

Site Address: Opal House, Wythenshawe, M23 9JD

Client Name: NHS Manchester University

Project Reference No: 8882CD

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Delivering sustainable development by promoting good health and well-being through effective management of noise.

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1. Introduction

NOVA Acoustics Ltd has been commissioned to prepare a validation noise impact assessment for the installation of 4 No. Ground Source Heat Pumps (GSHPs) ('the Development') at Opal House, Wythenshawe, M23 9JD ('the Site').

The applicant has received conditional approval for planning application No. 133782/FO/2022 - *Erection of a single storey external detached plant room to house ground source heat pump equipment* ('the Application') to Manchester City Council. Accordingly, this technical report has been prepared to discharge Condition 3 of the approved planning application imposed by the Local Planning Authority.

A baseline noise survey has previously been undertaken to accompany a predictive assessment of the site. This baseline data is utilised to assess potential impact within this validation assessment.

This noise assessment is necessarily technical in nature; therefore, a glossary of terms is included in Appendix A to assist the reader.

1.1 Standards, Legislation, Policy & Guidance

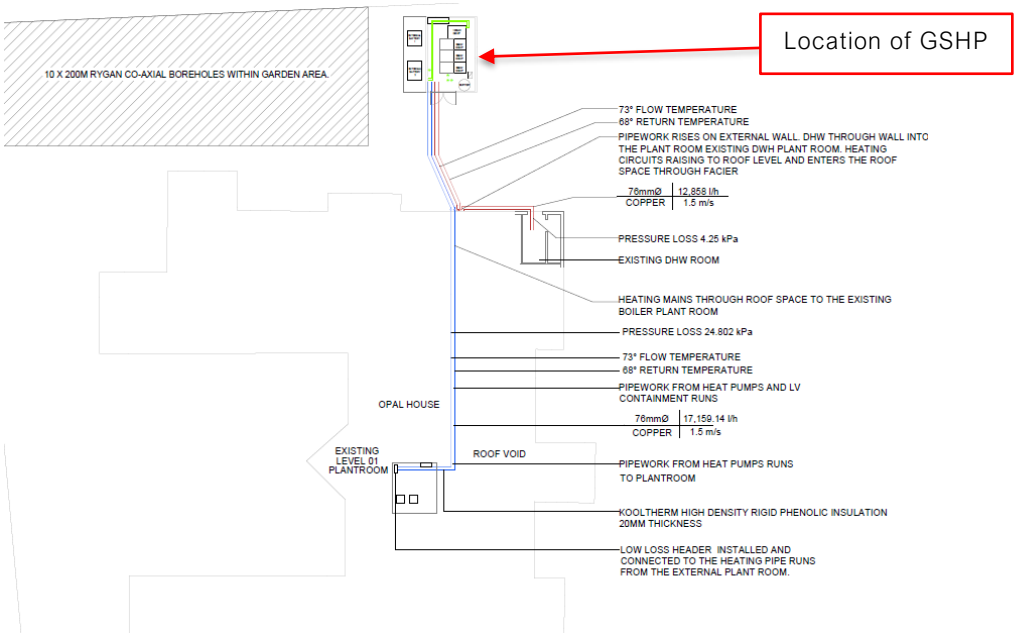
The following performance standards, legislation, policy and guidance have been considered to ensure good acoustic design in the assessment:

- The Local Planning Authority's (LPA's) conditional approval; specifically, 'Condition 3'.
- National Planning Policy Framework (2024)
- Noise Policy Statement for England (2010)
- British Standard BS4142:2014+A1:2019 – 'Methods for rating and assessing industrial and commercial sound'
- Health Technical Memorandum (HTM) 08-01: Acoustics (2013)

Further information on the legislation can be found in Appendix B.

1.2 Proposal Brief

The proposal is for the installation of GSHP equipment to service the 24/7 care home at Opal House. It is understood that the GSHP may operate 24 hours a day. All equipment is be housed within a detached plantroom, located approximately 9m north of Opal House, as shown in the below figure.



Drawing Ref No. OP-101 provided by 'Ground Heat Installations Ltd.'

Figure 1 – Development Plans

1.3 Local Planning Authority

The LPA's conditional approval has the following relevant condition:

3) a) Externally mounted ancillary plant, equipment, plant room and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5dB (LAeq) below the typical background (LA90) level at the nearest noise sensitive location. Prior to commencement of the use hereby approved the scheme shall be submitted to and approved in writing by the City Council as local planning authority in order to secure a reduction in the level of noise emanating from the site. The scheme shall be implemented in full before the use commences or as otherwise agreed in writing by the City Council as local planning authority.

b) Prior to the operation of the scheme a verification report shall be submitted to and approved in writing by the City Council as local planning authority to validate that the work undertaken throughout the development conforms to the recommendations and requirements in the approved acoustic report. The report shall also undertake post completion testing to confirm that the noise criteria have been met. Any instances of non-conformity with the recommendations in the report shall be detailed along with any measures required to ensure compliance with the agreed noise criteria.

Reason - To minimise the impact of the development and to prevent a general increase in pre-existing background noise levels around the site.

2. Environmental Noise Survey

Details regarding the baseline noise survey are presented in the predictive assessment. However, for ease, the measured background sound level (LA90) results are displayed in the figure below.

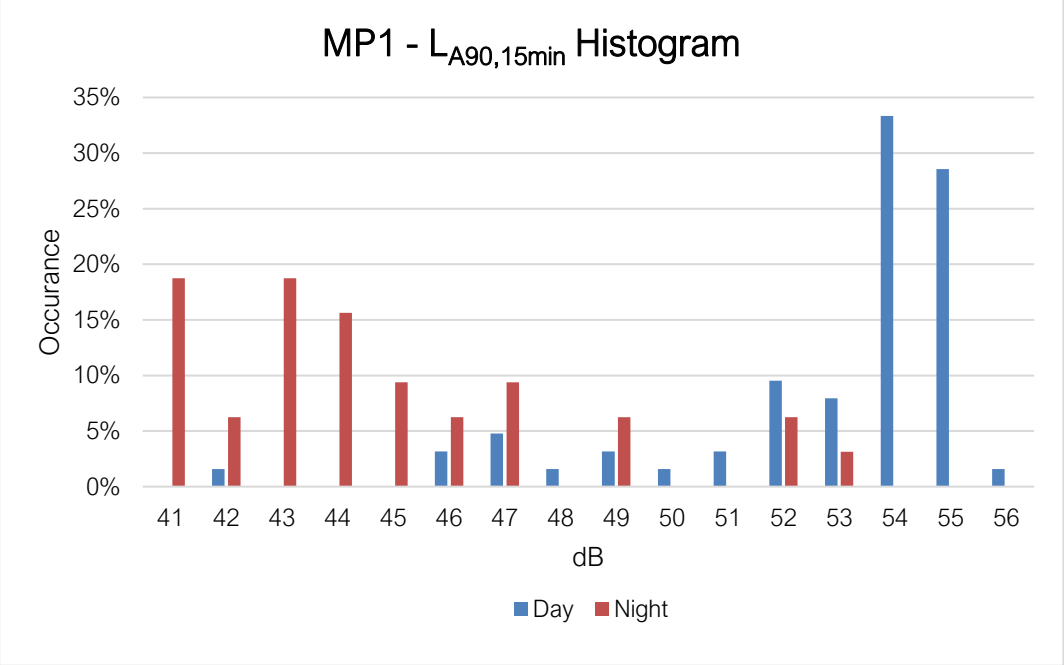


Figure 2 – Background Sound Level Analysis

As can be seen in the figure above, the modal $L_{A90,15min}$ value measured during the night-time operational hours is 41 dB and is deemed to be the 'lowest typical' background sound level and will be used in the following assessment.

3. Validation Noise Assessment

In the following section of the report, the impact of the noise emissions generated by the development is assessed.

It is considered that the LPA and BS4142 criteria are only applicable to off-site residential receptors (NSR2).

For on-site receptors (NSR1) guidance and criteria provided in HTM 08-01 are used. For overnight-wards, noise from building services and plant should be limited to NR20 internally. Assuming a partially open window provides 10-15dB of attenuation, this approximately equates to an external noise limit of NR30 outside the windows of Opal House.

3.1 Validation Assessment Measurements

It was not possible to distinguish noise from the plantroom outside the nearest NSRs over the prevailing noise levels. Accordingly, the specific sound level associated with the plant will ned to be determined through a combination of measurement and calculation, as outlined in paragraph 7.3.5 of BS4142.

Attended spot measurements have been undertaken internally and externally of the plantroom with the GSHPs in operation. External measurements were taken at a distance of approximately 1m from the plantroom.

The plantroom was noted to be constructed of a metal/composite panel. Noise emitting from the GSHPs was deemed to be audible when standing beside the plantroom. However, when standing at Opal House, this was not considered to be particularly dominant over the other existing noise sources during the time of the survey.

The following table presents the sound power level associated with the GSHPs breaking through the plantroom. Due to the close proximity of the measurement locations to the noise source, the sound power levels were calculated by summing over the surface area of each panel of the plant room.

Description	1/1 Octave Frequency Band (Hz, L_W dB)								Overall (dBA)
	63	125	250	500	1k	2k	4k	8k	
GSHP Plantroom	78	66	66	58	56	52	46	41	63

Table 1 – Sound Power Levels of GSHP Plantroom

3.2 *Noise Impact Assessment: On-site Receptors*

Description	1/1 Octave Frequency Band (Hz, dB)								Overall (dBA)
	63	125	250	500	1k	2k	4k	8k	
GSHP Plantroom	78	66	66	58	56	52	46	41	63
Propagation Loss to NSR1 – 9m (Q Factor: 2)	-27								-
Specific Sound Level at NSR1	51	39	39	31	29	25	19	14	35 (NR29)
HTM 08-01 External Noise Criteria									NR30
Exceedance									-1
NPPF & NPSE Outcome	Below the 'Lowest Observed Adverse Effect Level' (LOAEL).								
Mitigation measures are not required to further reduce noise impact.									

Table 2 – Noise Impact Assessment: On-site Receptors

3.3 *Noise Impact Assessment: Off-site Receptors*

Description	1/1 Octave Frequency Band (Hz, dB)								Overall (dBA)
	63	125	250	500	1k	2k	4k	8k	
GSHP Plantroom	78	66	66	58	56	52	46	41	63
Propagation Loss to NSR2 – 100m (Q Factor: 2)	-48								-
Specific Sound Level at NSR2	30	18	18	10	8	4	-2	-7	14
Acoustic Feature Correction – Just Perceptible Tonality	Potential for slight perceptible tonality at NSR2 during the quietest periods of the night-time.								+2
Rating Sound Level ($L_{Ar,T}$)									16
Background Sound Level (L_{A90})	Typical night-time background sound level.								41
Exceedance									-25
BS4142 Assessment Outcome	No impact, dependent on context, at the most affected residential receptor (NSR1). This is also below the LPA criteria of 5dB below the existing L_{A90}.								
NPPF & NPSE Outcome	The assessment indicates 'No Observed Effect Level' (NOEL) in accordance with the NPPF and NPSE.								
Mitigation measures are not required to further reduce noise impact.									

Table 3 – Noise Impact Assessment: Off-site Receptors

4. Conclusion

The development has been assessed against the requirements of HTM 08-01, BS4142 and the LPA requirements outlined in decision notice.

The validation assessment indicates that the predicted noise levels associated with the GSHPs is below the HTM 08-01 limits outside the nearest wards at Opal House (NSR1) and below the LPA's criteria outside the nearest residential dwellings (NSR2).

It is therefore recommended that Condition 3(a) and 3(b) associated with the application are discharged by the LPA.

Appendix A – Acoustic Terminology

A-weighted sound pressure level, L_{pA}	Quantity of A-weighted sound pressure given by the following formula in decibels (dBA). $L_{pA} = 10 \log_{10} (pA/p_0)^2$. Where: pA is the A-weighted sound pressure in pascals (Pa) and $p0$ is the reference sound pressure (20 µPa)
Background Sound	Underlying level of sound over a period, T, which might in part be an indication of relative quietness at a given location
Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$	Value of the A-weighted sound pressure level in decibels (dB) of a continuous, steady sound that, within a specified time interval, T, has the same mean-squared sound pressure as the sound under consideration that varies with time
Facade level	Sound pressure level 1 m in front of the facade
Free-field level	Sound pressure level away from reflecting surfaces
Indoor ambient noise	Noise in a given situation at a given time, usually composed of noise from many sources, inside and outside the building, but excluding noise from activities of the occupants
Noise Criteria	Numerical indices used to define design goals in a given space
Noise Rating (NR)	Graphical method for rating a noise by comparing the noise spectrum with a family of noise rating curves
Octave Band	Band of frequencies in which the upper limit of the band is twice the frequency of the lower limit
Percentile Level, $L_{AN,T}$	A-weighted sound pressure level obtained using time-weighting “F”, which is exceeded for N% of a specified time interval
Rating Level, $L_{Ar,Tr}$	Equivalent continuous A-weighted sound pressure level of the noise, plus any adjustment for the characteristic features of the noise
Reverberation time, T	Time that would be required for the sound pressure level to decrease by 60 dB after the sound source has stopped
Sound Pressure, p	root-mean-square value of the variation in air pressure, measured in pascals (Pa) above and below atmospheric pressure, caused by the sound
Sound Pressure Level, L_p	Quantity of sound pressure, in decibels (dB), given by the formula: $L_p = 10\log_{10}(p/p_0)^{2.}$ Where: p is the root-mean-square sound pressure in pascals (Pa) and $p0$ is the reference sound pressure (20 µPa)
Weighted sound reduction index, R_w	Single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies

Appendix B – Standards, Legislation, Policy, and Guidance

This report is to be primarily based on the following standards, legislation, policy and guidance.

B.1 – National Planning Policy Framework (2024)

Government policy on noise is set out in the National Planning Policy Framework (NPPF), with the latest revision published in 2024. This replaced all earlier guidance on noise and places an emphasis on sustainability. In section 15, Conserving and enhancing the natural and local environment, paragraph 187e, it states:

Preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans;

Paragraph 198 states:

Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) *Mitigate and reduce to a minimum potential adverse impact resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
b) *Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and*
c) *Limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.*

B.2 – Noise Policy Statement for England (2010)

Paragraph 198 of the NPPF also refers to advice on adverse effects of noise given in the Noise Policy Statement for England (NPSE). This document sets out a policy vision to:

Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.

To achieve this vision the Statement identifies the following three aims:

Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

1) Avoid significant adverse impacts on health and quality of life.
2) Mitigate and minimise adverse impacts on health and quality of life.
3) Where possible, contribute to the improvement of health and quality of life.

In achieving these aims the document introduces significance criteria as follows:

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur. It is stated that *"significant adverse effects on health and quality of life should be avoided while also considering the guiding principles of sustainable development".*

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected. It is stated that the second aim refers to the situation where impact lies somewhere between LOAEL and SOAEL and requires that: *"all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also considering the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur."*

NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise. This can be related to the third aim above, which seeks: *"where possible, positively to improve health and quality of life through the pro-active management of noise while also considering the guiding principles of sustainable development, recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society. The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim"*.

This is further expanded using the updated "Noise Exposure Hierarchy Table" which includes an additional level of impact referred to as the 'No Observed Adverse Effect Level' ('NOAEL'). It is stated that at this level: *"noise can be heard, but does not cause any change in behaviour, attitude or other physiological response"*. In addition, noise at this level *"can slightly affect the acoustic character of the area but not such that there is a change in the quality of life".*

The NPSE recognises that it is not possible to have a single objective noise-based measure that is mandatory and applicable to all sources of noise in all situations and provides no guidance as to how these criteria should be interpreted. It is clear, however, that there is no requirement to achieve noise levels where there are no observable adverse impacts but that reasonable and practicable steps to reduce adverse noise impacts should be taken in the context of sustainable development and ensure a balance between noise sensitive and the need for noise generating developments.

Any scheme of noise mitigation outlined in this report will, therefore, aim to abide by the above principles of the NPPF and NPSE whilst recognising the constraints of the site.

B.3 – BS4142:2014+A1:2019 – 'Methods for rating and assessing industrial and commercial sound'

Overview

BS4142 sets out a method to assess the likely effect of sound from factories, industrial premises or fixed installations and sources of an industrial nature in commercial premises, on people who might be inside or outside a dwelling or premises used for residential purposes in the vicinity.

The procedure contained in BS4142 for assessing the effect of sound on residential receptors is to compare the measured or predicted sound level from the source in question, the $L_{Aeq,T}$ 'specific sound level', immediately outside the dwelling with the $L_{A90,T}$ background sound level.

Where the sound contains a tonality, impulsivity, intermittency and other sound characteristics, then a correction depending on the grade of the aforementioned characteristics of the sound is added to the specific sound level to obtain the $L_{Ar,Tr}$ 'rating sound level'. A correction to include the consideration of a level of uncertainty in sound measurements, data and calculations can also be applied when necessary.

Rating Penalty

Section 9 of BS4142 describes how the rating sound level should be derived from the specific sound level, by deriving a rating penalty.

BS4142 states:

"Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location, add a character correction to the specific sound level to obtain the rating level. This can be approached in three ways:

a) subjective method;
b) objective method for tonality;
c) reference method."

Due to the nature of the development the subjective method has been adopted to derive the rating sound level from the specific sound level. This is discussed in Section 9.2 of BS4142, which states:

"Where appropriate, establish a rating penalty for sound based on a subjective assessment of its characteristics. This would also be appropriate where a new source cannot be measured because it is only proposed at that time, but the characteristics of similar sources can subjectively be assessed. Correct the specific sound level if a tone, impulse or other characteristics occurs, or is expected to be present, for new or modified sound sources."

BS4142 defines four characteristics that should be considered when deriving a rating penalty, namely; tonality; impulsivity; intermittency; and other sound characteristics, which are defined as:

a) Tonality

A rating penalty of +2dB is applicable for a tone which is "just perceptible", +4dB where a tone is "clearly perceptible", and +6dB where a tone is "highly perceptible".

b) Impulsivity

A rating penalty of +3dB is applicable for impulsivity which is "just perceptible", +6dB where it is "clearly perceptible", and +9dB where it is "highly perceptible".

c) Other Sound Characteristics

BS4142 states that where "the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distance against the residual acoustic environment, a penalty of +3dB can be applied."

d) Intermittency

BS4142 states that when the "specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time … if the intermittency is readily distinctive against the residual acoustic environment, a penalty of +3dB can be applied."

Background Sound Level

The background sound level is the underlying level of sound over a period, T, and is indicative of the relative quietness at a given location. It does not reflect the occurrence of transient and/or higher sound level events and is generally governed by continuous or semi-continuous sounds.

To ensure the background sound level values used within the assessment are reliable and suitably represent both the particular circumstance and periods of interest, efforts have been made to quantify a 'typical' background sound level for a given period. The purpose has not been to simply select the lowest measured value. Diurnal patterns have also been considered as they can have a major influence on background sound levels, for example, the middle of the night can be distinctly different (and potentially of lesser importance) compared to the start or end of the night time period for sleep purposes.

Since the intention is to determine a background sound level in the absence of the specific sound that is under consideration, it is necessary to understand that the background sound level can in some circumstances legitimately include industrial and/or commercial sounds that are present as separate to the specific sound.

Assessment of Impact

BS4142 states: *"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 source exceeds the background sound level and the context in which the sound occurs"*. An estimation of the impact of the specific sound can be obtained by the difference of the rating sound level and the background sound level and considering the following:

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

Interpreting the guidance given in BS4142, with consideration of the guidance given in the NPSE and NPPG Noise, an estimation of the impact of the rating sound is summarised in the following text:

- A rating sound level that is +10dB above the background sound level is likely to be an indication of a 'Significant Observed Adverse Effect Level';
- A rating sound level that is +5dB above the background sound level is likely to be an indication of a 'Lowest Observed Adverse Effect Level';
- The lower the rating sound 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 sound level does not exceed the background sound level, this is an indication of the specific sound source having a low impact and would therefore classify as 'No Observed Adverse Effect Level';
- At levels significantly below the measured background sound level (i.e. greater than 10dB), this is an indication of a 'No Adverse Effect Level'.

During the daytime, the assessment is carried out over a reference time period of 1-hour. The periods associated with day or night, for the purposes of the Standard, are 07.00 to 23.00 and 23.00 to 07.00, respectively.

B.4 – Health Technical Memorandum (HTM) 08-01: Acoustics

This document was published in 2013. It sets out minimum performance standards for the acoustics of healthcare buildings and describes the normal means of demonstrating compliance with the Building Regulations. In particular, this document provides a means of defining acoustic criteria for each space type within a healthcare building. Acoustic criteria are provided for the following:

- Internal ambient noise levels
- Noise from mechanical services
- Sound Insulation between adjacent spaces
- Reverberation times

This document also provides criteria on the sound insulation between spaces however when defining the required amount of sound insulation, the sound insulation matrix should be used. The required amount of sound insulation is based on the level of noise and privacy requirement in the source room, and the relative sensitivity of the receiving room.


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