Chartered Building Consultancy

Acoustic South East

BS4142:2014-A1:2019 Assessment – Plant Assessment

Report by: Scott Castle BSc (Hons) CEnvH, MCIEH MIOA

Date: 01/10/2024

Project: J3892

Issue 1

Site: **Hollington Youth Hub, 1 Wishing Tree Road. Hastings.**

Client: **East Sussex County Council (ESCC)**

Contents

Tables

Figures

Report by: Scott Castle BSc (Hons) CEnvH, MCIEH MIOA
Checked by: Simon Barrett BSc(Hons) MSc MIOA

Issue 1	01/10/2024	Original Issue

1 Introduction and Executive Summary

Acoustic South East have been appointed to undertake an acoustic assessment to support the installation of a number of pieces of external plant as part of a renovation of the Hollington Youth Hub.

Standards and guidance referenced for this assessment include:

- BS4142:2014+A1:2019
- National Planning Policy Framework (NPPF), 2023
- Planning Noise Advice Document Sussex, November 2023

Four pieces of plant are proposed on the roof of the sports hall of the current Hollington Youth Club building as part of a refurbishment project.

The plant will likely operate from as early as 06:00 hours to ensure that the building has hot water and is sufficiently warm/cool as required for a 08:00 hours opening.

The soundscape around the application site is dominated by road traffic noise on Old Church Road. Condensers are also noted on the flat roof behind 3 Wishing Tree Road North which is the local premier shop (Wishing Tree Stores).

Attended measurements have been made at the site to determine the soundscape experienced for the different receptors located to the North, South and West of the application building.

A noise modelling (IMMI) approach has been taken to model the propagation of sound energy across the site and has considered receptors located to the immediate North (106-112 Old Church Road), Edward Terrace to the South and Wishing Tree Road North to the West of the application site.

With background noise levels established, a BS4142:2014+A1:2019 assessment has taken place to consider the simultaneous operation of the four pieces of plant. The assessment concludes a low/no impact depending on context with the results being a rating level or $L_{Ar,Tr}$ of 2dB (rounded) below the lowest measured background sound pressure level. The assessment has also considered context and uncertainty, as required by BS4142:2014+A1:2019 and these are reported herein.

The proposed planning application should not therefore be refused or withheld on noise grounds.

2 Context, Noise Criteria & Noise Assessment Methodology

2.1 Context

The client, as part of a site refurbishment at the youth club, proposes a number of roof mounted pieces of plant. These are to be located on the sports hall roof and out of immediate sight.

2.2 Location

The application site is identified in Figure 1 below.

Figure 1. Site Location

2.3 Location and Description of the Plant

There are four individual pieces of plant confirmed by the client's M+E consultant (Tournay Godfrey) as follows:

2 x Mitsubishi VRF PURY 300 condensers – (Sound Power Level (each)-86.5dB(A))(Heating mode)

1x Daikin (EDLA16D3W1 (Air to Water heat pump) – (Sound Power Level 62dB(A))

1 x Mitsubishi CAHV-R450YA (Sound Pressure Level at 1m, 72dB)

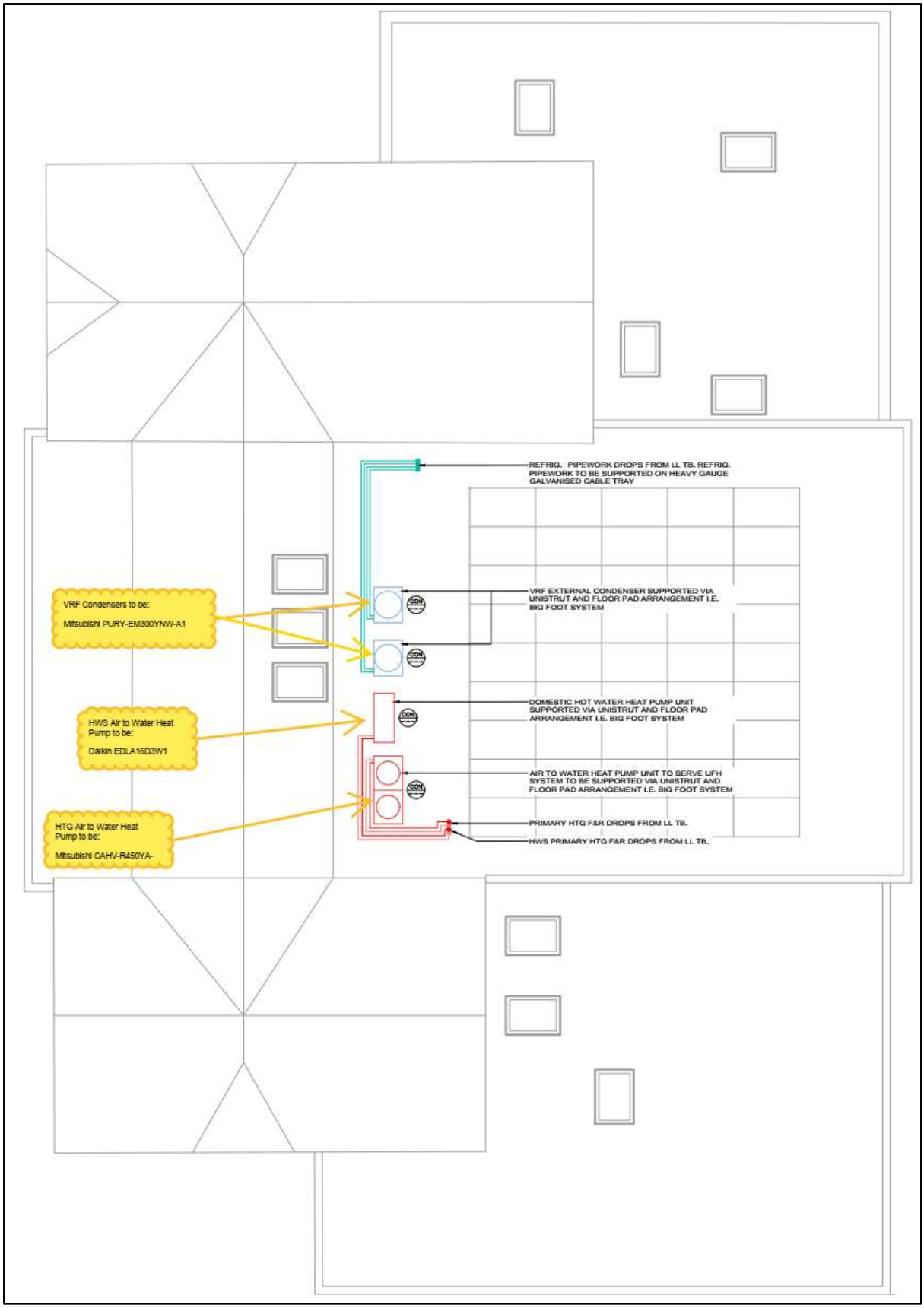

Figure 2. Rooftop Plant Layout

Figure 3. Sports Hall Roof and Plant Positioning

It is proposed that the PURY 300YNW plant would be run at 50% capacity. Figure 4 below shows the sound power level for the P300 as being reduced from 86.5dB to 69.5dB, a reduction of 17dB. Note that these are Sound Power Levels.

	Fan Speed Setting	Capacity	P200		P250		P300	
			PWL (dBA)	kW cooling	PWL (dBA)	kW cooling	PWL (dBA)	kW cooling
Foot Print (W x D) mm			920 x 740		920 x 740		920 x 740	
Heating	100%	100%	78	22.8	80	28.7	86.5	34.1
	85%	90%	74.5	20.5	76	25.8	78.5	30.7
	70%	75%	71.5	17.1	74.5	21.5	74.5	25.6
	60%	70%	69	16.0	72.5	20.1	72	23.9
	50%	60%	63	13.7	67	17.2	69.5	20.5

Figure 4. PURY Model set back data

For the single CAHV unit, this will be run at 75% of the COP priority mode and run at a sound pressure level of 62.9dB measured at 1m.

Outdoor temp. [°C]	Outlet water [°C]	Part load [%]	SPL [dB]
7	45	100	64.0
		75	62.9
		50	62.2
		25	61.9

Figure 5. Set Back Mode - CAHV Plant

2.4 Youth Club Opening Hours

The opening hours of the Youth Club are 08:00-21:00 hours.

It is normal practice to consider the operation of plant to warm the building up and provide hot water for approximately 2 hours prior to opening.

It is therefore wise to consider the operation of the units from 06:00 to 08:00 as a worst-case scenario. It follows that if data is used for the quieter periods, then this represents a worst case and the higher backgrounds, which will inevitably occur during the daytime period, should not be a concern.

2.5 Site Soundscape

An attended visit and measurements were made on 12th August 2024 and 24th September 2024. The soundscape is comprised of passing vehicular traffic including buses on Old Church Road to the North of the site. Gull noise and bird song was also noted as well as aviation.

2.6 Nearest Noise Sensitive Receptor(s)

The nearest noise sensitive receptors are located as follows and presented in plan in Figure 6 below.

- NSR 1 - Flats located to the North, 106-112 Old Church Road. These are approximately 23m to the North/East of the community facility.
- NSR 2 - Wishing Tree Road North to the West of the site, Approximately, 29-30m.
- NSR 3 - 1 Edward Terrace to the South, approximately 17m.

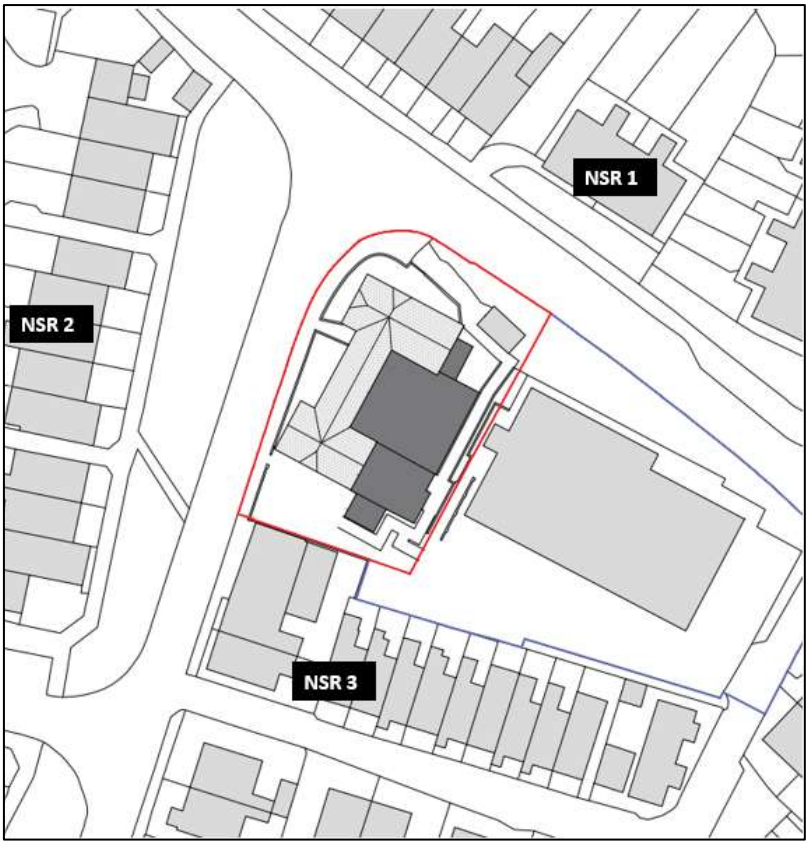

Figure 6. Receptor Locations

2.7 Planning Policy and Guidance

2.7.1 BS4142:2014-A1:2019

This document provides a means of assessing the impact of industrial or commercial sound upon nearby noise-sensitive receptors, including residential properties.

It does this by comparing the Rating Level of the noise from the industrial or commercial source with the pre-existent L_{90} background noise level affecting the same noise-sensitive premises. The Standard provides guidance that:

a) Typically, the greater the difference, the greater the magnitude of the impact.

b) A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.

c) A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.

d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background noise level, this is an indication of the specific sound source having a low impact, depending on the context.

2.7.2 NPPF, 2023

The National Planning Policy Framework (Dec 2023) defines the Government's planning policies for England and how these are expected to be applied. It sets out the Government's requirements for the planning system only to the extent that it is relevant, proportionate and necessary to do so.

The following paragraphs are relevant within NPPF Section 15 (Conserving and enhancing the natural environment) states the following:

Paragraph 180(e) - 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, and

Paragraph 191 - 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

Paragraph 193– Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.

2.7.3 Planning Noise Advice Document Sussex, November 2023

The above guidance has been followed in respect of the data collection and the formation of the reporting.

2.8 Methodology

A noise modelling approach is proposed to consider the impact of the plant on the nearest residential receptors. The predicted specific sound pressure levels at the receptor locations can then be adjusted for character corrections and a BS4142:2014 assessment carried out.

Due to recent reports of anti-social behaviour, and the risk of equipment being vandalised, tampered or stolen, early morning visits were made on different weekdays (Monday and Tuesday) to consider the site soundscape.

With the modal background sound pressure levels identified for when the plant will operate, an assessment can be made of the selected plant and its likely propagation and attenuation at the nearest residential receptors. An assessment is then made using BS4142:2014 to determine the impact of the newly introduced plant and the results considered are in line with context of the site and the uses, consistent with the approach detailed in the British Standard and the Planning and Noise Advice Document Sussex dated November 2023.

3 Sound Survey(s)

Both Attended and Unattended Surveys were used to quantify the site soundscape.

3.1 Attended Readings

Survey(s) carried out by	Scott Castle BSc(Hons) Env Health, MCIEH CEnvH MIOA
Equipment Used	ST1 - Norsonic 140 Class 1 Sound Level Meter ST2 - Svantek 307A Class 1 Sound Level Meter ST3 - Norsonic 118 Class 1 Sound Level Meter
Equipment Used	Castle Acoustic Calibrator – Serial No. 041173
Location	ST1 – 1.6m high. Tripod Mounted. 2.2m from Façade (Rock.Adults.Window*) ST2 – 1.8m high, Tripod Mounted. 8.7m from façade (Cliff.Splash.Mock*) ST3 – 2.3m high. Pole Mounted. 0.7m from wall.(Events.Divide.Wire*)
Duration	24th September 2024.
*Denotes What Three Words Location	

Table 1. Survey Details

Figure 7. Short Term Attended Readings (24th September 2024)

An attended survey was also carried out for the Northern façade on 12th August 2024 from 06:00-08:00 hours. For the 12th August 2024, contractors attended the site to cut hedgerows to the rear and strim the highway grass verges from 07:50 onwards, so the data measured thereafter is not considered representative and has not been included within the dataset.

Figure 8. Short Term Attended Readings (12 August 2024)

3.2 Unattended Measurements

An unattended sound survey was left on the top of the garage roof to limit the possibility of vandalism and tampering of the sound survey equipment, as the client warned of recent incidents of anti-social behaviour in the immediate area. The sound level meter placed was freefield and measured with a 15-minute resolution to ensure that data and more specifically, measured background sound pressure levels were capable of being extracted from the dataset. The sound level meter used ran using Fast and A weighting filters.

Unfortunately, due to a power issue with the sound level meter, measurements were only made from 16:00-23:15 hours.

Figure 9. Unattended Survey (23 August 2024)

Survey(s) carried out by	Scott Castle BSc(Hons) Env Health, MCIEH CEnvH MIOA
Equipment Used	LT1 - Norsonic 118 Class 1 Sound Level Meter
Equipment Used	Castle Acoustic Calibrator – Serial No. 041173
Location	LT1 – 1.6m high above garage flat roof (freefield) (stage.hung.locate*)
Duration	23rd August 2024.
*Denotes What Three Words Location	

Table 2. Long Term Position

4 Measured Data

4.1 Attended

A modal assessment (ie most frequently occurring) was used to consider the measured background sound pressure levels from ST1 on 12 August 2024 from 06:00-07:45 when strimming of the grass bunds and verges commenced.

A modal assessment was also used to consider the three simultaneous positions measured on 24th August 2024.

Short Term Attended Readings			
Date	Location	Time Period	Measured $L_{A90,15minutes}$
12/08/2024	ST1	06:00-07:45	39
24/09/2024	ST1	06:00-08:00	38
24/09/2024	ST2	06:00-08:00	36
24/09/2024	ST3	06:00-08:00	40

Figure 10. Outcomes of Modal Assessment of Measured Background Sound Pressure Levels, $L_{A90,15minutes}$

It is relevant to note that where there was more than one frequently occurring figure at the same value, the lower of the values has been applied to minimise uncertainty and ensure a robust assessment.

It is noted that ST3 had a higher measured background in relation to the other two receptor locations and this is likely due to the intermittent operation of roof mounted plant which serves the shop at 3 Wishing Tree Road adjacent to the application site.

Figure 11. Flat roof behind shop at 3 Wishing Tree Road

4.2 Unattended

Measured data from LT1 from 16:00 to 23:15 is presented below in Figure 12.

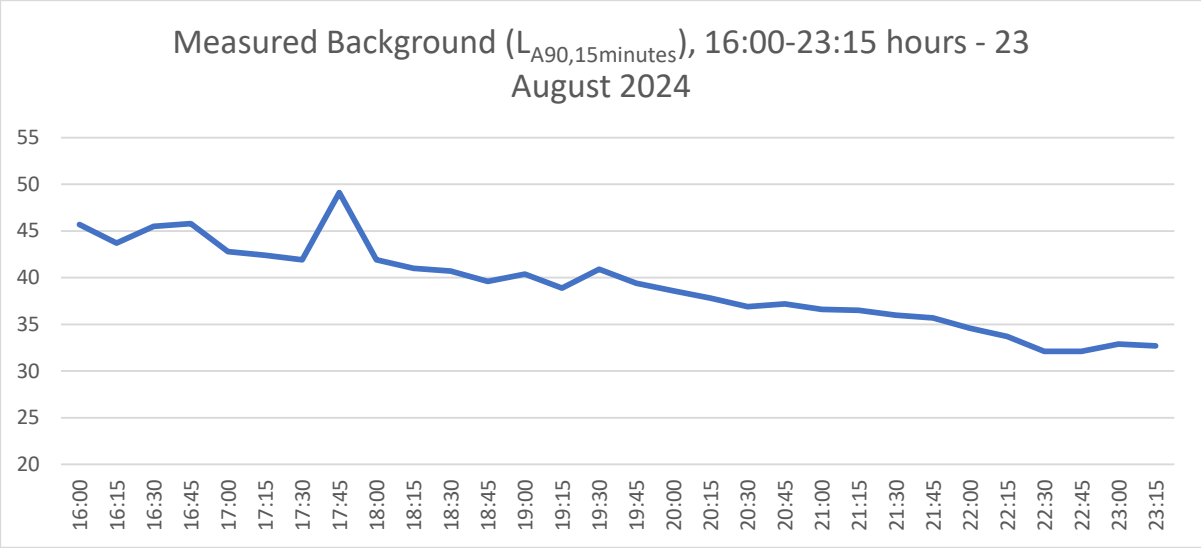

Figure 12. Results of Unattended Measured Data at ST1

It is noted that the morning and evening periods are a lot lower than the respective daytime periods.

5 IMMI Noise Modelling Approach

In order to see how noise varies at different positions around the proposed development it is possible to produce a noise contour map. A computer noise model has been completed using the computer package IMMI. Drawings of the area have been used to complete the noise models and the topography of the location recreated. IMMI faithfully implements the propagation method of ISO-9613:1996; Acoustics – Attenuation of sound during propagation outdoors.

The noise modelling software predicts freefield and A weighted dB values.

5.1 Noise Model Inputs

The Hollington Youth Hub was constructed based on elevations provided by the client's architects. The model was constructed to replicate as close as possible the existing building and specifically the sports hall flat roof, which is blocked to the West, North and South by roof returns at right angles.

Receptor locations have been placed at 4.5m above ground level to represent first floor bedrooms.

The manufacturer's data was used to obtain the following noise emissions:

Daikin – LWA- 62dB, adjusted to 65dB

Mitsubishi – VRF PURY 300 – 86.5dB, doubled to account for 2 condensers, 89.5, and additional of 3dB reflection, 92.5dB (L_{WA}).

Mitsubishi CAHV – Sound Pressure Level of 62.9dB at 1m. Adjusted to 64.8dB at 1m which accounted for 75% fan operation and a 3dB reflection. The spectral data was entered into the model to ensure accuracy.

Both the Mitsubishi PURY and CAHV models were set with directionality to 90degrees vertical propagation.

The size of the plant was also relevant and based on manufacturer's data, this was placed at certain heights (spot point sources) above the roof level. The Daikin Altherm was placed at 6.8m above ground level, the CAHV, at 7.6m above ground level and the PURY at 7.7m above ground level.

It is relevant to consider that the model considers all plant operating simultaneously.

5.2 Noise Model Outputs

The noise modelling outputs can be seen as follows:

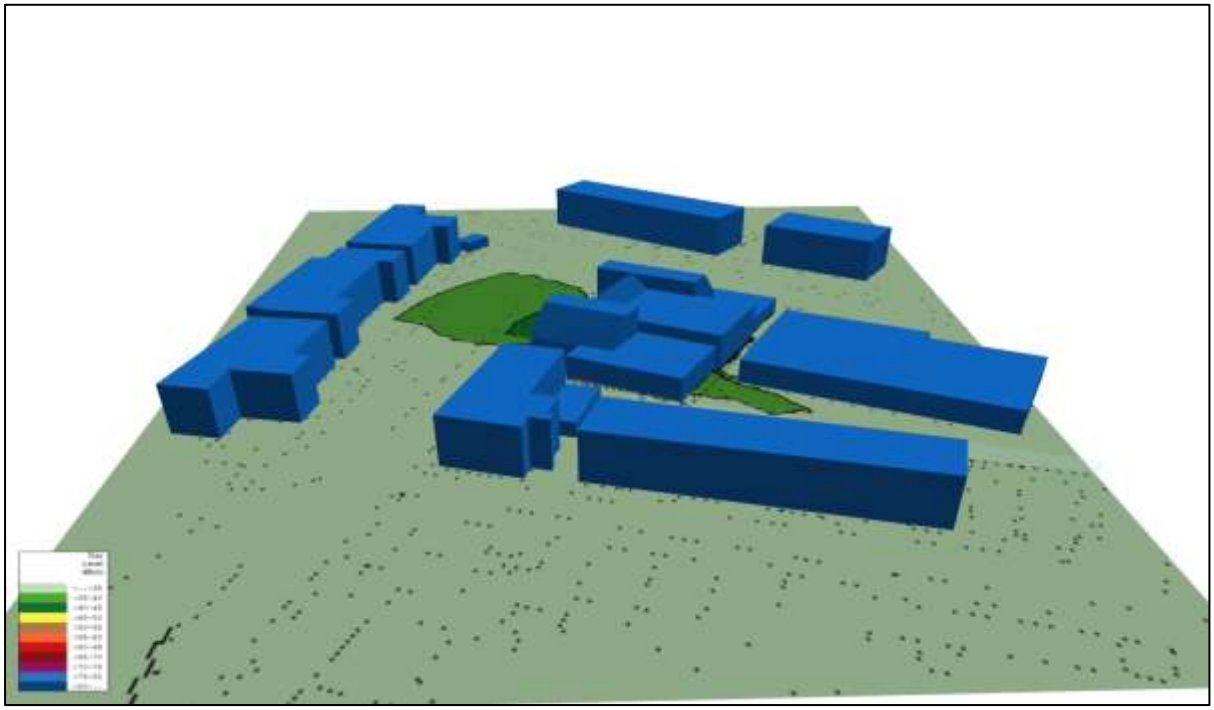

Figure 13. 3D Noise Model of Site

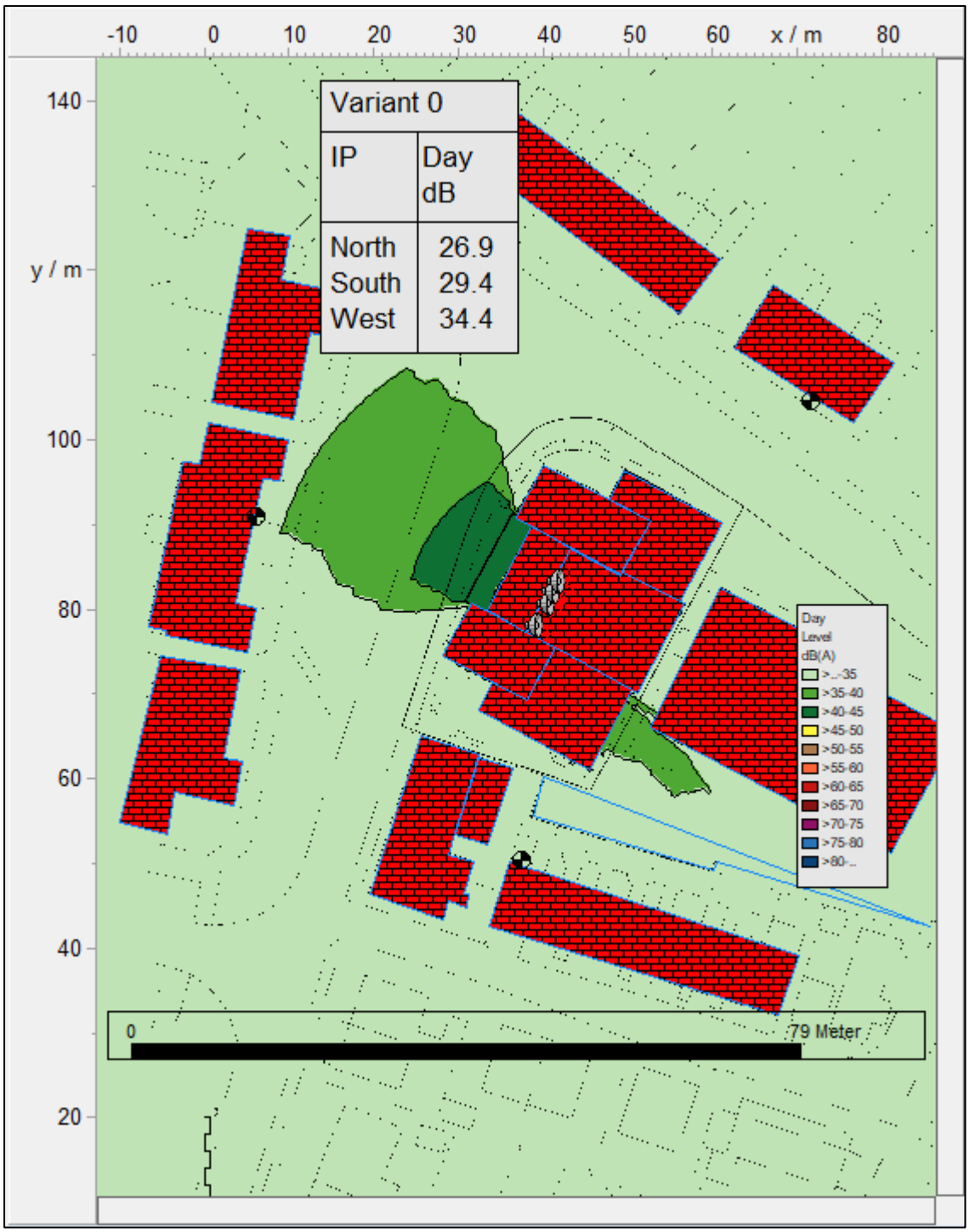

Figure 14. 2D Noise Contours of Site

5.3 Noise Model Verification Check

It is always relevant to consider whether the model outputs are as anticipated to ensure that there remains confidence in the noise modelling procedure.

The noise model was verified for ST3 as follows

Source noise levels – PURY (combined) – LWA-75.5, CAHV, SPL at 1m, 64.8, Daikin-LWA, 65.3

The approximate distance to ST 3 is 31.5m.Each piece of plant is assessed for the attenuation in distance to the receptor location and then summed at the receptor location.

(PURY)75.5 -20log(31.5)-8 = 37.5

(CAHV) 20log(31.5/1)=29.9 attenuation. Therefore 64.8-29.9=34.9

(Daikin) – 65.3-20log(31.5)-8 = 27.3

Summed at the receptor these account for 10log(103.75+103.49+102.73)=39.7dB

Accounting for a 10dB reduction for screening provides for 29.7dB at the receptor location.

The IMMI noise model prediction is 29.4dB. This accounts for a 0.3dB difference.

There is confidence in the model outcomes and reduced uncertainty in the calculation process.

6 BS4142:2014-A1:2019 Assessment

Given the anticipated early operation of the plant to generate hot water and heat the building prior to occupation, the assessment has been split into both night time and daytime periods. The night time period is considered as 23:00 to 07:00 hours and for the purposes of this assessment will account for 06:00-07:00 hours.

The daytime period considers 07:00-08:00 hours.

It should be noted that it is not intended to run the plant overnight.

It is relevant to note that the difference between 6.1 and 6.2 below is that the reference periods for BS4142 are different for the night time and daytime periods. The night time period considers a 15-minute reference period and allows for continuous operation of the units, whereas the daytime reference period is longer (1 hour) and considers intermittent operation as well as an ontime correction.

Whilst Figure 10 above presents data for measured background sound pressure levels ($L_{A90,15minutes}$) between 36-40dB, the lower of the values has been used to calculate the BS4142:2014-A1:2019 assessment.

6.1 Overnight (06:00-07:00 hours)

Night Time (06:00-07:00)			
Results	**Measurement Parameter**		**Relevant Clause**
Specifc sound level	$L_{Aeq(T)}$	34.4	7.3.4
On time corrected value	None	34.4	
Acoustic feature correction	None	34.4	9.2
Rating level	$L_{Ar,Tr}$	34.4	9.2
Background sound level	$L_{A90(T)}$	36	8
Excess of rating level over background sound level		-1.6	11
Assessment indicates a	Below Background and Low/No Impact depending on		11
Uncertainty of the assessment	Discussed		10

Figure 15. BS4142:2014-A1:2019 Night Time Assessment

6.2 Daytime (07:00-08:00 hours)

Daytime (07:00-08:00)			
Results	**Measurement Parameter**		**Relevant Clause**
Specifc sound level	$L_{Aeq(T)}$	34.4	7.3.4
On time corrected value	Minus 3	31.4	
Acoustic feature correction	Intermittent operation	3	9.2
Rating level	$L_{Ar,Tr}$	34.4	9.2
Background sound level	$L_{A90(T)}$	36	8
Excess of rating level over background sound level		-1.6	11
Assessment indicates a	Below Background and Low/No Impact depending on context		11
Uncertainty of the assessment	Discussed		10

Figure 16. BS4142:2014-A1:2019 Daytime Assessment

The BS4142:2014 outcomes are that for the daytime and short period of night time, the impact of the newly introduced plant is below background noise levels and should have low/no impact depending on context.

The context to assist the interpretation of the above findings is as follows:

- The roof mounted plant will only operate when the youth club is open and can be programmed to not operate overnight.
- The plant is relatively well hidden from sight and utilises the north and south roof returns to assist with containing the sound energy.
- The assessment has considered all plant operating at the same time, although in reality, this may not be the case.
- The assessment is wise to the relatively low noise levels experienced by residents and for this reason the M+E consultant has specified reduced mode operations to minimise the sound emissions from the site.

7 Predicted Sound Pressure Levels/Absolute Levels

The predicted sound pressure levels, as seen from the 2D noise contours in Figure 14 above range from 27dB $L_{Aeq,T}$ (rounded) for NSR1 to 34dB $L_{Aeq,T}$ (rounded) to NSR2.

Therefore, even for the worst-case scenario with a freefield sound pressure level of 34dB, with a reduction for an open window of 13dB (Industry standard, see AVOG, 2020), this accounts for a reverberant sound pressure level inside a first-floor room of 21dB.

BS8233:2014 provides an internal sound pressure level suitable for sleeping of 30dB $L_{Aeq,8hour}$. It is however noted that this relates to continuous and anonymous sound from road traffic noise, however, the internal criterion could easily be reduced by 5dB to account for sound which may not be continuous and anonymous.

It would therefore be reasonable for the 06:00-07:00 hours period when individuals are presumed to be sleeping, that a relevant assessment metric would be 25dB $L_{Aeq,1\ hour}$.

Based upon a worst case of an open window with the highest measured predicted sound pressure level from the combined plant operation, this internal criterion is achieved.

8 Plant Anti Vibration Mounts

The manufacturer's instructions and recommendations in respect of mounting conditions of the plant must be followed. It is strongly advised that to prevent sound energy being radiated into the building structure, that appropriate anti vibration mounts are considered for all roof mounted plant.

9 Uncertainty

It is important to recognise how and where uncertainty can be introduced into the assessment process and the measures taken to minimise this. The following are measures taken to minimise uncertainty.

- Close liaison with M+E consultant and discussions with plant manufacturers to ensure that the modelled data remains correct and representative of how the client wishes to utilise the building
- The report considers a worst-case scenario with all plant operating simultaneously.
- Where available, the spectral content of the proposed plant has been included within the assessment.
- Attended measurements have been carried out during the quietest period of the day when the plant would look to operate, as well as survey equipment being left in situ to identify increased daytime soundscapes.
- Noise model outputs have been checked to ensure that there remains confidence in the predicted noise levels.
- When processing data, where there are numerous lower values for measured background sound pressure levels, the lower values have been used within the assessment.
- A weather station was used to measure and record weather conditions for the short unattended survey period.

- When considering the noise sensitive receptor locations, multiple simultaneous measurements were made to consider the soundscape at three different locations.
- The final BS4142:2014 assessment has considered the predicted sound pressure levels against the lowest measured background sound pressure levels ($L_{A90,15minutes}$).

10 Conclusion

Four pieces of plant are proposed on the roof of the sports hall of the current Hollington Youth Club building as part of a refurbishment project.

The plant will likely operate from as early as 06:00 hours to ensure that the building has hot water and is sufficiently warm/cool as required for a 08:00 hours opening.

The soundscape around the application site is dominated by road traffic noise on Old Church Road. Condensers are also noted on the flat roof behind 3 Wishing Tree Road North which is the local premier shop (Wishing Tree Stores).

Attended measurements have been made at the site to determine the soundscape experienced for the different receptors located to the North, South and West of the application building.

A noise modelling (IMMI) approach has been taken to model the propagation of sound energy across the site and has considered receptors located to the immediate North (106-112 Old Church Road), Edward Terrace to the South and Wishing Tree Road North to the West of the application site.

With background noise levels established, a BS4142:2014+A1:2019 assessment has taken place to consider the simultaneous operation of the four pieces of plant. The assessment concludes a low/no impact depending on context with the results being a rating level or $L_{Ar,Tr}$ of 2dB (rounded) below the lowest measured background sound pressure level. The assessment has also considered context and uncertainty, as required by BS4142:2014+A1:2019 and these are reported herein.

The proposed planning application should not therefore be refused or withheld on noise grounds.