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ACOUSTICS

Land North of School Road, Arborfield
Acoustic Assessment
July 2026

Report Ref: 30416-ENV-0401



Land North of School Road, Arborfield Cross

Acoustic Assessment

July 2026

REPORT REF: 30416-ENV-0401

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EXECUTIVE SUMMARY

Site Address	Land North of School Road, Arborfield Cross, Berkshire
Site Description and Setting	The Site is located approximately 500m west of Arborfield Cross and comprises land proposed for residential development. The Site is bordered by arable farmland to the north and east, School Road to the south and Cole Lane to the west. The surrounding acoustic environment is generally quiet, with the dominant existing noise sources comprising occasional local road traffic, birdsong and intermittent aircraft movements.
Proposed Development	The development proposals comprise 70 residential dwellings together with associated access, landscaping, open space and associated infrastructure. This assessment has been undertaken to discharge Condition 18 of Outline Planning Permission Ref. 250735, which requires a detailed assessment of any proposed Air Source Heat Pumps (ASHPs).
ASHP Assessment	An environmental sound survey was undertaken to establish representative daytime and night-time background sound levels at the Site. Using manufacturer sound power data for the proposed Vaillant Arotherm Plus 5 kW ASHP units, a BS 4142 assessment has been undertaken for three representative worst-case installation scenarios identified across the development. The assessment demonstrates that the predicted ASHP rating levels are between 4 dB and 26 dB below the representative background sound levels at the nearest neighbouring dwellings. In accordance with BS 4142, this indicates a low impact in all assessed scenarios. The assessment also demonstrates that resulting sound levels remain well below the external amenity criteria contained within BS 8233.
Conclusions	The assessment demonstrates that the proposed ASHP installations are not expected to give rise to adverse acoustic impacts at neighbouring dwellings. The assessed scenarios represent the potentially highest noise impact situations identified within the development and therefore provide a robust worst-case indication of likely sound levels across the wider Site. Subject to the implementation of the recommended mitigation measure, the proposed ASHP installations are considered acceptable from an acoustic perspective and satisfy the requirements of Condition 18.
Recommendations	All ASHP units should be installed on suitable anti-vibration mounts to minimise the potential for structure-borne noise transmission.
This summary should be read in conjunction with the full report and reflects an assessment of the site based on information received by MEC at the time of production.	

CONTENTS

1.0	INTRODUCTION	5
2.0	STANDARDS AND GUIDANCE	7
3.0	ENVIRONMENTAL SOUND SURVEYS	9
4.0	ASSESSMENT METHODOLOGY	12
5.0	ASHP ASSESSMENT	14
6.0	CONCLUSIONS	16

APPENDICES

A.	SITE LAYOUT
B.	ACOUSTIC GLOSSARY
C.	ENVIRONMENTAL SOUND SURVEY DATA
D.	ASHP TECHNICAL SPECIFICATIONS
E.	SOUND LEVEL CONTOUR MAPS

1.0 INTRODUCTION

- 1.1 MEC Consulting Group Ltd (MEC) has been commissioned by Croudace Homes (hereafter referred to as 'the Client'), to undertake an Acoustic Assessment for a proposed residential development at Land North of School Road, Arborfield (hereafter referred to as 'the Site').

Existing Site

- 1.2 The Site is located approximately 500m west of the village of Arborfield Cross, Berkshire. It is currently bordered to the north and east by arable farmland; to the south by School Road and to the west by Cole Lane.
- 1.3 An approximate redline boundary is presented in Figure 1.1.

Figure 1.1: Approximate Redline Boundary



Development Proposals

- 1.4 The development proposals comprise a residential development of 70 dwellings together with associated access, landscaping, open space and associated works.
- 1.5 The site layout is presented in **Appendix A**.

Assessment Scope

- 1.6 It is understood the Site has been granted outline planning permission (application reference number: 250735) from Wokingham Borough Council (hereafter referred to as 'the Local Authority') subject to a number of planning conditions. Condition 18 specifically relates to noise as follows:

“Condition 18: In the event that Air Source Heat Pumps (ASHPs) are proposed as part of a Reserved Matters application for the development hereby approved, the Reserved Matters application shall be accompanied by a detailed Noise Impact Assessment (NIA). The NIA shall:

- a) Identify the predicted operational noise levels from all proposed ASHPs, including cumulative impacts where multiple units are proposed;*
- b) Evaluate the potential impact of this noise on the amenity of future occupants of the proposed dwellings and any existing noise-sensitive receptors in the vicinity of the proposed ASHPs; and*
- c) Detail the specific measures to be incorporated into the design, layout, orientation and specification of the ASHPs, and/or other mitigation measures (such as enclosures or screening), to ensure that noise from the ASHPs does not give rise to an unacceptable adverse impact on residential amenity.*

The design and layout of the development submitted pursuant to the Reserved Matters application shall be informed by, and incorporate the recommendations of, the Noise Impact Assessment. Any ASHPs shall subsequently be installed and maintained in accordance with the details approved in writing by the Local Planning Authority.

1.7 Therefore, in order to discharge Condition 18, the following scope of works has been undertaken:

- An environmental sound survey has been undertaken within the Site in order to determine the prevailing acoustic conditions;
- Using manufacturer’s data for the proposed ASHPs, the acoustic model has been utilised in order to determine the potential impact from ASHPs installed at the proposed dwellings in accordance with BS 4142¹; and
- Where required, appropriate mitigation measures have been provided to demonstrate compliance with the relevant standards.

1.8 The conclusions of this report aim to demonstrate to the Local Authority that external and internal acoustic conditions will be compliant with the relevant British Standards and Acoustic Guidance, and to satisfy Condition 18.

Disclaimer

1.9 MEC has completed this report for the benefit of the individuals referred to in Paragraph 1.1 and any relevant statutory authority which may require reference in relation to approvals for the proposed development. Other third parties should not use or rely upon the contents of this report unless explicit written approval has been gained from MEC.

1.10 MEC accepts no responsibility or liability for:

- The consequence of this documentation being used for any purpose or project other than that for which it was commissioned;
- The issue of this document to any third party with whom approval for use has not been agreed.

¹ BS 4142:2014+A1:2019 – ‘Methods for rating and assessing industrial and commercial noise’

2.0 STANDARDS AND GUIDANCE

General

2.1 An acoustic glossary is provided in **Appendix B** to assist the reader.

Summary of Guidance and Standards

2.2 The following guidance and standards relevant to the assessment are outlined below:

- National Planning Policy Framework (NPPF) 2024;
- Noise Policy Statement for England (NPSE) 2010;
- BS 4142:2014 +A1;2019 '*Methods for rating and assessing industrial and commercial sound*'; and
- BS 8233:2014 '*Guidance on sound insulation and noise reduction for buildings*';

2.3 For conciseness, the guidance and standards most appropriate to this assessment are summarised in this section.

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

2.4 BS 4142 describes methods for rating and assessing industrial and/or commercial sound and includes, but is not limited to, the assessment of:

- Sound from industrial and manufacturing processes;
- Sound from fixed installations which comprise mechanical and electrical equipment;
- Sound from the (un)loading of goods and materials at industrial/commercial premises; and
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes such as that from forklift trucks on or around an industrial and/or commercial site.

2.5 The methods described in BS 4142 use outdoor sound levels to assess the likely effects of sound on people who are typically outside residential premises. Although indoor effects can be indicated where the façade composition is known. A summary of the approach set out in BS 4142 is set out below:

- Establish or predict the specific sound level of the source(s) by considering both the ambient (includes the source to be assessed) and residual (excludes the source to be assessed but includes all remaining sources) sound level;
- Measure the representative background sound levels, typically by measuring close to the receptor location;
- Rate the specific sound level to account for any distinguishing characteristics (see below);
- Estimate the impact by subtracting the background sound level from the rating level; and
- Consider the initial estimate of impact, as determined above, in the context of the noise and its environment.

2.6 The specific sound level is rated to account for distinguishing characteristics by using penalties for tonality, impulsivity, intermittency and other sound characteristics. The dominant acoustic characteristic should be applied to avoid large penalties which is in accordance with the Institute of Acoustics response to BS 4142.

2.7 The character corrections are flexible according to whether the acoustic character is just perceptible at the noise receptor, or is clearly perceptible or highly perceptible, and range from 0 to 6 dB for tonal noise, 3 to 9 dB for impulsive noise, and 3 dB for other non-tonal/impulsive acoustic characteristics.

2.8 An initial estimate of impact of the specific sound is obtained by subtracting the background sound level from the rating level. Typically, the greater the difference, the greater the magnitude of impact.

- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context;
- At differences lower than +5 dB a low impact is likely, depending on the context. The lower the rating level is to the measured background sound level, the less likely it is that the specific sound source will have an impact.

2.9 The results of the initial assessment should then be considered in light of all pertinent contextual factors.

BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings':

2.10 BS 8233 provides recommendations for the control of noise in and around buildings.

2.11 The guidance provided includes appropriate internal and external noise level criteria which are applicable to residential buildings exposed to steady external noise sources. It is stated in the British Standard that it is desirable for internal ambient noise levels to not exceed the criteria set out in Table 2.1.

Table 2.1: BS 8233: 2014 Table 4 – Indoor Ambient Noise Levels for Dwellings

Activity	Location	07:00 – 23:00 L _{Aeq, 16hr} dB	23:00 – 07:00 L _{Aeq, 8hr} dB
Resting	Living Room	35	-
Dining	Dining Room/Area	40	-
Sleeping (daytime resting)	Bedroom	35	30

2.12 Additional guidance in BS 8233 indicates that appropriate ventilation should be provided, if relying on closed windows to meet the guide values, and that such ventilation should not compromise the façade insulation and resulting noise levels.

2.13 BS 8233 additionally includes guidance on external amenity areas whereby it states that external noise levels should not exceed 50 dB L_{Aeq, T} with an upper guideline of 55 dB L_{Aeq, T} which would be acceptable in noisier environments.

3.0 ENVIRONMENTAL SOUND SURVEYS

3.1 An environmental sound survey was undertaken between Thursday 7th and Monday 11th May 2026. The survey was undertaken in full accordance with the guidance set out in BS 7445².

3.2 A Sound Level Meter (SLM) was installed at one location, as follows:

- Continuous Measurement Position (CMP): towards the middle of the Site, to determine the existing background sound levels for the proposed dwellings.

3.3 The measurement position is identified in Figure 3.1.

Figure 3.1: Measurement Position



Equipment

3.4 Measurements were taken using a Class 1 integrating/averaging SLM housed in environmental protection apparatus. The SLM was installed in free field positions at a height of 1.5m above local ground level and were field calibrated before and after the survey using a Class 1 calibrator, with no significant drift in calibration noted.

3.5 The SLM was set up to capture the following parameters at a minimum: L_{Aeq} , L_{A90} and L_{AFmax} values, and full details of the equipment used to undertake the survey are presented in Table 3.1.

² BS 7445-1:2003 'Description and measurement of environmental noise, Part 1: Guide to quantities and procedures.'

Table 3.1: Equipment and Calibration Details

Measurement Position	Description	Manufacturer & Type No.	Serial No.	Calibration Due Date
CMP	Sound Level Meter	Type NOR140	1407932	22/02/2027
	Pre-Amplifier	Type 1209	23695	
	Microphone	Type 1225	505583	
	Calibrator	Norsonic 1251	34315	04/05/2027

Meteorological Conditions

- 3.6 During setup of the SLM on Thursday 7th May, weather conditions were warm, cloudy and dry with a south easterly wind of up to 2.9 m/s. On return to Site on Monday 11th May, weather conditions were dry and cloudy with a north westerly wind of 1.3 m/s.
- 3.7 A review of online weather data obtained from www.timeanddate.com, indicates that weather conditions remained consistent with what was observed during the visits to Site. Therefore, it is considered that there were no adverse weather conditions that could have significantly impacted the measured sound levels.

Observations

- 3.8 During the attended survey, the Site was generally observed to be acoustically quiet. The prevailing sound environment was dominated by birdsong, with occasional noise from vehicles travelling along School Road and distant road traffic audible throughout the survey period. These sources were not considered intrusive and no readily distinguishable tonal, impulsive or other distinctive acoustic characteristics were noted.
- 3.9 Traffic movements on School Road were observed to be relatively light and irregular in nature, comprising predominantly slow-moving cars. Bollards located on School Road restrict through traffic to the east, limiting traffic flows in the immediate vicinity of the Site.
- 3.10 Aircraft movements were also noted overhead intermittently during the survey period. However, these occurrences were infrequent and did not materially alter the overall character of the baseline sound environment.

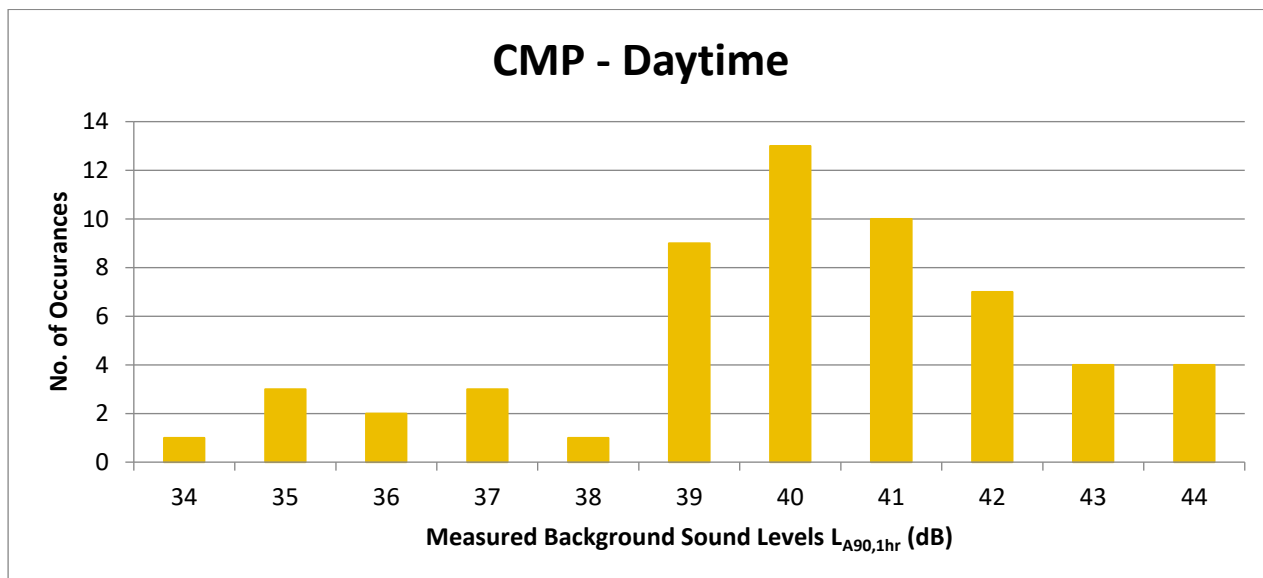
Results

- 3.11 A time history graph for the measurement position is provided in **Appendix C**.

Statistical Analysis of L_{A90} Data

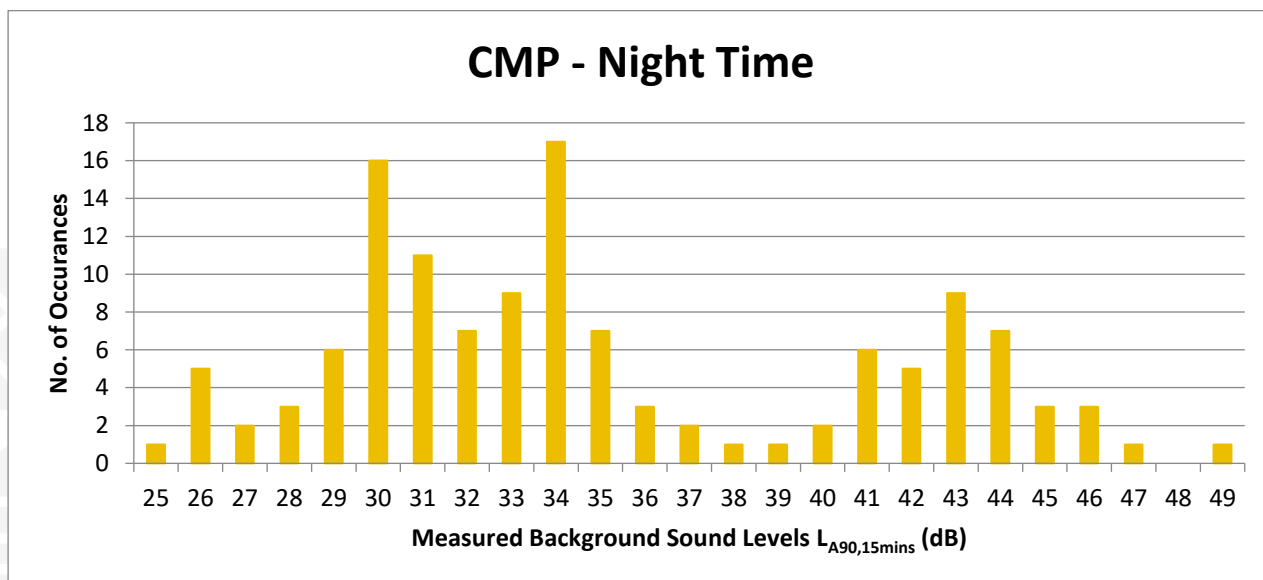
- 3.12 Statistical analysis of the measured daytime and night-time background sound levels at the CMP is presented in Figure 3.2 and Figure 3.3 respectively.

Figure 3.2: Statistical Analysis of Daytime Background Sound Levels $L_{A90,1hr}$, CMP



3.13 The statistical analysis of the daytime background sound levels demonstrates that values were generally clustered within the range of 39 dB to 42 dB $L_{A90,1hr}$, indicating a relatively stable daytime baseline acoustic environment across the survey period. The most frequently occurring value was 40 dB $L_{A90,1hr}$, which represents the lower end of the prevailing range. However, in order to provide a suitably robust assessment scenario, the lower, most prevalent background sound level of 39 dB $L_{A90,1hr}$ has been adopted for use within the daytime assessment.

Figure 3.3: Statistical Analysis of Night-time Background Sound Levels $L_{A90,15mins}$, CMP



3.14 The statistical analysis of the night-time background sound levels indicates that measured values were predominantly within the range of 30 dB to 36 dB $L_{A90,15mins}$. The most frequently occurring values were 34 dB $L_{A90,15mins}$ and 30 dB $L_{A90,15mins}$, with 30 dB $L_{A90,15mins}$ representing the lower end of the prevailing range. On this basis, and in order to provide a robust assessment of potential noise effects, the lower, most prevalent background sound level of 30 dB $L_{A90,15mins}$ has been adopted for use within the night-time assessment.

4.0 ASSESSMENT METHODOLOGY

Acoustic Modelling

- 4.1 An acoustic model of the Site and environs has been generated in Datakustik CadnaA® modelling software.
- 4.2 CadnaA® considers various inputs, including topography, buildings and noise sources, and calculates sound levels in accordance with national and international standards; in this case, the relevant UK standards are the procedures set out within ISO 9613-2³.
- 4.3 The modelling assumptions and input information for the acoustic model are as follows:
- Digital Terrain Model – Lidar 1m (Environment Agency, downloaded on 13th May 2026);
 - Open Street Map data (publicly available);
 - Ground absorption for the Site = 0.5 (mixed ground);
 - Building heights estimated following site observations or based upon masterplan;
 - Buildings set to be reflective only with no absorption coefficient;
 - First order reflections included in the modelling;
 - Temperature set to 10°C; and
 - Relative humidity set to 70%.

ASHP Assessment

Source Data

- 4.4 It has been advised by the Client that the ASHPs will consist of Vaillant Arotherm Plus 5 kW units. The specification datasheet for the ASHPs to be installed across the Site is provided in **Appendix D**.
- 4.5 The sound power level for the unit is 54 dB which will therefore be used to inform the assessment.

Assessment Time and Character Corrections

- 4.6 The study presented by M Torjussen⁴ indicated that an ASHP typically operates steadily throughout the day and then switches off in the evening. However, a review of available information from various manufacturers and installation companies indicates that ASHPs can be bespoke to the individual user and as such, an assessment of daytime and night-time will be undertaken.
- 4.7 ASHPs would typically be operational for steady and long periods of time, as such, impulsive and intermittent corrections are not considered warranted. Furthermore, it is considered that ASHPs do not exhibit any distinct tonal characteristics. The sound is broadband in nature, with no narrow-band frequency components that stand out from adjacent bands. Consequently, no character correction for tonality has been applied to the rating level.

³ ISO 9613-2 'Acoustics – Attenuation of sound during propagation outdoors, Part 2: General method of calculation.

⁴ Sound from Domestic Air Source Heat Pumps: A Case Study, M Torjussen, Proceedings from the Institute of Acoustics, Vol. 41, Pt.1, 2019.

Assessment Locations

- 4.8 In order to provide a robust assessment of the proposed ASHP installations across the development, three representative worst-case plot relationships have been selected for detailed assessment. The first scenario considers the relationship between Plot 43 and Plot 44, which represents one of the most acoustically onerous arrangements on the Site due to the narrow rear gardens and consequently minimal separation distance between adjacent dwellings and associated external plant locations. This arrangement is considered to represent the closest likely source-to-receptor spacing across the scheme and therefore provides a conservative assessment of direct sound propagation.
- 4.9 The second scenario considers Plot 59 in relation to Plot 60, where the presence of garages flanking the garden boundaries on either side has the potential to increase sound levels at the neighbouring receptor through reflective effects and reduced lateral sound dissipation.
- 4.10 The third scenario considers Plot 50 in relation to Plot 51, where the ASHP serving Plot 51 is positioned away from the dwelling façade within the rear garden area. This arrangement has been selected to represent a layout in which the plant cannot be located immediately adjacent to the host dwelling and is instead installed within a more exposed garden position. Unlike the other scenarios, this configuration reduces the degree of screening afforded by the dwelling itself and allows the influence of direct sound propagation across the garden space to be assessed. The scenario therefore examines the acoustic implications of locating an ASHP within a constrained rear garden environment where separation distances are limited and opportunities for building screening are reduced. As such, it provides an assessment of a realistic and potentially onerous installation arrangement that may arise across the development and allows the suitability of ASHP locations positioned away from dwelling façades to be robustly evaluated.
- 4.11 For each scenario, the ASHP has been modelled as a point source positioned 0.5 m above local ground level, representative of a typical external unit installation, with sound levels calculated at the nearest adjacent receptor façade. The model also includes standard 1.8 m high close-boarded timber fencing along the garden boundaries, to reflect the proposed as-built site arrangement and account for the screening effects that would be provided in practice.
- 4.12 As these locations represent the potentially highest noise impact situations identified within the proposed layout, the results are considered to provide a robust worst-case indication of likely sound levels across the wider development. On this basis, where compliance is demonstrated for these representative cases, it is reasonable to consider that the remaining plots across the Site, which benefit from equal or greater separation distances and/or less reflective surrounding geometry, would also be expected to achieve acceptable acoustic performance.
- 4.13 The model outputs for the three assessed plots are presented in **Appendix E**.

5.0 ASHP ASSESSMENT

5.1 The Initial Numerical Impact Assessments (INIA) for the selected plots is presented in Table 5.1.

Table 5.1: Initial Numerical Impact Assessment

Assessment Step	Plot 44		Plot 50		Plot 60	
	Daytime	Night-time	Daytime	Night-time	Daytime	Night-time
Modelled Specific Sound Level [A]	16 dB L _{Aeq,1hr}	26 dB L _{Aeq,15mins}	14 dB L _{Aeq,1hr}	23 dB L _{Aeq,15mins}	13 dB L _{Aeq,1hr}	21 dB L _{Aeq,15mins}
Acoustic Character Correction [B]	-	-	-	-	-	-
Rating Level [C = A + B]	16 dB L _{Ar,1hr}	26 dB L _{Ar,15mins}	14 dB L _{Ar,1hr}	23 dB L _{Ar,15mins}	13 dB L _{Ar,1hr}	21 dB L _{Ar,15mins}
Background Sound Level [D]	39 dB L _{A90,1hr}	30 dB L _{A90,15min}	39 dB L _{A90,1hr}	30 dB L _{A90,15min}	39 dB L _{A90,1hr}	30 dB L _{A90,15min}
Rating over Background [E = C – D]	-23 dB	-4 dB	-25 dB	-7 dB	-26 dB	-9 dB
Estimation of Impact ^(a)	Low	Low	Low	Low	Low	Low
^(a) Impact dependent upon context and other pertinent factors.						

5.2 At the façade of the selected plots, the Rating Level due to operational noise lies 4 dB to 26 dB below the background sound level, for which BS 4142 states, “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.”

Context

5.3 Context is an important factor in determining the BS 4142 impact upon existing receptors. BS 4142 states “... to fully understand the context in which the sound from an industrial and/or commercial source(s) is being assessed, describe and report the sources of sound which comprise the acoustic environment.” BS 4142 goes on to state “...The significance of sound of an industrial and/or commercial nature depends upon both 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 effective assessment cannot be conducted without an understanding of the ... context in which the sound occurs/will occur. When making assessment and arriving at decisions, therefore, it is essential to place the sound in context”.

5.4 Consideration should therefore be given to the overall context of the planning application, general environment around the Site as well as other aspects of the design.

5.5 For example, whilst it has been demonstrated that the Rating Levels all fall below the measured background sound levels, it is also important to note that the resulting sound levels remain below BS 8233's lower-level

criterion of 50 dB $L_{Aeq,16hr}$, indicating that the general daytime outdoor sound environment would be consistent with what is typically regarded as desirable for residential use.

- 5.6 Additionally, it is important note that night-time sound levels have been taken from external areas of the receptors. However, residents would likely be located indoors and as such, it is important to take into account the external to internal sound level reduction provided by the façade of the dwelling. As a worst case, assuming an open window provides approximately 10 dB of attenuation⁵, the resulting internal sound level would be substantially lower than the levels outlined within Table 5.1, indicating that the audibility and potential impact would be substantially reduced.
- 5.7 Although the assessment and the surrounding context indicate that the operational sound from the ASHPs would result in a 'Low' impact at the receptors, it is nevertheless recommended that the units be mounted on anti-vibration mounts. This precautionary measure helps to minimise the potential for structure-borne noise transmission through the building fabric, ensuring that any vibration is effectively isolated. Implementing such mitigation provides additional assurance that the acoustic performance of the development will remain consistent and that amenity levels for occupants will be protected.

⁵ ANC 'Approved Document O: Noise Guide' - 2024

6.0 CONCLUSIONS

- 6.1 MEC has been commissioned by Croudace Homes to undertake an ASHP Acoustic Assessment for a proposed residential development at Land North of School Road, Arborfield.
- 6.2 Using source sound power levels taken from the manufacturer's datasheet provided by the Client, a BS 4142 assessment has been undertaken for three representative worst-case scenarios. The selected scenarios have been chosen to assess a range of potentially onerous ASHP installation arrangements across the development, including units positioned in close proximity to neighbouring receptors, boundary-adjacent installations and locations set away from dwelling façades where there is reduced benefit from building screening.
- 6.3 The outcome of the BS 4142 assessment shows that at the proposed dwellings, the Rating Levels due to the ASHP noise fall below the background sound level. Therefore, the overall conclusion in accordance with BS 4142 is that *"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"*.
- 6.4 When considering the wider acoustic context, including the fact that the predicted amenity sound levels fall below the BS 8233 desirable external living area criterion and that the assessment has been undertaken using conservative assumptions, any adverse effects on residential amenity are considered highly unlikely.
- 6.5 As previously mentioned, given the assessed plots represent the potentially highest noise impact situations identified within the proposed layout, the results are considered to provide a robust worst-case indication of likely sound levels across the wider development. On this basis, as compliance is demonstrated for these representative cases, it is reasonable to consider that the remaining plots across the Site, which benefit from equal or greater separation distances and/or less reflective surrounding geometry, would also be expected to achieve acceptable acoustic performance.
- 6.6 Nevertheless, whilst a 'Low' impact has been predicted, it has been advised that the proposed ASHPs are installed on anti-vibration mounts to reduce the potential for reradiated sound via structure borne noise.
- 6.7 On the basis of the assessment undertaken, and subject to the implementation of the recommended mitigation measure, the proposed ASHP installations are not expected to give rise to adverse acoustic impacts at neighbouring dwellings. It is therefore considered that the requirements of Condition 18 have been satisfied and that the Site is suitable for the proposed residential development.



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APPENDICES

Appendix A







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APPENDICES

Appendix B



GLOSSARY OF TECHNICAL TERMS

Noise is defined as unwanted sound. Human ears are able to respond to sound in the frequency range 20 Hz (deep bass) to 20,000 Hz (high treble) and over the audible range of 0 dB (the threshold of perception) to 140 dB (the threshold of pain). The ear does not respond equally to different frequencies of the same magnitude, but is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates the response of the human ear, a weighting mechanism is used. This reduces the importance of lower and higher frequencies, in a similar manner to the human ear.

Furthermore, the perception of noise may be determined by a number of other factors, which may not necessarily be acoustic. In general, the impact of noise depends upon its level, the margin by which it exceeds the background level, its character and its variation over a given period of time. In some cases, the time of day and other acoustic features such as tonality or impulsiveness may be important, as may the disposition of the affected individual. Any assessment of noise should give due consideration to all of these factors when assessing the significance of a noise source.

The most widely used weighting mechanism that best corresponds to the response of the human ear is the 'A'-weighting scale. This is widely used for environmental noise measurements, and the levels are denoted as dB(A) or L_{Aeq} , L_{A90} etc., according to the parameter being measured.

The decibel scale is logarithmic rather than linear, and hence a 3 dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective, but as a general guide a 10 dB(A) increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3 dB(A) is generally regarded as the minimum difference needed to perceive a change under normal listening conditions.

Typical sound levels found in the environment

Sound Level	Location
0 dB(A)	Threshold of hearing
20 to 30 dB(A)	Quiet bedroom at night
30 to 40 dB(A)	Living room during the day
40 to 50 dB(A)	Typical office
50 to 60 dB(A)	Inside a car
60 to 70 dB(A)	Typical high street
70 to 90 dB(A)	Inside a factory
100 to 110 dB(A)	Burglar alarm at 1m away
110 to 130 dB(A)	Jet aircraft taking off
140 dB(A)	Threshold of pain

Descriptor	Terminology
Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level	The sound level is the sound pressure relative to a standard reference pressure of $20\mu\text{Pa}$ (20×10^{-6} Pascals) on a decibel scale.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s_1 and s_2 is given by $20 \log_{10} (s_1 / s_2)$. The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is $20\mu\text{Pa}$.
A-weighting (dB(A))	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
$L_{eq, T}$	A noise level index called the equivalent continuous noise level over the time period, T . This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{AFmax, T}$	A noise level index defined as the maximum noise level during the measurement period. L_{Max} is sometimes used for the assessment of discrete loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. It is typically measured using the 'fast' sound level meter response.
$L_{90, T}$	A noise level index. The noise level exceeded for 90% of the time over the period, T . L_{90} can be considered to be the "average minimum" noise level and is often used to describe the background noise.
$L_{10, T}$	A noise level index. The noise level exceeded for 10% of the time over the period, T . L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m.
Façade	At a distance of 1m in front of a large sound reflecting object such as a building facade.
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit
One-third Octave Band	A frequency band in which the upper limit is $2^{1/3}$ times the frequency of the lower limit.
Rating Level	The specific sound level, plus any adjustment for characteristic feature of sound in BS 4142.
Specific Sound Level	The A-weighted L_{eq} sound level produced by a sound source during a specified period of time. Commonly known as the sound source under investigation as defined in BS 4142.
Typical Maximum Level	The 90 th percentile maximum event level (L_{AFmax}) measured during a period. Used for assessing night-time maximum levels under typical and overheating conditions.



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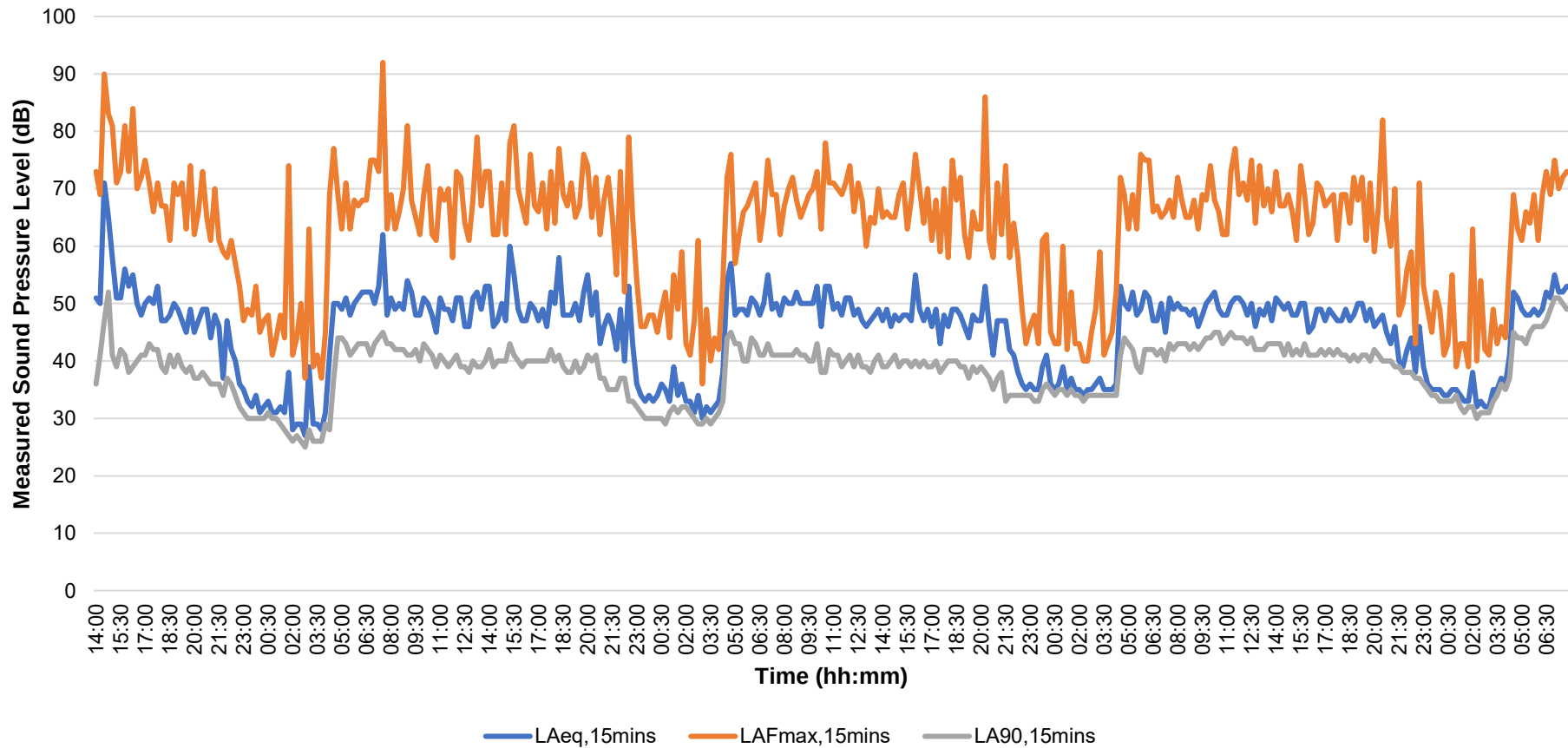
APPENDICES

Appendix C



**Land North of School Road, Arborfield Cross - CMP
Environmental Noise Monitoring Survey Results**

$L_{Aeq,15mins}$, $L_{AFmax,15mins}$ & $L_{A90,15mins}$ Measured Sound Levels - 7th to 11th May 2026





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APPENDICES

Appendix D





Heating



Hot water



Renewables

aroTHERM plus

Air source heat pump

Dimensions

Model	Width	Height	Depth
aroTHERM plus 3.5kW aroTHERM plus 5kW	1100mm	765mm	490mm (including back plate and mounting brackets)
aroTHERM plus 7kW		965mm	
aroTHERM plus 10kW aroTHERM plus 12kW		1565mm	



Overview

The aroTHERM plus is our flagship air source heat pump range, available in a wide range of heat output sizes for many times types of property with 3.5, 5, 7, 10 and 12kW models available.

This heat pump continues to win awards around the world for its innovative use of the refrigerant R290, which gives it a Global Warming Potential (GWP) of just three. This refrigerant is already used in household appliances all over the world and offers many advantages over refrigerants traditionally used in heat pumps. Coupled with market leading technical features that improve efficiency and deliver higher flow temperatures, the aroTHERM plus is perfect for new and existing heating systems (including hybrid). It's also impressively quiet in operation and has been accredited by Quiet Mark*, making it suitable for use even in densely built-up terraced housing estates.

Features & benefits



High performance ASHP range

With a flow temperature of up to 75°C, the aroTHERM plus can deliver more usable hot water with high hot water comfort levels whilst removing the need for direct electric immersion to sterilise the water, protecting from legionella.



Super quiet operation

From just three metres away, the acoustic pressure level is less than 30 dB(A) for easier planning and siting.



Higher energy-efficiency performance

With a SCOP of up to 5.03, the aroTHERM plus is extremely energy efficient, enabling high energy savings against certain fossil fuels.



R290 natural refrigerant with Low GWP

Already fulfilling the next NZEB requirements, the aroTHERM plus uses monobloc technology with a hermetically sealed refrigerant circuit.



Fully adaptable system approach

The aroTHERM plus can also be combined with photovoltaic systems and integrated into smart power grids (SG-ready), so your customers can enjoy the benefits of variable electricity tariffs.



Quality by design

Suitable for installations less than 150m away from the sea with salt resistant construction C5 class.

* Models 3.5, 5 and 12kW.



Technical data	Unit	3.5kW	5kW	7kW	10kW	12kW
Dimensions						
Product dimensions (H x W x D)	mm	765 x 1100 x 450		965 x 1100 x 450	1565 x 1100 x 450	
Weight, with packaging	kg	132		150	223	
Weight, ready for operation	kg	114		128	194	
Electrical data						
Rated voltage	V	230 V (+10%/- 15%), 50 Hz, 1~/N/PE			400 V (+10%/-15%), 50 Hz,3~/N/PE*	
Fuse type		Type C, slow blow, single pole switching				
RCD type**		B				
Inrush current (with inrush current limiter)	A	14.3		15	23.3	15*
Rated current, maximum	A	14.3		15	23.3	15*
IP rating		IP 15B				
eBUS cable minimum size (communication)	mm²	0.75				
eBUS cable maximum length (communication)	m	50				
Fan power consumption	W	40			50	
Fan quantity			1		2	
Fan air flow, maximum	m³/h	2300			5100	
Hydraulic connection						
Heating flow / return	BSP male	G 1 1/4"				
Heating circuit / building circuit						
Water volume in the heat pump	l	1.5		2.0	4.5	
Minimum heating circuit volume for defrost, backup activated/deactivated	l	15 / 40		20 / 55	45 / 150	
Minimum operating pressure	bar	≥0.5				
Maximum operating pressure	bar	≤2.5				
Minimum flow temperature heating	°C	20				
Maximum flow temperature heating	°C	75				
Minimum volume flow	l/h	400		540	995	
Maximum volume flow	l/h	860		1205	2065	
Maximum electrical power heating circuit pump	W	2-50			3-87	
Max. length heating pipework, outside to inside	m	20				
Pump remaining feed pressure	kPa / mbar	56 / 560		44 / 440	55 / 550	
Refrigerant circuit						
Refrigerant type		R 290				
Volume of refrigerant circuit in the heat pump	kg	0.60		0.90	1.30	
Global Warming Potential (GWP) in accordance with EU No. 517/2014		3				
CO ₂ equivalent	t	0.0018		0.0027	0.0039	
Expansion valve type		Electronic				
Oil type	bar	31.5				
Compressor type		Rotary			Scroll	
Oil type		Specific polyalkylene glycol (PAG)				
Compressor control		Electronic				
Noise emissions, heating mode						
Sound power, EN 12102, EN 14511 LWA, A7/W35	dB(A)	51		53	58	
Sound power, EN 12102, EN 14511 LWA, A7/W45	dB(A)	53			58	
Sound power, EN 12102, EN 14511 LWA, A7/W55	dB(A)	54		55	60	
Energy efficiency class						
Energy efficiency class 35°C and 55°C	(A+++ to F)	A+++				

*400v models 10 and 12kW only.

**All Vaillant heat pumps must be installed with a type B RCD rated to 20kHz or greater and with a minimum trigger point of 150mA above 1kHz.



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APPENDICES

Appendix E

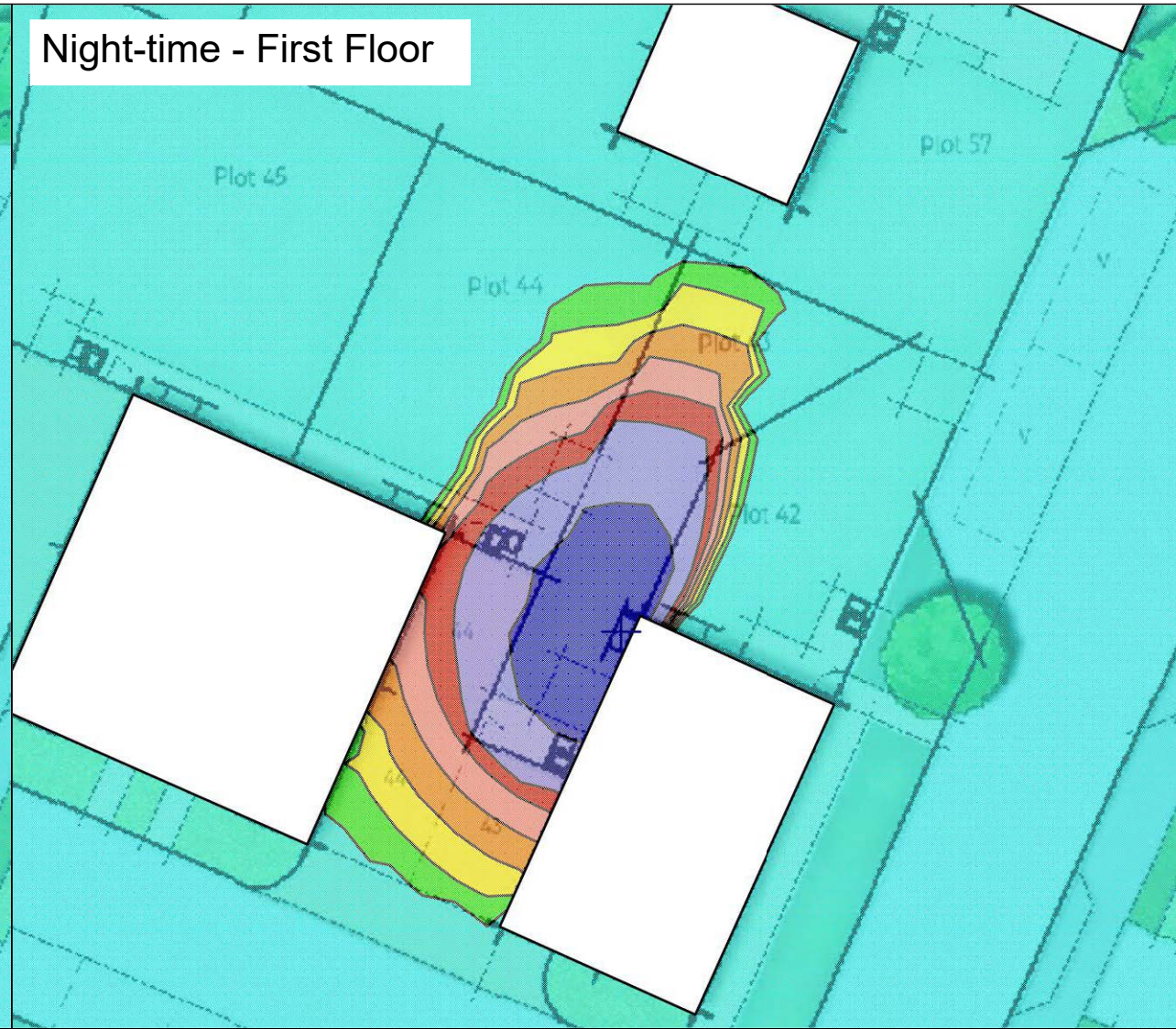




Daytime - Ground Floor



Night-time - First Floor



NOTES:

1. DO NOT SCALE THIS DRAWING.

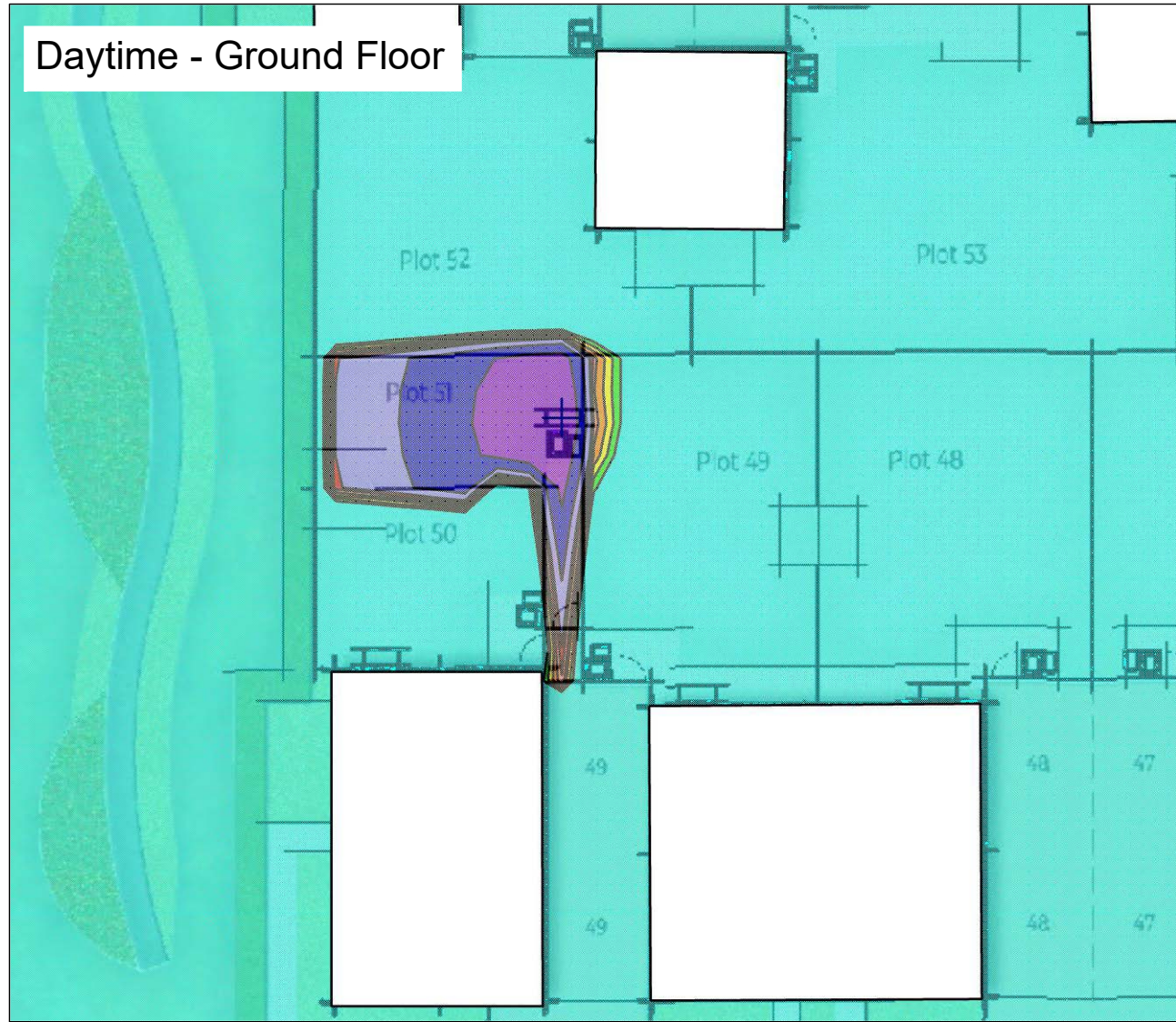
KEY

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	22-23dB(A)
	23-24dB(A)
	24-25dB(A)
	25-26dB(A)
	26-27dB(A)
	27-30dB(A)
	30-35dB(A)
	>35dB(A)

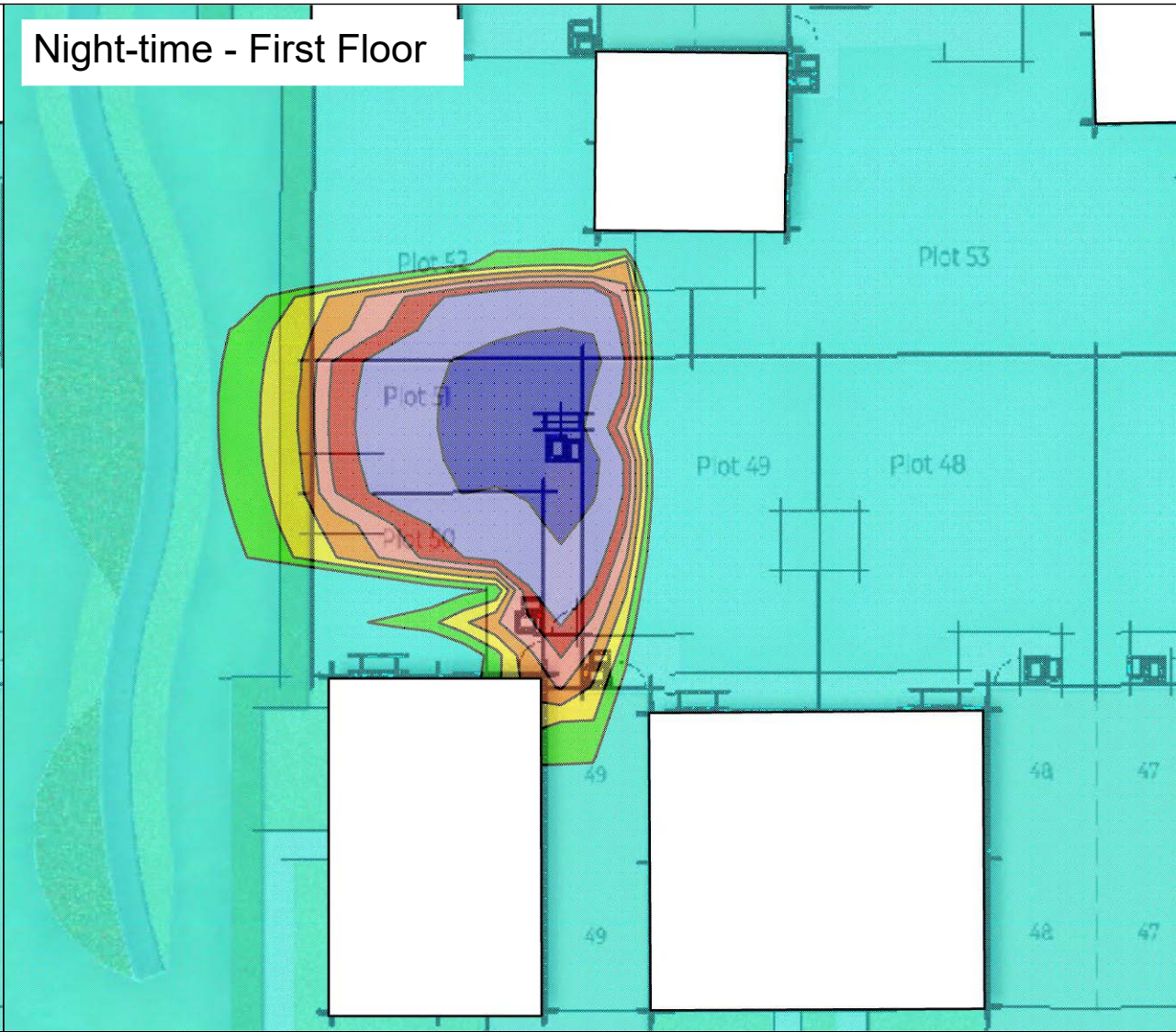
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PROJECT: LAND NORTH OF SCHOOL ROAD, ARBORFIELD CROSS					
DRAWING TITLE: PLOT 44 ASHP ASSESSMENT					
CLIENT: CROUDACE HOMES					
DRAWING NUMBER: 30416_04_120_01					
REVISION: -	SHEET SIZE: A3		SCALE: NTS		
STATUS: FOR INFORMATION / APPROVAL					
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Daytime - Ground Floor



Night-time - First Floor



NOTES:

1. DO NOT SCALE THIS DRAWING.

KEY



REV:	FIRST ISSUE	HJ	NF	TR	23.06.26
AMENDMENTS:	DRN	CHK	APP	DATE:	

PROJECT: LAND NORTH OF SCHOOL ROAD, ARBORFIELD CROSS

DRAWING TITLE: PLOT 50 ASHP ASSESSMENT

CLIENT: CROUDACE HOMES

DRAWING NUMBER: 30416_04_120_02

REVISION: - SHEET SIZE: A3 SCALE: NTS

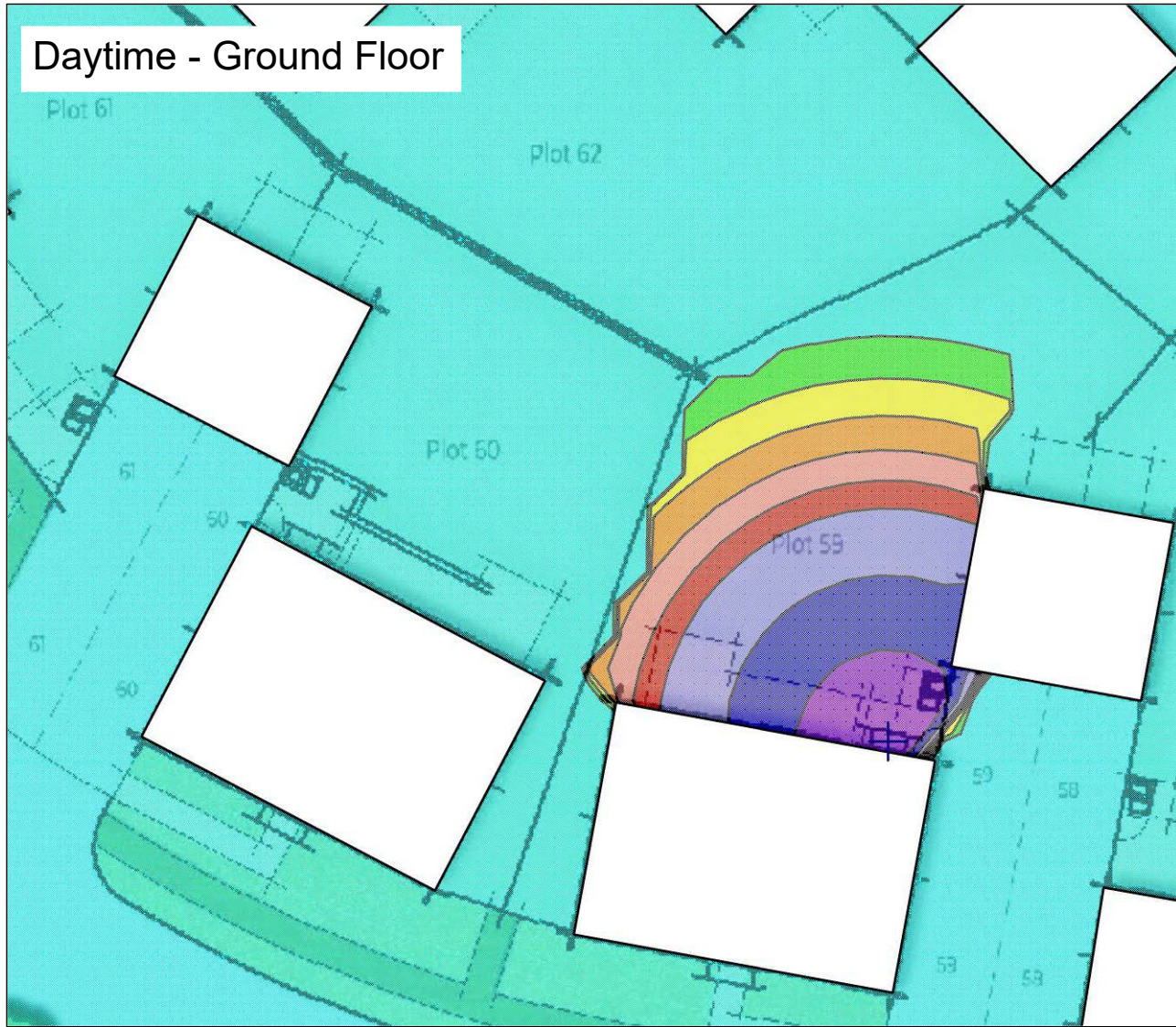
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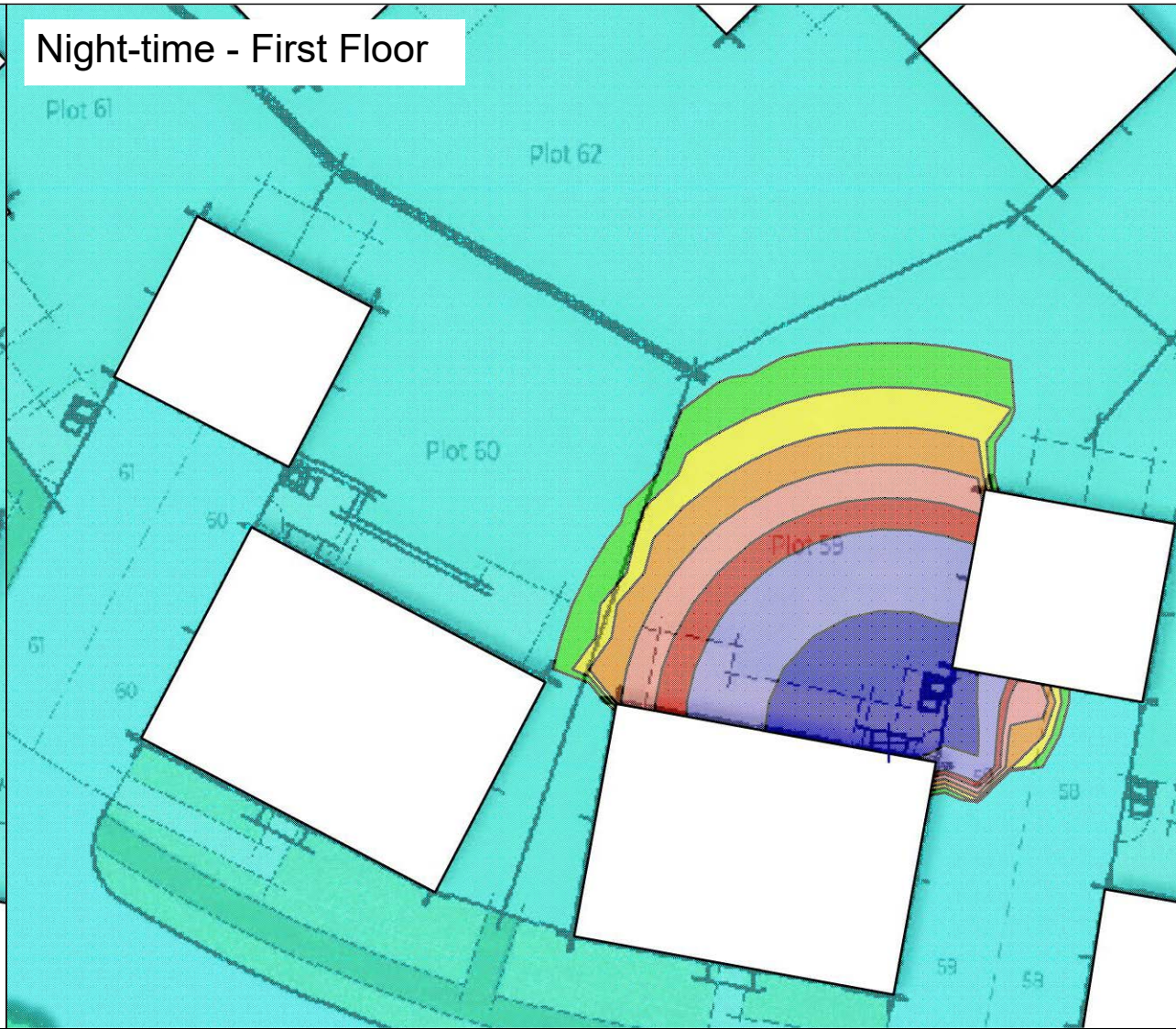
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Website: www.m-ec.co.uk
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Daytime - Ground Floor



Night-time - First Floor



NOTES:

1. DO NOT SCALE THIS DRAWING.

KEY

	0-22dB(A)
	22-23dB(A)
	23-24dB(A)
	24-25dB(A)
	25-26dB(A)
	26-27dB(A)
	27-30dB(A)
	30-35dB(A)
	>35dB(A)

REV.	FIRST ISSUE	HJ	NF	TR	23.06.26
REV.	AMENDMENTS:	DRN	CHK	APP	DATE:

PROJECT: LAND NORTH OF SCHOOL ROAD, ARBORFIELD CROSS

DRAWING TITLE: PLOT 60 ASHP ASSESSMENT

CLIENT: CROUDACE HOMES

DRAWING NUMBER: 30416_04_120_03

REVISION: - SHEET SIZE: A3 SCALE: NTS

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