

Mechanical Plant Noise Impact Assessment

Garages North of 40-48 Northview, Swanley, BR8 7BQ

Report ref.

RJ48/21231/0

Issued to

Helix Limited

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1. SUMMARY

- Helix Limited propose minor material amendments to existing planning permission to install air source heat pumps in the rear gardens of three housing sites in Swanley. This report deals with one of these sites, garages north of 40-48 Northview, Swanley, BR8 7BQ.
- The Local Authority, Sevenoaks District Council, require a noise impact assessment in accordance with their current guidelines to demonstrate that the proposed plant items will have an acceptable impact upon nearby residences.
- The nearest noise sensitive receptor is the residence at 3 Kettlewell Court.
- The air source heat pumps have the potential to operate at any time throughout the day and night.
- This report describes the analysis carried out in determining the baseline noise environment, noise emission levels from the proposed air source heat pumps and the resultant Rating Level at the nearest noise-sensitive location for assessment purposes.
- The calculated Rating Level at the nearest noise sensitive receiver is equal to the Background Sound Level.
- The background sound survey was completed during partial Covid-19 restrictions, although this is not considered to have had a significant effect on measured noise levels.
- The assessment concludes that the proposed air source heat pumps will have a low noise impact to nearby receptors.



2. INTRODUCTION

Helix Limited are seeking a minor material amendment to existing planning permission to install air source heat pumps at three housing sites in Swanley. This report deals with one of these sites, garages north of 40-48 Northview. The air source heat pumps are to be installed externally within the rear gardens of the new houses.

As part of minor material amendment process, Sevenoaks District Council (SDC) require an acoustic report to be prepared, assessing the noise impact of the proposed mechanical plant installation.

Spectrum Acoustic Consultants have been commissioned to assess the noise impact from the proposed equipment.

This report presents the results of the assessment, including:

- Details of the assessment criteria;
- Measurements of existing background sound levels;
- Manufacturer's noise data for the proposed air source heat pumps;
- Predictions of noise levels to the nearest noise-sensitive receptors;
- Assessment of the noise impact against BS 4142¹.

3. SITE DESCRIPTION AND PROPOSALS

3.1 GENERAL DESCRIPTION OF THE SITES AND AREA

All three housing sites are located in close proximity to one another in a primarily residential area of Swanley. A satellite image indicating the location of each site is included in Appendix C. A plan showing the proposed site layout for garages north of 40-48 Northview, including the location of air source heat pumps, is included in Appendix A.

3.1.1 Garages North of 40 - 48 Northview

This site is located approximately 85m north west of the land adjacent to Kettlewell Court site. Swanley park and allotment lie directly to the north with a path to access the park at the north west corner of site. The remaining surrounding land use is residential.

The ambient sound at this location is identical to that of Kettlewell Court. On weekdays during the daytime, noise from construction work at Kettlewell Court is dominant. At all other times the noise climate is controlled by intermittent local network and distant road traffic noise.

The nearest noise sensitive receivers are residences at 1-3 Kettlewell Court to the east and 44-46 Northview to the south.

¹ BS 4142:2014+A1:2019 *Methods for rating and assessing industrial and commercial sound*

3.2 DETAILS OF PLANT

A product datasheet for the condenser unit, including noise emission data, is given in Appendix B. The sound power level of the proposed air source heat pump is summarised in Table 1 below.

Manufacturer	Model	Manufacturer's noise data
Mitsubishi	PUZ-WM50VHA	Mitsubishi's noise data indicates a sound pressure level at 1m of 52 dBA equivalent to a sound power level of 61 dBA. Spectral data is supplied for the sound pressure level at 1m for both heating and cooling operation. The heating spectrum has been used to form the sound power spectrum to match the sound power level of 61 dBA. This sound power spectrum has been used for noise modelling.

Table 1: Sound power level of proposed air source heat pump

The air source heat pump will operate continuously when in use. The periods of use will be controlled by the residents of the proposed properties. It can be assumed that during winter there will be periods when the air source heat pumps will be operational 24 hours a day.

4. CRITERIA

The NPPF² requires new development to avoid noise giving rise to significant adverse impacts on health and the quality of life.

An enquiry has been made to Sevenoaks District Council (SDC) Environmental Health to establish suitable criteria for assessment for residential plant adjacent to residential receivers. No response has been received, as such the guidance in Chapter 11 of BS 4142 has been deemed suitable to be used for the assessment of plant noise from the proposed air source heat pumps.

4.1 BS 4142:2014+A1:2019 METHOD FOR RATING AND ASSESSING INDUSTRIAL AND COMMERCIAL SOUND

The principle of BS 4142 is to determine an initial estimate of impact of industrial/commercial sound on nearby residents by comparing the Rating Level (sound level from the industrial/commercial source, with a correction applied for any acoustic features that would increase the significance of the impact) with the Background Sound Level (L_{A90} as measured in absence of the industrial/commercial source).

Generally, the greater the difference by which the Rating Level exceeds the Background Sound Level, the greater the magnitude of impact. BS 4142 states that *'a difference of around +10 dB or more is likely to be an indication of a significant adverse impact [...]. A difference of around +5 dB is likely to be an indication of an 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.'*

However, BS 4142 also advises that *'when making assessments and arriving at decisions [...] it is essential to place the sound in context'* so in each case, the context in which the sound is placed must be considered and the initial estimate of impact should be modified accordingly. For example, it advises *'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.'* It also indicates that impacts estimated during *'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.'*

For the purpose of this assessment, the noise from proposed air source heat pumps will be taken from noise data provided by the manufacturer. Discussion on feature corrections and Rating Levels is provided below. A representative Background Sound Level has been identified from an unattended noise survey carried out at locations representative of the nearest noise sensitive windows to the proposed air source heat pumps at each site.

² National Planning Policy Framework, DCLG, 19.02.2019, Paragraph 123 (Noise)

5. SURVEY

5.1 MEASUREMENT PROCEDURE

An unattended background sound survey has been carried out between Friday 25th and Monday 28th June 2021. Two measurement positions were used to represent the background sound levels of nearby receptors at the three sites. The measurement positions and survey results are summarised in Appendix C.

Measurement position 1 was within the Kettlewell Court site at a height of 4m above ground to be representative of nearby first floor windows. As the Northview site is so near to the Kettlewell Court site and was also exposed to the same noise climate, this position was deemed to be representative of background sound levels for existing receivers next to the Northview site. A picture of this measurement position is shown in Figure 1 below.



Figure 1: Measurement position 1 at Kettlewell Court

This assessment was carried out during a partial COVID-19 lockdown within the UK, during Step 3 of the government's roadmap out of lockdown. This meant that non-essential retail and leisure centres were open. Travel restrictions were not in place, however those who could work from home were still advised to do so.

Data from the Department for Transport³ states that traffic flows during the measurement period were around 100% of equivalent traffic flows recorded in February 2020. Therefore, the noise from road traffic measured during the survey is considered representative of typical conditions.

The data at measurement position 1 was affected by groundworks at Kettlewell Court during the daytime of Friday 25th June and Monday 28th June. These periods have been excluded from the assessment.

There were brief periods of scattered showers during the survey on the morning and evening of Sunday 27th June, in addition to the morning of Monday 28th June. These brief periods of precipitation are not thought to have materially affected the results. Regardless, there was no rain during the night time periods measured and these are the background sound periods that the impact of the air source heat pumps are

³ Transport use by mode: Great Britain, since 1 March 2020, Department for Transport

to be assessed against. This is due to background sound levels being at their lowest during this time period, therefore this represents the greatest potential impact of the air source heat pumps.

5.2 INSTRUMENTATION

The following instrumentation was used during the survey:

Measurement position 1

- Bruel & Kjaer Type 2250 Light Sound Level Meter s/n 3006950
- Bruel & Kjaer Type 4952 Microphone s/n 2922623
- Bruel & Kjaer Type 4231 Acoustic Calibrator s/n 3009564

Before and after the survey, the sound level meter was field-calibrated in accordance with the manufacturer’s guidelines, and no significant drift was observed. The meter, microphone and field calibrator are laboratory calibrated biennially in accordance with UKAS procedures or to traceable National Standards.

5.3 MEASUREMENT RESULTS

Continuous measurements were taken over 4 days, in contiguous 15 minute periods. Noise metrics consisted of equivalent continuous ($L_{Aeq,15min}$) noise levels and maximum (L_{Amax}) noise levels as well as statistical noise levels (termed L_n , where n is the percentage of time the level is exceeded during the measurement period) including $L_{A90,15min}$ levels (the noise level exceeded for 90% of the individual measurement period) which is taken to be the background sound level. Overall A-weighted measurements were stored for later analysis.

Results of the background noise survey are included graphically in Appendix C. Table 2 below summarises the representative Background Sound Level.

As the air source heat pumps have the potential to operate continuously, their greatest noise impact upon nearby noise sensitive receptors will be during the night time period (23:00 – 07:00) when ambient noise is at a minimum. To determine a representative Background Sound Level from this period, a histogram of measured $L_{A90,15min}$ values over all night time periods that the survey covered has been used. This is attached in Appendix D. From this a representative value of $L_{A90,15min}$ 31 dB has been chosen to assess plant noise against. This is because this is the modal value measured across all night time periods at the measurement position.

Measurement position	Proposed operating period	Representative measured background sound level during night time ($L_{A90,15min}$, dB)
1 - Kettlewell Court	24 hours	31

Table 2: Representative background sound level for continuous operating period of proposed plant

6. ASSESSMENT

6.1 DESCRIPTION OF CALCULATIONS

The calculations have been based on the manufacturer’s noise data, as discussed in more detail in Section 3.2 and Appendix B.

The particular prediction model that has been used for this analysis is Bruel & Kjaer’s Type 7810 ‘Predictor’ software. This acoustic model implements the procedures set out in ISO 9613-2:1996 “Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation to determine noise levels”, and is Quality Assured to all parts of ISO 17534:2015 “Acoustics – Software for the calculation of sound outdoors”. The Predictor model takes account of the following features in its calculation procedure:

- Source sound power level (for point, line and area sources)
- Reflection from nearby structures and source directivity
- Distance from noise source (geometric spreading)
- Atmospheric absorption
- Acoustic screening of intervening structures and topography
- Ground absorption
- Ground effects (which includes the height of ground relative to the noise source)

6.2 CALCULATIONS

For the purpose of predicting noise levels of proposed air source heat pumps at nearby noise sensitive receptors, they have been modelled as set out in drawing attached in Appendix A. Sound power levels for the proposed air source heat pumps have been derived from manufacturer’s data as described in Section 3.2. All air source heat pumps have been modelled as running continuously at the same time, representing the greatest potential noise impact to nearby residences.

The results of Specific Sound Level from the proposed air source heat pumps are summarised below with respect to a receiver location at the nearest noise sensitive window. The results of the acoustic computer modelling, with incident levels to each nearby receiver and a noise map at a height of 4m, are included in Appendix E.

Site	Nearest noise sensitive receiver (first floor window)	Night time, 23:00 – 07:00, Specific Sound Level (L_{pA} , dB)
Garages North of 40 - 48 Northview	3 Kettlewell Court	31

Table 3: Predicted incident ASHP noise at the nearest noise sensitive window

7. DISCUSSION

Based upon the intended use of the air source heat pumps for either consistent heating/cooling for constant operation when in use, in addition to the spectral noise data from the client as attached in Appendix B, it has been determined that no feature correction is necessary and so the Rating Level is equal to the Specific Sound Level in Table 3. This is because there is no indication that the air source heat pumps will be tonal, intermittent, or impulsive.

The Rating Level at the nearest noise sensitive window of 3 Kettlewell Court, with relation to the representative Background Sound Level identified in Section 5.3, is summarised in Table 4 below.

Site	Plant Item	Rating Level (L_{Ar} , dB)	Background Sound Level ($L_{A90,15min}$, dB)	Rating Level minus Background Sound Level (dB)
Garages North of 40 - 48 Northview	6 x Mitsubishi PUZ-WM50VHA	31	31	0

Table 4: BS 4142 Assessment of Rating Level impact with respect to night-time Background Sound Level

As the Rating Level at the nearest noise sensitive window does not exceed the Background Sound Level, the initial assessment of the impact of the proposed air source heat pumps represents a low impact as defined in BS 4142.

There are no characteristics of the local area or prevailing noise environment which would significantly exacerbate or mitigate the impact of noise from the ASHP unit, so the context does not alter the initial assessment of noise impact of this equipment.

This assessment is presented against the most sensitive time period of the night time with a cautious choice for the representative Background Sound Level. In addition, while heat pumps are able to operate at night-time, heating demand at this time is likely to be low, so that the likelihood is they will be operating a small proportion of the time. When they do operate, the noise from the air source heat pumps will mostly be well below background levels and therefore masked by residual noise sources within the existing noise climate.

Additionally, the absolute level of L_{pA} 31 dB incident upon the nearest receptors is very low. With closed windows this level of noise is likely to be inaudible and with open windows the noise ingress to adjacent receptors will be very much below, for example, acceptable limits for noise ingress. As a result, the noise impact from the operation of the ASHP will be low.

8. CONCLUSIONS

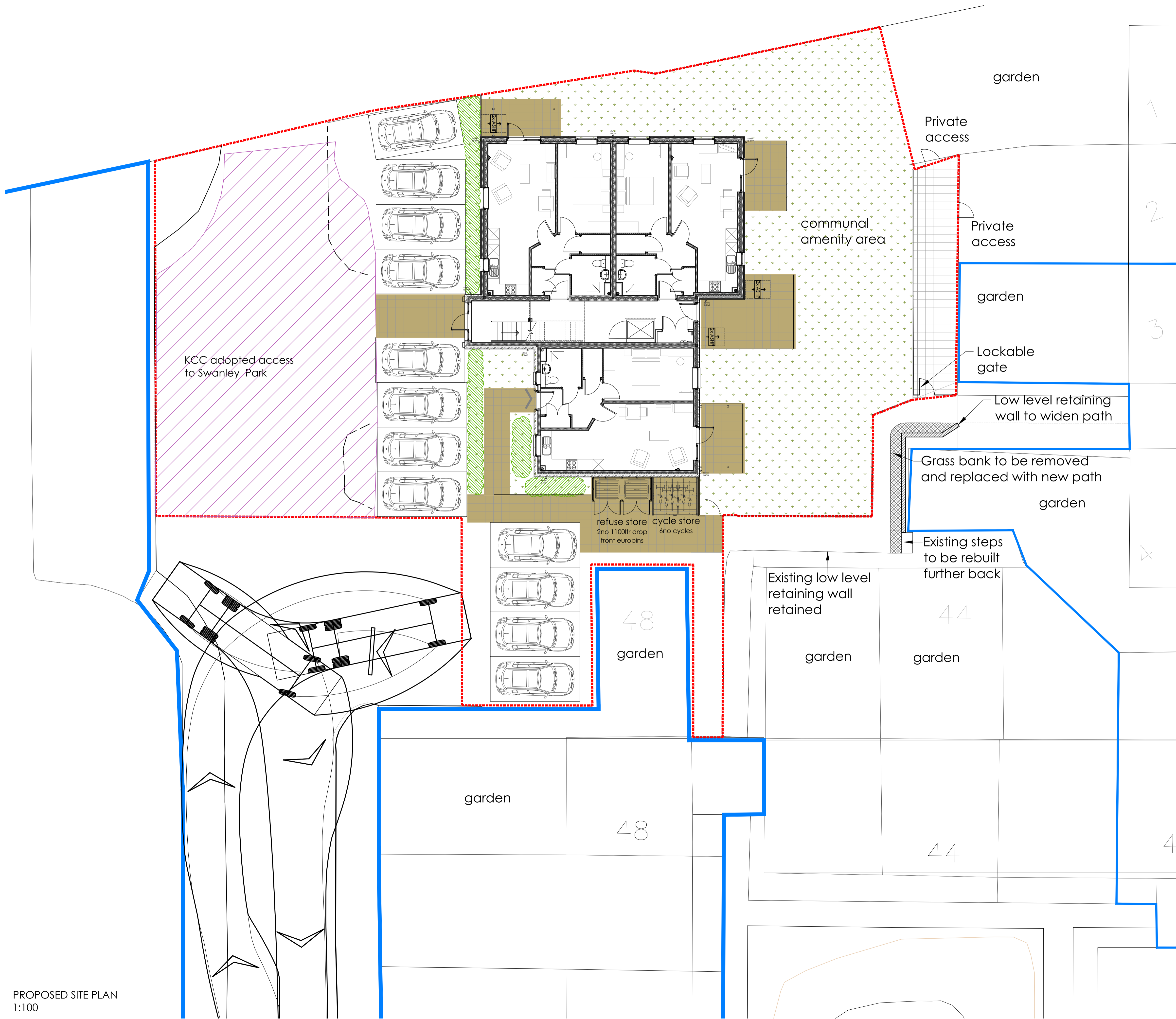
Helix Limited propose the installation of 6 air source heat pumps at the rear of their garages north of 40-48 Northview site.

The Local Authority require a noise impact assessment to inform a minor material amendment to existing planning permission prior to the installation of any external air source heat pumps. A noise survey has been carried out to determine the existing Background Sound Level, and noise emission from the proposed plant has been calculated at the nearest noise-sensitive receptors.



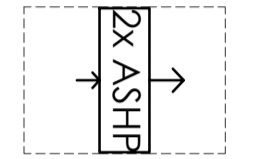
The Rating Level from the proposed air source heat pumps at the nearest residence has been calculated to be equal to the representative Background Sound Level at night time, which is when the pumps would have their greatest potential impact. This constitutes a low noise impact on nearby residences. In addition, these predicted levels are low in absolute terms, so the operation of air source heat pumps is considered to be acoustically acceptable at this site.

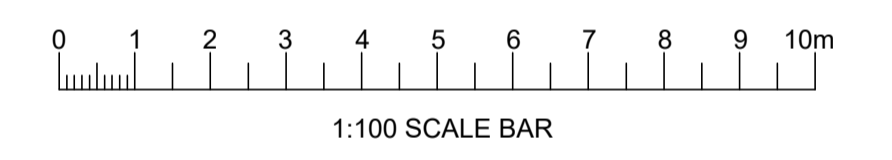
APPENDIX A

Proposed Plant/Site Layout Drawing



NOTES
 1 THIS DRAWING IS PROTECTED UNDER COPYRIGHT AND IT SHALL NOT BE REPRODUCED IN WHOLE OR PART WITHOUT PRIOR EXPRESS PERMISSION OF THE ARCHITECT
 2 DO NOT SCALE DIMENSIONS OFF THIS DRAWING CHECK ALL DIMENSIONS ON SITE BEFORE FABRICATION ALL DISCREPANCIES TO BE REPORTED TO THE ARCHITECT
 3 ALL MATERIALS AND WORKMANSHIP TO BE IN ACCORDANCE WITH ALL CURRENT BRITISH STANDARDS AND CODES OF PRACTICE / STATUTORY AUTHORITY AND MANUFACTURERS RECOMMENDATIONS AND SPECIFICATIONS

KEY:
 Application site boundary
 Land owned by WKHA
 2x ASHPs stacked vertically Mitsubishi Ecodan 5kw (PUZ-WM50VHA) (as below image)



PROPOSED SITE PLAN
1:100

MMA	MMA Planning Issue	16-06-21	
REV		DATE	CHKD
			
2nd Floor, The Grange, Market Square Westerham, Kent, TN31 6 THB T: +44 (0)1959 561078 F: +44 (0)1732 448118 E: office@architects-plus.co.uk W: www.architects-plus.co.uk			
D - design	PL - planning	PT - pre-tender	
T - tender	P - preliminary		
C - construction	R - record		
Project Garages North Of 40 - 48 Northview SWANLEY BR8 7BQ			
Client West Kent Housing Association			
Drawing Proposed Site Plan			
Date	Cad Ref	Drn	Chkd
02-2021	21927/Northview	DC	CB
Scale	Drawing No		Rev
1:100 @A1	0032/Architect/NV/02		MMA

APPENDIX B

Air Source Heat Pump Data Sheet

PUZ-WM50VHA(-BS)

Ecodan R32

Monobloc Air Source Heat Pump



Key Features:

- A+++ high efficiency system
- Ultra quiet noise levels
- Maintains full heating capacity at low temperatures
- Zero carbon solution
- MELCloud enabled

Key Benefits:

- Ultra low running cost
- Flexible product placement
- Confident and quick product selection
- Help to tackle the climate crisis
- Remote control, monitoring, maintenance and technical support

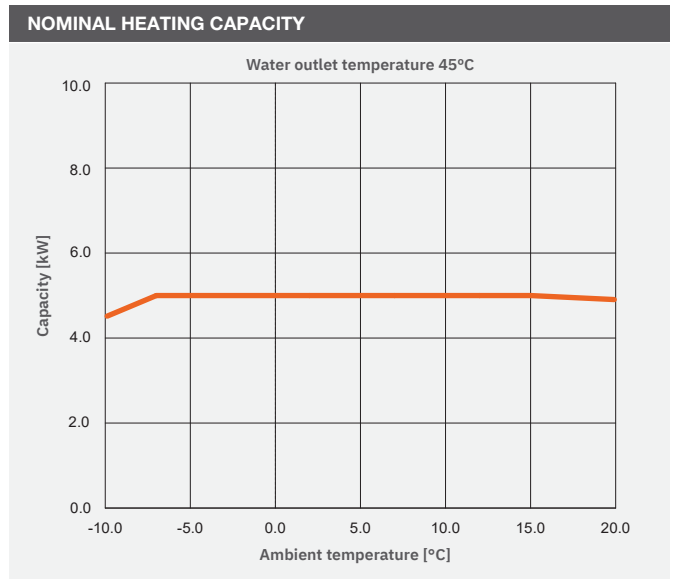


ecodan[®]
Renewable Heating Technology

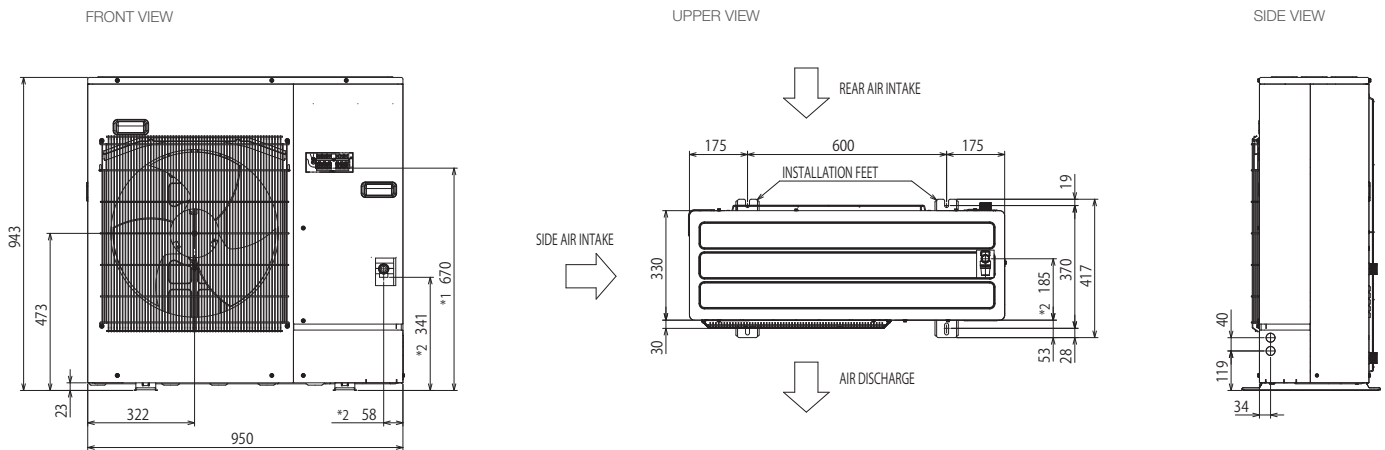
OUTDOOR UNIT		PUZ-WM50VHA(-BS)
HEAT PUMP SPACE HEATER - 55°C	ErP Rating	A++
	η_s	129%
	SCOP (MCS)	3.22
HEAT PUMP SPACE HEATER - 35°C	ErP Rating	A+++
	η_s	183%
	SCOP (MCS)	4.57
HEAT PUMP COMBINATION HEATER - Large Profile ¹	ErP Rating	A+
	η_{wh}	135%
HEATING ² (A-7/W35)	Capacity (kW)	5.0
	Power Input (kW)	1.67
	COP	3.00
OPERATING AMBIENT TEMPERATURE (°C DB)		-20 ~ +35
SOUND DATA ³	Pressure Level at 1m (dBA)	52
	Power Level (dBA) ⁴	61
WATER DATA	Pipework Size (mm)	22
	Flow Rate (l/min)	14
	Water Pressure Drop (kPa)	12.0
DIMENSIONS (mm)	Width	950
	Depth	330+30 ⁷
	Height	943
WEIGHT (kg)		71
ELECTRICAL DATA	Electrical Supply	220-240v, 50Hz
	Phase	Single
	Nominal Running Current [MAX] (A) ⁵	4.64 [13]
	Fuse Rating - MCB Sizes (A) ⁶	16
REFRIGERANT CHARGE (kg) / CO ₂ EQUIVALENT (t)	R32 (GWP 675)	2.0 / 1.35

Notes:

- *1 Combination with E*PT20X Cylinder
 - *2 Under normal heating conditions at outdoor temp: -7°CDB / -8°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 55°C, inlet water temp 47°C as tested to BS EN14511.
 - *4 Sound power level tested to BS EN12102.
 - *5 Under nominal heating conditions at outdoor temp: 7°C, outlet water temp: 35°C.
 - *6 MCB Sizes BS EN60898-2 & BS EN60947-2.
 - *7 Grille.
- η_s is the seasonal space heating energy efficiency (SSHEE) η_{wh} is the water heating energy efficiency



PUZ-WM50VHA(-BS) DIMENSIONS



All dimensions (mm)

*1--INDICATION OF TERMINAL CONNECTION LOCATION.
*2--INDICATION OF PRESSURE RELIEF VALVE DRAIN PORT.

MITSUBISHI ELECTRIC
Changes for the Better

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IRELAND Mitsubishi Electric Europe, Westgate Business Park, Ballymount, Dublin 24, Ireland. Telephone: (01) 419 8800 Fax: (01) 419 8890 International code: (003531)

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Note: The fuse rating is for guidance only. Please refer to the relevant databook for detailed specification. It is the responsibility of a qualified electrician/electrical engineer to select the correct cable size and fuse rating based on current regulation and site specific conditions. Mitsubishi Electric's air conditioning equipment and heat pump systems contain a fluorinated greenhouse gas, R410A (GWP:2088), R32 (GWP:675), R407C (GWP:1774), R134a (GWP:1430), R513A (GWP:631), R454B (GWP:466), R1234ze (GWP:7) or R1234yf (GWP:4). *These GWP values are based on Regulation (EU) No 517/2014 from IPCC 4th edition. In case of Regulation (EU) No.626/2011 from IPCC 3rd edition, these are as follows. R410A (GWP:1975), R32 (GWP:550), R407C (GWP:1650) or R134a (GWP:1300).

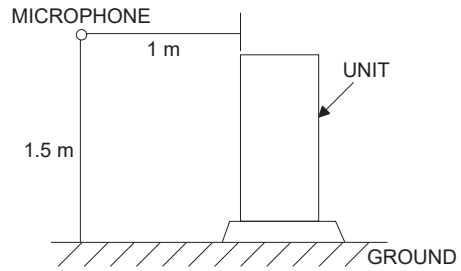
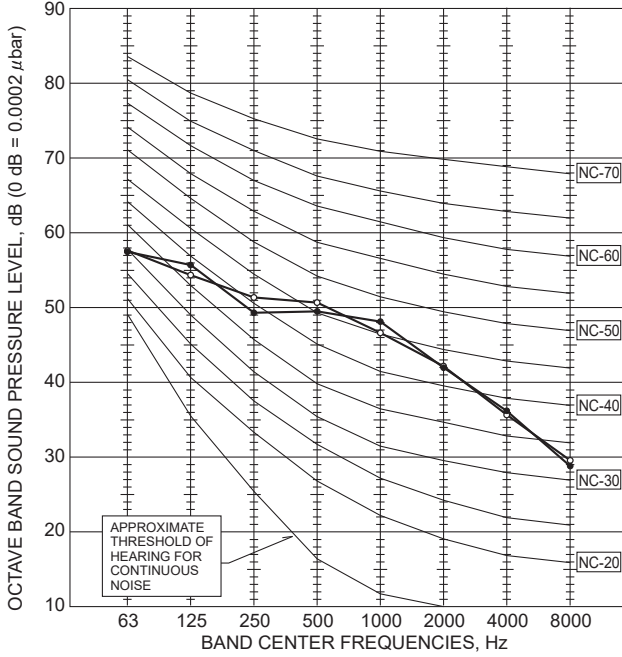
Effective as of August 2020



NOISE CRITERION CURVES

PUZ-WM50VHA.UK
PUZ-WM50VHA-BS.UK

MODE	SPL(dB)	LINE
COOLING	52	○—○
HEATING	52	●—●



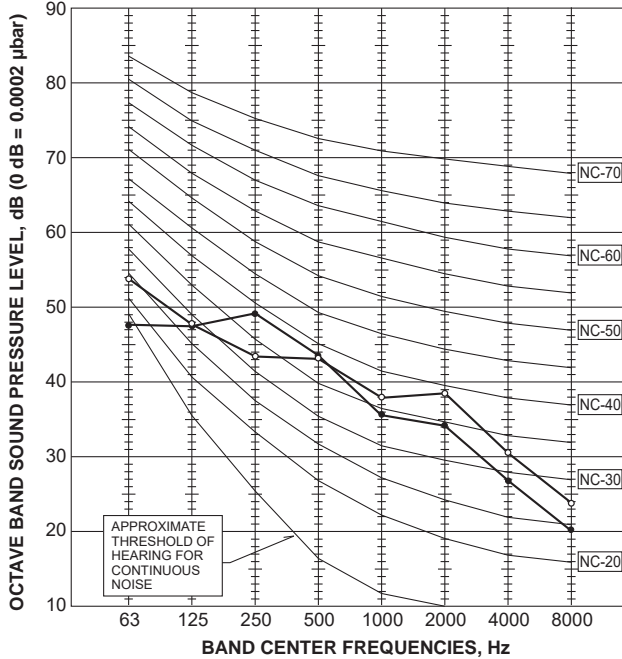
PUZ-WM60VAA.UK
PUZ-WM85VAA.UK
PUZ-WM85YAA.UK

PUZ-WM60VAA-BS.UK
PUZ-WM85VAA-BS.UK
PUZ-WM85YAA-BS.UK

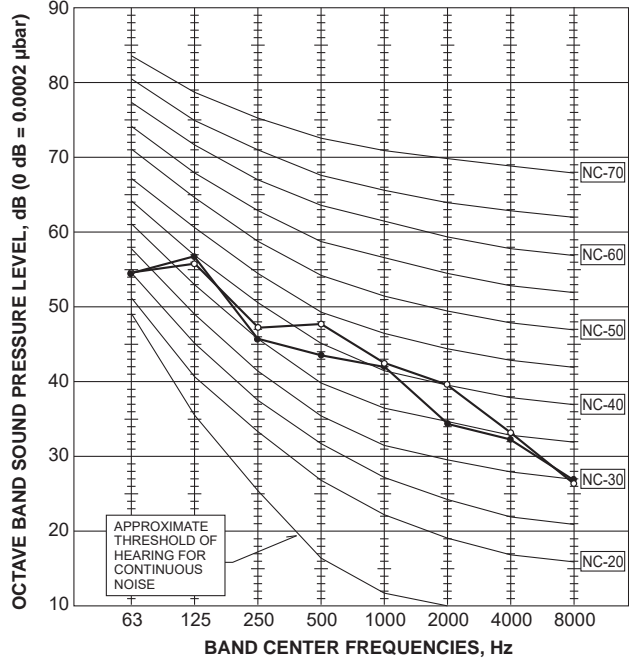
PUZ-WM112VAA.UK
PUZ-WM112YAA.UK

PUZ-WM112VAA-BS.UK
PUZ-WM112YAA-BS.UK

MODE	SPL(dB)	LINE
COOLING	45	○—○
HEATING	45	●—●



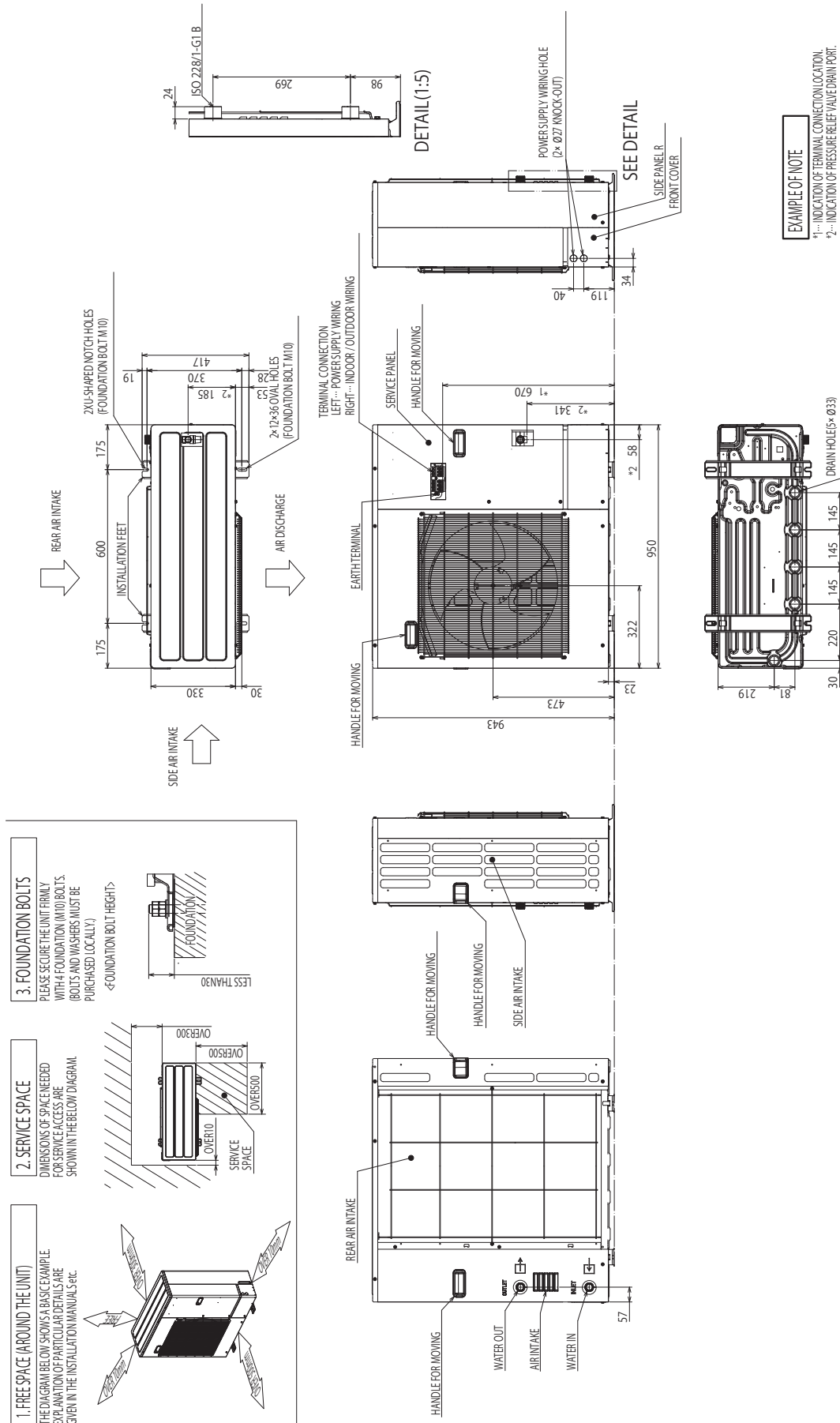
MODE	SPL(dB)	LINE
COOLING	49	○—○
HEATING	47	●—●



PUZ-WM50VHA.UK

PUZ-WM50VHA-BS.UK

Unit: mm

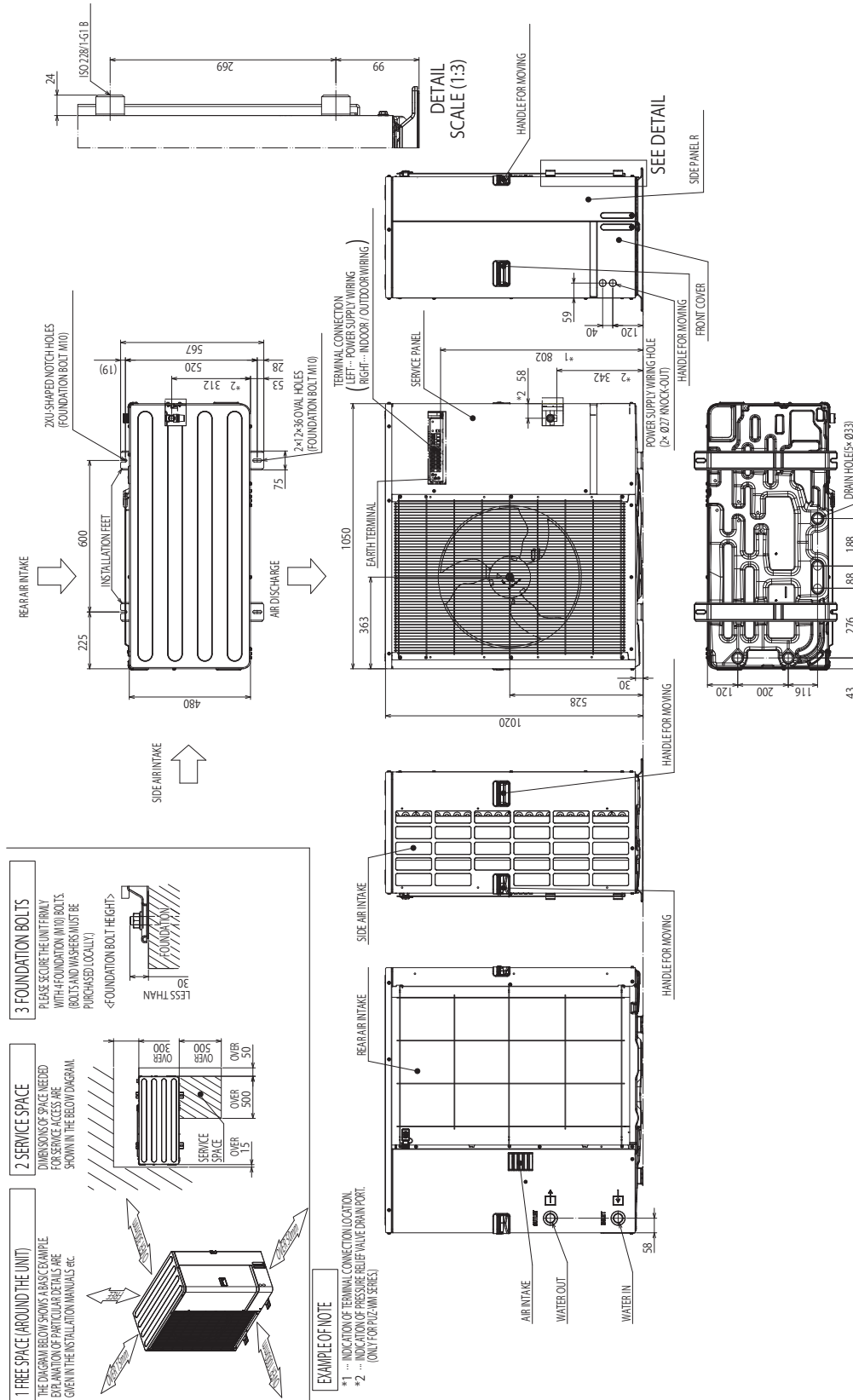


PUZ-WM60VAA.UK
 PUZ-WM60VAA-BS.UK
 PUZ-WM112VAA.UK
 PUZ-WM112VAA-BS.UK

PUZ-WM85VAA.UK
 PUZ-WM85VAA-BS.UK
 PUZ-WM112YAA.UK
 PUZ-WM112YAA-BS.UK

PUZ-WM85YAA.UK
 PUZ-WM85YAA-BS.UK

Unit: mm



APPENDIX C

Noise Survey Details and Results



Measurement position 2

Land off Pear Tree Close
BR8 7US

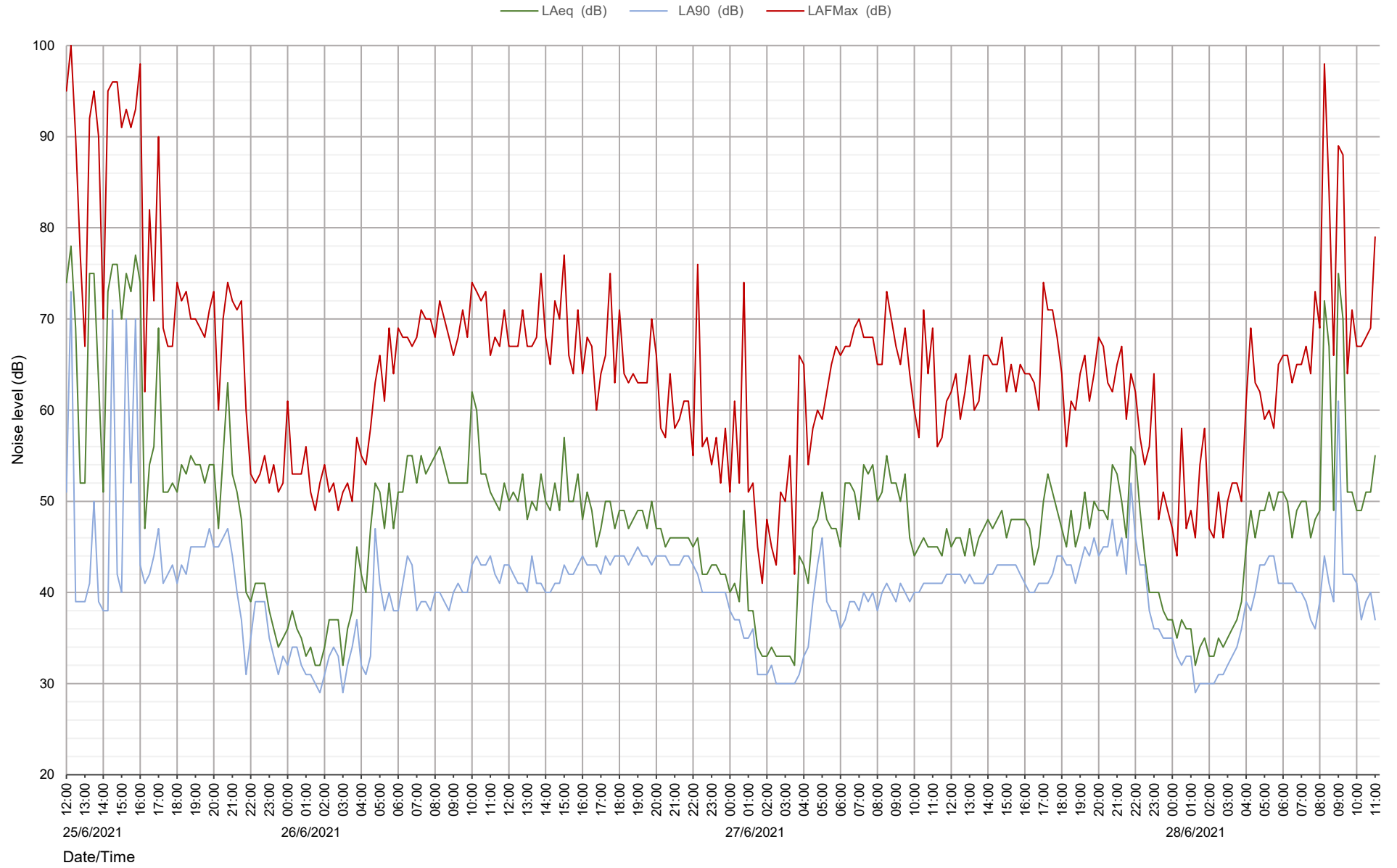
Garages North of 40-48
Northview
BR8 7BQ

Measurement position 1

Land Adjacent to
20 Kettlewell Court
BR8 7BP



Noise levels at measurement position 1: Kettlewell Court (25 to 28 June 2021)



APPENDIX D

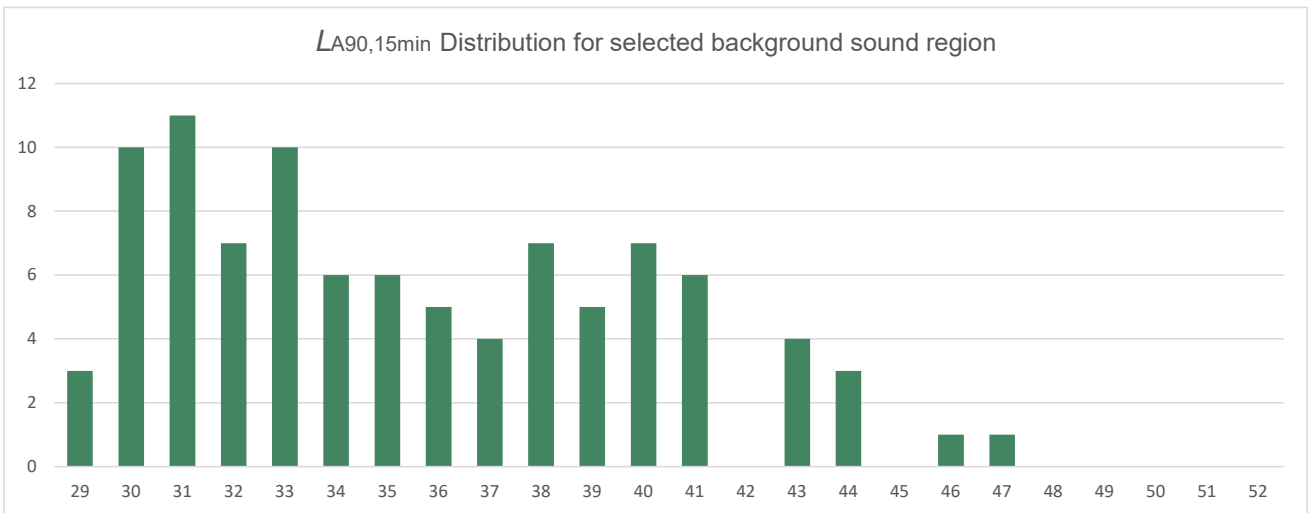
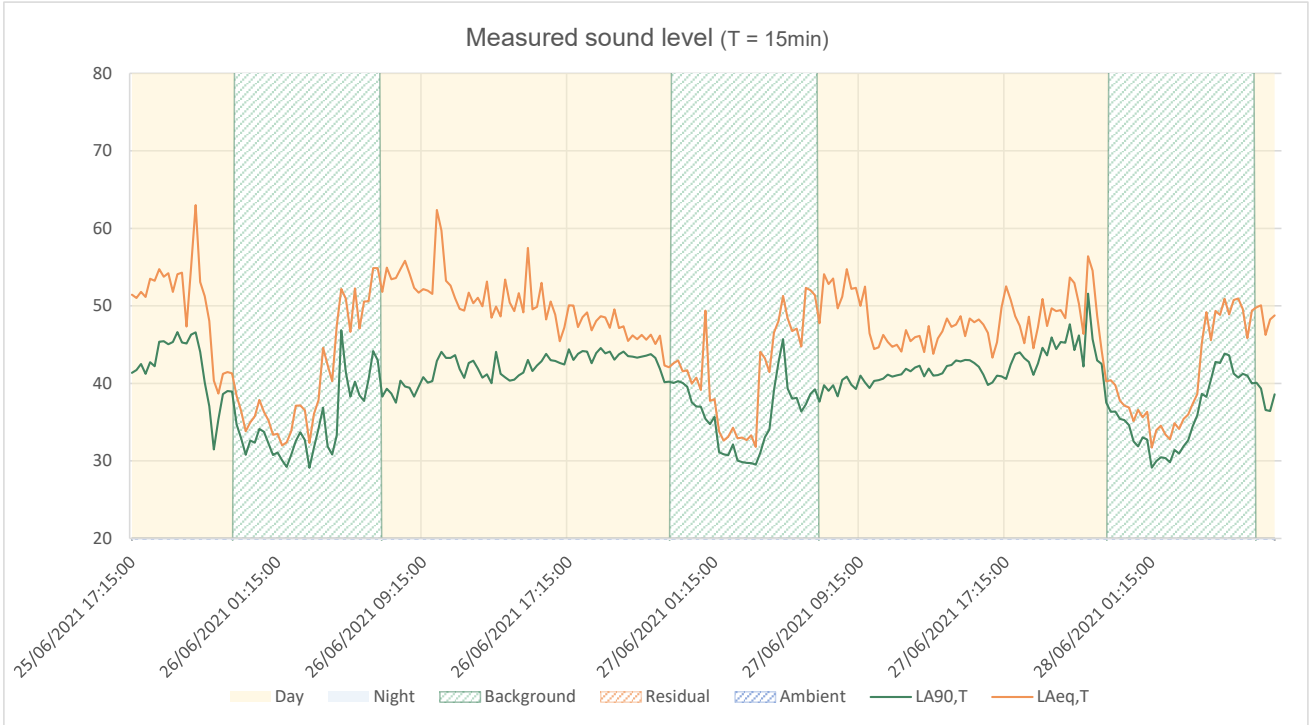
*L*_{A90,15min} Night Time Histogram

Measured Sound Data Analysis



Project Three Sites in Swanley
 Project number 21231
 Date 05/07/2021

Monitoring location 1 - Kettlewell Court
 Analysis Background Sound Level



Background sound level analysis

Range: 29 - 47 Mean: 36 Mode(s): 31 Median: 35 Std. Dev.: 4.5

Residual sound level

LAeq

Ambient sound level

LAeq

Specific sound level

LAeq -

Project Three Sites in Swanley
Project number 21231
Date 05/07/2021

Monitoring location 1 - Kettlewell Court
Analysis Background Sound Level

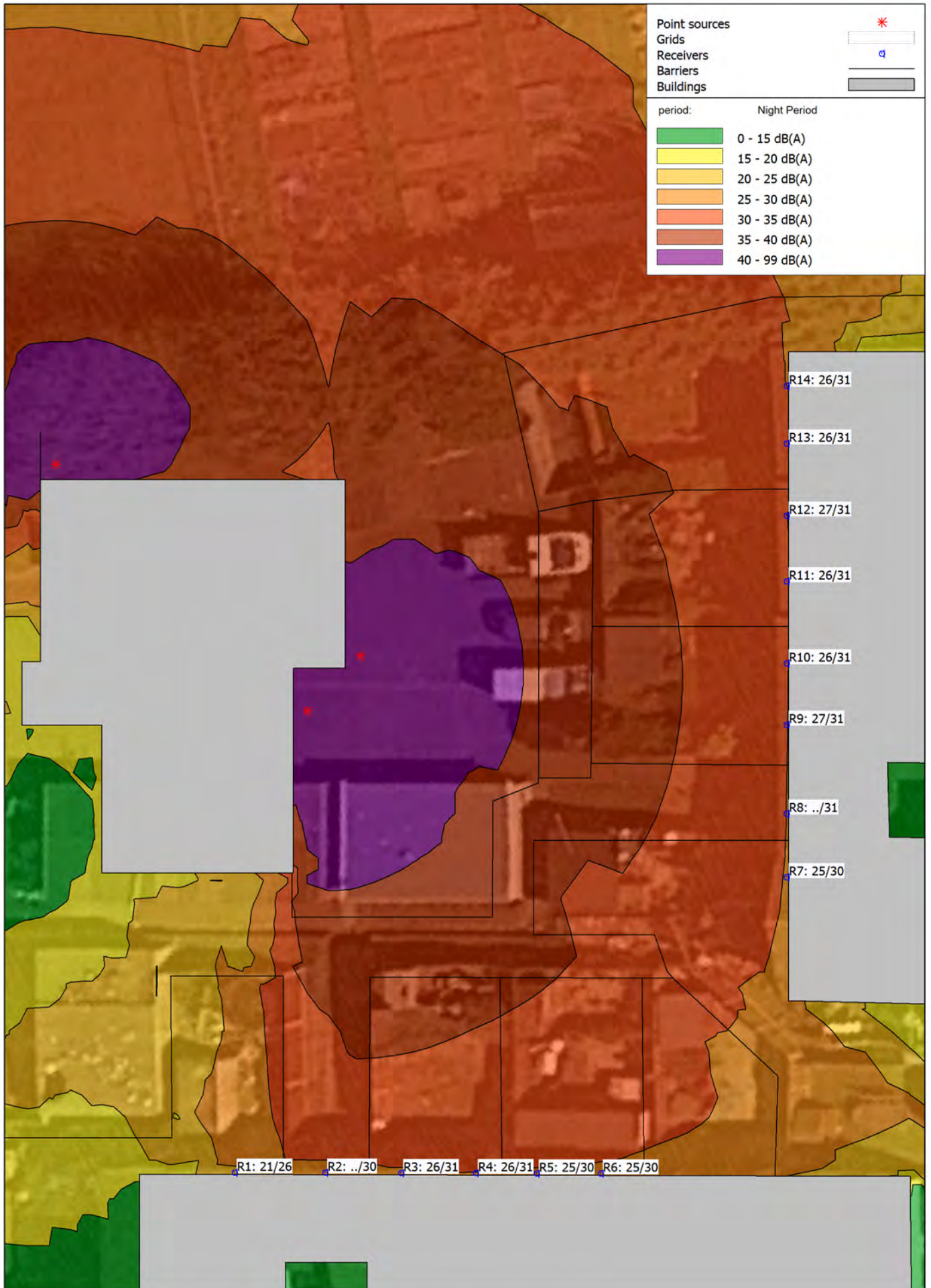
Markers	Start time	End time	Duration	LAeq
Background	25/06/2021 23:00:00	26/06/2021 07:00:00	8:00:00	
Background	26/06/2021 23:00:00	27/06/2021 07:00:00	8:00:00	
Background	27/06/2021 23:00:00	28/06/2021 07:00:00	8:00:00	

Comments:

APPENDIX E

Predictor Computer Simulation Results

5 Jul 2021, 14:56



Garages North of 40 - 48 Northview

Predicted Noise Levels with All Air Source Heat Pumps Operating


Report: Table of Results
 Model: initial model
 LAeq: total results for receivers
 Group: (main group)
 Group Reduction: No

Name			Height	Night
Receiver	Description			
R13_B	1 Kettlewell Court		4.00	31.1
R3_B	46 Northview		4.00	31.1
R10_B	3 Kettlewell Court		4.00	31.1
R14_B	1 Kettlewell Court		4.00	31.1
R9_B	3 Kettlewell Court		4.00	31.1
R4_B	46 Northview		4.00	30.9
R11_B	2 Kettlewell Court		4.00	30.9
R8_B	4 Kettlewell Court		4.00	30.8
R12_B	2 Kettlewell Court		4.00	30.6
R5_B	44 Northview		4.00	30.4
R7_B	4 Kettlewell Court		4.00	30.2
R6_B	44 Northview		4.00	29.7
R2_B	48 Northview		4.00	29.6
R9_A	3 Kettlewell Court		1.50	26.7
R12_A	2 Kettlewell Court		1.50	26.6
R4_A	46 Northview		1.50	26.5
R14_A	1 Kettlewell Court		1.50	26.4
R10_A	3 Kettlewell Court		1.50	26.3
R13_A	1 Kettlewell Court		1.50	25.8
R1_B	48 Northview		4.00	25.7
R11_A	2 Kettlewell Court		1.50	25.6
R3_A	46 Northview		1.50	25.6
R6_A	44 Northview		1.50	25.2
R5_A	44 Northview		1.50	24.8
R7_A	4 Kettlewell Court		1.50	24.7
R1_A	48 Northview		1.50	21.0


All shown dB values are A-weighted

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