RBA ACOUSTICS

ABBEY AREA, PHASE 3

Level 2 Overheating Assessment

Reference: 9770.RP02.AVO2.2
Prepared: 29 April 2022
Revision Number: 2

Wates
Wates House
Station Approach
Leatherhead
Surrey
KT22 7SW

Level 2 Overheating Assessment

ABBEY AREA, PHASE 3

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Revision	Comment	Date	Prepared By	Approved By
0	First issue of report	11 March 2022	Toby Walton	Russell Richardson
1	Minor Amendments	25 April 2022	Toby Walton	Russell Richardson
2	Minor Amendments	29 April 2022	Toby Walton	Russell Richardson

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The recommendations within this report relate to acoustics performance only and will need to be integrated within the overall design by the lead designer to incorporate all other design disciplines such as fire, structural integrity, setting-out, etc. Similarly, any sketches appended to this report illustrate acoustic principles only and again will need to be developed in to full working drawings by the lead designer to incorporate all other design disciplines.

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1.0 INTRODUCTION

RBA Acoustics have been appointed by Wates to undertake an assessment regarding the risk of overheating at Phase 3 of the regeneration of the Abbey Road area.

Many buildings require closed windows to provide good internal acoustic conditions, however, opening a window is the normal way to keep a building cool during the warmer summer months. These opposing requirements have become a major issue in the design of buildings, in particular for housing, especially given the general desire to avoid the widespread use of mechanical cooling.

The Acoustics Ventilation and Overheating – Residential Design Guide (AVO) attempts to address the need for an integrated approach to consider noise, ventilation, and overheating. The guide involves a two-level approach to addressing issues of overheating with respect to noise.

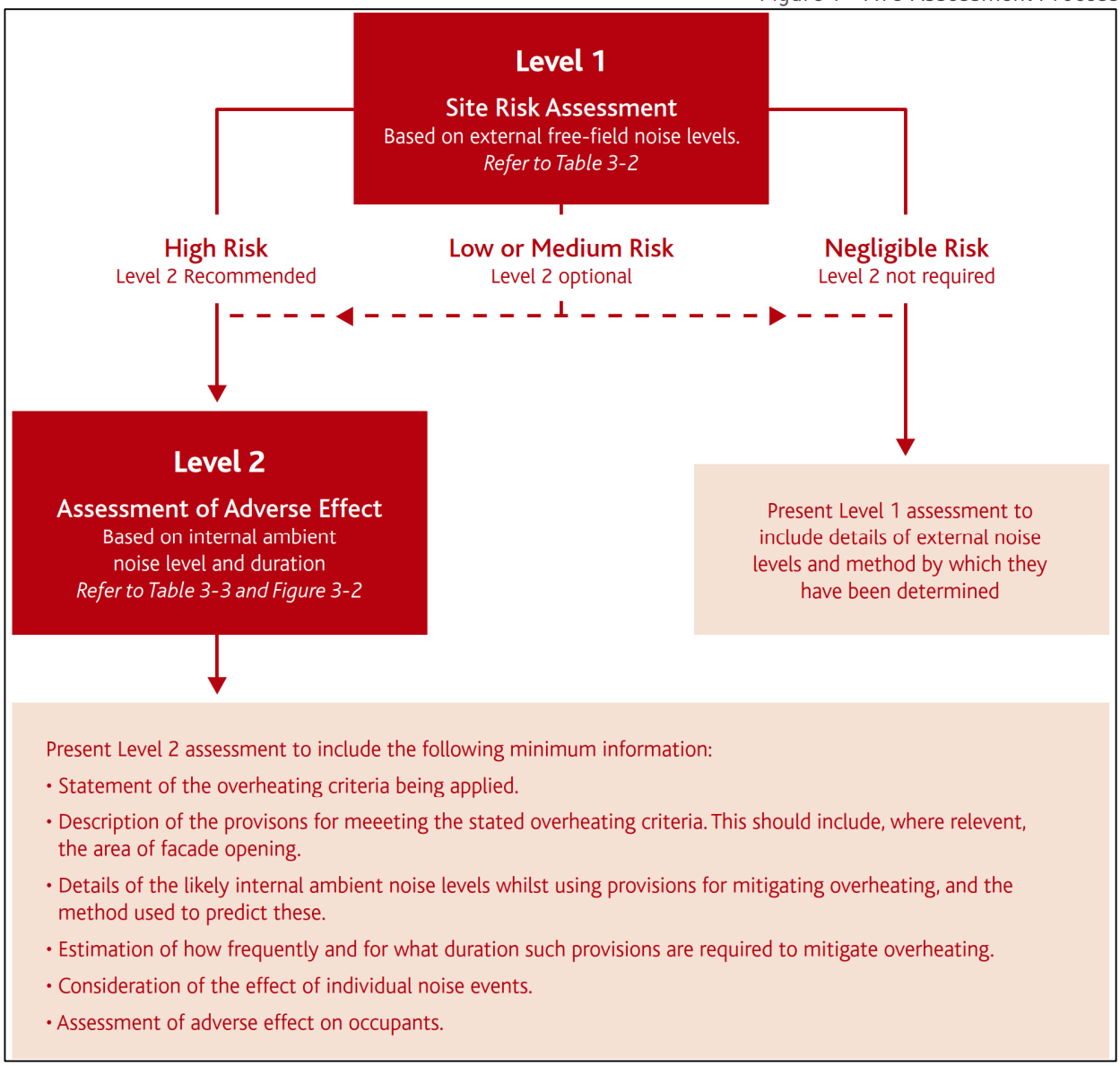
The results of an initial Level 1 assessment for the development indicated that apartments located on the Abbey Road and Belsize Road façades of the development would typically fall into either the 'high risk' or 'medium risk' categories with respect to the external noise environment. High and medium risk category dwellings have the potential to experience unacceptable internal noise levels where opening windows is the strategy for mitigating overheating. Based on this outcome, a Level 2 assessment has been undertaken, which considers internal noise levels within habitable rooms in greater detail so that the risk to occupants of both overheating and adverse noise conditions can be assessed against each other and, if necessary, suitable mitigation measures proposed.

Background ventilation is discussed within our External Building Fabric Assessment reference 9770.RP01.EBF.4 dated 29 April 2022.

2.0 ACOUSTIC VENTILATION AND OVERHEATING

The Acoustics Ventilation & Overheating (AVO) guide published by the Association of Noise Consultants (ANC) involves a two-level approach to addressing issues of overheating with respect to noise as described in Figure 1:

Figure 1 – AVO Assessment Process



2.1 AVO Level 1 Assessment

The Level 1 assessment is based purely upon external noise levels, where a 13 dB reduction between external and internal noise levels is assumed for a partially open window. The results of this initial assessment identified that apartments located on the Abbey Road and Belsize Road facades of the proposed development fall into the 'high risk' and 'medium risk' categories for both the day and night-time periods, with respect to the external noise environment.

The categorisation of risk was based on a design intent to achieve the recommended internal ambient noise levels for dwellings provided in Table 4 of BS 8233:2014, 'Guidance on sound insulation and noise reduction for buildings'. The proposed internal noise levels are:

- Daytime (07:00-23:00) 35dBA $L_{Aeq,16hour}$
- Night-time (23:00-07:00) 30dBA $L_{Aeq,8hour}$

Note 7 of Table 4 in BS 8233:2014, states that the internal target levels may be relaxed by up to 5 dB "where development is considered necessary or desirable".

Although these standards relate to internal noise levels due primarily to steady external noise sources (e.g. road traffic noise) and should not be deemed to be fixed thresholds, we consider the guidance within BS 8233:2014 to represent an appropriate design target for the overheating condition in this instance.

Drawings outlining the Level 1 AVO Assessment undertaken are provided in Figures 1 and 2 of Appendix B.

2.2 AVO Level 2 Assessment

The Level 2 assessment considers internal noise levels within habitable rooms during the overheating condition in relation to the likely outcomes and risk of adverse effect from the occupants, as presented in Figure 2 below.

Figure 2 – Level 2 Assessment Guidance from The Acoustics Ventilation & Overheating (AVO) guide

Internal ambient noise level [Note 2]			Examples of Outcomes [Note 5]	
$L_{Aeq,T}$ [Note 3] during 07:00 – 23:00 [Note 6]	$L_{Aeq,8h}$ during 23:00 – 07:00	Individual noise events during 23:00 – 07:00 [Note 4]		
> 50 dB	> 42 dB	Normally exceeds 65 dB $L_{AF,max}$	Noise causes a material change in behaviour e.g. having to keep windows closed most of the time	Avoiding certain activities during periods of intrusion. Having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.
			Increasing likelihood of impact on reliable speech communication during the day or sleep disturbance at night	At higher noise levels, more significant behavioural change is expected and may only be considered suitable if occurring for limited periods. As noise levels increase, small behaviour changes are expected e.g. turning up the volume on the television; speaking a little more loudly; having to close windows for certain activities, for example ones which require a high level of concentration. Potential for some reported sleep disturbance. Affects the acoustic environment inside the dwelling such that there is a perceived change in quality of life. At lower noise levels, limited behavioural change is expected unless conditions are prevalent for most of the time. [Note 8]
≤ 35 dB	≤ 30 dB	Do not normally exceed $L_{AF,max}$ 45 dB more than 10 times a night	Noise can be heard, but does not cause any change in behaviour	Noise can be heard, but does not cause any change in behaviour, attitude, or other physiological response[Note 9]. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.

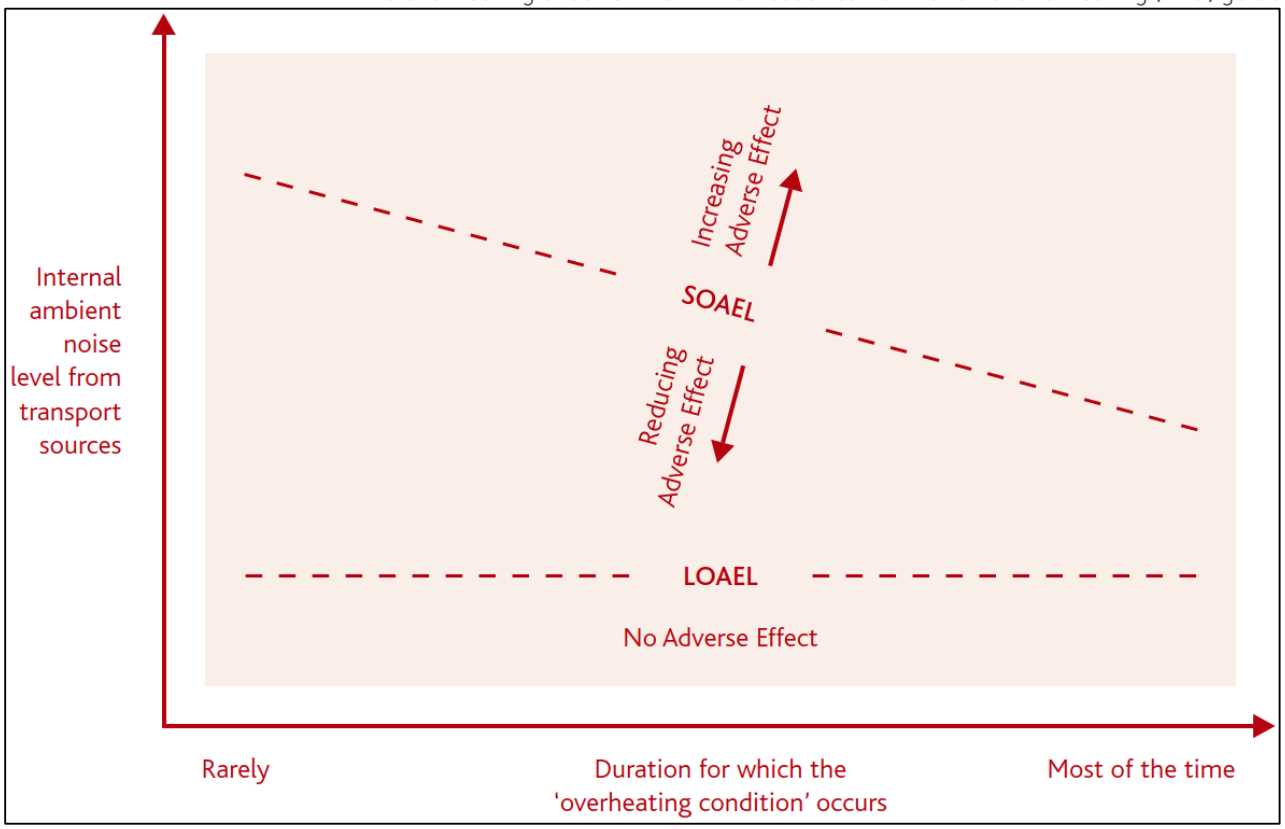
The numerical values shown in the assessment guidance above are once again chosen to reflect the design intent to achieve the relaxed reasonable internal conditions as discussed in BS 8233:2014.

The Level 2 assessment also introduces the concept of Effect Levels as a way of determining the impact of a particular outcome. The Effect Levels are outlined in the Noise Policy Statement for England (NPSE) and are as follows:

- No Observed Effect Level (NOEL)
- Lowest Observed Adverse Effect Level (LOAEL)
- Significant Observed Adverse Effect Level (SOAEL)

The NPSE guidance is that the SOAEL should be avoided, and that impacts which sit between the LOAEL and SOAEL should be mitigated and reduced to a minimum. The effect level will be a product of not only the noise level experienced, but also the duration and frequency of the overheating condition, the time of day at which it occurs, etc. Qualification of the potential impact on occupants is therefore a product of both acoustic and thermal comfort. To this end, the AVO guidance presents an indicative graph in order to consider the relationship between the frequency/duration of the overheating condition and the magnitude of the noise with respect to the likely adverse effect on occupants of the dwellings, as shown in Figure 3 below.

Figure 3 – Qualitative guidance on combined effect of internal ambient noise level and duration for the overheating situation from The Acoustics Ventilation & Overheating (AVO) guide



From Figure 3, it can be seen that the noise level at which a Significant Observed Adverse Effect (SOAEL) occurs reduces with increasing frequency/duration of the predicted overheating condition. Similarly, if the frequency/duration of the overheating condition can be reduced, the magnitude of the noise it is considered reasonable for occupants to experience can increase.

3.0 AVO LEVEL 2 ASSESSMENT

3.1 Assumptions - Noise

Predicted internal noise levels have been calculated in the following manner:

- Façade incident noise levels have been predicted for apartments included in this assessment, based on the noise survey results.
- Detailed calculations have been undertaken for selected rooms based upon the surface area of the external façade, surface area of the windows and room dimensions. This is based upon PTE Architects General Arrangement drawings and elevations dated April 2022.
- It is assumed that bedrooms will be acoustically 'soft' with soft furnishings, while living rooms are assumed to less acoustically absorptive.
- A sound reduction performance of $D_{n,e,w}$ 17 dB for a partially open bottom-hinge window has been assumed, based on information contained within *NANR116: Open/Closed Window Research* produced by Napier University.

3.2 Assessment

The Level 1 assessment demonstrated that flats to the rear of the site are within the LOAEL noise levels with windows open regardless of the time period. As such, these have not been assessed within the Level 2 assessment.

The Level 2 assessment has focused purely on those flats for which the implications of opening windows to address overheating issues would lead to noise levels above the LOAEL value, that have to date been assessed by the Overheating Consultant.

3.3 Results

The following analysis shows the units that have undergone a TM59 Assessment to date at the Abbey Road and Belsize Road facades which fell into the High or Low/Medium Risk categories as a result of the AVO Level 1 analysis, shown above in Figures 1 & 2 in Appendix A. The following internal noise levels have been predicted:

Table 1 – Resulting Internal Noise Levels with windows open based on current design proposals

Level	Block	Unit Reference *	External Level, $L_{Aeq,T}$ (dB)		Predicted Resulting Internal Level, $L_{Aeq,T}$ (dB)	
			Day (07:00-23:00)	Night (23:00-07:00)	Day (07:00-23:00)	Night (23:00-07:00)
3	A	A L03_02 Bed (double)	64	57	47	40
3	A	A L03_02 Bed (single)	64	57	47	40
3	A	A L03_02 Liv/Kitch	64	57	47	40
5	A	A L05_02 Bed (double)	64	57	47	40
5	A	A L05_02 Bed (single)	64	57	47	40
5	A	A L05_02 Liv/Kitch	64	57	47	40
5	B	B L05 Bed (double)	60	55	43	38
5	B	B L05 Liv/Kitch	60	55	43	38
10	B	B L10 Bed (double)	60	55	43	38
10	B	B L10 Liv/Kitch	60	55	43	38

Table 2 outlines the assessment undertaken by the Overheating Consultant, with regards to the percentage of time windows are required to be open to provide adequate cooling during the summer months.

Table 2 – Percentage of Time Windows are Required to be Open for Cooling

Level	Block	Unit Reference *	Percentage of Time Open during Summer Months	
			Day (07:00-23:00)	Night (23:00-07:00)
3	A	A L03_02 Bed (double)	98%	65%
3	A	A L03_02 Bed (single)	98%	61%
3	A	A L03_02 Liv/Kitch	85%	71%
5	A	A L05_02 Bed (double)	99%	67%
5	A	A L05_02 Bed (single)	99%	63%
5	A	A L05_02 Liv/Kitch	85%	71%
5	B	B L05 Bed (double)	96%	69%
5	B	B L05 Liv/Kitch	85%	70%
10	B	B L10 Bed (double)	99%	56%
10	B	B L10 Liv/Kitch	84%	67%

3.4 Example Graphical Unit Analysis

Figure 4 – Level 1+ Assessment (Living Rooms - Daytime)

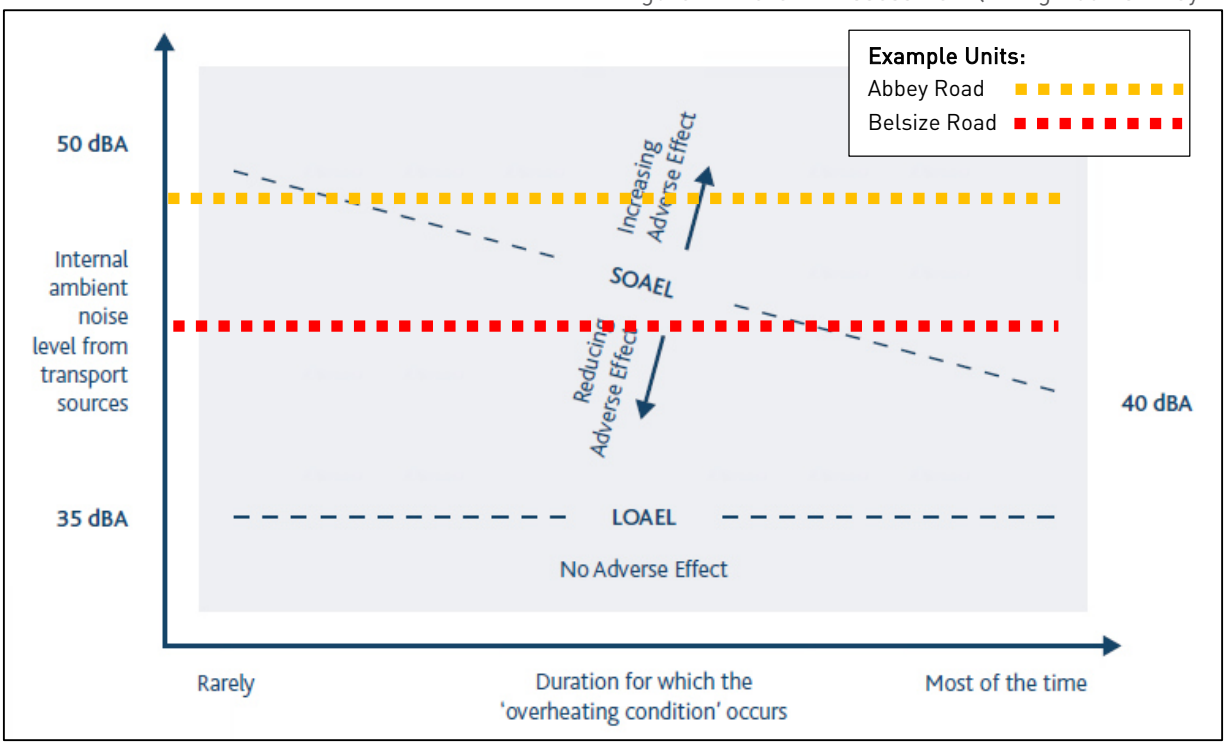
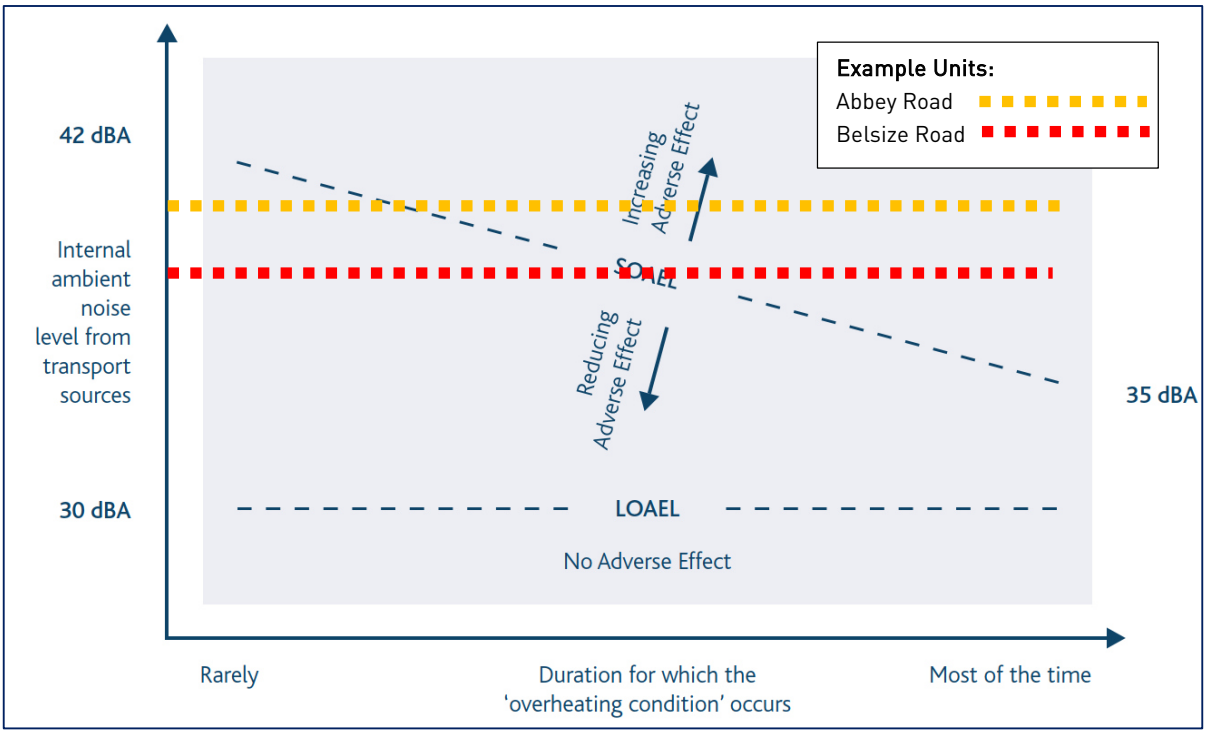


Figure 5 – Level 1+ Assessment (Bedrooms - Night-time)



4.0 DISCUSSION

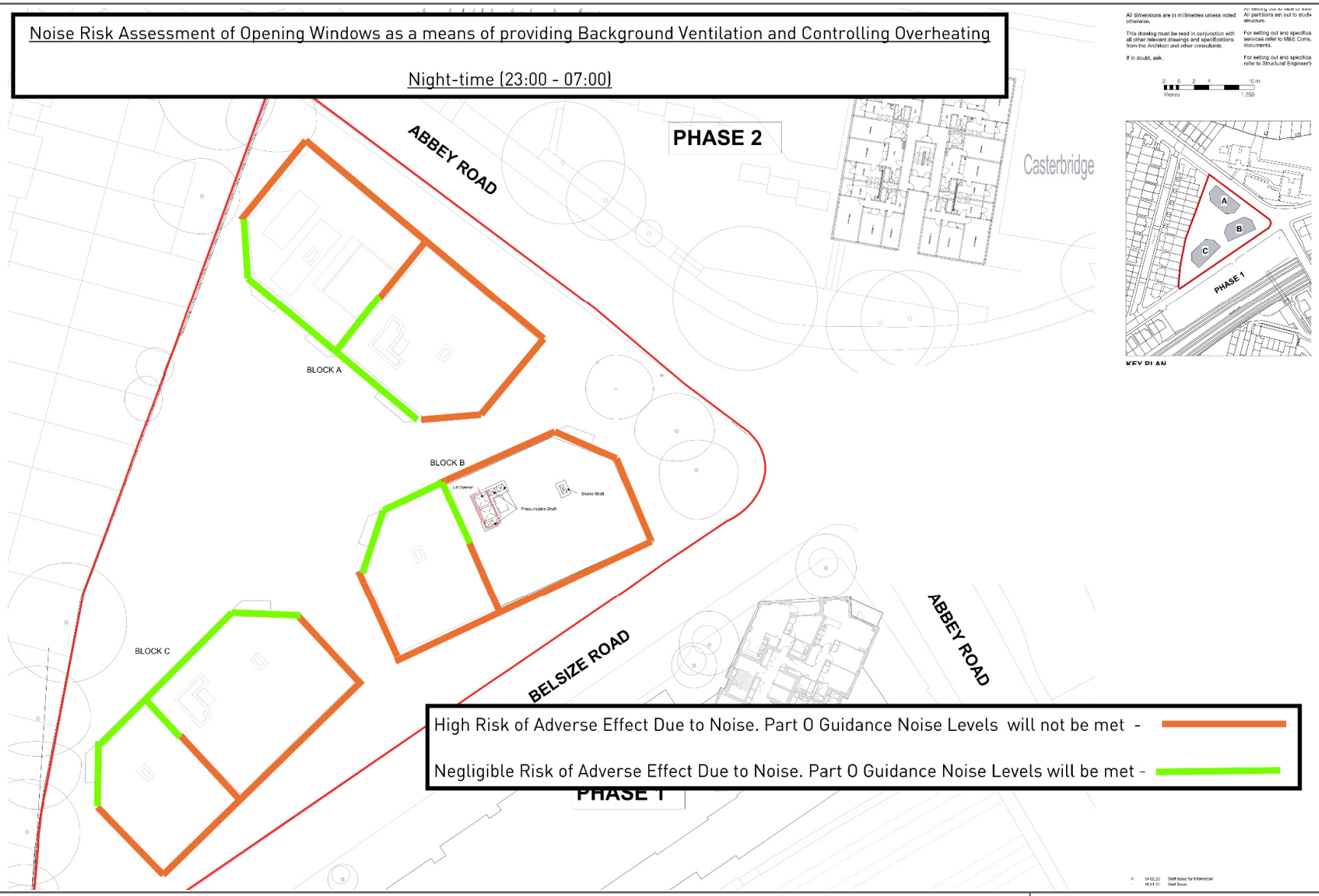
It is clear from the duration that the 'overheating condition' occurs will result in an internal level that is above the SOAEL threshold for all the units presented within this assessment should opening windows be reilied upon to mitigate overheating. It is therefore recommended that alternative options are explored as a means to providing cooling to the apartments.

We understand that a temperature lopping solution, with the inclusion of internal blinds has been put forward by the overheating assessor which will therefore remove the need to rely upon opening windows as the main method of mitigating overheating, and therefore preventing the risk of adverse noise conditions.

Appendix A - Acoustic Terminology

dB	Decibel - Used as a measurement of sound pressure level. It is the logarithmic ratio of the noise being assessed to a standard reference level.
dB(A)	The human ear is more susceptible to mid-frequency noise than the high and low frequencies. To take account of this when measuring noise, the 'A' weighting scale is used so that the measured noise corresponds roughly to the overall level of noise that is discerned by the average human. It is also possible to calculate the 'A' weighted noise level by applying certain corrections to an un-weighted spectrum. The measured or calculated 'A' weighted noise level is known as the dB(A) level. Because of being a logarithmic scale noise levels in dB(A) do not have a linear relationship to each other. For similar noises, a change in noise level of 10dB(A) represents a doubling or halving of subjective loudness. A change of 3dB(A) is just perceptible.
L_{eq}	L_{eq} is defined as a notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (1 hour).
L_{Aeq}	The level of notional steady sound which, over a stated period of time, would have the same A-weighted acoustic energy as the A-weighted fluctuating noise measured over that period.
L_{An} (e.g. L_{A10}, L_{A90})	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time, hence L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the average minimum level and is often used to describe the background noise.
$L_{max,T}$	The instantaneous maximum sound pressure level which occurred during the measurement period, T. It is commonly used to measure the effect of very short duration bursts of noise, such as for example sudden bangs, shouts, car horns, emergency sirens etc. which audibly stand out from the general level of, say, traffic noise, but because of their very short duration, maybe only a very small fraction of a second, may not have any effect on the L_{eq} value.

Appendix B – Site Plans



Abbey Area, Phase 3

AVO Level 1 Assessment, Night-time (23:00 – 07:00)

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Figure 1

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Not to Scale

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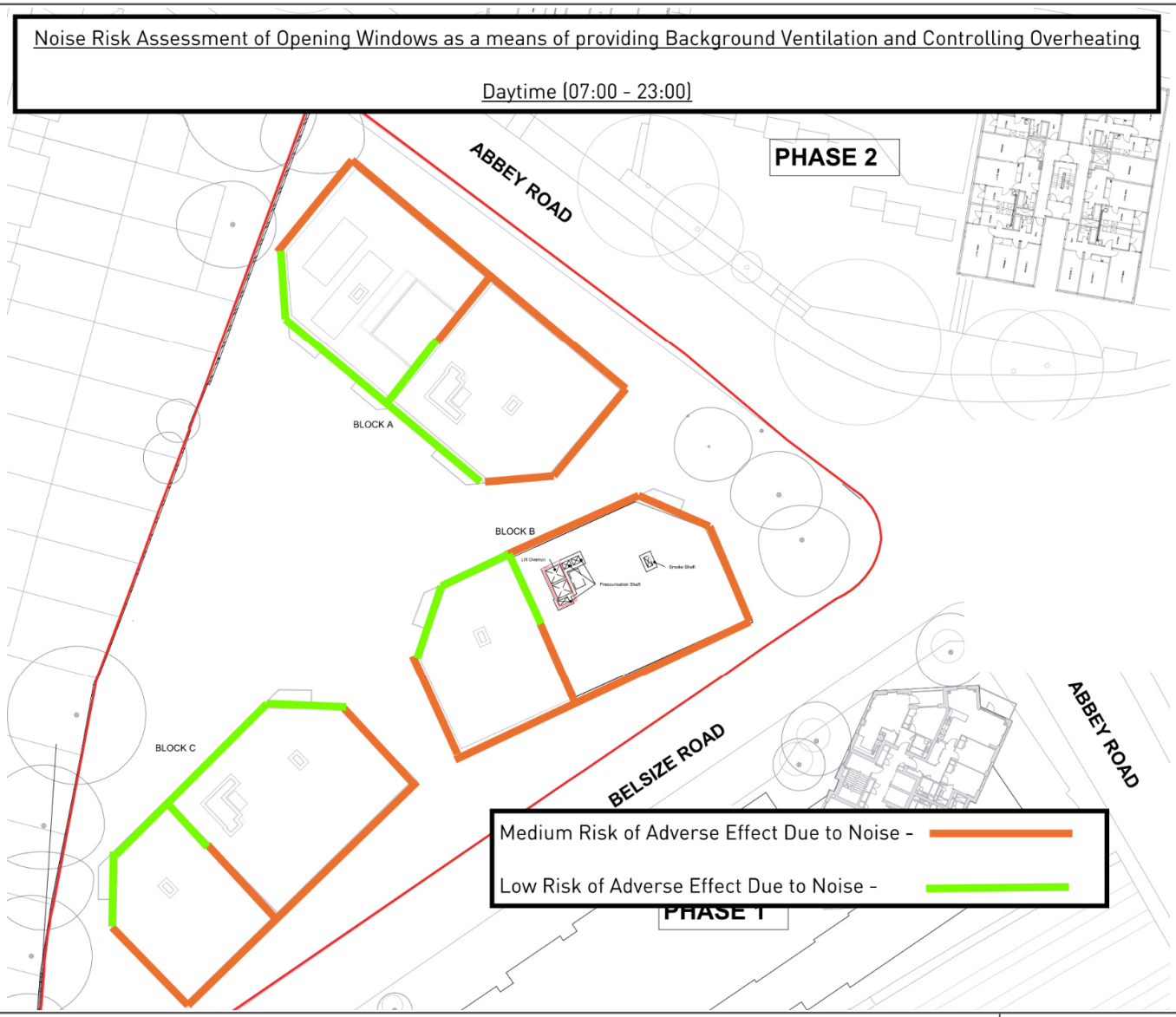

Abbey Area, Phase 3

AVO Level 1 Assessment, Daytime (07:00 – 23:00)

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Figure 2

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Not to Scale

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