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ENVIRONMENT

Wain Estates (Land) Limited
Wilderness Park
Land North of Wilderness Lane, Great Barr
Noise Impact Assessment

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Notice

EXECUTIVE SUMMARY

BWB Consulting have been instructed by Wain Estates (Land) Ltd, to undertake a Noise Impact Assessment to support an outline planning application (with the exception of access) for a proposed residential development at Wilderness Park, land north of Wilderness Lane, Great Barr, Birmingham.

A baseline noise survey was undertaken in July 2023 and the subsequent assessment work has been undertaken in accordance with current standards and guidance.

This assessment considers the impact of road traffic on the Proposed Development and its future residents and where necessary, consideration has been given to mitigation measures.

It is concluded that noise levels in external amenity spaces can be met through careful consideration of the development layout (for example, garden spaces may be located on the screened side of dwellings to the dominant sources of noise). Where this is not possible, mitigation in the form of acoustic barriers may be required to reduce noise levels in external amenity areas.

For worst affected properties located closest to Birmingham Road, all criteria would be achieved with standard thermal double glazing which would need to provide a minimum $R_w + C_{tr}$ of 31 dB with an example configuration of 4mm pane / 12mm airgap / 10mm pane would be required. Acoustic trickle ventilators, which achieve a minimum performance of $D_{n,e,w} + C_{tr}$ 40 dB would be required.

For worst affected properties located closest to Wilderness Lane, all criteria would be achieved with standard thermal double glazing which would need to provide a minimum $R_w + C_{tr}$ of 31 dB with an example configuration of 4mm pane / 12mm airgap / 10mm pane. Acoustic trickle ventilators, which achieve a minimum performance of $D_{n,e,w} + C_{tr}$ 40 dB would be required.

Based on the results of this assessment, it has been demonstrated that the Site is suitable for residential development. It is therefore considered that noise need not be a determining factor in the granting of planning permission for the Site.

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1. INTRODUCTION

Appointment & Background

1.1 BWB Consulting Ltd were instructed by Wain Estates (Land) Ltd ('The Client') to undertake a noise impact assessment for a proposed residential development at Wilderness Park, land north of Wilderness Lane, Great Barr, Birmingham ('the Site').

1.2 The key noise source with potential to impact the development is road traffic on Birmingham Road to the north and Wilderness Lane to the south-east to the east.

1.3 A baseline noise survey was undertaken in July 2023 and the subsequent assessment work has been undertaken in accordance with current standards and guidance.

1.4 Where appropriate, consideration has been given to noise mitigation measures to demonstrate how an appropriate level of protection could be afforded to proposed Noise Sensitive Receptors (NSRs) across the Site.

1.5 This report is necessarily technical in nature, so to assist the reader, a glossary of acoustic terminology can be found in **Appendix A**.

Site Setting

1.6 The proposed development site currently comprises managed/low value farmland and is located to the north-west of Birmingham. The north of the site is bordered by Birmingham Road with existing residential beyond and Aston University Recreation Centre to the north-west. To the east, the site is bordered by existing dwellings situated off Peak House Road. The south of the site is bordered by Q3 Academy Great Barr with Wilderness Lane to the south-east and the M6 situated further to the south. To the west, the site is bordered by land associated with West Bromwich Albion training ground.

1.7 The location of the Site is shown in **Figure 1.1.**

Figure 1.1: Site Location

Proposed Development

1.8 The proposed development comprises the construction of up to 150 dwellings. A Development Framework Plan is detailed in **Figure 1.2**.

Figure 1.2: Development Framework Plan

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2. STANDARDS AND GUIDANCE

National Planning Policy Framework (NPPF)

2.1 Published in September 2023 this document sets out the Government's planning policies for England and supersedes the previous NPPF published in 2021. It makes the following reference to noise in the section entitled Conserving and enhancing the natural environment:

> *"174. Planning policies and decisions should contribute to and enhance the natural and local environment by:*
>
> *[…]*
>
> *e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans."*

2.2 It also makes the following references to noise in the Section entitled *Ground conditions and pollution*:

> *"185. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*
>
> *a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life[60];*
>
> *b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.*
>
> *[65] See Explanatory Note to the Noise Policy Statement for England (Department for Environment, Food & Rural Affairs, 2010)."*

BS 8233:2014: Guidance on Sound Insulation and Noise Reduction for Buildings

2.3 This standard provides guidance for the control of noise in and around buildings. The guidance provided within the document is applicable to the design of new buildings, or refurbished buildings undergoing a change of use, but does not provide guidance on assessing the effects of changes in the external noise levels to occupants of an existing building.

2.4 The guidance provided includes appropriate internal and external noise level criteria which are applicable to dwellings for steady external noise sources. It is stated that it is

desirable that the internal ambient noise level does not exceed the following criteria set out in **Table 2.1** below:

Table 2.1: Summary of Internal Ambient Noise Levels to be achieved in Habitable Rooms when Assessed in Accordance with BS 8233

Activity	Location	Period	
		07:00 to 23:00 Hours, i.e. Daytime	23:00 to 07:00 Hours, i.e. Night-time
Resting	Living Room	35 dB $L_{Aeq, 16\ Hour}$	-
Dining	Dining Room/area	40 dB $L_{Aeq, 16\ Hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq, 16\ Hour}$	30 dB $L_{Aeq, 8\ Hour}$

2.5 Whilst BS 8233:2014 recognises that a guideline value may be set in terms of SEL or L_{AFmax} for the assessment of regular individual noise events that can cause sleep disturbance during the night-time, a specific criterion is not stipulated. Accordingly, reference has been made in this assessment to the World Health Organisation (WHO) 1999: *Guidelines for Community Noise* below.

2.6 With respect to external amenity space such as gardens and patios it is stated that it is desirable that the noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. It is then confirmed that higher external noise criteria may be appropriate under certain circumstances such as within city centres, urban areas, and locations adjoining the strategic transportation network, where it may be necessary to compromise between elevated noise levels and other factors such as convenience of living, and efficient use of land resource.

World Health Organisation (WHO) 1999: Guidelines for Community Noise

2.7 The World Health Organisation (WHO) guidance: 1999: Guidelines for Community noise includes guidance for individual maximum noise events during the night-time. This document draws upon guidance from Vallet and Vernay, which states:

> *"For good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{AFmax} more than 10-15 times per night"*

Consultation with Sandwell Metropolitan Borough Council

2.8 Consultation was undertaken by email with the Environmental Health Department at Sandwell Metropolitan Borough Council (SMBC). The following was proposed:

- Utilise the measured baseline noise data to inform the assessment of road traffic;
- Assess the impact of noise from existing road traffic at proposed sensitive receptors in accordance with BS 8233:2014; and
- Where appropriate, noise mitigation measures will be considered to reduce noise to within acceptable levels at proposed noise sensitive receptors.

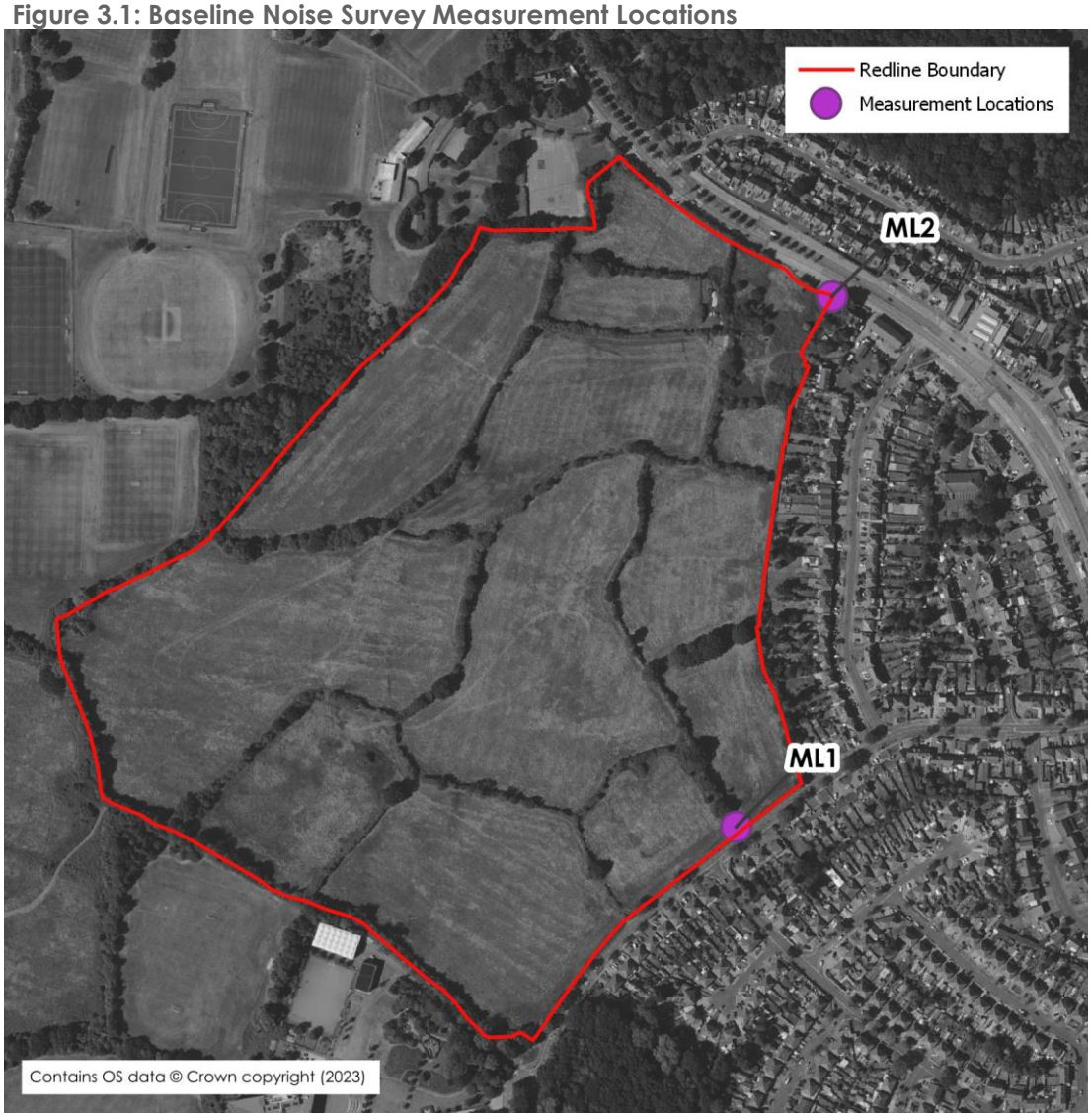
2.9 At the time of writing, an official response has not been received.

3. BASELINE NOISE MEASUREMENTS

Summary

3.1 A baseline noise survey has been undertaken to determine noise levels incident on the site due to road traffic on the surrounding road network. Baseline noise measurements have been undertaken at the measurement locations identified in **Figure 3.1.**

Figure 3.1: Baseline Noise Survey Measurement Locations



Survey Methodology

Measurement Location 1

3.2 Unattended noise measurements were undertaken at Measurement Location 1 (ML1) over a 24-hour period commencing at 16:00 on 24th July 2023. The measurement equipment was established in free-field conditions at 1.5 m above local ground level and circa. 5.5 m from the nearside kerb edge of Wilderness Lane. During periods of attendance the noise climate at ML1 was noted to be dominated by intermittent road

traffic noise from vehicles on Wilderness Lane to the east, and distant road traffic noise from Birmingham Road to the north.

Measurement Location 2

3.3 Noise monitoring was undertaken at Measurement Location 2 (ML2) over a 24-hour period commencing at 16:15 on 24th July 2023. The measurement equipment was established in free-field conditions at 1.5 m above local ground level and circa. 6.5 m from the nearside kerb edge of Birmingham Road. During periods of attendance the noise climate at ML2 was noted to be dominated by road traffic noise from Birmingham Road to the north.

3.4 It was noted that during the night-time period, between 23:00 and 04:00 noise levels at ML2 were elevated, therefore the measured noise level between 05:00 and 07:00 has been utilised for the assessment work as a worst-case.

Measurement Equipment

3.5 The baseline noise survey was undertaken using the Class 1 specification noise measurement equipment detailed in **Table 3.1**. The equipment was calibrated using a portable calibrator immediately before and after the measurements with no significant drift in calibration observed. The sound level meters, pre-amplifiers and microphones were calibrated to traceable standards within the 24 months prior to the measurements. The portable calibrators were calibrated within the 12 months preceding the date of the survey.

Table 3.1: Noise Measurement Equipment

Position	Equipment	Make and Model	Serial Number
ML1	Sound Level Meter	SVAN 971	60745
	Microphone	ACO 7052E	64535
	Preamp	SV18	66815
ML2	Sound Level Meter	Svantek 971A	113221
	Microphone	Aco Pacific 7152	80629
	Preamp	Svantek SV18A	113722
ML1 & ML2	Calibrator	B&K DB0311	449050

Weather Conditions

3.6 The weather was generally conducive to environmental noise measurement, it being dry with negligible winds during all survey periods (<5 ms-1).

Measurement Results

3.7 A summary of measured sound pressure levels at ML1 and ML2 is presented below and overleaf. Full results are included in **Appendix B**.

Table 3.2: Summary of Measured Sound Pressure Levels at ML1

Period	Start Date and Time	Period (T)	dB $L_{Aeq,T}$	dB $L_{A90,T}$[1]	dB L_{AFmax}[2]
Daytime	24/07/2023 16:00[3]	16-hours	59	47	-
Night-time	24/07/2023 23:00	8-hours	52	45	76

[1] arithmetic average $L_{A90,15mins}$ during measurement period,
[2] 90th Percentile L_{AFmax} noise levels during measurement period
[3] Includes periods between 16:00 and 23:00 on 24th July and between 07:00 and 12:00 on 25th July 2023.

Table 3.3: Summary of Average (logarithmic) Octave Band Sound Pressure Levels at ML1

Period	Octave Band Sound Pressure Levels (L_{eq} dB)								dB(A)
	63 Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz	
Daytime	64	60	56	55	56	50	43	37	59
Night-time	57	49	46	49	50	42	33	28	52

Table 3.4: Summary of Measured Sound Pressure Levels at ML2

Period	Start Date and Time	Period (T)	dB $L_{Aeq,T}$	dB $L_{A90,T}$[1]	dB L_{AFmax}[2]
Daytime	24/07/2023 16:15[3]	16-hours	64	57	-
Night-time[4]	24/07/2023 23:00	8-hours	63	48	78

[1] arithmetic average $L_{A90,15mins}$ during measurement period,
[2] 90th Percentile L_{AFmax} noise levels during measurement period
[3] Includes periods between 16:15 and 23:00 on 24th July and between 07:00 and 12:00 on 25th July 2023.
[4]Calculated using noise levels between 05:00 and 07:00

Table 3.5: Summary of Average (logarithmic) Octave Band Sound Pressure Levels at ML2

Period	Octave Band Sound Pressure Levels (L_{eq} dB)								dB(A)
	63 Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz	
Daytime	67	60	58	59	62	55	45	34	64
Night-time	68	60	57	59	60	53	44	34	63

4. ASSESSMENT

4.1 The results of the baseline noise survey undertaken in July 2023 have been used as a basis for the noise assessment. Following on site observations it was noted that road traffic was dominant across the site and noise from the nearby school was not audible and therefore this has not been considered within the assessment.

Noise Model

4.2 A detailed noise model has been generated in order to calculate the daytime and night-time noise propagation across the Site from road traffic on Birmingham Road and Wilderness Lane. The following prediction methodologies were adapted for the modelling exercise:

- The noise model was set up to apply the noise prediction methodology set out in the 1988 Department of Transport Welsh Office document Calculation of Road Traffic Noise for road traffic noise sources;
- The noise data collected from the Site was used to calibrate the road traffic noise sources;
- Mapping of the Site and the surrounding area was calibrated into the noise model based on known Ordinance Survey grid reference points;
- Indicative ground topography was approximated using Lidar Data available from the DEFRA Website;
- Off-site buildings which would provide screening to the Site have been incorporated as reflective façades;
- To reflect the local ground cover, ground absorption was set to G = 0.5 (50% acoustically absorptive ground);
- The model was set to include second order reflected noise from solid structures;
- Noise levels in outdoor amenity spaces have been predicted with the grid height set at 1.5m; and,
- Incident noise levels at windows of habitable rooms have been predicted at 4m.

4.3 A receiver location for ML1 and ML2 has been included in the model and the road traffic noise has been adjusted until the predicted level in the model at these locations is equal to the noise level measured for the daytime and night-time periods.

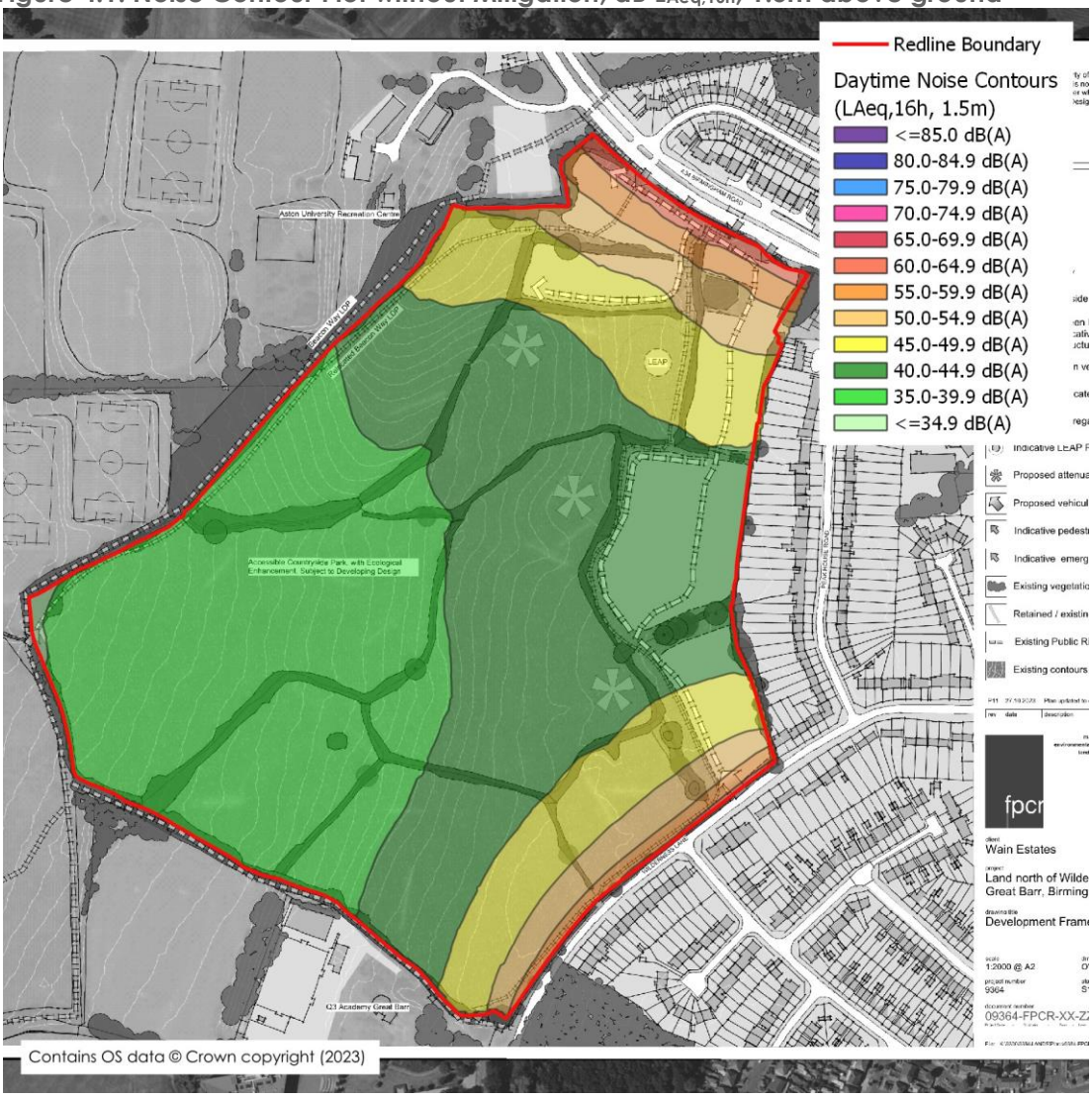
4.4 The development framework masterplan shown in **Figure 1.2** has been incorporated into the model and the free-field level at the nearest proposed facades have been calculated. Noise contours have been calculated showing the external free-field noise levels in external amenity areas, across the proposed development site. The predicted noise levels have been used to inform the assessment.

External Daytime Noise Levels

4.5 The daytime noise contour plot shown in **Figure 4.1** indicates that for the majority of the site, noise levels in external areas are likely to be below the upper guideline value of 55 dB with no mitigation in place. For properties located closest to Birmingham Road and Wilderness Lane, noise levels in outdoor living areas will be above the upper '*desirable*'

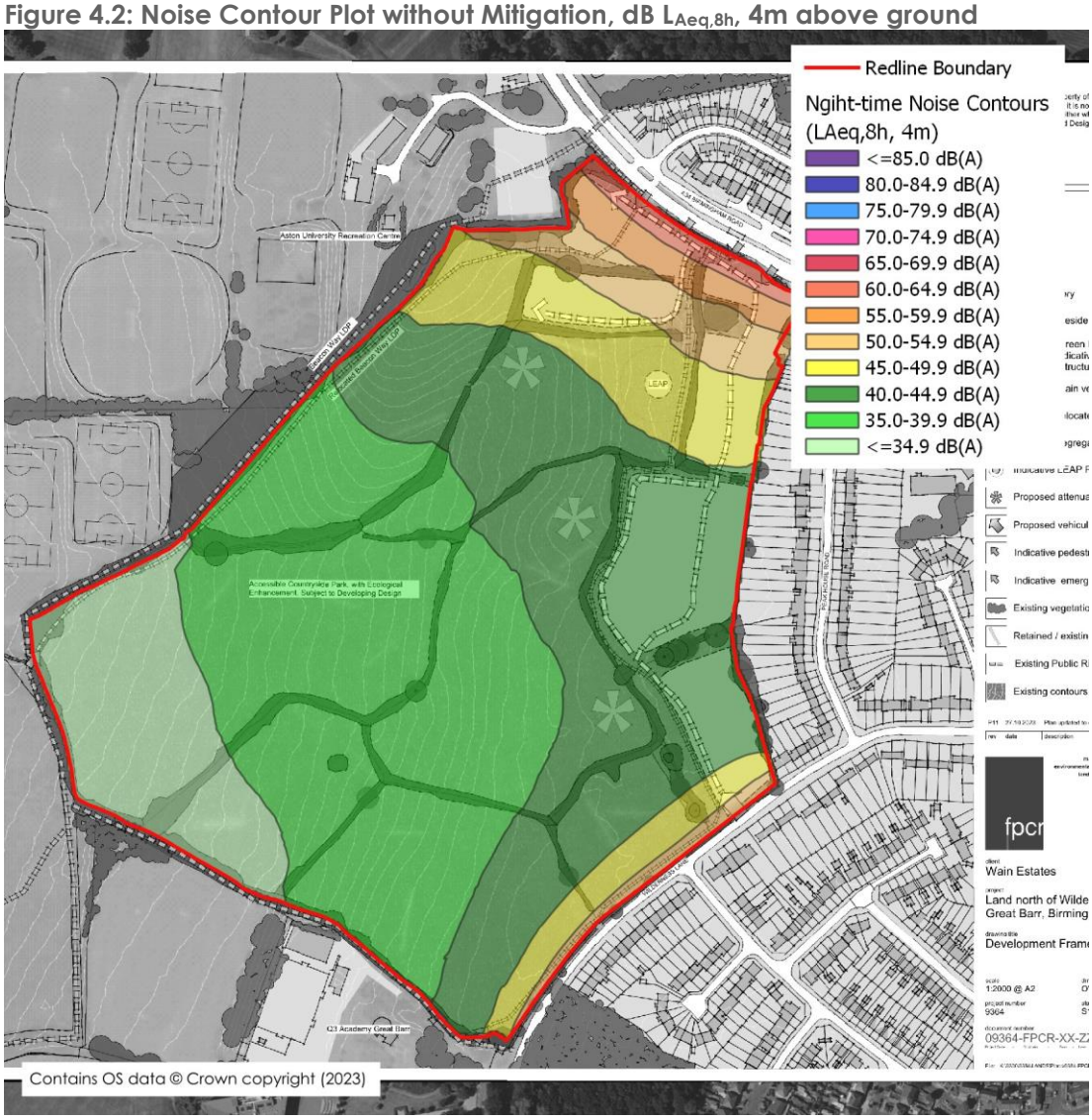
guideline value of 55 dB $L_{Aeq,16hr}$ in line with BS 8233 and WHO guidance. Therefore, consideration has been given to mitigation in **Section 5**.

Figure 4.1: Noise Contour Plot without Mitigation, dB $L_{Aeq,16h}$, 1.5m above ground



4.6 **Fig 4.2** shows the resultant noise contour plot across the site, during the night-time at 4m in height.

Figure 4.2: Noise Contour Plot without Mitigation, dB $L_{Aeq,8h}$, 4m above ground



Internal Noise Levels

4.7 The results of the noise modelling indicate that the nearest proposed developable area to Birmingham Road would be exposed to free-field levels of 64 dB $L_{Aeq,16hr}$ and 63 dB $L_{Aeq,8hr}$ for daytime and night-time, respectively. Given that the closest proposed developable area is at a similar distance back from Birmingham Road as ML2, it is considered that the measured L_{AFmax} noise level of 78 dB is representative. Therefore, this has not been corrected for distance.

4.8 Assuming a 15 dB loss through a partially opened window, this would result in internal levels of 49 dB $L_{Aeq,16h}$ and 48 dB $L_{Aeq,8h}$ for daytime and night-time, respectively. A partially opened window would also result in an internal level of 63 dB L_{AFmax} during the night-time. Therefore, the criteria of 35 dB for the daytime and 30 dB for the night-time and 45 dB for L_{AFmax}, are likely to be exceeded, assuming partially opened windows.

4.9 The results of the noise modelling indicate that the nearest proposed developable area to Wilderness Lane would be exposed to free-field levels of 59 dB $L_{Aeq,16hr}$ and 52 dB $L_{Aeq,8hr}$ for daytime and night-time, respectively. Given that the closest proposed

developable area is at a similar distance back from Wilderness Lane as ML1, it is considered that the measured L_{AFmax} noise level of 76 dB is representative. Therefore, this has not been corrected for distance.

4.10 Assuming a 15 dB loss through a partially opened window, this would result in internal levels of 44 dB $L_{Aeq,16h}$ and 37 dB $L_{Aeq,8h}$ for daytime and night-time, respectively. A partially opened window would also result in an internal level of 61 dB L_{AFmax} during the night-time. Therefore, the criteria of 35 dB for the daytime and 30 dB for the night-time and 45 dB for L_{AFmax}, are likely to be exceeded, assuming partially opened windows. Consideration has been given to mitigation in **Section 5.**

5. MITIGATION

5.1 In **Section 4**, it has been determined that consideration should be given to mitigation measures for internal habitable areas of the residential aspect of the Proposed Development to provide a commensurate level of protection against road traffic noise for future occupants.

External Living Areas

5.2 Noise levels in outdoor living areas of the proposed dwellings located closest to Birmingham Road and Wilderness Lane are above the recommended guideline noise level. Therefore, mitigation would be required to reduce noise levels from road traffic to within acceptable levels as recommended in BS 8233 and WHO.

5.3 To reduce the noise impact in the nearest proposed gardens to within acceptable limits, it is recommended that gardens are placed on the screened side of dwellings. Where this is not possible, it is considered likely that mitigation in the form of localised acoustic barriers will be required, which remove line of sight to the noise sources as a minimum. It is widely accepted that any barrier which removes line of sight to the source will provide a reduction of approximately 10 dB. The barriers must extend from ground level to at least the specified height, be solid i.e. imperforate and have a minimum superficial mass of 15 kg/m^2. Any penetrations or junctions should be treated to maintain acoustic integrity.

Internal Living Areas

5.4 It is widely considered that first amelioration measure available to an occupant will be to close windows. Therefore, in order to assess the noise mitigation required to ensure an adequate level of protection against noise, it is appropriate to explore in the first instance the protection that could be afforded by the sound insulation performance of the external building fabric, and in particular the glazing elements.

5.5 Detailed noise break-in calculations have been undertaken in accordance with the rigorous method from section G.2 from BS 8233 based on the frequency spectra measured on-site and the following assumed dimensions:

- Room dimensions of 3m (width) x 4.4m (depth) x 2.5m (height);
- Double glazed window dimensions of 1.0m (width) x 2.5m (height);
- A reverberation time of 0.5 seconds; and,
- A single 2500mm^2 ventilator per habitable room.

5.6 The break-in calculations have been undertaken for the 1st floor, to provide a worst-case scenario.

5.7 To achieve the daytime internal noise criterion of 35 dB $L_{Aeq,16h}$ adopted for this assessment, based on the façade closest to Birmingham Road experiencing 64 dB $L_{Aeq,16h}$, a reduction of 29 dB(A) would be required for habitable rooms. To achieve the internal criteria of 30 dB $L_{Aeq,8h}$ and 45 dB L_{AFmax} during the night-time, adopted for this assessment a reduction of up to 33 dB(A) would be required for habitable rooms.

5.8 All criteria would be achieved with standard thermal double glazing which would need to provide a minimum $R_w + C_{tr}$ of 31 dB with an example configuration of 4mm pane / 12mm airgap / 10mm pane would be required. Acoustic trickle ventilators, which achieve a minimum performance of $D_{n,e,w} + C_{tr}$ 40 dB would be required, for worst affected properties located closest to Birmingham Road.

5.9 To achieve the daytime internal noise criterion of 35 dB $L_{Aeq,16h}$ adopted for this assessment, based on the façade closest to Wilderness Lane experiencing 59 dB $L_{Aeq,16h}$, a reduction of 24 dB(A) would be required for habitable rooms. To achieve the internal criteria of 30 dB $L_{Aeq,8h}$ and 45 dB L_{AFmax} during the night-time, adopted for this assessment a reduction of up to 31 dB(A) would be required for habitable rooms.

5.10 All criteria would be achieved with standard thermal double glazing which would need to provide a minimum $R_w + C_{tr}$ of 31 dB with an example configuration of 4mm pane / 12mm airgap / 10mm pane would be required. Acoustic trickle ventilators, which achieve a minimum performance of $D_{n,e,w} + C_{tr}$ 40 dB would be required, for worst affected properties located closest to Wilderness Lane.

6. CONCLUSION AND RECOMMENDATIONS

6.1 BWB Consulting Ltd was appointed by Wain Estates (Land) Ltd to undertake a noise impact assessment for an outline planning application (with the exception of access) for a proposed residential development at Wilderness Park, land north of Wilderness Lane, Great Barr, Birmingham.

6.2 This assessment has been undertaken based on the results of a baseline noise survey undertaken in July 2023 at the Site. The results of the survey have been assessed in accordance with current standards and guidance.

6.3 This assessment considers the impact of road traffic on the proposed development and its future residents and where necessary, consideration has been given to mitigation measures.

6.4 It is concluded that noise levels in external amenity spaces can be met through careful consideration of the development layout (for example, garden spaces may be located on the screened side of dwellings to the dominant sources of noise). Where this is not possible, mitigation in the form of acoustic barriers may be required to reduce noise levels in external amenity areas.

6.5 For worst affected properties located closest to Birmingham Road, all criteria would be achieved with standard thermal double glazing which would need to provide a minimum $R_w + C_{tr}$ of 31 dB with an example configuration of 4mm pane / 12mm airgap / 10mm pane would be required. Acoustic trickle ventilators, which achieve a minimum performance of $D_{n,e,w} + C_{tr}$ 40 dB would be required.

6.6 For worst affected properties located closest to Wilderness Lane, all criteria would be achieved with standard thermal double glazing which would need to provide a minimum $R_w + C_{tr}$ of 31 dB with an example configuration of 4mm pane / 12mm airgap / 10mm pane would be required. Acoustic trickle ventilators, which achieve a minimum performance of $D_{n,e,w} + C_{tr}$ 40 dB would be required.

6.7 Based on the results of the assessment, and with appropriate mitigation measures in place, it is considered that the site is suitable for residential development.

APPENDICES

APPENDIX A: Glossary of Terms

Noise

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 measurement, 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.

Acoustic Terminology

dB (decibel)	The scale on which sound pressure level is expressed. Sound pressure level is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure (2x10-5Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' - weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
$L_{Aeq,T}$	L_{Aeq} is defined as the notional steady sound level which, over a stated period of time (T), would contain the same amount of acoustical energy as the A - weighted fluctuating sound measured over that period.
L_{Amax}	L_{Amax} is the maximum A - weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L_{10} and L_{90}	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 the L_{90} is the level exceeded for 90% of the time.
Free-field Level	A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other reflective surfaces. Generally as measured outside and away from buildings.
Façade Level	A sound field determined at a distance of 1m in front of a large sound reflecting object such as a building façade.

APPENDIX B: Full Survey Results

Figure B.1: Measured Sound pressure levels at ML1

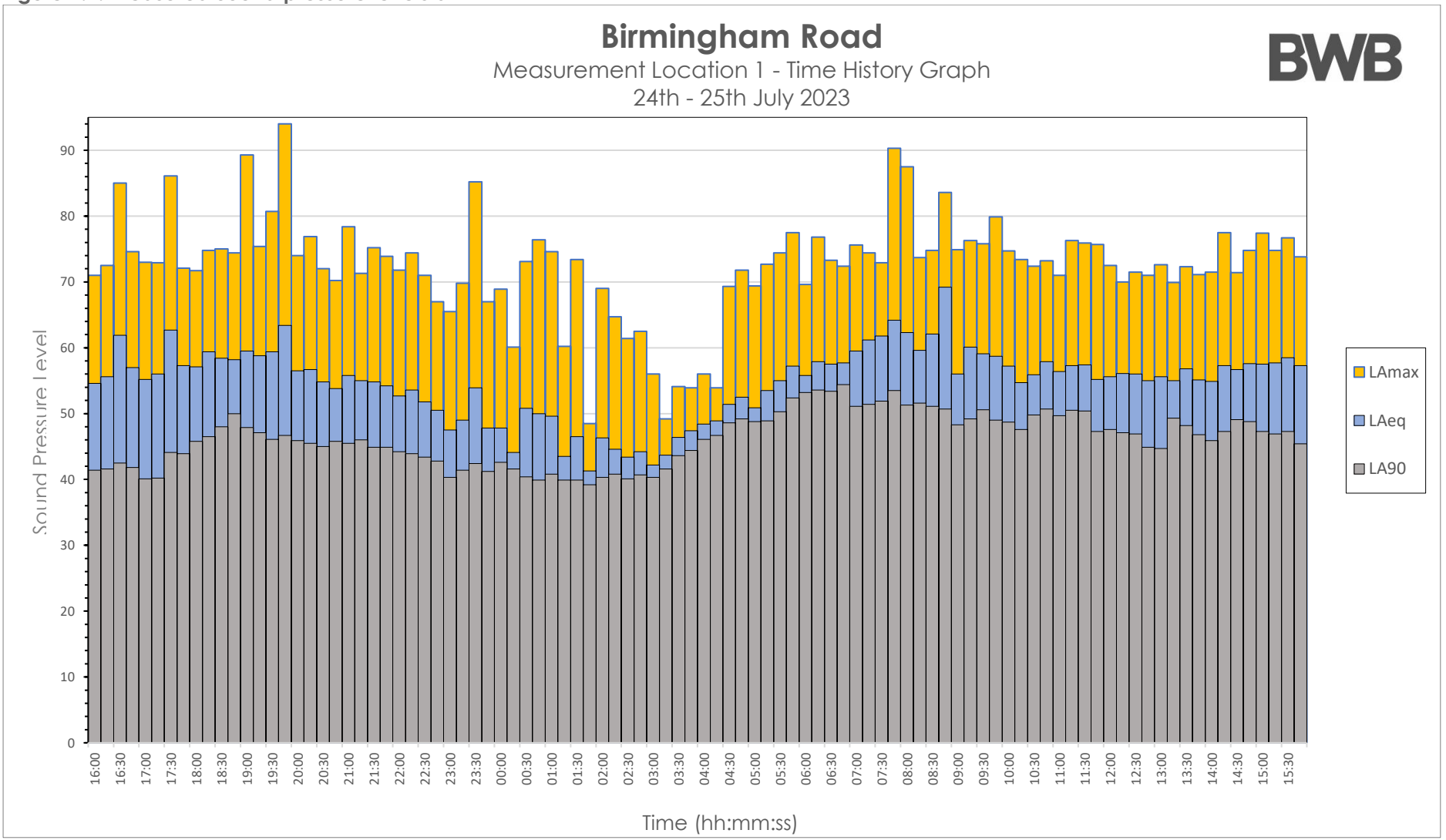
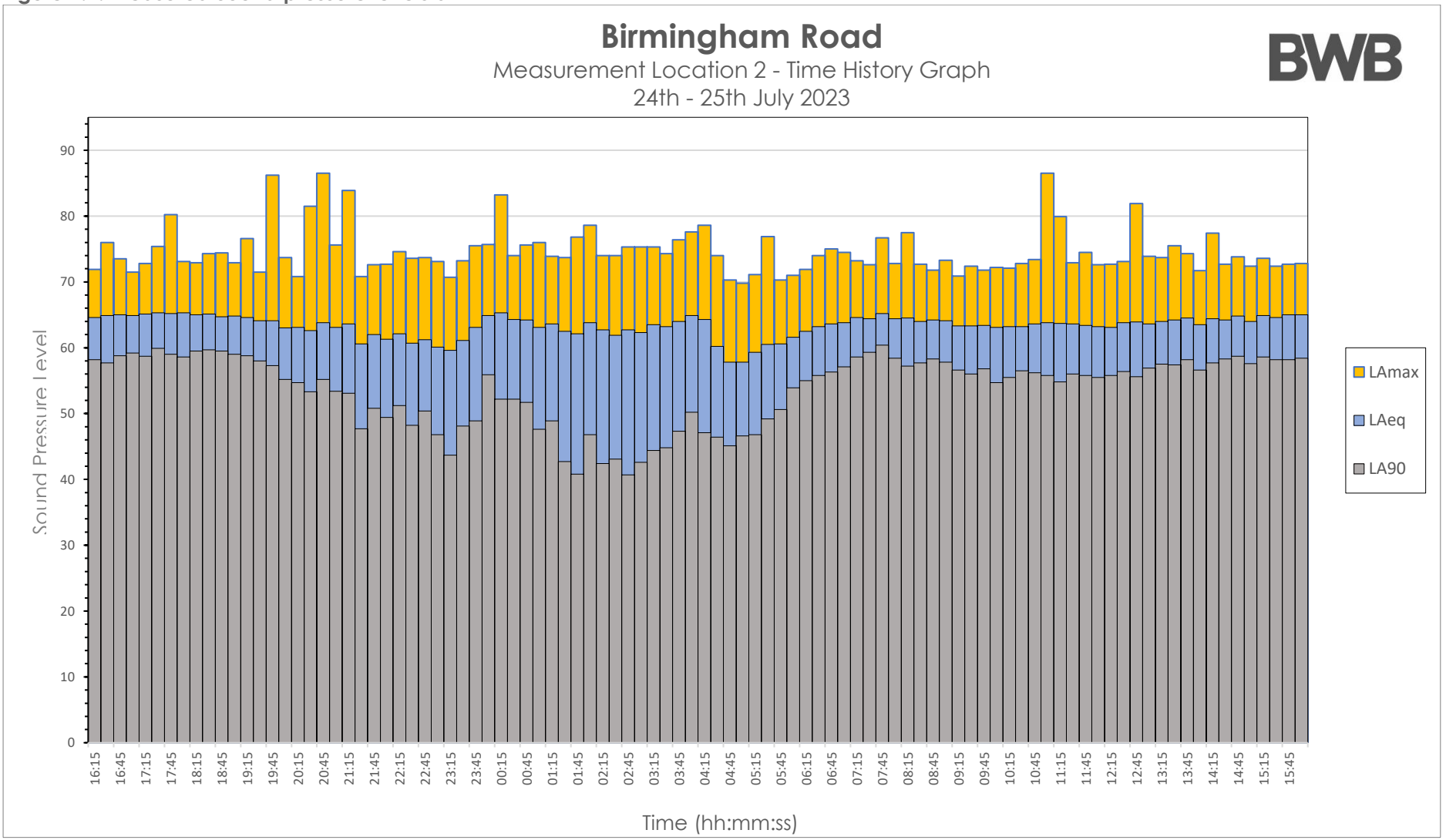


Figure B.2: Measured Sound pressure levels at ML2



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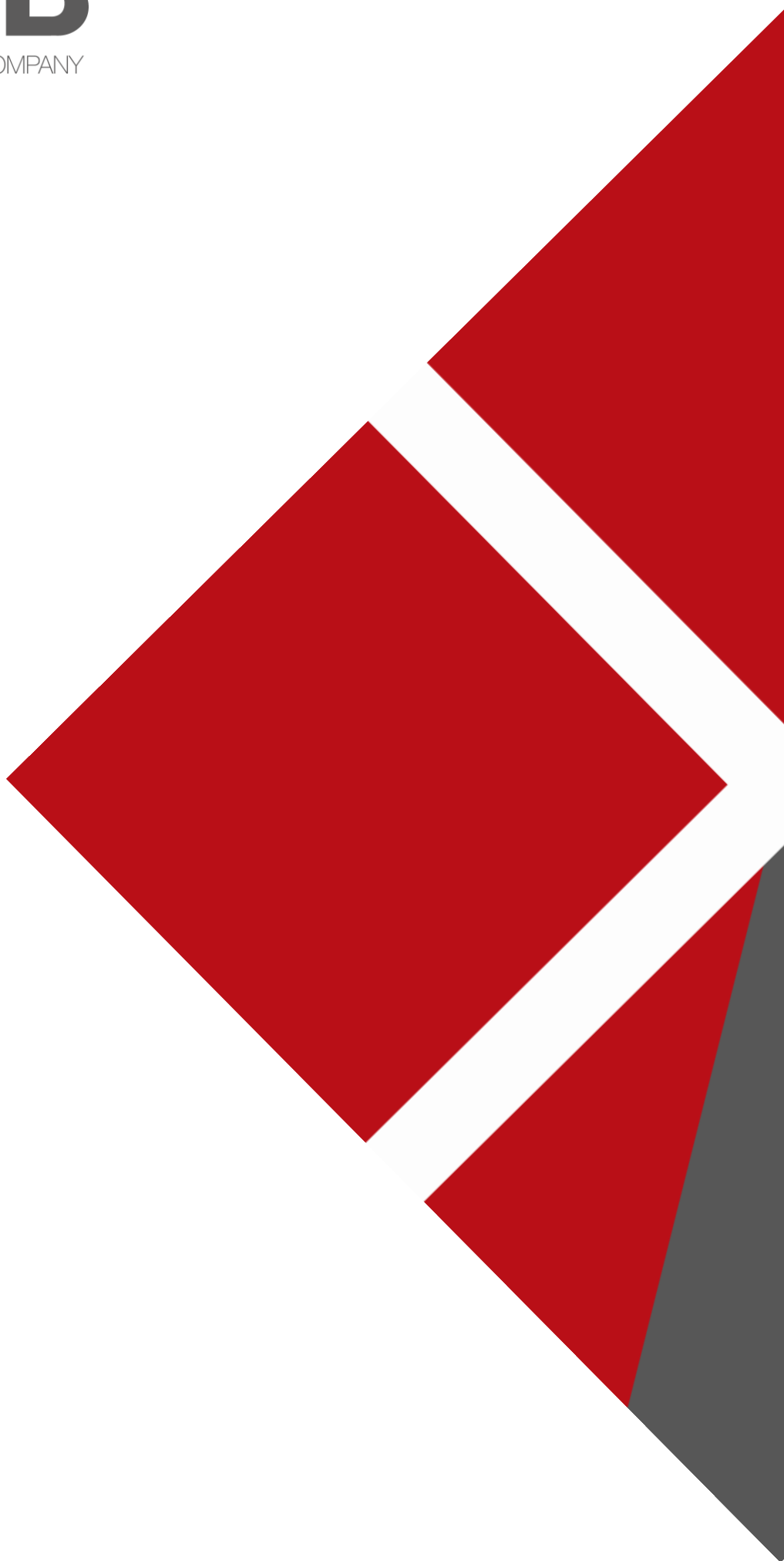

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