



Noise Impact Assessment

Site Address: Land Off Kenmore Drive, Cleckheaton, BD19 3EJ

Client Name: Robertson Construction Yorkshire & East Midlands

Project Reference No: NP-011418-2



Authorisation and Version Control

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Revision	Date	Summary of Amendments
001	27/11/2024	--
002	12/03/2025	Report updated to reflect reduced plant quantity.
003	28/03/2025	NIA of electrical substation included.

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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 noise impact assessment for installation of 4no. air source heat pump ('ASHP') units ('the proposed development') at Land Off Kenmore Drive, Cleckheaton, BD19 3EJ ('the site').

The applicant has received conditional planning approval (no. 2020/62/91746/E) ('the application') from Kirklees Metropolitan Council. This report has been prepared as evidence to discharge condition 17 imposed on the application by the Local Planning Authority ('LPA').

A noise survey has been undertaken to establish the prevailing background sound levels at the closest Noise Sensitive Receptors ('NSR'). The report details the existing background sound climate and the predicted noise emissions associated with the proposed development.

Measures required to mitigate noise impact from the proposed development have been recommended where necessary and assessed in accordance with the relevant performance standards, legislation, policy and guidance.

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 LPA's conditional approval, specifically;
 - o Condition 17.
- The Kirklees Local Plan, specifically;
 - o Policies LP24 and LP52.
- The West Yorkshire Planning Consultation Guidance – Noise & Vibration 2016.
- 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'.
- University of Salford Manchester – 'Procedure for the assessment of low frequency noise complaints (NANR45)'.

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

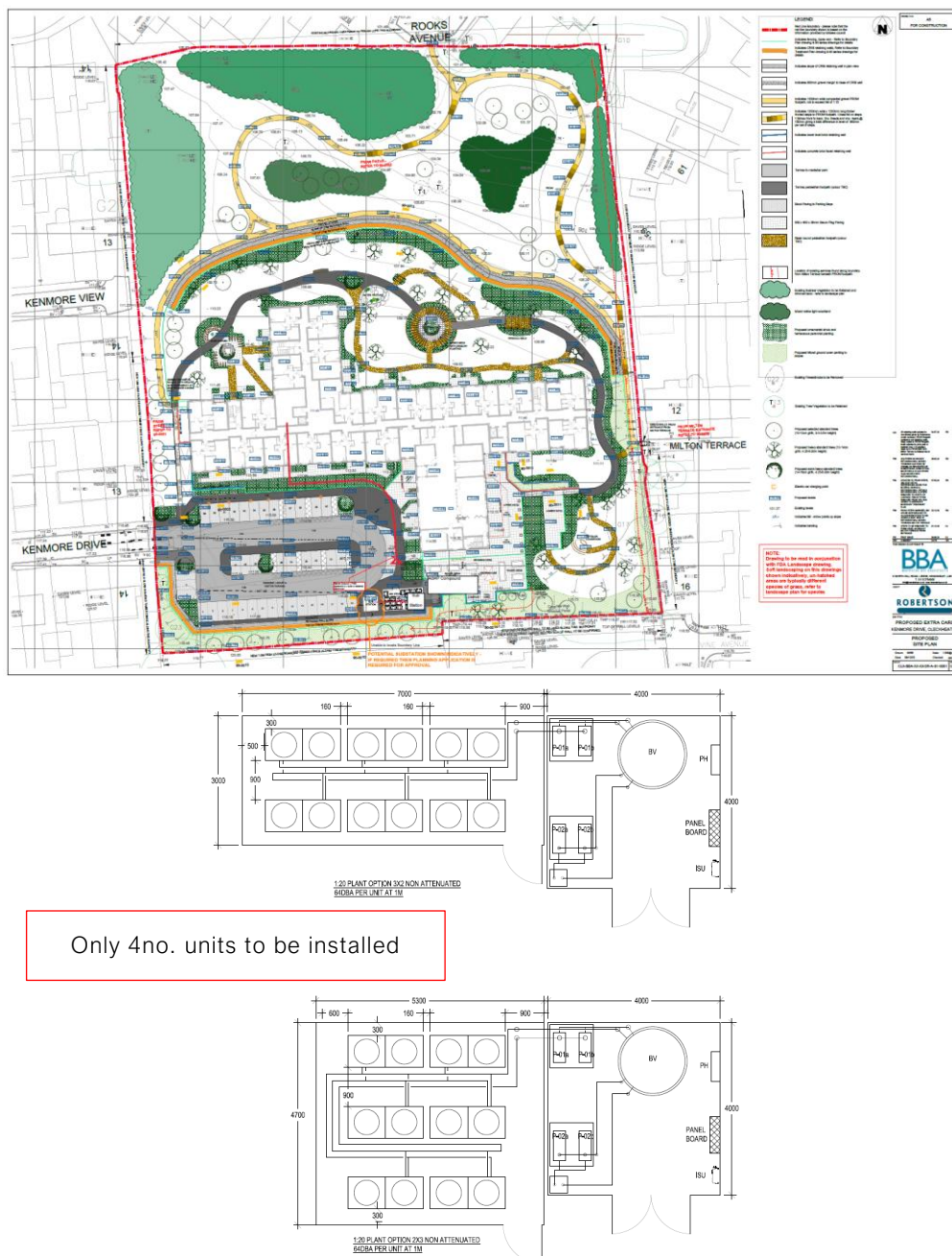
1.2 Proposal Brief

The proposal is for the installation of 4no. ASHP units (model ref: CAHV-R450YA-HPB) within an external ground level plant compound to south of the new residential block. A Minera 800kVA substation shall also be installed to serve the residential site.

Due to the units being for residential use, it is assumed they could run 24-hours a day, seven days a week.

The ASHP units will also be installed within a plant compound, however, any designs are speculative at this stage.

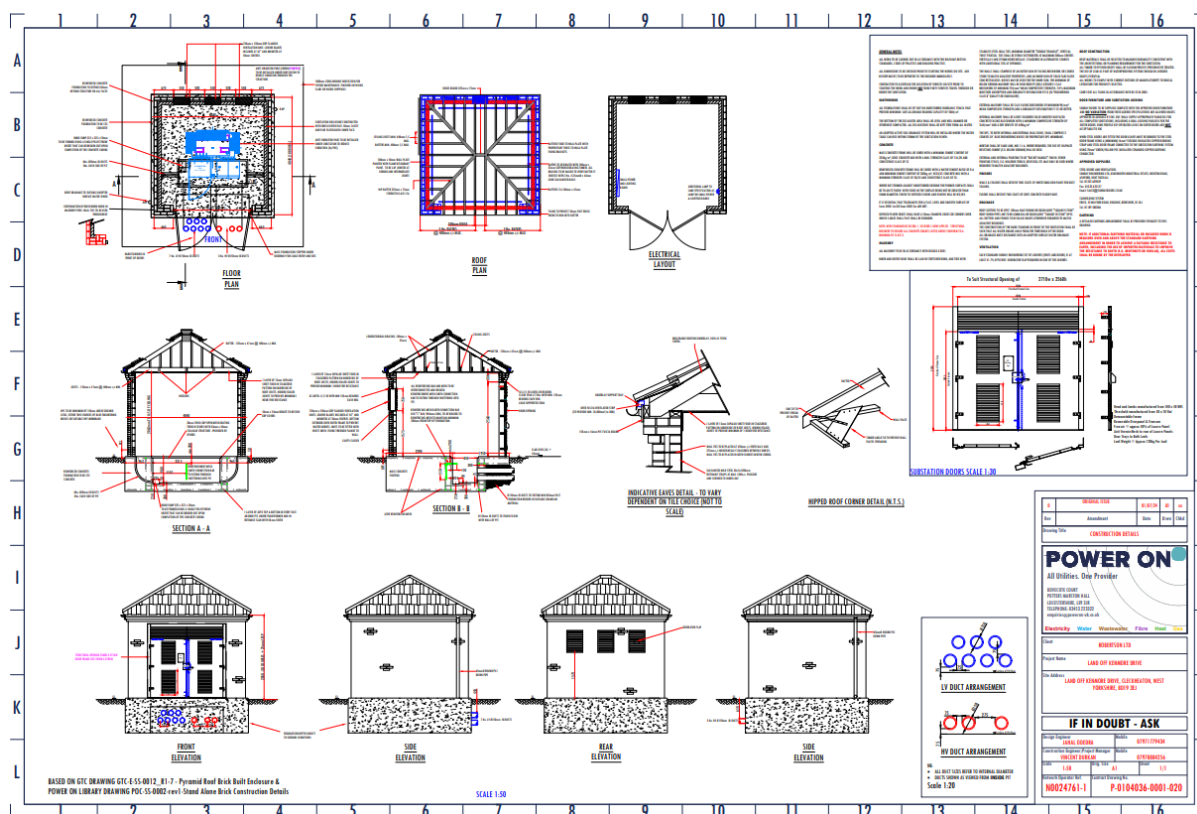
The figure below shows the proposed development and the two ASHP layout options at this stage.



Drawings by 'BBA' & 'Wheatley Mechanical & Electrical Building Services'

Figure 1 – Proposed Development

The masonry substation enclosure design is shown below.



1.3 Local Planning Authority & Adopted Criteria

Kirklees Metropolitan Council have imposed the following planning condition that requires discharging:

“17.) The combined noise from any fixed mechanical services and external plant and equipment at the development shall be effectively controlled so that the combined rating level of noise form all such equipment does not exceed the background sound level at any time. “Rating level” and “background sound level” are as defined in BS4142:2014+A1:2019.

Reason: To ensure the proposed development does not cause harmful noise pollution within any noise sensitive location or near the site, in the interest of amenity, to comply with the aims and objectives of Policies LP24 and LP52 of the Kirklees Local Plan and chapters 12 and 15 of the National Planning Policy Framework.”

2. Environmental Noise Survey

2.1 Measurement Methodology

The following table outlines the measurement dates and particulars. The survey equipment register and weather conditions can be found in Appendix D.

A 130mm diameter windshield was fitted to all microphones, with field calibrations undertaken before and after the survey; negligible drift was noted.

Location	Survey Dates	Measurement Particulars
MP1 (Long-term)	22-25/11/2024	Equipment mounted on a tripod at the site boundary adjacent to NSR1. The microphone was positioned approximately 1.5m above the ground and at least 3.5m from any other large reflective surface.

Table 1 – Measurement Methodology

The figure below outlines the site surroundings and measurement locations:



Imagery ©2024 Google, Imagery ©2024 Maxar Technologies, Map data ©2024

Figure 2 – Measurement Locations and Site Surroundings

2.1 Context & Subjective Impression

The area surrounding the site is predominantly residential and the noise profile in the absence of on-going daytime construction works was dominated by distant road traffic noise emissions from the M62. Second in nature were the sporadic road traffic noise emissions from the local road network.

On-site construction works were present during daytime hours, however, works ceased from mid-afternoon on day 1 (Friday) of the survey, and continued the morning of day 4 (Monday).

The closest NSR(1) is a two-storey detached dwelling off Vine Ave approximately 15m from the centre of the proposed ASHP compound.

NSR2 is also a two-storey detached dwelling approximately 55m east of the proposed AHSP compound, and NSR3 is an end-terrace dwelling approximately 73m west of the compound.

2.2 Environmental Noise Survey Results

Background Sound Level Analysis

The figures below each show a histogram graph across both day and night-time periods. The background sound levels have been derived from statically analysis and are dependent on the range and distribution of the $L_{A90,15min}$ measurements. The time history results can be found in Appendix D.

$L_{A90,15min}$ measurements have been utilised during the daytime to allow for more precise data manipulation due to the weather and M62 road closure on Friday evening.

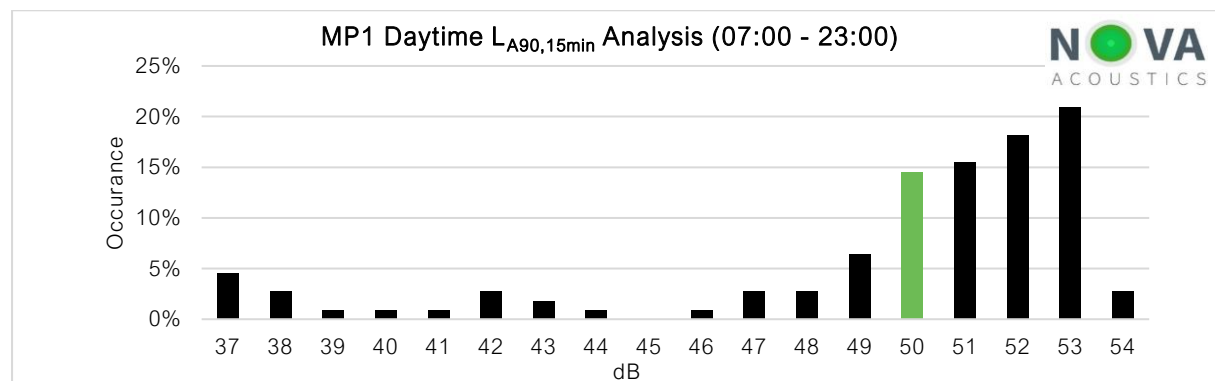


Figure 3 – MP1 Daytime Operational Hours Background Sound Level Analysis

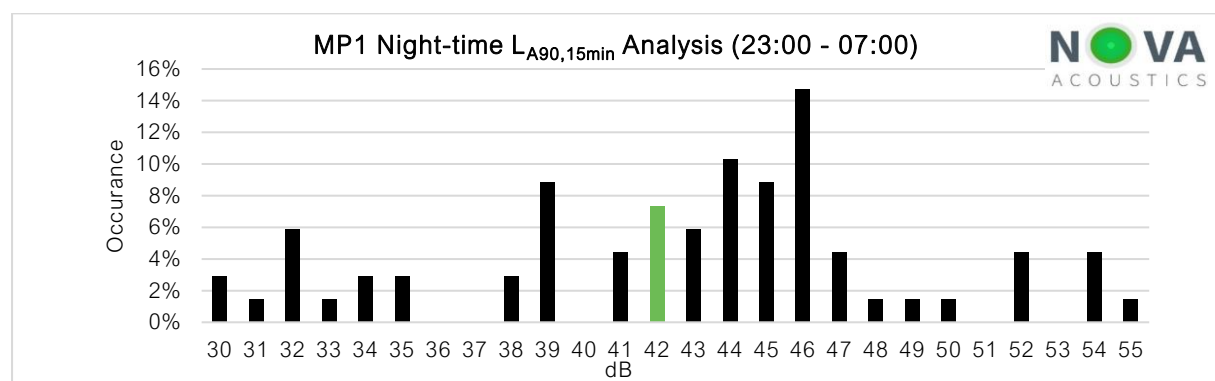


Figure 4 – MP1 Night-time Operational Hours Background Sound Level Analysis

As can be seen in figures 3 and 4, the background sound levels are taken as 50dB and 42dB $L_{A90,15min}$ for the daytime and night-time periods, respectively.

The $L_{A90,15min}$ sound levels fell to unusually low levels due to the M62 being closed on Friday evening and night of the survey. The data has been cross-referenced to data collected on the same site by NOVA Acoustics in 2020 (ref: 4296PC), and it was found that the background sound climate has remained largely the same and with the equivalent background sound levels stated above.

In light of the above the background sound levels highlighted in Figures 3 and 4 are deemed adequate to protect the residential amenity of nearby NSRs.

3. BS4142 Noise Impact Assessment

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

3.1 Proposed External Fixed Plant & Specific Sound Levels

The following table shows the calculated 1/1 octave frequency band sound power levels of the proposed ASHP and 800kVA substation that will be used in the subsequent calculations.

Please note that the sound pressure levels spectrum provided by the ASHP manufacturer does not equate to the stated global A-weighted level, therefore, a small correction has been applied across the spectrum to achieve the higher stated global A-weighted level.

The clients M&E designers have stipulated that the 'Cop Priority Mode' is to present a 'worst-case' scenario given how the ASHP units are to be installed and operated.

The sound pressure level from the substation manufacturer has been un-A-weighted and sound power levels have been calculated in accordance with industry guidance assuming the surface area of the equipment.

The manufacturers data sheets can be found in Appendix E.

Description	1/1 Octave Frequency Band (Hz, L _w dB)								Overall (dBA)
	63	125	250	500	1k	2k	4k	8k	
1no. CAHV-R450YA-HPB	68	76	72	70	64	62	64	54	72
4no. CAHV-R450YA-HPB	74	82	78	76	70	68	70	60	78
1no. Minera 800kVA Substation	51	53	46	39	28	27	26	--	42

Table 2 – Sound Power Levels of Proposed Plant Equipment

The following assumptions have been made within the specific sound level calculations:

- The cumulative sound power levels presented in Table 2.
- A source height of approximately 1.7m (top of the units).
- Each ASHP is 2m from the compound wall.
- A directivity factor of Q8.
- The plant compound walls are 2m tall and constructed from close-board timber (min surface mass 15kg/m²) with no holes or gaps.
- NSR1 is approximately 15m from the centre of the plant compound.
- The worst-case NSR1 window is 4m above local ground.
- The substation is also 15m from the closest NSR1 window and has direct line of sight. The masonry enclosure for the substation has not been included for a 'robust' assessment.

3.2 BS4142 Noise Impact Assessment

The calculations and BS4142 noise impact assessment at the most affected NSRs during the more sensitive night-time period is presented in the table below. The full specific sound level calculations can be found in Appendix F.

It is assumed that provided 'low impact' in accordance with BS4142 is achieved during the more sensitive night-time period, 'low impact' can also be achieved during the daytime when the background sound climate is higher.

Calculations & BS4142 Noise Impact Assessment – NSR1									
Description	1/1 Octave Frequency Band (Hz, dB)								Overall (dBA)
	63	125	250	500	1k	2k	4k	8k	
Specific Sound Level at NSR1 (Leq)	45	53	49	47	41	39	41	31	49
BS4142 Subjective Acoustic Feature Correction	Previous experience with AHSP units are that low frequency hums are commonly present, therefore a +2dB correction for ‘just perceptible tonality’ has been applied. Also, due to the typical on / off nature of ASHPs, a +3dB correction for perceptible ‘intermittency’ has also been applied.								+5
Rating Sound Level (LAr,Tr)	Specific sound level + above rating penalties								54
Background Sound Level	MP1 Night-time LA90,15min (Figure 4)								42
Exceedance	LAr,Tr – LA90,15min								+12
BS4142 Initial Assessment Outcome	‘Significant adverse impact, dependent on context’ at NSR1.								
NPPF & NPSE Outcome	‘Significant Observed Adverse Effect Level (‘SOAEL’).								
Discussion: Due to the ‘significant adverse impact’ predicted at NSR1, mitigation measures are necessary to reduce the noise impact and comply with the requirements of Condition 17. Given the margin by which the rating sound levels exceeds the background sound level, any minor uncertainty is not deemed to have a material effect on the assessment outcome.									

Table 3 – Calculations & BS4142 Noise Impact Assessment – NSR1

3.3 NANR45 Low Frequency Noise Screening Assessment

BS4142 explicitly states that the standard is not applicable to the assessment of low frequency noise and comments that NANR45 'Procedure for the assessment of low frequency noise disturbance (A. Moorhouse, et al., Rev1, 2011) should be consulted.

The following NANR45 assessments should be considered indicative as the assessments have been conducted external to the closest NSRs. A NANR45 assessment should be undertaken internally within

the NSR property, however, an external assessment provides an indication as to the extent of any potential noise impact, particularly in the case of partially open windows that typically provide up to 5dB of sound reduction per 1/3 octave band (Sondergaard, et al., 2019).

Presented in the table below is a comparison of the substation specific sound levels at the closest NSRs with the NANR45 curve criteria. Please note that frequencies below 50Hz have not been included as manufacturers data is not provided, however based on the assessment below, the substation poses a low risk of noise impact.

Description	1/3 Octave Frequency Band (Hz, L _{eq} dB)					
	50	63	80	100	125	160
Specific Sound Level at NSR1	12	18	11	21	3	-7
NANR45 Curve	43	42	40	38	36	34
Exceedance	-31	-24	-29	-17	-33	-41

Table 4 – NANR45 Assessment

The indicative NANR45 assessment above shows that the L_{eq} noise emissions predicted from the substation are well below the criteria outside the window of the closest NSR(1). Given that the assessment has not accounted for the substation enclosure, the assessment above is a positive indication that the associated noise emissions would be unlikely to adversely affect the nearby NSRs.

The noise impact is classed as below a 'No Observed Adverse Effect Level' ('NOAEL') in accordance with the NPSE and NPPF.

4. Recommendations & Mitigation Measures

In the following section, the recommendations and mitigation measures necessary to reduce the predicted noise impact are defined.

Please note that the noise emissions from the substation are predicted to be well below the adopted criterion and shall not constructively add the cumulative plant sound level at the most affected NSR. Therefore, no mitigation measures are required for this plant item.

4.1 Mitigation Options

Option 1:

- Relocate the ASHP compound to at least 30m from any NSR.
- Increase the height of the compound walls to 2.2m.
- Line the internal faces of the compound walls with a Class C absorption panel (e.g., iKoustic Noisestop Essential Barrier).

Option 2:

- Retain the proposed ASHP compound location.
- Fit the Ambient Acoustics 'CAHV-R450YA-HPB Bolt-On Acoustic Kit' to all ASHP units.
- Increase the height of the compound walls to 2.6m.

Option 3:

- Retain the proposed ASHP compound location.
- Fit the Ambient Acoustics 'CAHV-R450YA-HPB Bolt-On Acoustic Kit' to all ASHP units.
- Increase the height of the compound walls to 2.4m.
- Line the internal faces of the compound walls with a Class C absorption panel (e.g., iKoustic Noisestop Essential Barrier).

4.2 Mitigated BS4142 Noise Impact Assessment

All three options outlined above result in a specific sound level of 35dBA to 37dBA. The full specific sound levels calculations can be found in Appendix F, however the 'worst-case' BS4142 noise impact assessment for option 2 is shown in the table overleaf.

Calculations & BS4142 Noise Impact Assessment – NSR1									
Description	1/1 Octave Frequency Band (Hz, dB)								Overall (dBA)
	63	125	250	500	1k	2k	4k	8k	
4no. CAHV-R450YA-HPB (L _w)	74	82	78	76	70	68	70	60	78
On-Time Correction	0 (continuous)								--
Propagation Loss to NSR1	-25 (15m – Q8)								--
Sound Reduction of Bolt-On Acoustic Kit	-3	-4	-6	-8	-9	-4	-10	-7	--
Acoustic Shielding (2.6m tall)	-5	-6	-7	-8	-10	-13	-16	-19	--
Specific Sound Level at NSR1 (L _{eq})	41	47	40	35	26	26	19	9	37
BS4142 Subjective Acoustic Feature Correction	Previous experience with AHSP units are that low frequency hums are commonly present, therefore a +2dB correction for 'just perceptible tonality' has been applied. Also, due to the typical on / off nature of ASHPs, a +3dB correction for perceptible 'intermittency' has also been applied.								+5
Rating Sound Level (L _{Ar,Tr})	Specific sound level + above rating penalties								42
Background Sound Level	MP1 Night-time L _{A90,15min} (Figure 4)								42
Exceedance	L _{Ar,Tr} – L _{A90,15min}								0
BS4142 Initial Assessment Outcome	'Low impact, dependent on context' at NSR1.								
NPPF & NPSE Outcome	'No Observed Adverse Effect Level ('NOAEL').								
Discussion: It should be recognised that the assessment is based on the 'robust' assumption that all units are operating simultaneously. Furthermore, the cumulative specific sound level at the most affected NSR window during the night would be circa 6dB below the BS8233 internal ambient noise level criteria (30dBA).									

Table 5 – Calculations & BS4142 Noise Impact Assessment – NSR1 (Mitigation Option 2)

4.3 Anti-Vibration Mitigation

Whilst plant equipment vibration is not thought to pose a risk of impact on any nearby receptors, the equipment should be installed on the appropriate anti-vibration mounts as per the manufacture's recommendations.

5. Conclusion and Action Plan

The proposed development has been assessed against the requirements of BS4142 and the criteria outlined in Condition 17 of the approved planning application.

Provided one of the three mitigation options are duly implemented and retained thereafter, the cumulative rating sound level from the proposed development is not predicted to exceed the prevailing background sound level at the most affected NSR. This equates to a 'low impact' in accordance with BS4142 and in this instance a 'No Observed Adverse Effect Level ('NOAEL') in line with the NPSE and NPPF.

Based on the more onerous night-time assessment assuming all units are operational, it can be assumed that the daytime noise impact will be less due to the higher background sound climate.

Provided one of the three mitigation options are duly implemented the requirements of Condition 17 can be achieved.

Whilst plant equipment vibration is not thought to pose a risk of impact on any nearby receptors, the equipment should be installed on the appropriate anti-vibration mounts as per the manufacture's recommendations.

The make and models should not be altered. If alterations to the specification and location of the equipment is necessary, then further assessment may be required.

The findings of this report will require written approval from the Local Authority prior to work commencing.

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 p_0 is the reference sound pressure (20 μ Pa)
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 p_0 is the reference sound pressure (20 μ Pa)
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), updated 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:

- Avoid significant adverse impacts on health and quality of life;
- Mitigate and minimise adverse impacts on health and quality of life;
- 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 above 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 recognizing the constraints of the site.

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

Overview

BS4142:2014 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 BS4142:2014 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 $L_{Ar,T}$ '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 BS4142:2014 describes how the rating sound level should be derived from the specific sound level, by deriving a rating penalty.

BS4142:2014 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 BS4142:2014, 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."

BS4142:2014 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 +2 dB is applicable for a tone which is "just perceptible", +4 dB where a tone is "clearly perceptible", and +6 dB where a tone is "highly perceptible".

b) Impulsivity

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

c) Other Sound Characteristics

BS4142:2014 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 +3 dB can be applied."

d) *Intermittency*

BS4142:2014 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 +3 dB 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

BS4142:2014 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 negligible impact, depending on the context.”

Interpreting the guidance given in BS4142:2014, 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 +10 dB above the background sound level is likely to be an indication of a Significant Observed Adverse Effect Level;

- A rating sound level that is +5 dB 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 negligible impact and would therefore be classified as No Observed 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.

Appendix C –Location Plans



Appendix D – Environmental Survey

D.1 – Time History Noise Data

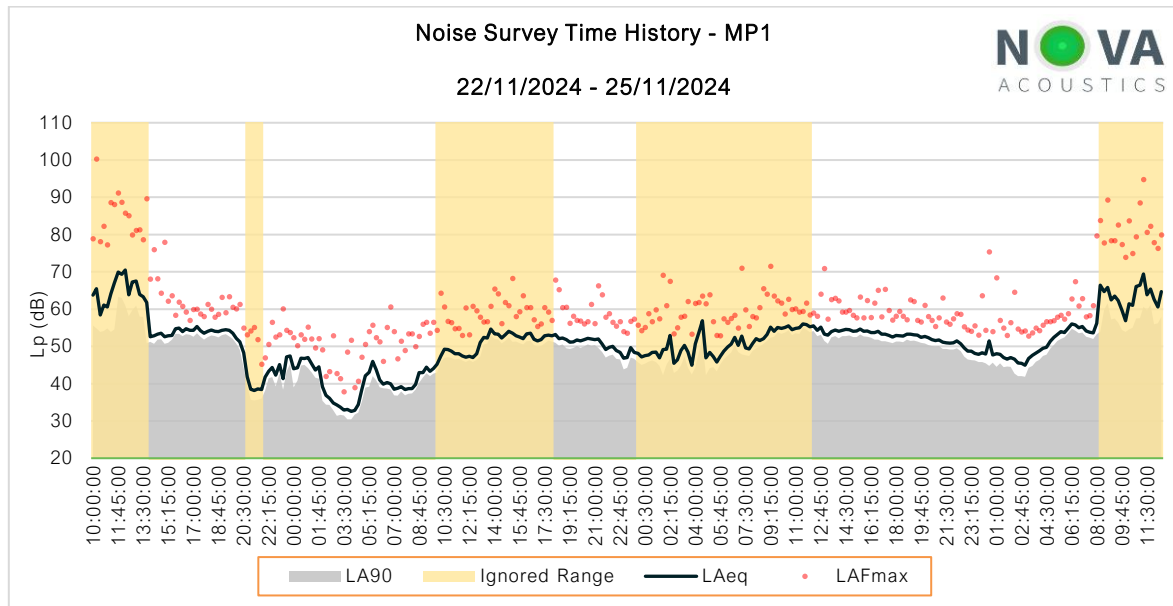


Figure 5 – MP1 Noise Survey Time History

D.2 – Surveying Equipment

Piece of Equipment	Serial No.	Calibration Deviation
Svantek 971A Class 1 Sound Level Meter	141346	≤0.1
Svantek SV33B Class 1 Calibrator	125695	

Table 6 – Surveying Equipment

All equipment used during the survey was field calibrated at the start and end of the measurement period with a negligible deviation of ≤ 0.1 dB. All sound level meters are calibrated every 24 months and all calibrators are calibrated every 12 months by a third-party calibration laboratory. All microphones were fitted with a protective windshield for the entire measurements period. Calibration certificates can be provided upon request.

D.3 – Meteorological Conditions

As the environmental noise survey was carried out over a long un-manned period, no localised records of weather conditions were taken. However, all measurements have been compared with met office weather data of the area, specifically the closest weather station, and the data from the weather station is outlined in the table below. When reviewing the time history of the noise measurements, any scenarios that were considered potentially to be affected by the local weather conditions have been omitted.

The analysis of the noise data includes statistical and percentile analysis and review of minimum and maximum values, which aids in the preclusion of any periods of undesirable weather conditions. The weather conditions were deemed suitable for the measurement of environmental noise in accordance with BS7445 Description and Measurement of Environmental Noise. The table below presents the average temperature, wind speed and rainfall range for each 24-hour period during the entire measurement.

Weather Conditions – Victoria Close (Approx. 1.6km S of Site)				
Time Period	Air Temp (°C)	Rainfall (mm/h)	Prevailing Wind Direction	Wind Speed (m/s) ^[1]
22/11/24: 00:00 – 23:59	-0.9 – 4.6	0.0 – 1.8 ^[1]	SW	0.0 – 1.1
23/11/24: 00:00 – 23:59	-0.1 – 15.2	0.0 – 40.8 ^[1]	SW	0.0 – 4.5
24/11/24: 00:00 – 23:59	9.3 – 15.5	0.0 – 13.8 ^[1]	WSW	0.0 – 6.0 ^[2]
25/11/24: 00:00 – 23:59	4.3 – 9.8	0.0 – 6.0	SW	0.0 – 4.3
Notes: [1] Adverse periods of precipitation removed from data set used to derive background sound levels. [2] Adverse and prolonged period of high wind speeds (above 5 m/s) removed from data set used to derive background sound levels.				

Table 7 – Survey Weather Conditions

Appendix E – Manufacturers' Data Sheets

MODEL			CAHV-R450YA-HPB
Power source			3-phase 4-wire 380-400-415V 50/60 Hz
Capacity (EN14511) *1			40
	Power input	kW	14.03
	Current input	A	23.7-22.5-21.7
	COP (kW/kW)		2.85
	SCOP Low/Medium		3.57/3.24
Capacity *2			33.4
	Power input	kW	16.6
	Current input	A	28.0-26.6-25.7
	COP (kW/kW)		2.01
Maximum current input		A	44.0-41.8-40.3
Water pressure drop *1			10.2 kPa (1.47 psi)
Temperature range *5	Outlet water temperature		24-70°C
	Outdoor temperature	D.B.	-25-43°C
Circulating water volume range *5			25 l/min-250 l/min
Sound pressure level (measured 1m below the unit in an anechoic room) *1*4		dB (A)	64
Sound pressure level (measured 1m below the unit in an anechoic room) *3*4		dB (A)	72
Water pipe diameter and type	Inlet	mm (in)	38.1 (1 1/2"), housing type joint
	Outlet	mm (in)	38.1 (1 1/2"), housing type joint
External finish			Acrylic painted steel sheet <Munsell 5Y 8/1 or similar>
External dimensions H x W x D		mm	1710 x 1750 x 740
Net weight		kg (lbs)	359 (791)
Design pressure	R454C	MPa	3.85
	Water	MPa	1.0
Heat exchanger	Water-side		Copper brazed stainless steel sheet
	Air-side		Plate fins and copper tubes
Compressor	Type		Inverter scroll hermetic compressor
	Manufacturer		DAIKIN
	Starting method		Inverter
	Motor output	kW	12.1
	Lubricant		PVC32EA
Fan	Air flow rate	L/s	2500 x 2
	External static pressure		10 Pa (1mm H ₂ O)
	Type and quantity		Propeller fan x 2
	Control and driving mechanism		Inverter control, direct driven by motor
	Motor output	kW	0.92 x 2
HIC (Heat inter-changer) circuit			Copper pipe
Protection devices	High pressure		High-pressure sensor and switch set at 3.85 MPa (643 psi)
	Inverter circuit		Overheat and overcurrent protection
	Compressor		Overheat protection
	Fan motor		Thermal switch
Defrosting method			Auto-defrost mode (Reversed refrigerant cycle)
Refrigerant	Type and factory charge	kg	R454C, 9.0 kg
	Flow and temperature control		LEV and HIC circuit

Notes:

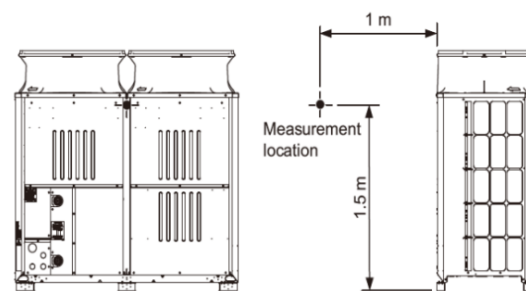
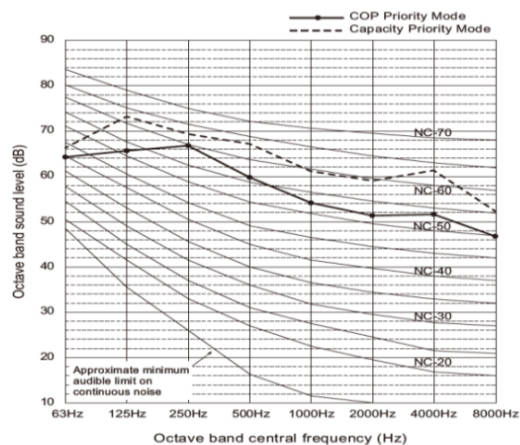
*1 Under normal heating conditions at the outdoor temperature of 7°CDB/6°CWB, the outlet water temperature of 45°C, and the inlet water temperature of 40°C.

*2 Under normal heating conditions at the outdoor temperature of -5°CDB/-6°CWB and the outlet water temperature of 55°C.

*3 Under normal heating conditions at the outdoor temperature of 7°CDB/6°CWB when the unit is set to the "Capacity Priority" mode through the dry NC-contact.

*4 The sound pressure level is a value measured in an anechoic room in accordance with the conventional method in JRA4060.

Noise Level



Measurement Position for Sound Pressure Level

Sound Pressure Level: 64/72 dB (COP Priority Mode/Capacity Priority Mode)

Operation condition: COP Priority Mode: 7°CDB/6°CWB, Inlet water temp.: 40°C, Outlet water temp. 45°C

CAHV R450YA-HPB BOLT-ON ACOUSTIC KIT



This full acoustic kit is capable of reducing the noise emissions from the Mitsubishi CAHV-R450 Air Source Heat Pump by up to 7dBA without any impact on the unit performance due to the low airflow resistance design of the kit components. Ambient Acoustics kits have been tested in Mitsubishi's own test facilities, both in the UK and in Japan and are approved for use with their products.

Key Features

- Mitsubishi Electric UK Tested and Approved
- Up to 7dBA Noise Level Reduction
- Simple to Install design
- No warranty issues*
- No negative impact on machine performance*

* provided units and kits are spaced and installed in accordance with Mitsubishi Electric and Ambient Acoustics recommendations.

63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
-3	-4	-6	-8	-9	-4	-10	-7

To achieve the maximum noise reduction performance as above, it is necessary for all the components of the Full Kit to be fitted but in applications where limited space does not permit the fitting of the air inlet acoustic louvres, the Top Only Kit can still be fitted to achieve a noise reduction of approximately 4dBA.

Options of FULL KIT or TOP ONLY KIT available

FULL KIT

Consists of left, right and rear acoustic air inlet louvres plus top air discharge attenuator box

TOP ONLY KIT

Consists of top discharge attenuator box only

The acoustic kit will increase the overall footprint of the unit by 500mm on width and 250mm front to back while overall height will be increased by 360mm. The weight of a Full Kit is approximately 215kg.



Test Certificate		N°: I760108-01		Schneider Electric	
Type : MINERA	Determination of Sound Level			Page Nr. : 1 of 1 pages	
Customer :					
WPD	Fb Nr : 760108	Mach. Nr : 760108-01			
Power (kVA) : 800	Voltage (kV) : 11 / 0.433	Standard IEC 60076-10			
Measurement method :		Sound pressure ☒		Trf. Coolers with ☐ without ☐	
		Sound intensity ☐		Fans switch on ☐ off ☐	
Test conditions :		Plan of test object :			
Test laboratory MPT					
Ambient temperature 22.9(±2) °C					
Height of mic. above grd. 1/2 h 0.524 m					
Excitation voltage 0.433 kV					
Frequency 50 Hz					
Tap position -					
Measurement distance 0.3 m					
Length of prescribed cont. 4.1 m					
Height of test object, h 1.048 m					
Area of meas. surface (S) 5.6 m²					
10lg(S/S ₀) 7.5					
A-weighted sound pressure levels of the background noise :					
Pos.	At start of test	At end of test			
A	23.2	23.4			
B	23.7	23.6			
C	22.9	23.1			
D	23.4	24.1			
L _{bg}	23.3	23.6 (A)			
A-weighted sound pressure levels L _{pA}		Average 1/3 Octaveband Analyse :			
Pos.	1/2 h	-			
1	31.4				
2	32.4				
3	32.1				
4	32.1				
5	35.1				
6	32.6				
7	33.6				
8	34.6				
9	34.0				
10	31.1				
11	33.1				
12	30.7				
L _{pA0} 32.9 dB(A)					
L _{pA0} - maximum L _{bgA} 32.9 - 23.6 = 9.4 dB(A)		Measuring instrument :			
Correction for sound reflections by factor K = 0.0 dB		Manuf. : 01dB-Metravib Meter type : NETdB			
Correction for steady-state background noise = 0.5 dB		Serial number : LCF026330-262			
Corrected average A-weighted sound pressure level L _{pA} = 32.4 dB(A)		Microphone type : MCE 212			
Calculated A-weighted sound power level L _{WA} = 39.9 dB(A)		Serial number : 101069			
		Power Analyser: Yokogawa WT 3000			
		Serial number : 91KB11116			
L _{pA} : Guaranteed - dB(A) Result : -					
L _{WA} : Guaranteed - dB(A) Result : -					
Tested by : E.ORFA		Checked by : H.SEVIL		Customer or Representative :	
Test Engineer		Test Team Leader		Revision No :	
Date : 07.09.2021		Date : 07.09.2021		Date :	

Appendix F – Specific Sound Level Calculations

Pre-mitigation

Description	Item	Source Term	Parameter	dBA	1/1 Octave Frequency Band (Hz, dB)							
					63	125	250	500	1k	2k	4k	8k
Model / Unit	CAHV-R450YA-HPB	Octave-Band Lw	Lw	72	68	76	72	70	64	62	64	54
No. of	4											
Data Type	Manufacturers Data		Total Lw	78	74	82	78	76	70	68	70	60
Source Mitigation No												
Description												
Time Corrected Lw of Fixed Plant	On-Time (min)	Time Period	Correction (dB)	78	74	82	78	76	70	68	70	60
	15	Night	0									
Propagation Loss to NSR1 (Point Source)	Distance (m)	Q Factor	Loss (dB)		Shielding (dB)							
	15	8	-25		-4	-4	-4	-4	-4	-4	-4	-4
Specific Sound Level at NSR1				49	45	53	49	47	41	39	41	31

Description	Item	Source Term	Parameter	dBA	1/1 Octave Frequency Band (Hz, dB)							
					63	125	250	500	1k	2k	4k	8k
Model / Unit	800kVA Substation	Octave-Band Lw	Lw	42	51	53	46	39	28	27	26	
No. of	1											
Data Type	Manufacturers Data		Total Lw	42	51	53	46	39	28	27	26	
Source Mitigation No												
Description												
Time Corrected Lw of Fixed Plant	On-Time (min)	Time Period	Correction (dB)	42	51	53	46	39	28	27	26	0
	15	Night	0									
Propagation Loss to NSR1 (Point Source)	Distance (m)	Q Factor	Loss (dB)		Shielding (dB)							
	15	2	-32									No
Specific Sound Level at NSR1				11	19	22	15	8	-3	-4	-5	-32

Mitigation Option 1

Description	Item	Source Term	Parameter	dBA	1/1 Octave Frequency Band (Hz, dB)							
					63	125	250	500	1k	2k	4k	8k
Model / Unit	CAHV-R450YA-HPB	Octave-Band Lw	Lw	72	68	76	72	70	64	62	64	54
No. of	4											
Data Type	Manufacturers Data		Total Lw	78	74	82	78	76	70	68	70	60
Source Mitigation No												
Description												
Time Corrected Lw of Fixed Plant	On-Time (min)	Time Period	Correction (dB)	78	74	82	78	76	70	68	70	60
	15	Night	0									
Propagation Loss to NSR1 (Point Source)	Distance (m)	Q Factor	Loss (dB)		Shielding (dB)							
	30	4	-35		-5	-5	-5	-6	-7	-9	-11	-14
Specific Sound Level at NSR1				37	34	42	38	35	28	24	24	11

Mitigation Option 2

Description	Item	Source Term	Parameter	dBA	1/1 Octave Frequency Band (Hz, dB)							
					63	125	250	500	1k	2k	4k	8k
Model / Unit	CAHV-R450YA-HPB	Octave-Band Lw	Lw	72	68	76	72	70	64	62	64	54
No. of	4											
Data Type	Manufacturers Data		Total Lw	78	74	82	78	76	70	68	70	60
Source Mitigation Yes					3	4	6	8	9	4	10	7
Description Ambient Acoustics Bolt-On Kit				71	71	78	72	68	61	64	60	53
Time Corrected Lw of Fixed Plant	On-Time (min)	Time Period	Correction (dB)	71	71	78	72	68	61	64	60	53
	15	Night	0									
Propagation Loss to NSR1 (Point Source)	Distance (m)	Q Factor	Loss (dB)		Shielding (dB)							
	15	8	-25		-5	-6	-7	-8	-10	-13	-16	-19
Specific Sound Level at NSR1				37	41	47	40	35	26	26	19	9

Mitigation Option 3

Description	Item	Source Term	Parameter	dBA	1/1 Octave Frequency Band (Hz, dB)							
					63	125	250	500	1k	2k	4k	8k
Model / Unit	CAHV-R450YA-HPB	Octave-Band Lw	Lw	72	68	76	72	70	64	62	64	54
No. of	4											
Data Type	Manufacturers Data		Total Lw	78	74	82	78	76	70	68	70	60
Source Mitigation Yes					3	4	6	8	9	4	10	7
Description	Ambient Acoustics Bolt-On Kit			71	71	78	72	68	61	64	60	53
Time Corrected Lw of Fixed Plant	On-Time (min)	Time Period	Correction (dB)									
	15	Night	0	71	71	78	72	68	61	64	60	53
Propagation Loss to NSR1 (Point Source)	Distance (m)	Q Factor	Loss (dB)		Shielding (dB)							
	15	4	-28		-5	-5	-6	-6	-8	-10	-13	-15
Specific Sound Level at NSR1				35	38	45	38	34	25	26	19	10



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