Report

07 January 2020

TEMPLE
LEADERS IN ENVIRONMENT, PLANNING & SUSTAINABILITY.

Report for – Peter Morris and Emily Kennedy
20 Vicar's Road
T4692 20 Vicar's Road, Plant Noise Assessment

Document version control

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Appendices

0.0 Executive Summary

Temple Group (Temple) has been appointed by Peter Morris and Emily Kennedy to undertake a plant noise assessment for equipment proposed as part of the redevelopment of the site. This includes a plunge pool located at roof level and two heat transfer units at street level.

The site currently contains a single 2 storey house while the proposed development will consist of two separate dwellings built in semi-detached style.

Camden Council has expressed their requirement that the equipment noise levels achieve "Green Effect Level" as stated in Appendix C from the Local Plan 2017. This refers to Rating Level of 10 dB below background for daytime and night-time including no events over 57dBLAmax during night periods.

The assessment indicates that the rating level of the two heat transfer units will meet the Camden Council criteria of 10 dB below the background noise level at nearby noise sensitive receptors.

The noise assessment on the proposed pool pump was carried out and permitted noise levels specified to meet the Camden Council criteria of a rating level of 10 dB below the background noise level.

1.0 Introduction

Proposal are in place for the development of 2 new build house on the site of 20 Vicar's Road, London, NW5 4NL. As part of the planning process, Temple has been appointed to undertake a noise assessment for new plant associated with a spa/plunge pool at roof level and heat transfer units at ground level.

The purpose of the noise assessment is to assess the impact on nearby noise sensitive receptors and, where required, to provide outline mitigation measures. The assessment has been carried out in line with the guidance from Camden Council and relevant national standards.

The following sections of the report describe criteria for plant noise emissions, assessment methodology, along with results of the assessment of the proposed plant.

The acoustic terminology used in this report is explained in Appendix A.

2.0 Criteria for Plant Noise Emission

2.1 Guidance from Local Authority

Nick Priddle, Technical Officer Contaminated Land and Noise working for Camden Council was contacted to agree the assessment and survey methodologies. Temple has been advised to follow the design criteria in Table C of Appendix 3 Noise thresholds in Camden Local Plan 2017 and refer to "Green Effect Level".

Existing Noise sensitive receptor	Assessment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAL (Red)
Dwellings**	Garden used for main amenity (free field) and Outside living or dining or bedroom window (façade)	Day	'Rating level' 10dB* below background	'Rating level' between 9dB below and 5dB above background	'Rating level' greater than 5dB above background
Dwellings**	Outside bedroom window (façade)	Night	'Rating level' 10dB* below background and no events exceeding 57dBLAmax	'Rating level' between 9dB below and 5dB above background or noise events between 57dB and 88dB LAmax	'Rating level' greater than 5dB above background and/or events exceeding 88dBLAmax

Policy A4 Noise and Vibration from Camden Local Plan 2017 [1]states the following:

"The Council will seek to ensure that noise and vibration is controlled and managed.

Development should have regard to Camden's Noise and Vibration Thresholds (Appendix 3). We will not grant planning permission for:

a. development likely to generate unacceptable noise and vibration impacts; or

b. development sensitive to noise in locations which experience high levels of noise, unless appropriate attenuation measures can be provided and will not harm the continued operation of existing uses.

[1] Camden Local Plan 2017

We will only grant permission for noise generating development, including any plant and machinery, if it can be operated without causing harm to amenity. We will also seek to minimise the impact on local amenity from deliveries and from the demolition and construction phases of development."

2.2 Standards and Guidance

British Standard 4142

The latest edition of British Standard 4142 (BS 4142:2014+A1:2019) distinguishes between the uses of the words "sound and "noise". Sound can be measured by a sound level meter or other measuring system. Noise is related to a human response and is routinely described as unwanted sound, or sound that is considered undesirable or disruptive.

The methods described in this standard use outdoor sound levels to assess the likely effects of sound of an industrial and/or commercial nature on people who might be inside or outside a dwelling or premises used for residential purposes upon which the sound is incident. The standard is not intended to be applied to the derivation of indoor sound levels arising from sound levels outside, or the assessment of indoor sound levels.

In the case of where a new noise-sensitive receptor is introduced and there is extant industrial and/or commercial sound, it ought to be recognised that the industrial and/or commercial sound forms a component of the acoustic environment. In such circumstances other guidance and criteria in addition to or alternative to this standard can also inform the appropriateness of both introducing a new noise-sensitive receptor and the extent of required noise mitigation.

The standard requires determination of the following:

• Rating level - $L_{Aeq,Tr}$ sound level produced by the specific sound source at the assessment location with any adjustment for the characteristic features of the sound which could be added to the specific sound level if a tone, impulse or other characteristic occurs, or is expected to be present.

• Background sound level – $L_{A90,T}$ - A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T.

• Tr is the reference time interval over which the specific sound level is determined. This is 1-hour for daytime (07:00-23:00 h) and 15-minutes for night-time (23:00-07:00 h).

The assessment methodology considers the Specific Sound Level, as measured or calculated at a potential noise sensitive receptor, due to the source under investigation. A correction factor is added to this level to account for the acoustic character of the sound as follows:

- **Tonality** – A correction of up to 6 dB depending on the prominence of tones;
- **Impulsivity** - A correction of up to 9 dB depending on the prominence of impulsivity;
- **Other sound characteristics** - A 3 dB correction may be applied where a distinctive acoustic character is present that is neither tonal nor impulsive;
- **Intermittency** - A 3 dB correction may be applied where the specific sound has identifiable on/off conditions.

An estimate of the impact of the specific sound generated can be obtained by subtracting the measured background sound level from the rating level, and the following is considered:

a) Typically, the greater this difference, the greater the magnitude of the impact.
b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

All pertinent factors should be taken into consideration when assessing the impact, including the following:

- Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night;
- The character and level of the residual sound compared to the character and level of the specific sound; and
- The sensitivity of the receptor.

3.0 Site and the Surrounding Area

The development proposed is to be located at 20 Vicar's Road, London NW5 4NL. The existing house will be demolished and replaced with 2 semi-detached houses; no.20 will be 4-bed house split over 3 storeys and no.20a will be 3-bed house split over 3 storeys, both properties will have rood terrace space.

Figure 1 shows a site plan with sensitive receptors marked as follows:

The neighbouring property on the west is a bilingual primary school (A) and new residential properties are located to the east (C) and north (B). On the opposite side of Vicar's Road are additional residential properties (D) and St Martins Church (E).

The client has proposed to install two heat transfer units (one for each new dwelling) on the southern perimeter, between the property and Vicar's Road at ground level. These units will be enclosed in metal perforated boxes (see locations on Figure 2). Heat pump 1 (HP1) will serve No.20 Vicar's Road and heat pump 2 (HP2) will service no.20a Vicar's Road.

A plunge pool will be installed on the roof terrace of no.20 (see location on Figure 3).

Figure 1 – Site plan and sensitive receptors

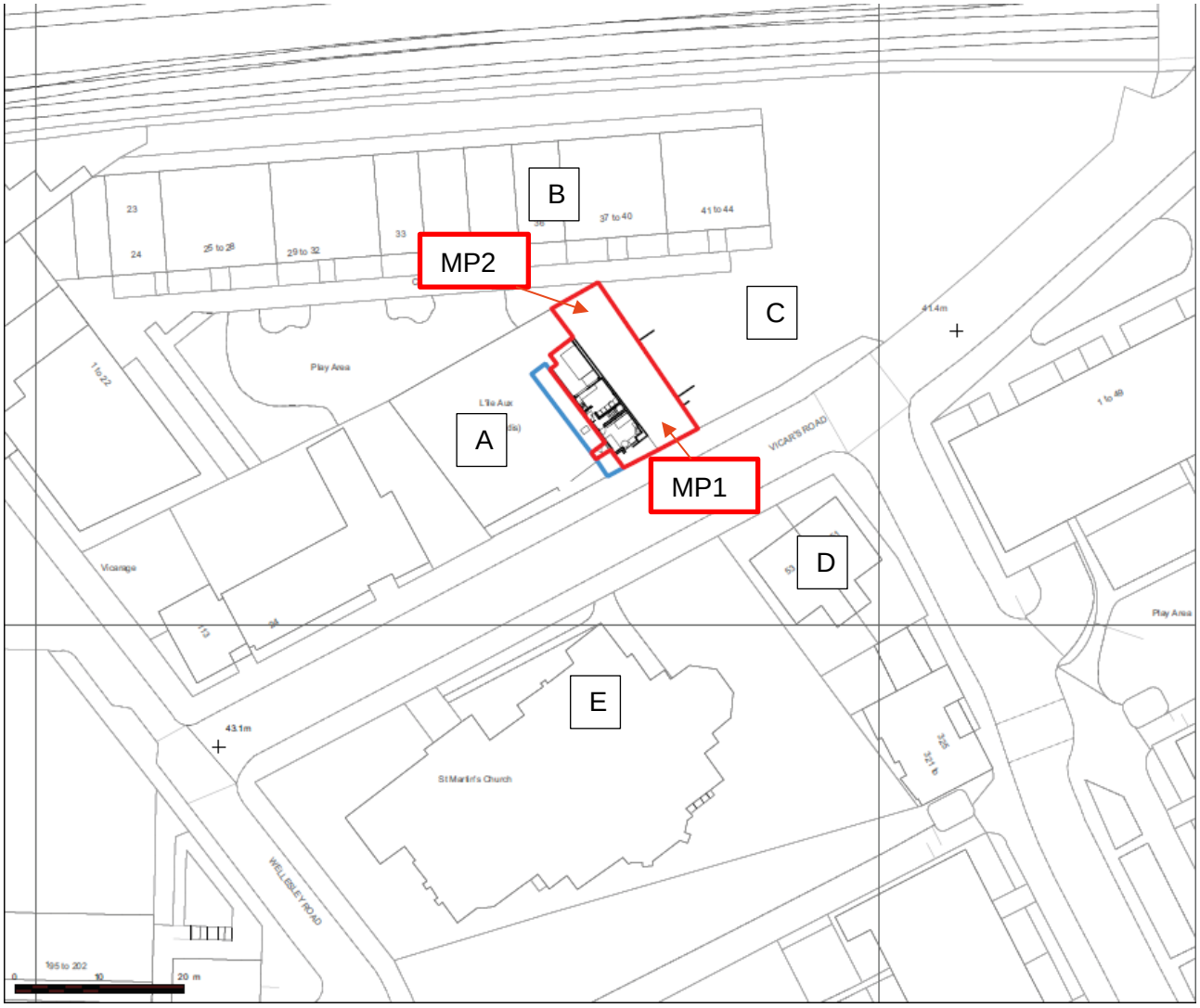
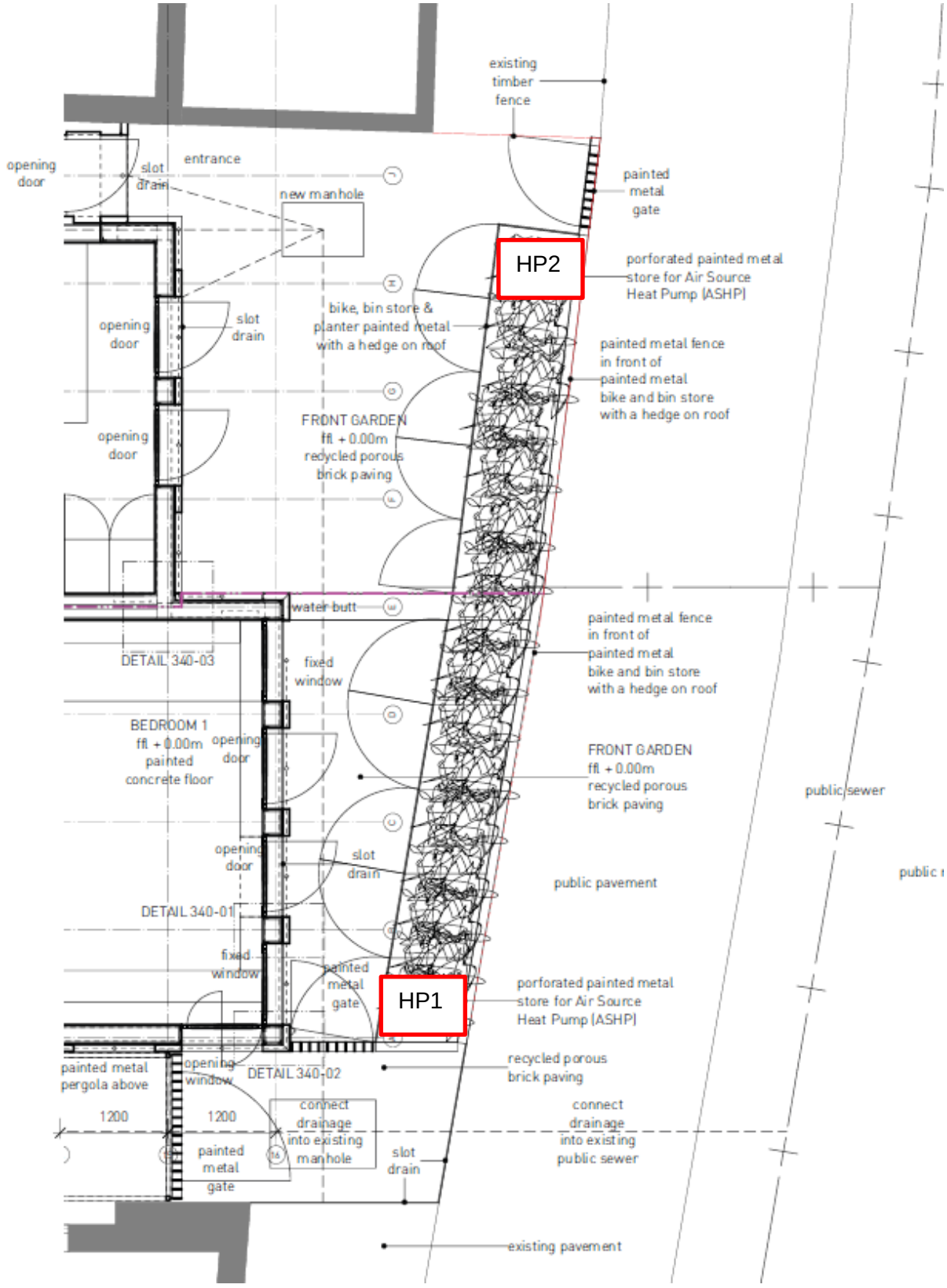


Figure 2 – Heat transfer unit locations



4.0 External Noise Measurements

An unattended noise survey was carried out at two positions within the site perimeter for a period in excess of 24 hours starting on Monday 3rd February 2020 approximately 12:00hr to around 12:00hr on Tuesday 4th February 2020 to establish the background noise climate in the area.

Measurement position 1 (MP1) was selected at the front of the garden and measurement position 2 (MP2) at the rear of the property (see Figure 1). Photographs of the measurement positions are presented in Appendix B.

Measurement intervals of 15 minutes were used to inform the assessment for daytime and night-time. The $L_{Aeq,T}$ and $L_{A90,T}$ metrics were recorded to inform the assessment.

The equipment used is detailed in **Table 4.0.1**. The measurement systems were checked using the calibrator before and after the measurements and no variation occurred. Calibration certificates are available upon request.

The weather conditions during the surveys were dry and calm with minimal wind. Wind speeds were below the recommended maximum limits of 5 m/s.

Table 4.0.1 Survey Equipment

Manufacturer	Item	Type	Serial Number
Rion	Sound Level Meter	NA-28	01260205
Rion	Sound Level Meter	NL-52	00410086
Rion	Calibrator	NC-74	34936354

5.0 Assessment

Due to the distance separation and location of the proposed plant both heat pump and plunge pool both types of plant were assessed separately.

5.1 Background Noise

For reference, BS 4142: 2014 states that "The monitoring duration should reflect the range of background sound levels for the period being assessed. In practice, there is no "single" background sound level as this is a fluctuating parameter. However, the background sound level used for the assessment should be representative of the period being assessed." An example of a statistical analysis of measurement results to determine a background sound level is also presented. A similar approach has been used below to the determine background noise levels during the daytime at each measurement location.

Using the guidance from BS 4142: 2014 background noise level for was determined using a statistical analysis. Values used are summarised in **Table 5.1.1**.

Table 5.1.1 Background noise levels

MP1		MP2	
Day	**Night**	**Day**	**Night**
58	52	42	37

Figure 5.1.1 - Statistical analysis to determine daytime background sound level at MP1

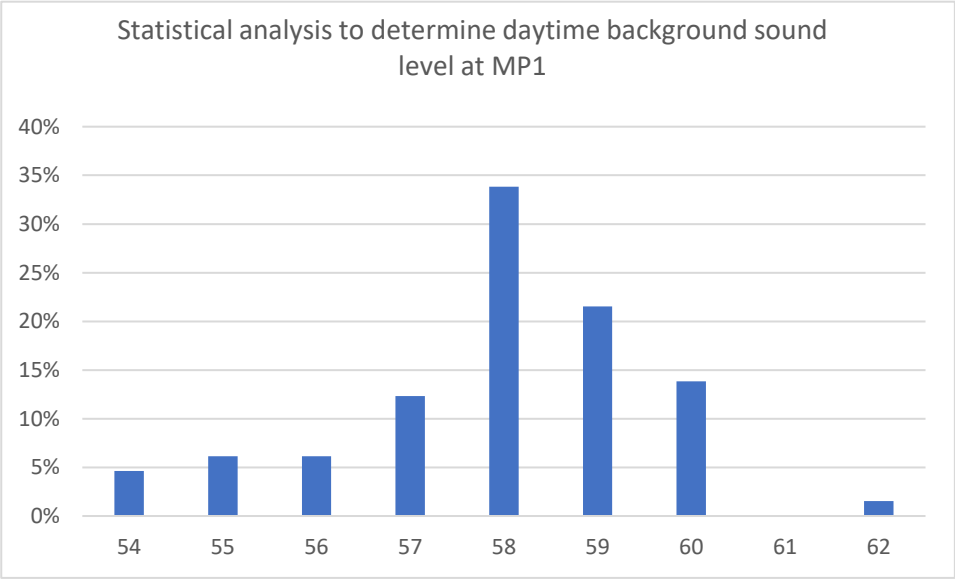


Figure 5.1.2 - Statistical analysis to determine night-time background sound level at MP1

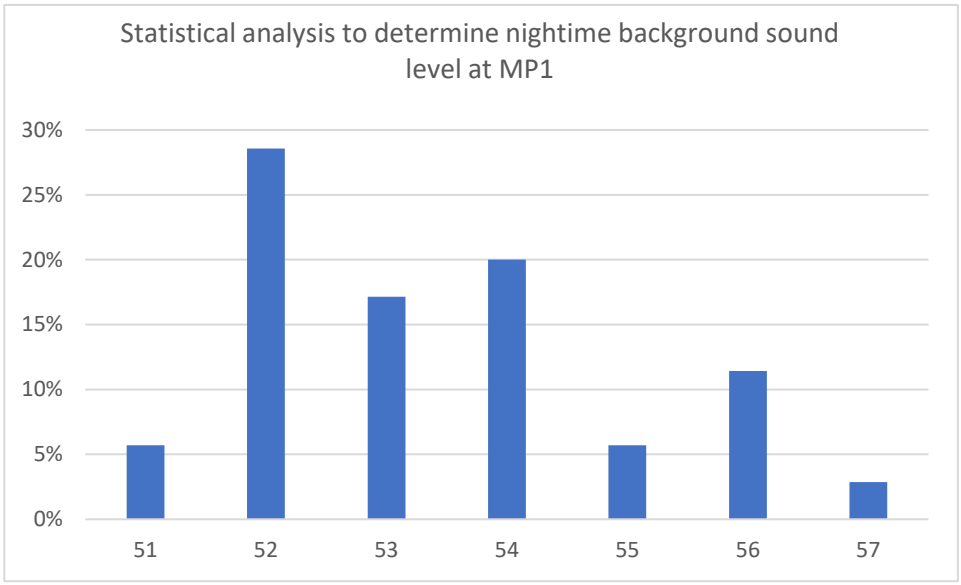


Figure 5.1.3 - Statistical analysis to determine daytime background sound level at MP2

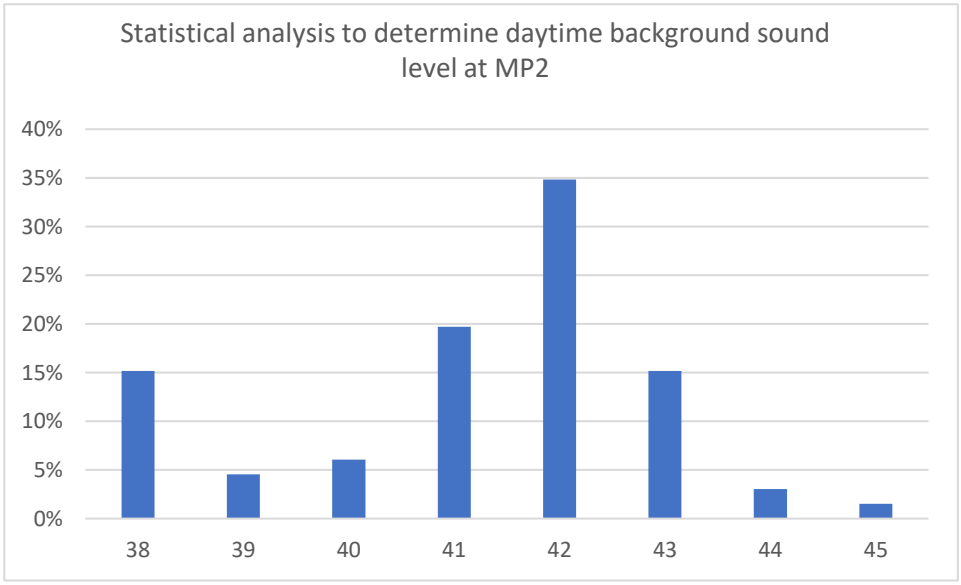
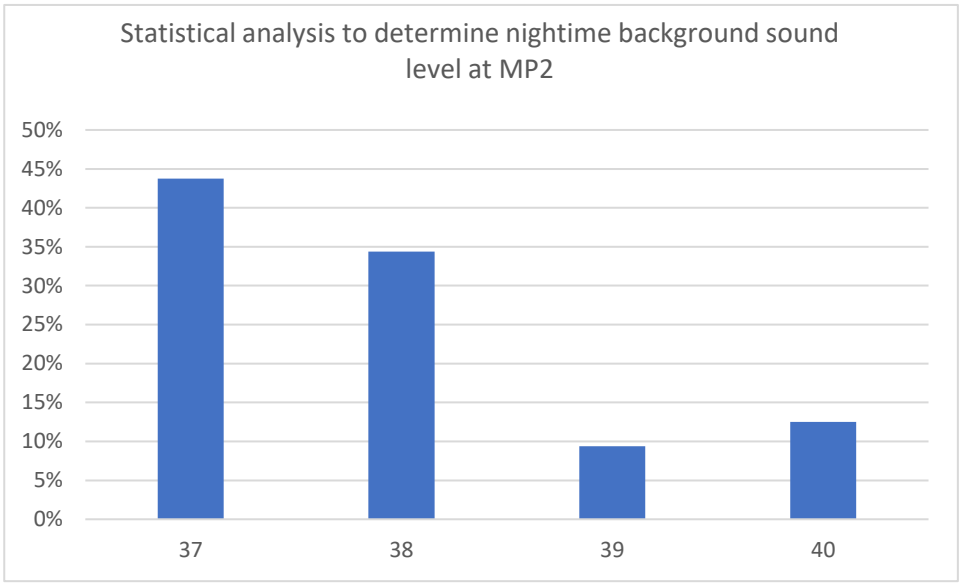


Figure 5.1.4 - Statistical analysis to determine night-time background sound level at MP2



5.2 Heat pumps assessment

A number of scenarios were assessed for day and night-time using BS 4142 as follows:

1. HP2 impact on property C (Table 5.2.1);
2. HP2 impact on property D (Table 5.2.2);
3. Cumulative effect from HP1 and HP2 on property C (Table 5.2.3); and
4. Cumulative effect from HP1 and HP2 on property D (Table 5.2.4).

Table 5.2.1 - BS4142 assessment of scenario 1 HP2 impact on property C

Results		**dB (day)**	**dB (night)**	
Background sound level	$L_{A90,15mins}$	58	52	Measured for 24h period.

Assessment made for 24h period, reference time interval is 15mins. The plant is assumed to be used on demand 24 hours, for the entire week.

Plant Sound Pressure level	L_p	51	51	Sound pressure level at 1 metre distance the from plant, as specified my manufacturer. See Appendix C.
Distance attenuation	*20log(1/4)*	-12	-12	Distance between HP2 to property C is 4m to nearest window (located behind a barrier brick fence, not taken into account).
Specific sound level	$L_{Aeq,Tr}$	39	39	Specific sound level taken from manufacturer data sheet.

Acoustic feature correction	*Tonality*	4	4	It was assumed that the plant will be tonal and clearly perceptible.
	Intermittency	3	3	Normal use of the plant means that it is switched on and off as needed.
Rating level		46	6	Rating level including acoustic feature corrections.
Excess of rating level over background sound level		-12	-6	The rating level is 12 dB below the daytime background level and therefore the assessment indicates that the specific sound source is likely to have a low impact (Green). The rating level is 6 dB below the nigh-time background level and therefore the assessment indicates that the specific sound source is likely to have a low impact to significant impact (Amber).
All calculations were based on the assumption that there is clean line of sight between the HP2 and receptor C. In reality, a solid brick wall is present, separating both properties. This would result of minimum of 5dB further attenuation, increasing the difference between background sound level and rating level to -11 dB for night-time.				

Table 5.2.2 - BS4142 assessment of scenario 2 HP2 impact on property D

Results		**dB (day)**	**dB (night)**	
Background sound level	$L_{A90,15mins}$	58	52	Measured for 24h period.
Assessment made for 24h period, reference time interval is 15mins. The plant is assumed to be used on demand 24 hours, for the entire week.				
Plant Sound Pressure level	L_p	51	51	Sound pressure level at 1 metre distance from the plant, as specified my manufacturer. See Appendix C.
Distance attenuation	*20log(1/9)*	-19	-19	Distance between HP2 to boundary of property D is 9m.
Specific sound level	$L_{Aeq,Tr}$	32	32	Specific sound level taken from manufacturer data sheet.
Acoustic feature correction	*Tonality*	4	4	It was assumed that the plant will be tonal and clearly perceptible.
	Intermittency	3	3	Normal use of the plant means that it is switched on and off as needed.
Rating level		39	39	Rating level including acoustic feature corrections.
Excess of rating level over background sound level		-19	-13	The rating level is 19 dB below the daytime background level and therefore the assessment indicates that the specific sound source is likely to have a low impact (Green). The rating level is 13 dB below the nigh-time background level and therefore the assessment indicates that the specific sound source is likely to have a low impact (Green).

Table 5.2.3 - BS4142 assessment of scenario 3 Cumulative effect from HP1 and HP2 on property C

Results		**dB (day)**	**dB (night)**	
Background sound level	$L_{A90,15mins}$	58	52	Measured for 24h period

Assessment made for 24h period, reference time interval is 15mins. The plant is assumed to be used on demand 24 hours, for the entire week.				
Plant sound pressure level	L_p	51	51	Sound pressure level at 1 metre distance from plant, as specified my manufacturer. See Appendix C
Distance attenuation	*20log(1/3)*	0	0	..
Specific sound level	$L_{Aeq,Tr}$	40	40	Cumulative calculation was carried out and distance correction applied
Acoustic feature correction	*Tonality*	4	4	It was assumed that the plant will be tonal and clearly perceptible.
	Intermittency	3	3	Normal use of the plant means that it is switched on and off as needed.
Rating level		47	47	Rating level including acoustic feature corrections.
Excess of rating level over background sound level		-11	-5	The rating level is 11 dB below the daytime background level and therefore the assessment indicates that the specific sound source is likely to have a low impact (Green). The rating level is 5 dB below the nigh-time background level and therefore the assessment indicates that the specific sound source is likely to have a low impact to significant impact (Amber).
All calculations were based on the assumption that there is clean line of sight between the HP2 and receptor C. In reality a solid brick wall is present, separating both properties. This would result of minimum of 5 dB further attenuation, increasing the difference between background sound level and rating level to -10 dB for night-time.				

Table 5.2.4 - BS4142 assessment of scenario 4 Cumulative effect from HP1 and HP2 on property D

Results		**dB (day)**	**dB (night)**	
Background sound level	$L_{A90,15mins}$	58	52	Measured for 24h period.
Assessment made for 24h period, reference time interval is 15mins. The plant is assumed to be used on demand 24 hours, for the entire week.				
Plant sound pressure level	L_p	51	51	Sound pressure level at 1 metre distance from plant, as specified my manufacturer. See Appendix C.
Two plant sound pressure level	L_p	54	54	Sum of the sound pressure level of two heat transfer units.
Distance attenuation	*20log(1/9)*	-19	-19	Distance between HP2 to boundary of property D is 9m.
Specific sound level	$L_{Aeq,Tr}$	35	35	Specific sound level taken from manufacturer data sheet.
Acoustic feature correction	*Tonality*	4	4	It was assumed that the plant will be tonal and clearly perceptible.
	Intermittency	3	3	Normal use of the plant means that it is switched on and off as needed.
Rating level		42	42	Rating level including acoustic feature corrections.
Excess of rating level over background sound level		-16	-10	The rating level is 16 dB below the daytime background level and therefore the assessment indicates that the specific sound source is likely to have a low impact (Green).

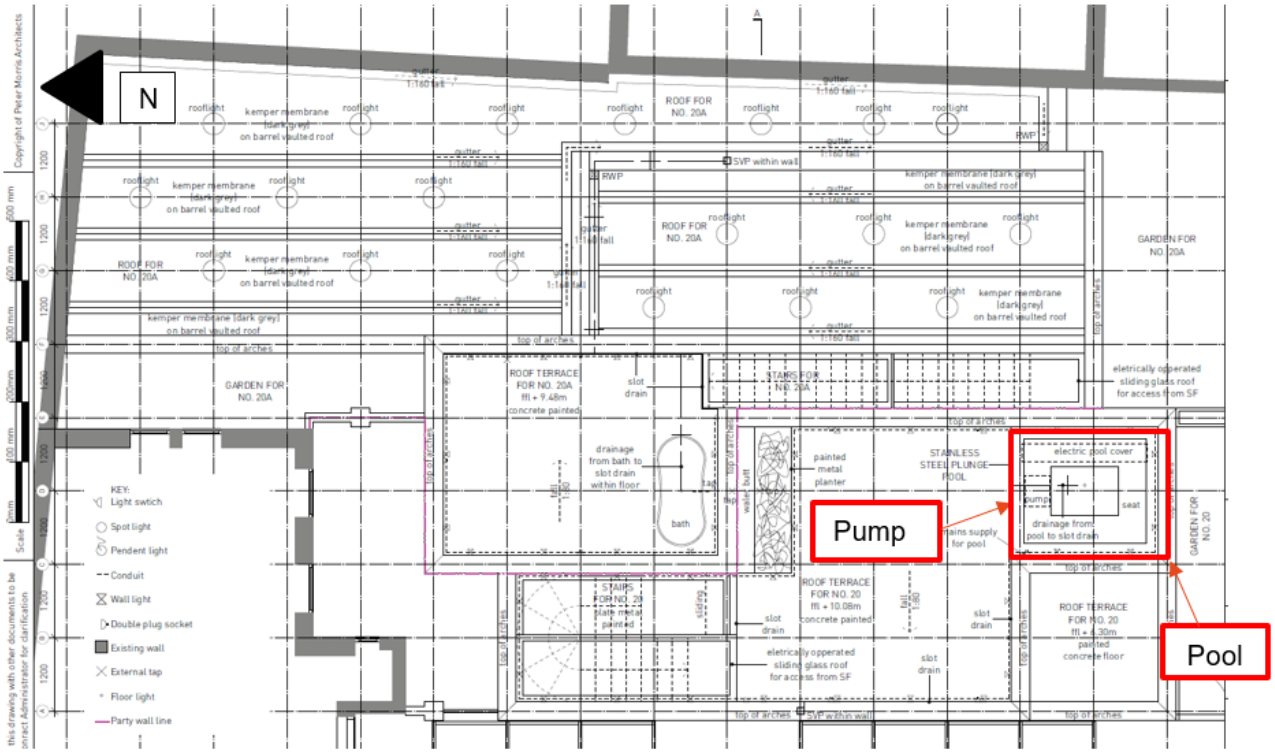
The rating level is 10dB below the nigh-time background level and therefore the assessment indicates that the specific sound source is likely to have a low impact (Green).

5.3 Plunge/Spa pool assessment

The following predictions are based on the background noise level measured at MP2 during day and night time periods as the location was further away from the noise source (Vicar's Road traffic) and screened from the north. This will closely resemble the future development where the pool will be located at roof terrace level above 2nd floor and screened from all sides.

The potentially worst affected sensitive receptor was identified to be development B to the north due to its height being approximately the same as the proposed development no.20 Vicars Road. The closest façade point to the pool is around 20m away to the north. It has been identified by Figure 3 that the pump operating in the pool enclosure will be the main noise source facing north, therefore the assessment was ruled by this component.

Figure 3 – Roof terrace plan and pool location



Residential building C will be heavily screened by no.20a and its maximum height is lower.

Manufacturer's data was not readily available at the time of the assessment. As such, a plant noise emission limit for the pool-pump to meet the Camden Council criteria of low impact (Green, 10 dB below background noise level) has been proposed.

Table 5.3.1 - BS4142 assessment of pool setup

Results		**dB (day)**	**dB (night)**	
Background sound level	$L_{A90,15mins}$	42	37	Measured for 24h period

Assessment made for 24h period, reference time interval is 15mins. The plant is assumed to be ysed on demand 24 hours, for the entire week.

Plant sound pressure level	L_p	51	46	Sound pressure level allowance at 1 metre from the source.
Distance attenuation	*20log(1/20)*	-26	-26	
Specific sound level	$L_{Aeq,Tr}$	20	20	Assumed sound pressure level of 46 dBA to meet local authority requirements.
Acoustic feature correction	*Tonality*	4	4	Due to water pumps nature of operation rating of 4 is assumed.
	Intermittency	3	3	Normal use of the plant means that it is switched on and off as required by the residents.
Rating level		23	27	Rating level including acoustic feature corrections.
Excess of rating level over background sound level		-10	-10	

Based on the potential for 24 hour use, the maximum sound pressure level for the pump has been predicted to be 46 dBA at 1 metre from the source to meet Camden Council's "Green" requirement. Should the pool only be used during the daytime (i.e. between 07:00hr-23:00hr), it is predicted that the maximum sound pressure level can be relaxed to 51 dBA at 1 metre from the source.

6.0 Conclusion

Temple has been instructed by Peter Morris and Emily Kennedy to undertake a noise assessment for a proposed plunge pool located on roof level and two proposed heat transfer units on street level to inform the planning application for 20 Vicar's Road, London, NW5 4NL.

Consequently, Temple has undertaken an unattended noise survey which has been used to assess the effects of proposed mechanical plants on nearest noise sensitive receptors for the proposed development. This has been assessed in line with the Camden Council guidance and relevant national standards.

The assessment indicates that the rating level of the two heat transfer units will meet the Camden Council criteria of 10 dB below the background noise level at nearby noise sensitive receptors.

The noise assessment on the proposed pool pump was carried out and permitted noise levels specified to meet the Camden Council criteria of a rating level of 10 dB below the background noise level.

Appendix A **Acoustic Terminology**

Noise/Sound

Noise and sound need to be carefully distinguished. Sound is a term used to describe wave-like variations in air pressure that occur at frequencies that can stimulate receptors in the inner ear and, if sufficiently powerful, be appreciated at a conscious level. Noise implies the presence of sound but also implies a response to sound: noise is often defined as unwanted sound.

Decibel, dB

The unit used to describe the magnitude of sound is the decibel (dB) and the quantity measured is the sound pressure level. The decibel scale is logarithmic, and it ascribes equal values to proportional changes in sound pressure, which is a characteristic of the ear. Use of a logarithmic scale has the added advantage that it compresses the very wide range of sound pressures to which the ear may typically be exposed to a more manageable range of numbers. The threshold of hearing occurs at approximately 0 dB (which corresponds to a reference sound pressure of 20 µPa) and the threshold of pain is around 120 dB.

Frequency, Hz

Frequency is the number of occurrences of a repeating event per unit second or Hertz (Hz). The human ear is sensitive to sound in the range 20 Hz to 20,000 Hz (20 kHz). For acoustic engineering purposes, the frequency range is usually divided up into octave bands, in which the upper limiting frequency for any band is twice the lower limiting frequency. The bands are described by their centre frequency value. In environmental acoustics the ranges typically used are from 63 Hz to 8 kHz.

A-weighting

The sensitivity of the ear is frequency dependent. Sound level meters are fitted with a weighting network which approximates to this response and allows sound levels to be expressed as an overall single figure value, in dB(A).

Ambient sound

Totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far.

Ambient sound level ($L_{Aeq,T}$)

Equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T.

Background sound level ($L_{A90,T}$)

A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90 % of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.

Rating level

Specific sound level plus any adjustment for the characteristic features of the sound.

Reference time interval

Specified interval over which the specific sound level is determined. This is 1 h during the day from 07:00 h to 23:00 h and a shorter period of 15 min at night from 23:00 h to 07:00 h.

Residual sound

Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.

Residual sound level ($L_{Aeq,T}$)

Equivalent continuous A-weighted sound pressure level of the residual sound at the assessment location over a given time interval, T.

Specific sound level

Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval.

Specific sound source

Sound source being assessed.

Appendix B Site Photos

Figure 4 – Background Measurement Position 1 (MP1)

Figure 5 – Background Measurement Position 2 (MP2)

Appendix C **Manufacturer plant data**

OUTDOOR UNIT		PUHZ-SW50VKA(-BS)	PUHZ-SW75VHA(-BS)	PUHZ-SW120VHA(-BS)
HEAT PUMP SPACE HEATER - 55℃	ErP Rating	A++	A++	A++
	η_s	125%	127%	125%
	SCOP	3.20	3.26	3.21
HEAT PUMP SPACE HEATER - 35℃	ErP Rating	A++	A++	A++
	η_s	163%	154%	162%
	SCOP	4.16	3.92	4.13
HEAT PUMP COMBINATION HEATER - Large Profile*1	ErP Rating	A	A	A
	η_{wh}	98%	93%	99%
HEATING*2 (A-3/W35)	Capacity (kW)	5.25	7.0	11.2
	Power Input (kW)	1.84	2.24	3.71
	COP	2.85	3.12	3.02
OPERATING AMBIENT TEMPERATURE (°C DB)*7		-15 ~ +35°C	-20 ~ +35°C	-20 ~ +35°C
SOUND PRESSURE LEVEL AT 1M (dBA)*3*4		46	51	54
LOW NOISE MODE (dBA)*3		42	48	51
WATER DATA - Water connections made at indoor hydrobox	Flow Rate (l/min)	11.8	22.9	45.9
DIMENSIONS (mm)	Width	809+62*8	950	950
	Depth	300	330+30*5	330+30*5
	Height	630	943	1350
WEIGHT (kg)		43	75	118
REFRIGERANT	Type	R410A	R410A	R410A
	Charge (kg) - 10m pipe length	1.4	3.2	4.6
	Pipe Size - Gas/Liquid (mm (in))	12.7 (1/2") / 6.35 (1/4")	15.88 (5/8") / 9.52 (3/8")	15.88 (5/8") / 9.52 (3/8")
	Connection Type	Flared	Flared	Flared
	Max Pipe Length (m)	40	40	75
	Min Pipe Length (m)	2	5	5
	Max Height Difference (m)	30	10	30
ELECTRICAL DATA	Electrical Supply	220-240v, 50Hz	220-240v, 50Hz	220-240v, 50Hz
	Phase	Single	Single	Single
	Nominal Running Current [MAX] (A)	3.8 [13]	8.1 [19]	17.5 [29.5]
	Fuse Rating - MCB Sizes (A)*6	16	25	40

*1 Combination with EHST20(D)(C)-MHCW Cylinders
*2 Under normal heating conditions at outdoor temp: -3°CDB / -4°CWB, outlet water temp 35°C, inlet water temp 30°C
*3 Under normal heating conditions at outdoor temp: 7°CDB / 6°CWB, outlet water temp 35°C, inlet water temp 30°C as tested to BS EN14511
*4 Sound power level of the PUHZ-SW50VKA is 62dBA, PUHZ-SW75VHA2 is 65.6dBA, PUHZ-SW120VHA is 68.8dBA. as tested to BS EN12102
*5 Grille
*6 MCB Sizes BS EN60898-2 & BS EN60947-2
*7 Heating maximum ambient temperature -21°CDB, DHW Hot water maximum ambient temperature -35°CDB
*8 Electrical cover

η_s is the seasonal space heating energy efficiency (SSHEE) η_{wh} is the water heating energy efficiency

Figure 6 – Heat transfer unit specification sheet, HP1 & HP2 model PUHZ-SW75VHA(-BS)