TotalAcoustics

BEREWOOD SOUTHERN ACCESS ROAD WATERLOOVILLE, HAMPSHIRE

NOISE AND VIBRATION IMPACT ASSESSMENT

Condition 17 Discharge Submission

*Operational Road Traffic Noise and Vibration Assessment (*DMRB LA 111)

22 July 2026

Applicant: Grainger plc
Site: Berewood Southern Access Road, Waterlooville, Hampshire
Local Planning Authority: Havant Borough Council
Document Status: Planning Condition 17 Discharge

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Assessment Scope, Status and Document Control

1. Document Status:

Condition 17 Discharge Submission – Noise and Vibration Impact Assessment (DMRB LA 111).

2. Purpose of Report:

This report presents a Noise and Vibration Impact Assessment of the proposed Berewood Southern Access Road (SAR), undertaken to support the discharge of Condition 17 of planning permission APP/10/00828.

The assessment considers the potential operational noise and vibration effects associated with the consented scheme and evaluates practicable mitigation measures to ensure that nearby residential amenity is suitably protected.

3. Assessment Framework:

This report has been prepared in accordance with DMRB LA 111: Noise and Vibration, Calculation of Road Traffic Noise (CRTN) (Department of Transport/Welsh Office, 1988), BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings, WHO Guidelines for Community Noise (1999), the National Planning Policy Framework (NPPF) and Planning Practice Guidance (PPG Noise).

The assessment is based on baseline environmental noise measurements and three-dimensional acoustic modelling undertaken using CadnaA software implementing the CRTN methodology.

4. Document Control

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5. Document History

Issue	Date	Purpose / Changes
1.0	19/05/2026	Condition 17 Discharge Submission
2.0	22/07/2026	Assessment updated following design revisions to replace the proposed low-noise surfacing with a standard HRA surface and a 3.5 m principal acoustic barrier.

6. Important Notice and Limitations

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Executive Summary

This Noise and Vibration Impact Assessment evaluates the potential operational noise and vibration effects associated with the consented Berewood Southern Access Road (SAR) in Waterlooville, Hampshire, in accordance with DMRB LA 111[1]. The assessment has been undertaken to support the discharge of Condition 17 of planning permission APP/10/00828, which requires the submission and approval of a scheme of noise protection for nearby residential properties prior to opening of the road.

The condition identifies three principal residential receptors for assessment, namely The Gables, The Lodge at Woodside House and 1–9 Marrels Wood Gardens. As The Gables has since been demolished, the assessment focuses on The Lodge at Woodside House and 1–9 Marrels Wood Gardens, with White House additionally included to ensure that all potentially affected residential receptors are appropriately represented. Existing baseline conditions were established through environmental noise measurements, with future road traffic noise levels predicted using a validated three-dimensional CadnaA model applying the CRTN methodology[2].

Predicted noise levels were assessed for both the opening year and the design year under "Do-Minimum" (without the SAR) and "Do-Something" (with the SAR) scenarios, enabling the specific effect of the new road to be isolated. Changes were evaluated against the DMRB LA 111 significance criteria, with additional reference to WHO (1999)[3] and BS 8233:2014[4] guideline values to provide a health– and amenity–based context.

The unmitigated assessment indicates that the SAR would give rise to Major adverse changes at NSR B (The Lodge at Woodside House) and Moderate adverse changes at NSR A (White House), reflecting the introduction of a new traffic source into a currently low-noise environment. In contrast, at NSR C (Marrels Wood Gardens), which is already influenced by traffic from London Road, predicted noise changes are Minor or Negligible, indicating that the SAR would represent only a small incremental component within an established traffic-dominated sound environment.

A mitigation strategy was iteratively developed and tested within the acoustic model to minimise adverse noise effects where reasonably practicable. During detailed design, the highway authority required the originally proposed low-noise surfacing to be replaced with Hot Rolled Asphalt (HRA). The mitigation strategy was therefore re-optimised through successive modelling iterations, refining the barrier height and extent to recover the majority of the acoustic benefit previously provided by the originally proposed low-noise surfacing concept. The final mitigation package was selected to secure material acoustic benefit whilst avoiding disproportionate visual, engineering and landscape effects, consistent with DMRB principles of proportionate and context-sensitive mitigation.

With mitigation in place, predicted residual effects are substantially reduced across all assessed receptors, with the majority falling within Minor or Negligible classifications. At NSR B (The Lodge at Woodside House), where the greatest unmitigated effects were identified, mitigation achieves reductions of 6.9–7.8 dB, removing Major adverse effects and reducing the residual classification to Moderate. Whilst a Moderate residual change remains at Woodside, this principally reflects the

[1] National Highways (2020); Design Manual for Roads and Bridges (DMRB), LA 111: Sustainability and Environment Appraisal – Noise and Vibration. Revision 2, May 2020.

[2] Department of Transport / Welsh Office (1988); '*Calculation of Road Traffic Noise*', HMSO.

[3] World Health Organisation (WHO) (1999); '*Guidelines for Community Noise*', WHO, Geneva.

[4] British Standards Institution (BSI) (2014); British Standard (BS) 8233 '*Sound insulation and noise reduction for buildings*', BSI, London.

comparatively low existing road traffic noise levels rather than an elevated resulting road traffic noise level.

A complementary health-based assessment demonstrates that external amenity levels remain within recognised guideline ranges and that predicted internal noise conditions are either compliant with, or remain broadly consistent with, the existing baseline environment. The scheme is therefore not expected to materially increase the likelihood of health-related effects such as annoyance or sleep disturbance.

In relation to vibration, the proposed road is not expected to generate perceptible ground-borne vibration at nearby dwellings, owing to modern pavement construction, relatively low HGV proportions and receptor stand-off distances of at least 40 m. The risk of perceptible vibration or structural damage is therefore considered extremely low, and no further assessment is required.

Key Outcomes

- Without mitigation, NSR B (The Lodge at Woodside House) would experience Major adverse effects, and NSR A (White House) would experience Moderate adverse effects, reflecting the introduction of a new traffic source into locations where existing road traffic noise levels are comparatively low.
- With mitigation in place, predicted residual effects are substantially reduced across all assessed receptors, with the majority falling within Minor or Negligible DMRB classifications. At the most affected receptor (NSR B – Woodside), mitigation achieves reductions of 6.9–7.8 dB relative to the unmitigated scheme, removing Major adverse effects. The remaining Moderate classification at Woodside principally reflects the comparatively low existing road traffic noise levels rather than an elevated resulting road traffic noise level
- The adopted mitigation strategy was refined through an iterative optimisation process following the highway authority's requirement to replace the originally proposed low-noise surfacing with Hot Rolled Asphalt (HRA). Barrier heights were subsequently re-optimised to recover the majority of the acoustic benefit previously provided by the originally proposed low-noise surfacing, whilst avoiding disproportionate visual, engineering and landscape impacts.
- The adopted mitigation strategy represents a proportionate, effective and technically robust solution that satisfies the requirements of Condition 17 whilst balancing acoustic performance with wider engineering, highway, landscape and planning considerations.

Accordingly, the assessment demonstrates that, subject to implementation of the proposed mitigation measures, the Berewood SAR can be delivered without significant residual operational noise or vibration effects. The proposed mitigation strategy is considered effective, proportionate and technically robust and satisfies the requirements of Condition 17.

1. Introduction

1.1 This report presents an assessment of the potential noise and vibration impacts associated with the Berewood Southern Access Road (SAR), which forms part of the Phase 4 infrastructure works in Waterlooville, Hampshire. The assessment has been prepared to support the discharge of Condition 17 of planning permission APP/10/00828, which requires the submission and approval of a scheme of noise protection for nearby residential properties prior to the opening of the road.

1.2 The SAR comprises a new section of highway extending south through the Berewood development to connect with Purbrook Heath Road. The works include a new priority junction, three sustainable drainage basins, utility corridors and a temporary construction compound, providing enabling infrastructure to support subsequent development phases. The road passes through an area that is currently undeveloped, introducing a new source of road traffic noise into a predominantly quiet residential environment. Accordingly, the assessment considers the extent to which appropriate mitigation can be incorporated into the scheme design to minimise effects on nearby residential receptors.

1.3 As The Gables has since been demolished, the assessment focuses on the remaining nearby dwellings: The Lodge at Woodside House and Marrels Wood Gardens. For completeness, White House has also been included to provide a robust basis for mitigation design and to reflect the existing residential context to the west of the scheme.

1.4 The assessment has been undertaken in accordance with DMRB LA 111 using baseline data derived from site measurements and three-dimensional acoustic modelling completed in CadnaA using the Calculation of Road Traffic Noise (CRTN) (Department of Transport and Welsh Office, 1988) methodology. Baseline conditions and assessment results are presented in Sections 4 and 5, respectively.

1.5 The purpose of the assessment is to quantify the operational road traffic noise effects associated with the consented SAR and to evaluate their significance in accordance with the criteria set out in DMRB LA 111. Where adverse effects are identified, practicable mitigation measures are evaluated to minimise those effects and ensure that the requirements of Condition 17 are satisfied through a proportionate scheme of noise protection.

1.6 The report is structured as follows: Section 2 describes the site context and proposed development; Section 3 sets out the methodology and assessment criteria; Section 4 summarises baseline conditions; Section 5 presents the assessment results; Section 6 details the proposed mitigation measures and associated residual effects; Section 7 provides a health-based assessment of the predicted acoustic environment; Section 8 considers potential road traffic-induced vibration; and Section 9 presents the conclusions.

1.7 A glossary of technical terminology is provided in **Appendix A.1**.

2. Site and Development Context

Site Description

2.1 The SAR forms part of the wider Berewood development within the West of Waterlooville Major Development Area (MDA) in Hampshire. The scheme is located at the southern edge of the Berewood site, extending southwards across currently undeveloped land to connect with Purbrook Heath Road. The road will provide a new vehicular link between the Berewood development and Purbrook Heath Road, establishing a strategic connection with the wider highway network.

2.2 A site location plan is provided in **Figure 1**, illustrating the extent of the SAR in relation to the surrounding transport network and nearby NSRs.

2.3 At present, the site comprises undeveloped grassland bounded by woodland that slopes from north to south. The immediate context is summarised as follows:

- **North** – The settlement of Berewood.
- **East** – Woodland and the settlement of Purbrook, including residential properties along London Road (former A3)
- **South** – Purbrook Heath Road.
- **West** – Open countryside with scattered rural dwellings.

Noise Climate

2.4 The existing noise climate is shaped predominantly by traffic on the surrounding road network, with London Road representing the principal source. Noise exposure varies according to receptor proximity to local roads and the degree of intervening screening. Properties closest to London Road (e.g. Marrels Wood Gardens) experience the highest and most continuous traffic noise levels. In contrast, more distant or screened locations, including White House and The Lodge at Woodside House, experience appreciably lower ambient noise levels characterised by a combination of distant road traffic, natural sounds, infrequent local vehicle movements and typical residential or nursery activity.

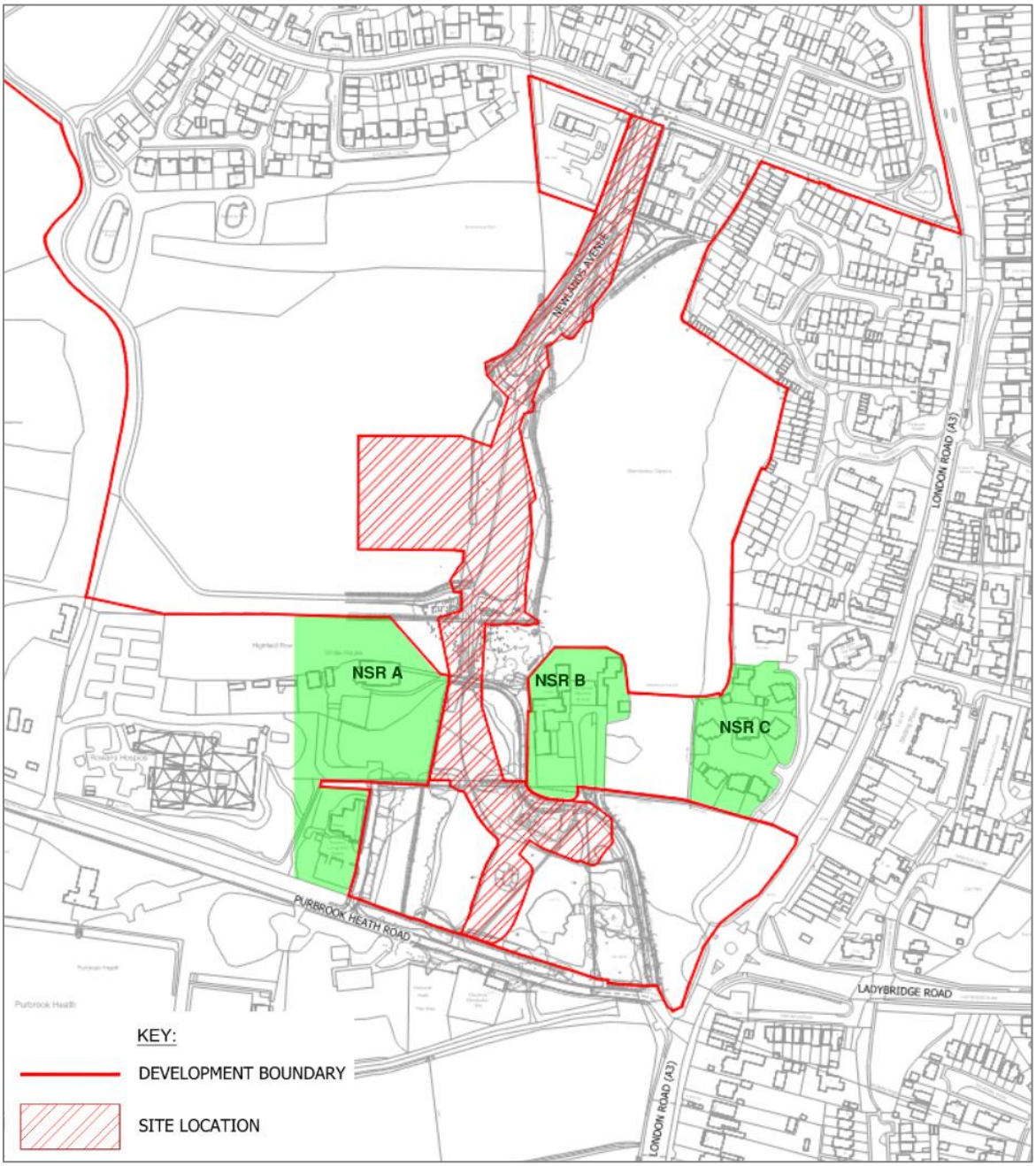

Figure 1: Location Plan of the Site and Receptor Positions

Noise Sensitive Receptors

2.5 The assessment considers the residential receptors identified within Condition 17, namely The Lodge at Woodside House and the dwellings at Marrels Wood Gardens. As The Gables has since been demolished, it is not considered within the assessment. White House has also been included to capture the wider residential context to the west of the scheme and to provide a robust basis for mitigation appraisal.

2.6 The assessed receptors are summarised in **Table 2.1** and illustrated on Figure 1.

Table 2.1: Noise Sensitive Receptors

NSR	Type of Receptor	Name / Address	Approx. Distance to Scheme (m)	Associated Sensitivity
n/a	Residential	The Gables	Demolished	n/a
NSR A	Residential	White House, Purbrook Heath Road, PO7 5RT	40 m	High
NSR B	Residential	The Lodge at Woodside House, Purbrook Heath Road, PO7 5RT	45 m	High
NSR C	Residential	1-9 Marrels Wood Gardens, Purbrook, PO7 5RS	45 m	High

Proposed Development

2.7 The SAR forms part of the Berewood Phase 4 infrastructure works, delivering essential enabling infrastructure to support the wider Berewood development. The Phase 4 works comprise:

- Construction of the SAR to provide a new vehicular link between the Berewood development and the wider highway network.
- Installation of sustainable drainage infrastructure, including three detention basins (PH4I/01, PH4I/02 and PH4I/03) with associated inlet/outlet structures, control chambers and access connections for future phases.
- Construction of utility corridors for water, electricity, communications and foul and surface water drainage.
- Installation of a substation and associated infrastructure.
- Establishment of a temporary site compound, including storage areas and designated access routes.

The extent of the works and their relationship to surrounding receptors are illustrated in Figure 1.

3. Methodology and Criteria

Introduction

3.1 This section outlines the methodology used to assess potential road traffic noise effects associated with the SAR, in accordance with DMRB LA 111. The approach comprises:

- Establishing existing baseline conditions.
- Predicting future noise levels for the Do-Minimum (without the scheme) and Do-Something (with the scheme) scenarios.
- Evaluating the magnitude and significance of change using the DMRB criteria and recognised health-based guidance.
- Considering practicable mitigation and reassessing residual effects.

Baseline Conditions

3.2 Existing baseline noise conditions were characterised through a combination of environmental noise measurements and acoustic modelling. The survey results are presented in Section 4 and provide the baseline against which predicted changes have been assessed.

Traffic and Noise Modelling Approach

- **Baseline conditions** – Existing noise levels were measured and modelled at representative NSRs, including dwellings nearest to the proposed SAR and along local access roads.
- **Future scenarios** – Noise predictions were undertaken for the Do Minimum (without the scheme) and Do Something (with the scheme) scenarios, based on traffic forecasts provided by the transport consultant (Mayer Brown Ltd). Predictions were generated using CadnaA acoustic modelling software applying the CRTN (1988) methodology, the recognised UK standard for road traffic noise assessment under DMRB. Assessments were undertaken for both the scheme opening year and design year (15 years post-opening).
- **Modelling considerations** – The assessment accounted for changes to the road network associated with the SAR, including geometric layout, traffic flows, road surface type, and, where relevant, speed and vehicle composition. The model also accounted for receptor distance and orientation relative to individual road links, local ground absorption and topographical screening.
- **Comparative assessment** – Predicted differences in noise levels between the Do-Minimum and Do-Something scenarios were calculated for each NSR to identify the magnitude of change attributable to the scheme.
- **Mitigation and residual effects** – Where potentially significant adverse effects were identified, practicable mitigation measures, including acoustic screening and speed management, were incorporated within the acoustic model and residual effects reassessed against the DMRB criteria.

Traffic Data & Assessment Years

3.3 Traffic information for the Berewood SAR was supplied by Mayer Brown Ltd in the form of 18-hour Annual Average Weekday Traffic (AAWT) flows for three key years:

- **2025:** Current traffic conditions, used only to check and calibrate the noise model.
- **2028:** Forecast traffic flows for the opening year of the SAR.
- **2043:** +15 years after opening, representing the design year[5].

3.4 For both 2028 and 2043, two sets of traffic flows were provided, enabling the assessment to isolate the effect of the SAR itself:

- Without the new road in place (called Do-Minimum).
- With the new road in place (called Do-Something).

3.5 In accordance with DMRB LA 111, the assessment compares noise levels between the Do-Minimum and Do-Something scenarios for both the Opening Year (2028) and the Design Year (2043). These comparisons identify:

- The short-term change in noise when the road first opens; and
- The long-term change once traffic has potentially increased over time.

3.6 Based on the traffic datasets supplied, the assessment therefore uses the following four scenarios:

Opening Year (2028)

- 2028 Without the SAR: Do-Minimum Opening Year (DMOY).
- 2028 With the SAR: Do-Something Opening Year (DSOY).

Design Year (2043)

- 2043 Without the SAR: Do-Minimum Future Year (DMFY).
- 2043 With the SAR: Do-Something Future Year (DSFY).

3.7 These four scenarios form the basis of the DMRB noise appraisal:

- Short-term change (Opening Year 2028):
  DSOY – DMOY
  This represents the immediate change in noise when the SAR first opens.
- Long-term change (Design Year 2043):
  DSFY – DMFY
  This shows the effect of the SAR 15 years after opening, once normal traffic growth has occurred in both scenarios. Comparing the two 2043 cases isolates the SAR's long-term impact independently of background traffic growth.

[5] This ensures the assessment reflects the maximum reasonably foreseeable future traffic conditions. Traffic in the design year is normally higher because it allows for expected population growth, increases in general travel demand, planned development in the area, and gradual changes in driver behaviour once a new road becomes established.

Receptor Selection

3.8 Assessment results are reported for the receptors defined in Section 2, in line with Condition 17.

Criteria for Assessment

3.9 In line with DMRB LA 111, changes in road traffic noise were assessed using the $L_{A10,18hr}$ index, derived in accordance with CRTN. This metric represents the established UK standard for the assessment of road traffic noise and ensures consistency with national policy and historic datasets.

3.10 For completeness, predicted noise levels were also expressed in terms of $L_{Aeq,16hr}$, which aligns with WHO, 1999 and BS 8233:2014 guidance for the assessment of environmental noise in relation to residential amenity. Presenting both indices enables the assessment to address both DMRB change-based criteria and recognised health-based guidance relevant to planning.

Noise Change Criteria (DMRB LA 111)

3.11 The magnitude of noise change has been classified in accordance with the DMRB LA 111 thresholds presented in **Table 3.1** and **Table 3.2**. These thresholds reflect the extent to which changes in road traffic noise are likely to be perceptible:

- **Short-term (opening year):** A change of 1 dB $L_{A10,18hr}$ is generally regarded as the smallest change that is perceptible over a short period.
- **Long-term (15 years):** Over longer periods, people tend to adapt to gradual changes in noise, such that changes of around 3 dB $L_{A10,18hr}$ or more are typically required before they become perceptible.

3.12 The differing short- and long-term thresholds reflect the fact that people are generally more sensitive to sudden changes in noise than to gradual changes occurring over many years. Consequently, a change of around 1 dB $L_{A10,18hr}$ may be perceptible when it occurs over a short period, whereas changes of around 3 dB $L_{A10,18hr}$ or more are typically required before they become perceptible over the long term.

Table 3.1: Classification of Short-Term Noise Change (DMRB LA 111)

Change in Noise Level (dB, $L_{A10,18hr}$)	Subjective Response	Magnitude of Change
< 1.0	Not perceptible	Negligible
1.0 – 2.9	Barely perceptible	Minor
3.0 – 4.9	Clearly perceptible	Moderate
≥ 5.0	Easily noticeable	Major

Table 3.2: Classification of Long-Term Noise Change (DMRB LA 111)

Change in Noise Level (dB, $L_{A10,18hr}$)	Subjective Response	Magnitude of Change
< 3.0	Not perceptible in the LT	Negligible
3.0 – 4.9	Noticeable	Minor
5.0 – 9.9	More noticeable	Moderate
≥ 10	Very noticeable	Major

3.13 The magnitude of change is then considered alongside the sensitivity of the receptor to determine significance:

- High-sensitivity receptors (dwellings, schools, hospitals) may experience significant adverse effects where moderate or major changes are predicted.
- Low-sensitivity receptors (offices, industrial premises) are less likely to be significantly affected.
- Minor changes are generally not significant but are noted in the assessment and inform design refinement and mitigation.

Health-Based Noise Criteria (WHO, 1999 and BS 8233:2014)

3.14 In addition to the DMRB criteria, the assessment also considers recognised health-based guideline values for residential amenity. These are drawn from WHO, 1999 and BS 8233:2014 guidance, which are widely referenced in UK planning decisions.

3.15 These criteria apply to both indoor and outdoor environments and represent levels below which the majority of people will not typically experience significant annoyance, sleep disturbance or interference with normal daily activities. A summary of the guideline values relevant to the assessment is presented in **Table 3.3**.

Table 3.3: BS 8233 and WHO Guideline Noise Levels for Residential Spaces

Guidance Document	Location	Noise Level, dB $L_{Aeq,T}$	
		Daytime	Night-time
BS 8233:2014	Living Rooms	35	-
	Dining Rooms	40	-
	Bedrooms	35	30
	Outdoor Living Areas	50 (desirable), 55 (upper limit)	
WHO, 1999	Indoor Living Areas	35	30, 45 [1]
	Outdoor Living Areas	50 (desirable), 55 (upper limit)	

Notes: [1] For a reasonable standard in bedrooms at night, the WHO, 1999 guidelines recommend that individual noise events (measured with F time-weighting) should not normally exceed 45 dB L_{AFmax}. The term 'normally' is typically interpreted as no more than 10-15 times per night.

3.16 Application in this assessment:

- Indoor amenity: The design intent is to achieve compliance with WHO and BS 8233 guideline values, particularly within bedrooms at night, through proportionate and practicable mitigation.
- Outdoor amenity: Both documents identify 50 dB $L_{Aeq,16hr}$ as a desirable criterion, with 55 dB $L_{Aeq,16hr}$ representing an upper guideline where it is not reasonably practicable to achieve the desirable guideline value. In such circumstances, the objective should be to achieve the lowest practicable external noise levels.

3.17 Together, these benchmarks provide a health-based framework alongside the DMRB change criteria, ensuring that the assessment considers both perceptible changes in noise and absolute amenity standards.

Consideration of Vibration

3.18 The scheme introduces a new road corridor, but no material increase in heavy vehicle flows is expected across the wider network. Road traffic vibration typically arises where heavy vehicles pass in close proximity to dwellings on irregular or poor-quality road surfaces. As the new link will be constructed to modern standards and lies at least 40 m from the nearest NSRs, perceptible levels of traffic-induced ground-borne vibration are not anticipated. A qualitative assessment has therefore been undertaken in accordance with DMRB guidance.

Summary of Approach

3.19 In summary, the assessment establishes baseline noise conditions, predicts future noise levels for the Do-Minimum and Do-Something scenarios using the CRTN methodology, and evaluates changes against DMRB thresholds and relevant health-based benchmarks to determine the likely magnitude and significance of effect.

4. Baseline Noise Survey

Introduction

4.1 This section presents the measured baseline noise survey results, which provide the reference against which the predicted changes presented in Section 5 are assessed.

Survey Overview

4.2 A comprehensive baseline environmental noise survey was undertaken between 31 July and 4 August 2025 to establish existing noise conditions at the receptors most likely to be affected by the scheme. The results provide a robust baseline against which future changes in road traffic noise can be evaluated.

Monitoring Locations

4.3 Long-term unattended monitoring was conducted at three locations representative of nearby NSRs, as summarised in **Table 4.1** and illustrated in **Figure 2**.

Table 4.1: Noise Monitoring Locations

Monitoring Location	Description	Observations
LT1 The Lodge, Woodside	Free-field measurement at the south-western boundary. Microphone height 2.45 m AGL.	Noise climate characterised by natural sounds (birdsong), occasional local traffic and distant road traffic.
LT2 Marrels Wood Gardens	Free-field measurement at the shared boundary between 2 and 3 Marrels Wood Gardens. Microphone height 2.2 m AGL.	Noise climate dominated by road traffic from London Road.
LT3 Church of St John the Baptist	Free-field measurement at Church of St John the Baptist, 4.3 m from the kerbside of London Road. Microphone height 1.8 m AGL.	

Survey Methodology

4.4 Measurements were taken using calibrated, Class 1 precision sound level meters with one-third-octave band frequency analysis to accurately characterise the prevailing noise environment. Weather conditions were monitored remotely and remained favourable throughout, being fine and dry, with light winds (<5 m/s) from the west-south-west to east-south-east prevailing.

4.5 Each meter was field calibrated before and after deployment using a UKAS-traceable calibrator, confirming stability within ±0.2 dB. Full instrumentation details and calibration certificates are available on request.

4.6 The measured noise indices included LAeq, LA90, LA10, LAmax and LA1, recorded at 1-second intervals in the A-weighting network, allowing determination of the noise level over different reference time intervals. The indices used in this assessment are described in Appendix A.1.

Figure 2: Noise Monitoring Locations

Noise Results

4.7 A summary of the principal measured noise indices – $L_{A10,18hr}$ (06:00–24:00), $L_{Aeq,16hr}$ (07:00–23:00), $L_{Aeq,8hr}$ (23:00–07:00) and $L_{AFmax,90\%}$ (23:00–07:00) is presented in **Table 4.2.** Supplementary attended short-term measurements are presented in **Table 4.3**. Full results are presented graphically in time-history format in **Figures 3** to **5**.

Table 4.2: Summary of Baseline Noise Monitoring Results

Parameter	LT1 (Woodside)	LT2 (MWGs)	LT3 (Church)
$L_{A10,18hr}$ (06:00-24:00) [1]	48 – 49 (48)	53 – 56 (54)	72 – 72 (72)
$L_{Aeq,16hr}$ (07:00-23:00) [2]	48 – 54 (49)	53 – 56 (54)	69 – 71 (69)
$L_{Aeq,8hr}$ (23:00-07:00) [2]	43 – 44 (43)	47 – 48 (47)	63 – 64 (64)
$L_{AFmax,90\%}$ (23:00-07:00) [3]	61 – 65 (63)	61 – 65 (62)	83 – 84 (83)

Notes: [1] Arithmetic mean of hourly L_{A10} values between 06:00 and 24:00 hours. [2] Logarithmic average across the defined day and night survey periods. [3] 90th percentile of maximum sound levels (L_{AFmax}) for the night survey period, representative of the typical highest maximum levels experienced. All values rounded to nearest whole decibel.

Table 4.3: Supplementary Short-term Attended Noise Measurements

Location	Period	L_{Aeq} (dB)	L_{A10} (dB)	L_{AFmax} (dB)
ST1: Purbrook Heath Road	Daytime (3 hours)	58	63	73
ST2: Ladybridge Road	Daytime (3 hours)	64	68	77

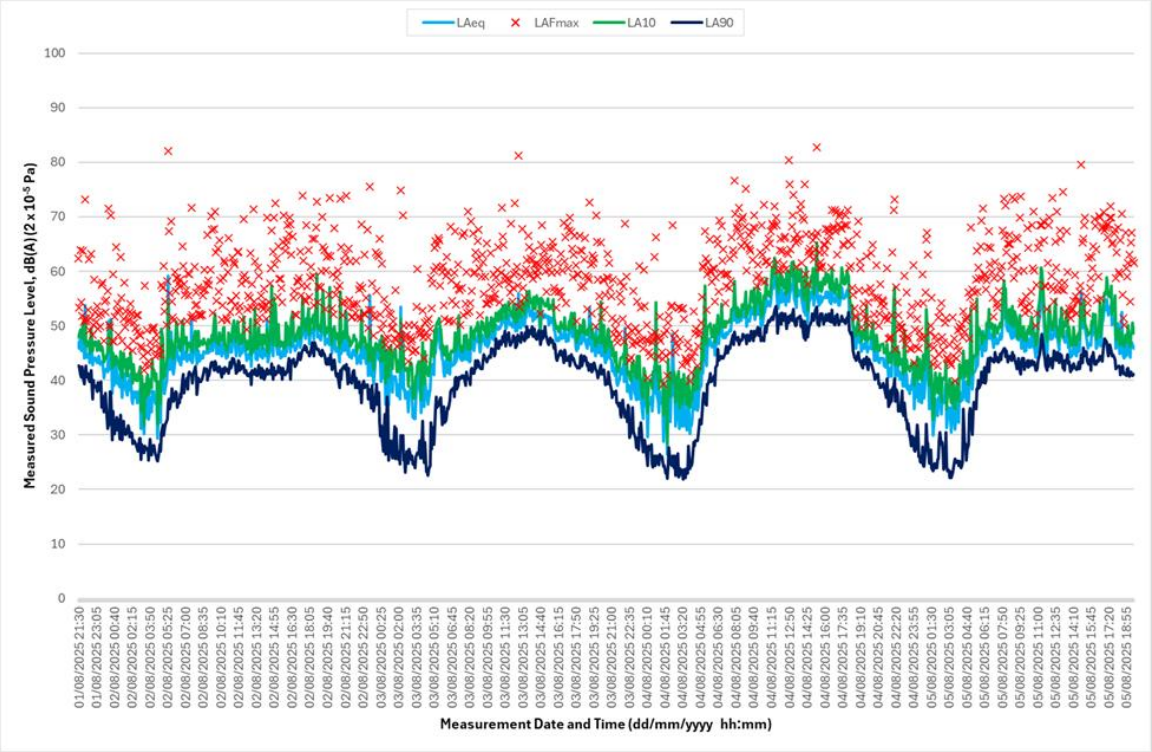

Figure 3: Noise Level Time History at LT1 (The Lodge, Woodside)

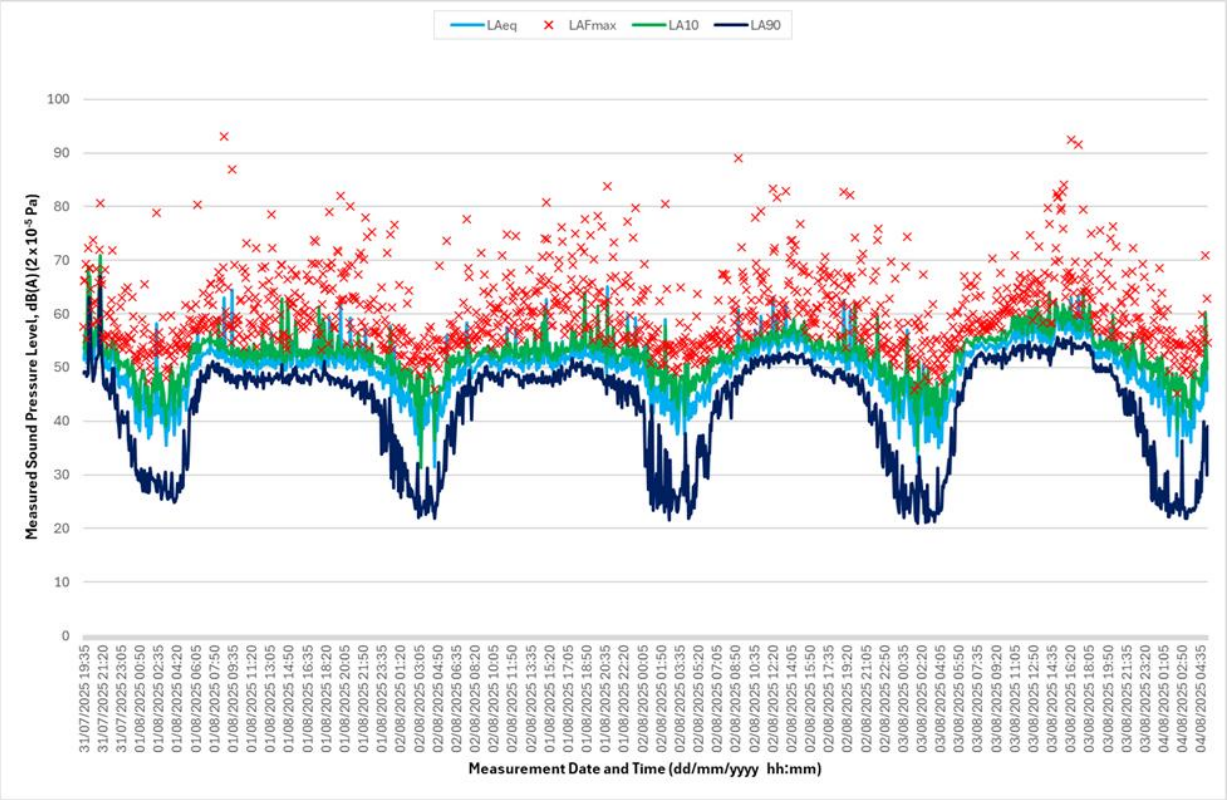

Figure 4: Noise Level Time History at LT2 (Marrels Wood Gardens)

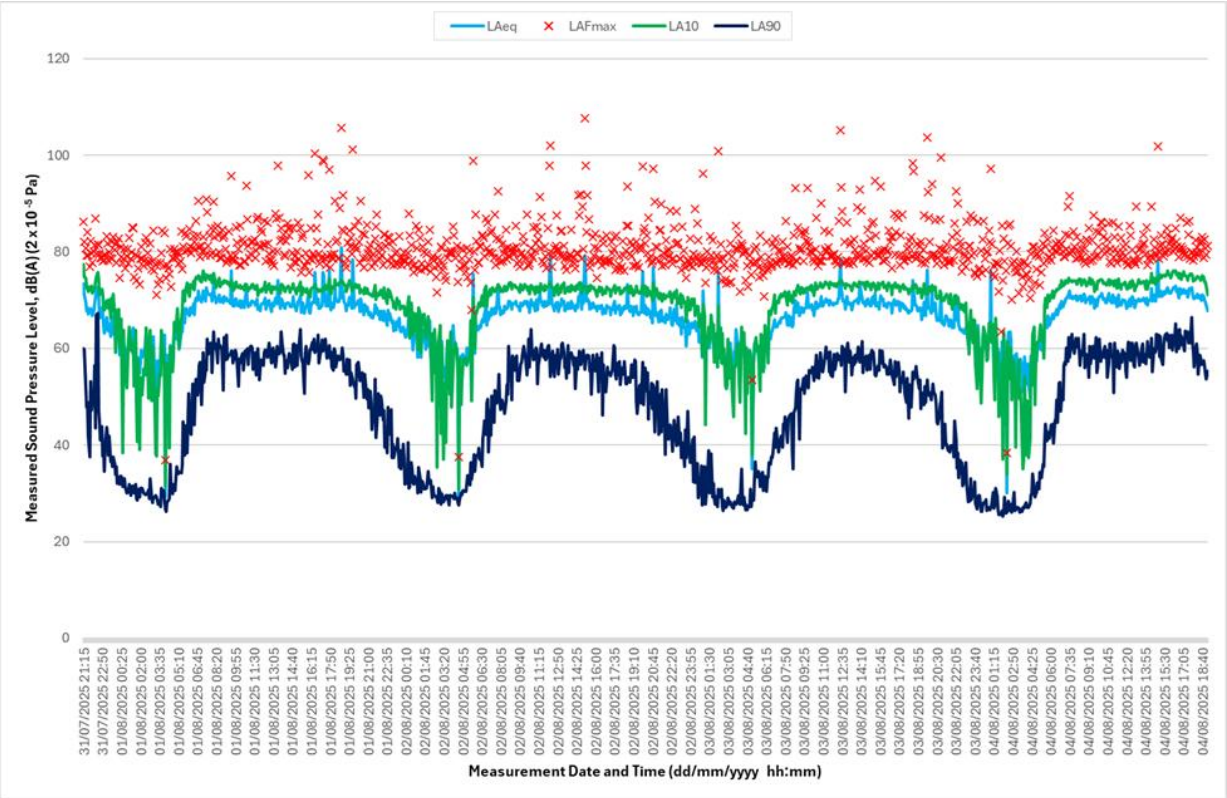

Figure 5: Noise Level Time History at LT3 (Church of St John the Baptist)

4.8 The survey results confirm a spatial pattern consistent with the noise climate described in Section 2.4, with measured noise levels varying principally according to proximity to London Road and the degree of intervening screening. The lowest levels were recorded at LT1 (Woodside), reflecting its more distant, shielded and remote position to the local road network. LT2 (Marrels Wood Gardens) exhibited moderate noise levels associated with the steady flow of traffic on London Road, reflecting its closer proximity to the carriageway and comparatively limited screening, while the highest levels occurred at LT3 (Church of St John the Baptist), immediately adjacent to London Road where road traffic remained the dominant source throughout the survey period.

4.9 The survey results provide a clear and representative baseline against which potential changes arising from the proposed scheme have been assessed in accordance with DMRB LA 111.

5. Predicted Noise Levels and Noise Change Assessment

Overview

5.1 This section presents the predicted unmitigated road traffic noise levels at each NSR and evaluates the resulting short- and long-term changes against the DMRB LA 111 magnitude criteria described in Section 3.

Predicted Noise Levels

5.2 Predicted road traffic noise levels have been calculated for all four assessment scenarios (DMOY, DSOY, DMFY and DSFY). The resulting short-term (2028) and long-term (2043) changes at each NSR are presented in **Tables 5.1** and **5.2** and form the basis of the DMRB LA 111 noise-change appraisal.

5.3 For consistency with DMRB reporting practice, results are presented for the most exposed façade of each receptor, representing the worst-case exposure relevant to impact classification and mitigation design.

5.4 The receptor-based results are supported by the short-term and long-term noise-change maps (DS–DM) presented in **Figure 6** and **Figure 7**. These figures provide a visual representation of the spatial pattern, direction and magnitude of road traffic noise changes across the study area and corroborate the numerical results presented in Tables 5.1 and 5.2.

5.5 For completeness, selected CadnaA model outputs are provided in Appendix A.2, comprising absolute noise contour plots for the Opening Year (2028) and Design Year (2043) scenarios under both unmitigated and mitigated conditions. These outputs provide supplementary context regarding the predicted acoustic environment and illustrate the influence of the proposed mitigation package across the wider assessment area.

Table 5.1: 2028 Short-Term Noise Change (Unmitigated DSOY – DMOY, $L_{A10,18hr}$)

Receptor	DMOY 2028 (dB)	DSOY 2028 (dB)	ST Change (dB)	ST Magnitude
NSR A (White House)	44.6	49.4	+4.8	Moderate
NSR B (Woodside)	33.3	44.8	+11.5	Major
NSR C (MWGs)	48.1	49.9	+1.8	Minor

Table 5.2: 2043 Long-Term Noise Change (Unmitigated DSFY – DMFY, $L_{A10,18hr}$)

Receptor	DMFY 2043 (dB)	DSFY 2043 (dB)	LT Change (dB)	LT Magnitude
NSR A (White House)	45.7	51.2	+5.5	Moderate
NSR B (Woodside)	33.8	47.5	+13.7	Major
NSR C (MWGs)	49.3	50.7	+1.4	Negligible

Notes: All levels are presented as free-field $L_{A10,18hr}$ at 1.5 m above ground level. Results are reported for the most exposed façade of each receptor.

Noise Change Analysis

5.6 The unmitigated results presented in Tables 5.1 and 5.2 demonstrate a clear spatial variation across the assessed NSRs, reflecting differences in receptor location, existing acoustic context and relative exposure to the proposed SAR. The effects of the scheme are highly localised, with the greatest changes confined to receptors immediately adjacent to the proposed road corridor. Beyond this area, predicted changes reduce rapidly with distance and existing road traffic remains the dominant influence on the acoustic environment.

5.7 At NSR A (White House), Moderate changes are predicted in both the opening and design years. Although the SAR would become a noticeable component of the local acoustic environment, the magnitude of change is lower than at Woodside because the existing Do-Minimum noise level is higher, reflecting White House's orientation and greater exposure to the existing road network.

5.8 NSR B (The Lodge, Woodside) experiences the greatest increases in road traffic noise, corresponding to Major changes in both assessment years. This reflects the introduction of a new road traffic source within an otherwise quiet acoustic environment and identifies Woodside as the principal receptor influencing the design of the mitigation scheme.

5.9 In contrast, NSR C (Marrels Wood Gardens), which already lies within an established traffic-influenced environment associated with London Road, experiences comparatively limited increases in road traffic noise. The predicted changes correspond to Minor and Negligible effects in the opening and design years respectively, indicating that the SAR would represent only a small incremental contribution within an already traffic-influenced acoustic environment, with no material change in acoustic character anticipated.

5.10 The predicted pattern of effect is broadly consistent between the opening year and design year, indicating that the relative influence of the SAR remains largely unchanged over time. While absolute traffic flows increase between 2028 and 2043, the magnitude of change attributable to the scheme remains governed primarily by receptor proximity to the new road rather than future traffic growth.

5.11 These patterns are illustrated in the short-term and long-term noise-change maps presented in Figures 6 and 7, which show a concentrated area of Moderate to Major increases adjacent

to the SAR corridor in the vicinity of Woodside, with more limited and localised changes elsewhere.

5.12 On this basis, the unmitigated scheme would give rise to the most pronounced adverse changes at NSR B (Woodside), with more moderate changes predicted at NSR A (White House). Accordingly, targeted mitigation is required to minimise adverse effects where reasonably practicable and to ensure that residual changes are not significant in planning terms. The mitigation strategy adopted for the scheme is therefore directed towards the receptors experiencing the greatest adverse effects and is discussed in the following section.

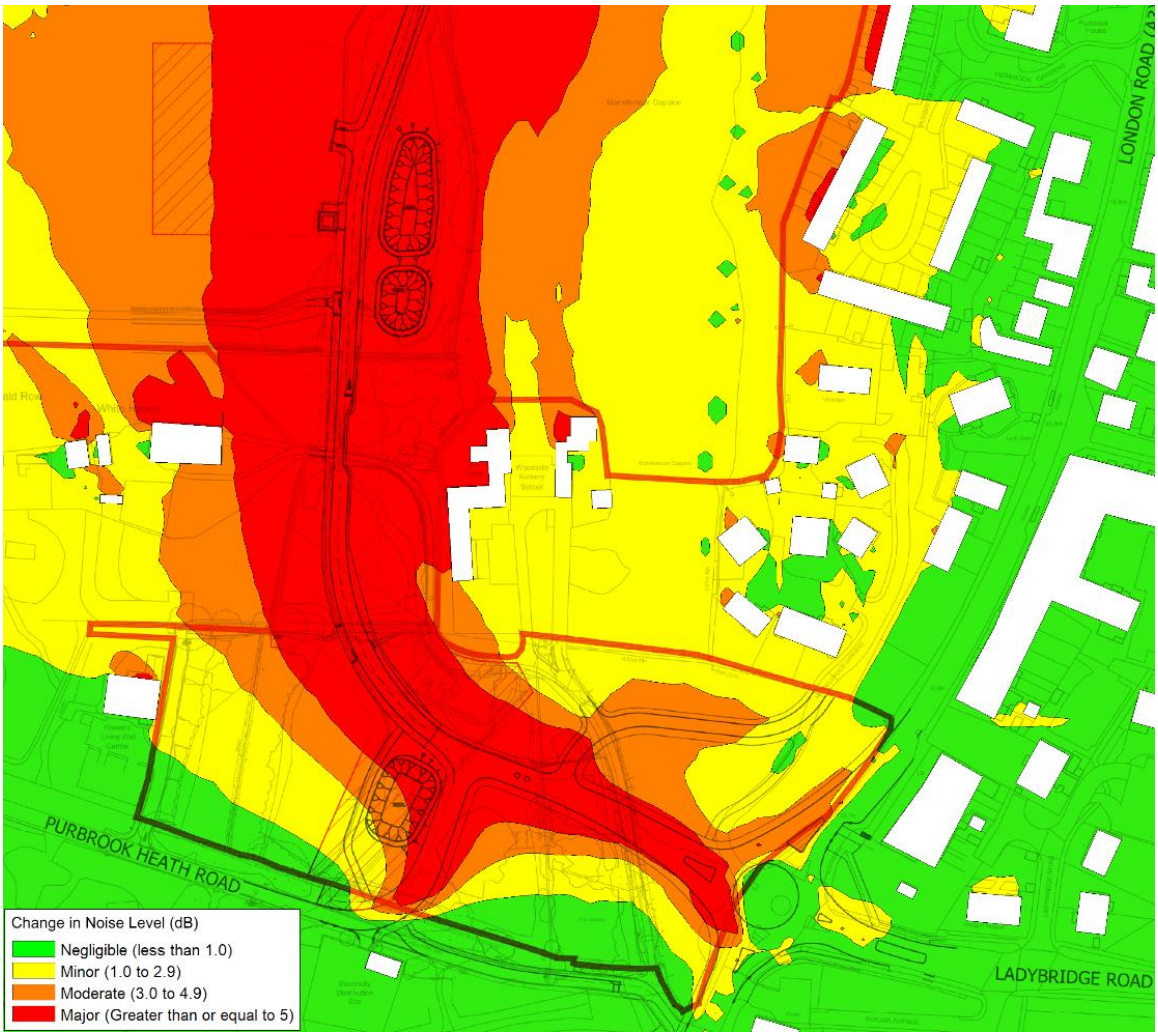

Figure 6: 2028 Short-Term Noise Change (Unmitigated DSOY – DMOY, $L_{A10,18hr}$)

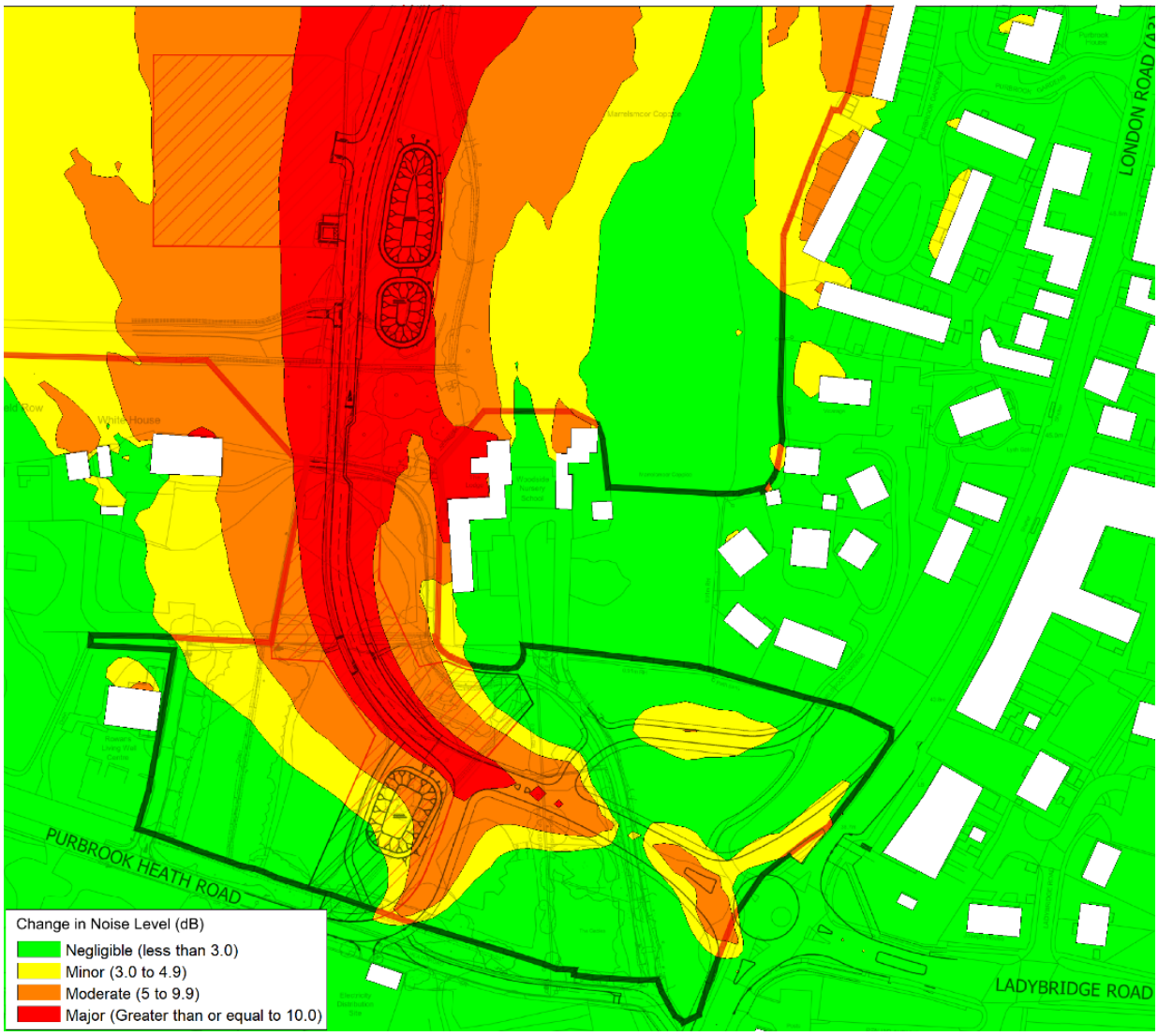

Figure 7: 2043 Long-Term Noise Change (Unmitigated DSFY – DMFY, $L_{A10,18hr}$)

6. Mitigation and Residual Effects

Introduction

6.1 This section identifies noise mitigation measures where predicted noise changes may otherwise give rise to significant effects (Moderate or Major under DMRB LA 111) and evaluates the residual effects following implementation of practicable mitigation.

Mitigation Principles

6.2 Consistent with established acoustic design practice, mitigation has been evaluated in accordance with the following hierarchy:

1) **Avoidance** – Minimising noise exposure through scheme design and layout.
2) **Reduction at source** – Measures that reduce noise generation, including low-noise surfacing, vehicle speed management and road alignment optimisation.
3) **Pathway control** – Measures that reduce sound propagation, including acoustic barriers, bunds and the use of natural topographical screening.

6.3 This hierarchy supports the selection of proportionate mitigation, prioritising permanent, robust and low-maintenance solutions wherever practicable.

Potential Mitigation Measures

6.4 A range of practicable mitigation measures was evaluated during the design optimisation process to reduce adverse noise effects, particularly at receptors where Moderate or Major increases were predicted. These measures included source-control measures, traffic management and acoustic screening. The adopted mitigation strategy represents the outcome of an iterative design process that balances acoustic performance with the engineering, operational and highway authority requirements of the scheme.

- **Low-noise surfacing:**

  Low-noise asphalt was evaluated to reduce tyre-road interaction noise at source. This measure provides broad-area acoustic benefit with minimal visual or operational impact. However, following consultation during the detailed design process, this option was not taken forward as part of the adopted scheme.

- **Speed management / traffic control:**

  Implementation of reduced speed limits and traffic-smoothing measures to minimise rapid acceleration and braking events, which can otherwise increase tyre and power-unit noise emissions.

- **Alignment optimisation:**

  Local refinement to the horizontal alignment of the carriageway to maximise separation distance to sensitive receptors and exploit natural topographical screening where feasible within engineering and land-take constraints.

- **Noise barriers or bunds:**

  Localised acoustic screening, including absorptive barriers, timber barriers and/or earth bunds, at locations where receptors would otherwise experience Moderate or Major adverse changes.

Optimisation and Residual Effects

6.5 An iterative mitigation design process was undertaken to identify the most effective and proportionate package of measures capable of reducing predicted noise changes at sensitive receptors to acceptable levels. This involved systematic testing of alternative barrier positions and heights, surfacing types and traffic management approaches within the acoustic model, with performance assessed against the DMRB LA 111 magnitude criteria, the overarching objective of achieving the lowest practicable noise levels, and wider engineering, environmental and planning considerations.

6.6 Consistent with good acoustic design practice, the mitigation strategy integrates complementary measures, recognising that combined interventions typically deliver greater overall benefit than individual measures in isolation.

6.7 The original mitigation strategy incorporated low-noise asphalt surfacing, acoustic barriers and speed management. During the detailed design process, however, Hampshire County Council advised that the proposed bus route should be surfaced using standard Hot Rolled Asphalt (HRA), rather than low-noise asphalt, in accordance with the highway authority's requirements. The mitigation strategy was therefore re-optimised using HRA surfacing, with alternative barrier heights evaluated to recover the majority of the acoustic benefit previously provided by the low-noise surfacing.

6.8 As part of the re-optimisation process, multiple barrier configurations were evaluated to identify the most effective replacement strategy following the adoption of HRA surfacing. Sensitivity testing confirmed that increasing the eastern barrier from 3.0 m to 3.5 m recovered the majority of the acoustic benefit previously provided by the low-noise surfacing. Increasing the barrier further to 4.0 m produced only marginal additional reductions (up to 0.4 dB), insufficient to justify the additional visual, structural and engineering implications.

6.9 These outcomes demonstrate the diminishing acoustic benefit associated with incremental increases in barrier height, where increasingly modest acoustic gains are offset by disproportionately greater structural, visual and landscape impacts. In accordance with DMRB LA 111, the adopted barrier heights have therefore been selected on the basis of context-specific mitigation, balancing acoustic benefit against wider environmental, visual, engineering and practical considerations, including landscape impact, planning risk, structural loading, buildability, maintenance requirements, safety and potential overbearing effects. Accordingly, a 3.5 m eastern barrier was identified as the optimum balance between acoustic performance and the wider constraints applicable to the scheme.

6.10 The resulting optimised mitigation package comprises the following coordinated measures:

- **Acoustic screening**

Installation of 2.2 m high absorptive-faced acoustic barriers to the west of the SAR and 3.0 to 3.5 m high barriers to the east, targeted at locations where receptors would otherwise experience Moderate or Major unmitigated increases.

The proposed roadside barriers should be designed and certified in accordance with BS EN 1793/1794, providing high airborne sound insulation of typically 28–32 dB (laboratory sound reduction performance, DL_R) and incorporating Class A3 absorption (αw ~0.65–0.85) on the road-facing side to minimise reflected noise.

For this scheme, the required performance should be achieved using durable timber or timber composite panels of sufficient mass (≥ 25 kg/m^2), incorporating weather-resistant finishes, a minimum 20-year service life and a visually sympathetic appearance appropriate to the surrounding context.

- **Speed management and traffic smoothing:**

Implementation of a 20-mph speed limit along the SAR to promote smoother and more consistent vehicle movement. At this speed, tyre–road noise is inherently modest, meaning that the benefit of low-noise asphalt when used in isolation is relatively limited (≈ 2 dB).

However, narrowing of the SAR to a single lane through the woodland cut assists in discouraging abrupt vehicle manoeuvres and stop–start driving behaviour that could otherwise generate short-duration, higher-level noise events. By stabilising the traffic flow and associated emission profile, these measures support the consistent performance of the acoustic barriers and reduce short-term fluctuations in noise character.

- **Highway surfacing:**

In accordance with the highway authority's requirements, the adopted scheme incorporates HRA surfacing in place of the originally proposed low-noise asphalt. Although this provides a modest reduction in source-control performance relative to the original concept, optimisation of the barrier design substantially offsets this effect, resulting in only minor increases in predicted façade noise levels compared with the original mitigation strategy.

6.11 The spatial arrangement and design intent of the mitigation measures are illustrated on the mitigation strategy drawing in **Figure 8**, which identifies barrier locations and heights, the reduced-speed zone and the positions of the relevant receptors.

6.12 Overall, the mitigation strategy has been developed to provide an effective and proportionate response to the identified impacts. Although the adopted highway surfacing differs from the original design concept, optimisation of the acoustic barriers ensures that the overall acoustic performance remains broadly equivalent, enabling the SAR to be delivered without significant residual effects in planning terms.

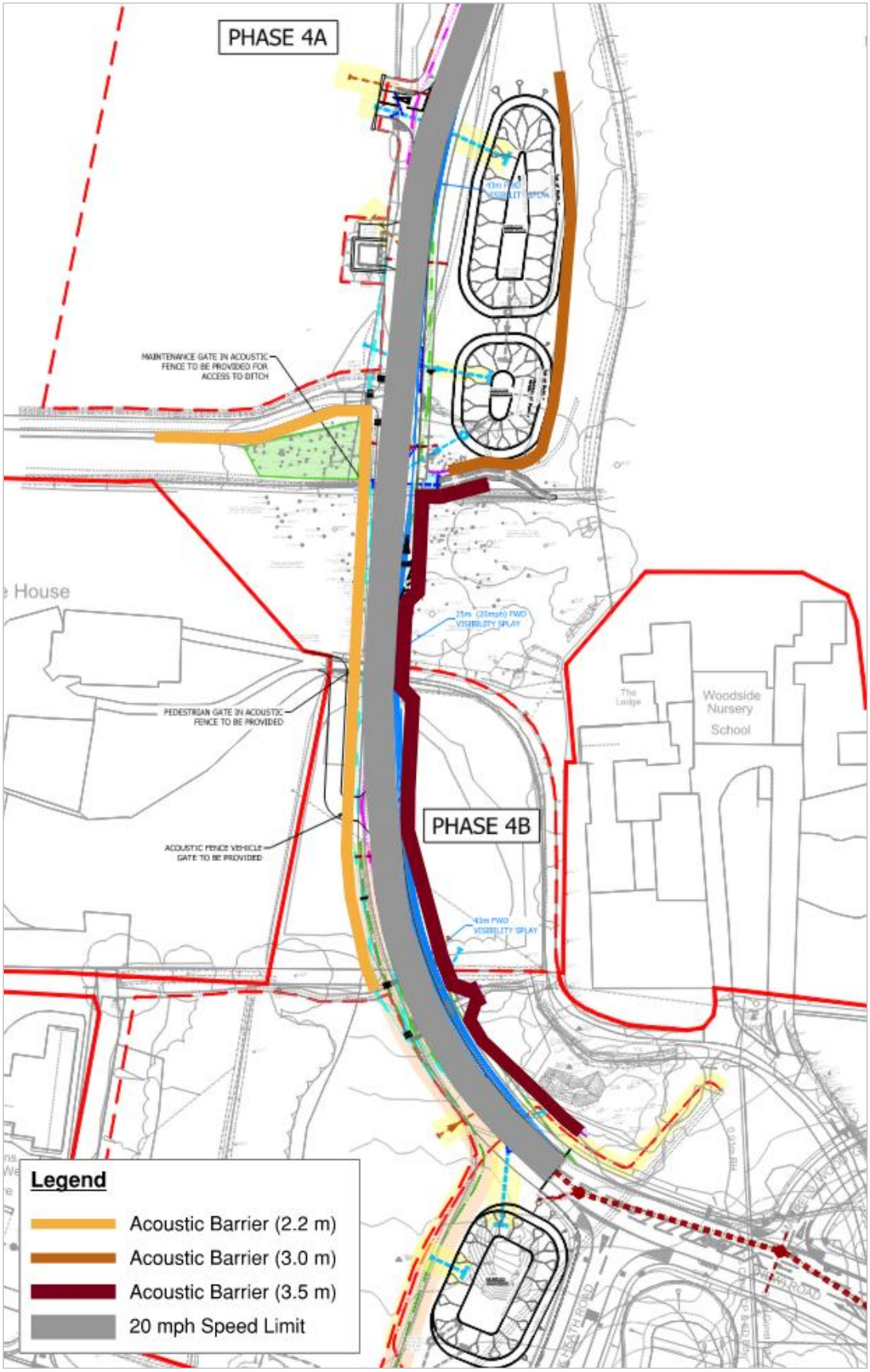

Figure 8: Proposed Noise Mitigation Strategy

Residual Effects

6.13 To determine the extent to which adverse noise effects can be reduced, the optimised mitigation package was developed within the acoustic model and road traffic noise levels recalculated in accordance with DMRB LA 111. The resulting short-term (2028) and long-term (2043) residual changes at each receptor are presented in **Tables 6.1** and **Table 6.2**, together with the associated mitigation benefit, defined as the reduction in noise level relative to the unmitigated predictions presented in Tables 5.1 and 5.2.

6.14 The receptor-based results are supported by the post-mitigation noise-change maps presented in **Figures 9** and **10**, which illustrate the spatial pattern and magnitude of residual change across the study area. These plots directly corroborate the numerical outcomes reported in Tables 6.1 and 6.2 and demonstrate where material reductions in noise have been achieved and where residual increases remain.

6.15 Together, the tabulated results and the supporting figures provide a robust basis for understanding the effectiveness of the mitigation strategy, demonstrating both the scale of reduction achieved at key receptors and the limited spatial extent of any residual effects.

Table 6.1: 2028 Short-Term Noise Change (Mitigated DSOY – DMOY, $L_{A10,18hr}$)

Receptor	DMOY 2028 (dB)	DSOY 2028 (dB)	ST Change with Mitigation (dB)	DMRB ST Magnitude with Mitigation	Mitigation Benefit (dB)
NSR A (White House)	44.6	46.0	+1.4	Minor	3.4
NSR B (Woodside)	33.3	37.8	+4.5	Moderate	6.9
NSR C (MWGs)	48.1	49.7	+1.6	Minor	0.2

Table 6.2: 2043 Long-Term Noise Change (Mitigated DSFY – DMFY, $L_{A10,18hr}$)

Receptor	DMFY 2043 (dB)	DSFY 2043 (dB)	LT Change With Mitigation (dB)	DMRB LT Magnitude With Mitigation	Mitigation Benefit (dB)
NSR A (White House)	45.7	47.3	+1.6	Negligible	3.9
NSR B (Woodside)	33.8	39.7	+5.9	Moderate	7.8
NSR C (MWGs)	49.3	50.5	+1.2	Negligible	0.2

Notes: All levels are presented as free-field $L_{A10,18hr}$ at 1.5 m above ground level. Results are reported for the most exposed façade of each receptor.

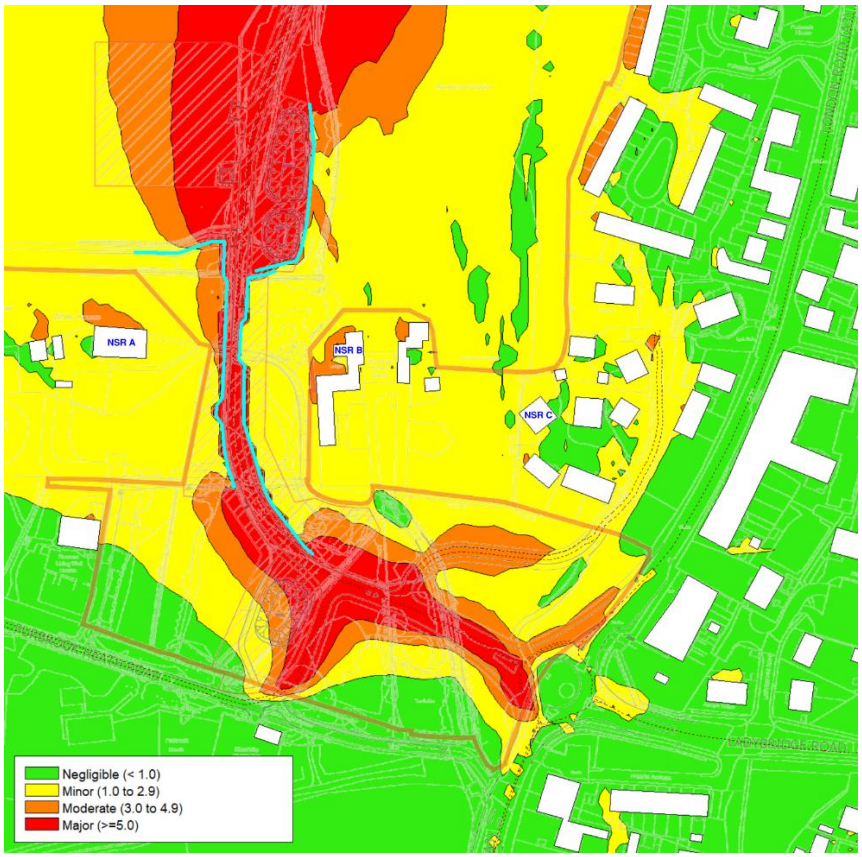

Figure 9: 2028 Short-Term Noise Change (Mitigated DSOY – DMOY, $L_{A10,18hr}$)

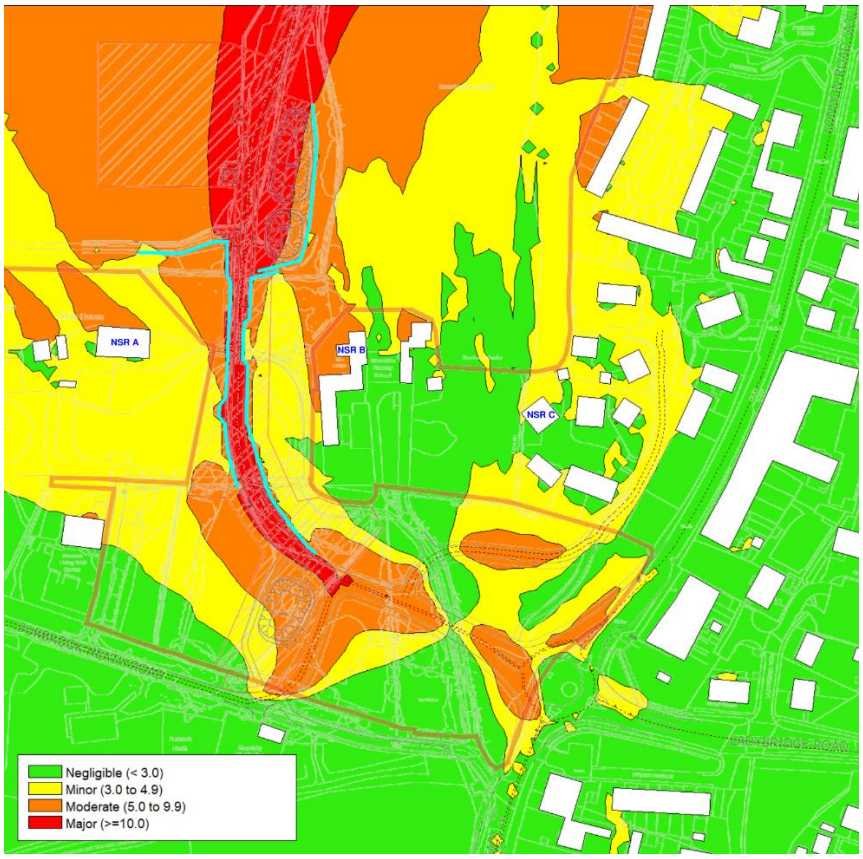

Figure 10: 2043 Long-Term Noise Change (Mitigated DSFY – DMFY, $L_{A10,18hr}$)

6.16 Whilst DMRB LA 111 provides the appropriate framework for classifying the magnitude of change arising from the scheme, those classifications should be interpreted alongside the resulting acoustic environment. This broader context is considered further in the Health-based Assessment (Section 7).

6.17 The mitigated results presented in Tables 6.1 and 6.2 demonstrate substantial reductions in predicted noise effects following implementation of the mitigation strategy, with the majority of residual effects falling within the Minor or Negligible classifications. The remaining Moderate residual effect at NSR B (Woodside) should be interpreted in the context of the comparatively low existing road traffic noise levels at this receptor, which are a principal determinant of the magnitude of change reported under the DMRB assessment.

6.18 At NSR A (White House), residual changes reduce to +1.4 dB in 2028 (Minor) and +1.6 dB in 2043 (Negligible), equating to mitigation benefits of 3.4–3.9 dB relative to the unmitigated scheme. With mitigation in place, the remaining increase is comparatively limited and is not anticipated to materially alter the prevailing acoustic environment at this receptor.

6.19 At NSR B (The Lodge, Woodside), which experiences the greatest unmitigated effects within the study area (+11.5 dB in 2028 and +13.7 dB in 2043, both classified as Major), the optimised mitigation package achieves substantial reductions in predicted noise effects. The relatively large unmitigated change principally reflects the introduction of a new road traffic source into a location that is well screened from the existing highway network, where existing road traffic noise levels are comparatively low owing to substantial separation from surrounding roads and intervening screening.

6.20 Residual changes reduce to +4.5 dB in 2028 and +5.9 dB in 2043, corresponding to mitigation benefits of 6.9 dB and 7.8 dB respectively. These reductions improve the DMRB classifications from Major to Moderate in the Opening and Design Year. Whilst a Moderate short-term magnitude of change remains, this principally reflects the comparatively low existing road traffic noise levels rather than an elevated resulting road traffic noise level. The implications of the resulting absolute noise environment are considered further in Section 7.

6.21 At NSR C (MWGs), residual changes of +1.6 dB in 2028 and +1.2 dB in 2043 fall within the Minor and Negligible classifications respectively. These results are broadly consistent with the unmitigated position and reflect the dominant influence of existing traffic associated with London Road. The SAR therefore remains only a limited incremental contributor at this receptor group and is not anticipated to materially alter the prevailing acoustic environment.

6.22 Overall, the adopted mitigation package substantially reduces both the magnitude and extent of predicted noise effects, with the greatest reductions achieved at the receptors that would otherwise experience the largest adverse impacts. Although the replacement of low-noise surfacing with HRA results in modest increases in predicted noise levels, optimisation of the barrier design limits the additional increase to no more than 0.7 dB compared with the original mitigation concept. The adopted mitigation therefore represents a proportionate and balanced solution that satisfies both acoustic and highway design requirements while recognising the wider engineering, environmental and planning constraints applicable to the scheme.

6.23 On this basis, the residual effects of the scheme are assessed as Not Significant in planning terms following implementation of the adopted mitigation strategy.

7. Health-Based Assessment

Introduction

7.1 A health-based assessment has been undertaken to contextualise the predicted absolute noise levels against recognised amenity benchmarks for residential environments. Relevant indoor and outdoor guideline values, derived from WHO (1999) and BS 8233:2014, are summarised in Table 3.3 and represent sound levels below which the likelihood of annoyance, sleep disturbance and interference with daily activities is expected to be low for the majority of occupants.

7.2 As the road-traffic predictions are expressed as $L_{A10,18hr}$, a first-order conversion of $L_{Aeq,16hr} \approx L_{A10,18hr} - 3$ dB has been applied to facilitate comparison with the LAeq-based health criteria. This approach is widely adopted in UK road traffic noise assessments, although it remains an approximation and is less reliable under low-flow or highly variable traffic conditions.

7.3 In evaluating internal amenity, a conservative 10 dB outside-to-inside level difference has been assumed for façades with windows opened sufficiently to assist with overheating control. This assumption is supported by published research, including DEFRA NANR116[6], which reports typical open-window level differences of approximately 10–15 dB, depending on window configuration and the spectral characteristics of the noise source, together with guidance supporting Approved Document O (ADO Noise Guide, Version 1.1, November 2024, IOA/ANC[7]), which indicates that open-window sound insulation may reduce to around 5 dB where large openings are required under high overheating risk, increasing to around 10 dB under medium-risk conditions. Actual performance will vary with window opening, geometry, façade orientation and the spectral characteristics of the noise source. The 10 dB assumption adopted therefore represents a realistic but conservative basis for assessment.

7.4 The assessment considers both the absolute acoustic environment experienced at each receptor and the incremental changes introduced by the scheme. This provides a health- and amenity-based context to the DMRB change-based assessment presented in the preceding section.

7.5 The purpose of this section is therefore to identify whether predicted external and internal noise levels are compatible with recognised residential amenity benchmarks, and whether the scheme has potential to give rise to material health-related concerns.

7.6 The assessment therefore complements the DMRB evaluation presented in Section 6 by considering whether the resulting noise levels, following implementation of mitigation, remain compatible with recognised health and residential amenity objectives.

[6] DEFRA (2007); '*Open/Closed Window Research – Sound Insulation Through Ventilated Domestic Windows*', BRE / University of Salford. (NANR116).
[7] Institute of Acoustics & Association of Noise Consultants (2024); '*Approved Document O Noise Guide: Methods and Guidance for Demonstrating Compliance with Noise Constraints in ADO*', Version 1.1, November 2024.

External Amenity Assessment

7.7 **Table 7.1** summarises the existing measured daytime noise levels and the predicted daytime levels with the scheme and mitigation in place. With mitigation in place, external amenity levels are predicted to fall within 40–55 dB $L_{Aeq,16hr}$, ranging from conditions comfortably below guideline values in quieter locations to levels within the 50–55 dB $L_{Aeq,16hr}$ range identified by WHO (1999) and BS 8233:2014 as representing an acceptable external acoustic environment where achieving lower levels is not reasonably practicable. The variation reflects baseline context, receptor proximity to road traffic sources and the effect of mitigation.

Table 7.1: External Amenity Noise Levels – Existing vs With Scheme + Mitigation

Receptor	Existing (dB $L_{Aeq,16hr}$)	Scheme + Mitigation (dB $L_{Aeq,16hr}$)	Change (dB)	Classification (WHO / BS 8233 Context)
NSR A (White House)	49	50	+1	Within desirable guideline range (≤50 dB)
NSR B (Woodside)	40	43	+3	Below guideline range (≤50 dB)
NSR C (MWGs)	54	55	+1	Within upper guideline range (≤55 dB)

7.8 At NSR A (White House), external amenity levels are predicted to increase marginally from 49 dB to 50 dB $L_{Aeq,16hr}$, representing a +1 dB change. This very small increase would be unlikely to be readily perceptible and would not be expected to materially alter the overall character of the acoustic environment at this receptor. A daytime level of 50 dB lies at the upper end of the desirable range for residential external amenity and remains consistent with a good standard of outdoor acoustic comfort in this rural–urban fringe setting.

7.9 At NSR B (The Lodge, Woodside), external amenity levels are predicted to increase from ≈ 40 dB to 43 dB $L_{Aeq,16hr}$ with the introduction of the SAR. The scheme incorporates a 3.5 m high roadside barrier together with a 20 mph speed limit in this section, which collectively restrict the SAR noise contribution and limit the magnitude of change. Although the introduction of a new road may be perceptible in this quieter setting, the resulting external level remains low in absolute terms and compatible with a high standard of outdoor amenity. Accordingly, no material adverse effect on the usability or quality of external amenity space is anticipated.

7.10 At NSR C (MWGs), external amenity levels are predicted to change marginally from 54 dB to 55 dB $L_{Aeq,16hr}$. This 1 dB increase is unlikely to be perceptible and remains within the upper guideline value for residential outdoor amenity. The scheme is therefore not expected to materially affect the usability or enjoyment of private outdoor space at this receptor group.

Internal Amenity Assessment

7.11 The future internal amenity assessment is based on the road-traffic noise predictions generated from the AAWT model, as this is the only source for which future-year data are available. Unlike the existing measured baseline, which captures the full acoustic

environment from all local and distant sources, the future values represent only road-traffic contributions from the modelled road links. Accordingly, they should not be interpreted as precise predictions of total future internal noise levels.

7.12 The future assessment therefore provides an indication of whether road-traffic noise associated with the scheme, with mitigation in place, is likely to exceed, materially approach or remain below the WHO / BS 8233 internal guideline values. This provides a proportionate basis for evaluating whether the scheme could materially contribute to health-related risks such as annoyance or sleep disturbance, while avoiding unwarranted precision in forecasting conditions that cannot reliably be modelled at this stage.

Table 7.2: Existing Internal Amenity Assessment (Day & Night)

Receptor	External $L_{Aeq,16hr}$ Day (dB)	Internal $L_{Aeq,16hr}$ Day (dB)	WHO / BS 8233 Day Target (35 dB)	Compliance?
NSR A (White House)	49	39	35	**No** (+4 dB)
NSR B (Woodside)	36	26	35	**Yes** (-9 dB)
NSR C (MWGs)	54	44	35	**No** (+9 dB)
Receptor	**External $L_{Aeq,8hr}$ Night (dB)**	**Internal $L_{Aeq,8hr}$ Night (dB)**	**WHO / BS 8233 Night Target (30 dB)**	**Compliant?**
NSR A (White House)	43	33	30	**Marginal** (+3 dB)
NSR B (Woodside)	33	23	30	**Yes** (-7 dB)
NSR C (MWGs)	47	37	30	**No** (+7 dB)

Notes: [1] Internal levels estimated by applying a conservative 10 dB outside-to-inside level difference for partially-open windows.

7.13 Existing internal noise conditions vary across the three receptors. Under the conservative open-window assumption, NSR B (Woodside) remains comfortably below the WHO / BS 8233 guideline values during both daytime and night-time periods, reflecting the relatively quiet baseline environment at this location.

7.14 At NSR A (White House), internal levels are modestly above guideline values, corresponding to exceedances of +4 dB during the day and +3 dB at night. While above the guideline thresholds, these exceedances remain relatively limited in scale and are derived using conservative open-window assumptions.

7.15 At NSR C (MWGs), internal conditions exceed guideline levels by wider margins under both daytime (+9 dB) and night-time (+7 dB) periods, consistent with the higher external noise climate at this location. This indicates a greater baseline likelihood of disturbance, particularly where occupants rely on open-window ventilation and cooling. Although such exceedances are not uncommon in urban contexts, they highlight sensitivity to external noise at this receptor cluster in the existing situation, independent of the development.

7.16 Overall, the results indicate that existing internal noise conditions are compliant at NSR B (Woodside), with internal levels comfortably below WHO / BS 8233 guideline values during both day and night-time periods. At NSR A (White House), exceedances are relatively modest (+3–4 dB) and confined to the most exposed façade, whereas at NSR C (MWGs) exceedances are more pronounced (+7–9 dB), reflecting the established influence of existing road traffic. These conditions represent the existing baseline rather than effects associated with the proposed scheme and provide important context for interpreting predicted future performance and evaluating whether the scheme could materially alter the existing pattern of acoustic exposure.

Table 7.3: Future Internal Amenity Assessment (Road Traffic Contribution Only)

Receptor	External $L_{Aeq,16hr}$ (dB)	Internal $L_{Aeq,16hr}$ Day (dB)	WHO / BS 8233 Day Target (35 dB)	Compliance?
NSR A (White House)	50	40	35	**No** (+5 dB)
NSR B (Woodside)	39	29	35	**Yes** (-6 dB)
NSR C (MWGs)	53	43	35	**No** (+8 dB)
Receptor	**External $L_{Aeq,8hr}$ Night (dB)**	**Internal $L_{Aeq,8hr}$ Night (dB)**	**WHO / BS 8233 Night Target (30 dB)**	**Compliant?**
NSR A (White House)	44	34	30	**No** (+4 dB)
NSR B (Woodside)	33	23	30	**Yes** (-7 dB)
NSR C (MWGs)	47	37	30	**No** (+7 dB)

Notes: [1] Internal levels estimated by applying a conservative 10 dB outside-to-inside level difference for partially-open windows.

7.17 At NSR A (White House), predicted future internal levels are approximately 40 dB $L_{Aeq,16hr}$ during the day and 34 dB $L_{Aeq,8hr}$ at night, corresponding to exceedances of approximately +5 dB and +4 dB respectively relative to the WHO / BS 8233 guideline values. However, these levels are only marginally above the existing baseline condition (typically by around 1 dB), indicating that the scheme would not materially alter the prevailing internal acoustic environment at this receptor. Given the modest scale of change and the conservative open-window assumptions applied, the potential for material adverse health effects is considered low.

7.18 At NSR B (The Lodge, Woodside), internal levels from road traffic remain comfortably below guideline values during both periods, at approximately 29 dB $L_{Aeq,16hr}$ (day) and 23 dB $L_{Aeq,8hr}$ (night). These results are broadly consistent with existing measured performance and indicate that, following mitigation, road-traffic noise from the SAR is not expected to materially affect the internal acoustic environment at this receptor.

7.19 At NSR C (MWGs), predicted internal levels of 43 dB $L_{Aeq,16hr}$ during the day and 37 dB $L_{Aeq,8hr}$ at night correspond to exceedances of +8 dB and +7 dB respectively. These values are broadly comparable with the existing condition and reflect the prevailing influence of road traffic at this location. The assessment therefore indicates that the SAR would not materially alter the overall internal acoustic environment at this receptor group.

7.20 Taken together, the results indicate that, even under conservative open-window assumptions, road-traffic noise associated with the scheme is unlikely to materially alter internal amenity beyond the existing baseline condition. At NSR A, exceedances remain moderate and consistent with the site's existing acoustic context; at NSR B, performance remains comfortably compliant; and at NSR C, exceedances remain broadly consistent with the prevailing traffic-dominated acoustic environment.

7.21 On this basis, the assessment indicates that the scheme would not materially alter the existing pattern of acoustic exposure at nearby residential receptors and is not expected to materially increase the likelihood of health-related effects such as annoyance or sleep disturbance beyond those already associated with the existing baseline environment. Future internal amenity conditions would remain governed principally by the existing local road traffic context rather than the incremental contribution of the SAR.

Maximum Noise Events

7.22 To supplement the assessment of continuous road traffic noise (L_{Aeq} / $L_{A10\ indices}$), the potential effects of individual transient noise events have also been examined. Short-duration maxima can affect sleep quality and acoustic perception differently from average noise levels, and WHO (1999) advises that indoor L_{AFmax} should not normally exceed 45 dB during night-time to minimise the likelihood of sleep disturbance.

7.23 Using a realistic upper-bound source level of L_w = 100 dB (≈ 92 dB at 1 m under hemispherical propagation), the modelling indicates that predicted external L_{AFmax} levels at nearby dwellings do not exceed ≈ 50 dB at the most exposed façades. Assuming a representative 10 dB outside-to-inside level difference for partially open windows, corresponding internal maxima are expected to remain in the ≈ 40 dB range, comfortably below the WHO (1999) guideline of 45 dB L_{AFmax}.

7.24 For context, measured baseline data indicate representative higher-end maximum noise events of approximately 63 dB L_{AFmax}, indicating that predicted maxima associated with SAR traffic would remain substantially below peak events already occurring within the local area. Whilst the introduction of the SAR may increase the occurrence of additional lower-level maximum noise events, these would be expected to remain subordinate in magnitude to existing higher-order events and would therefore not be anticipated to materially alter the prevailing pattern of night-time maximum noise exposure.

8. Road Traffic-Induced Vibration

8.1 Road-traffic-induced ground-borne vibration is typically associated with high proportions of heavy vehicles travelling at speed over irregular or defective carriageway surfaces, particularly where receptors are located in close proximity to the running lane, typically within approximately 20 m. DMRB guidance recognises that, under such circumstances, vibration may be perceptible within nearby buildings, although significant adverse effects are generally unlikely.

8.2 For the proposed scheme, no material increase in HGV flows is predicted relative to existing network conditions, and the SAR will be constructed to modern highway standards with a smooth engineered pavement surface. These design characteristics are expected to minimise vibration generation at source. In addition, the nearest NSRs are located at least 40 m from the proposed carriageway, substantially beyond distances at which perceptible vibration effects would typically be expected, even under less favourable surface or traffic conditions.

8.3 Having regard to the forecast traffic composition, road design, pavement specification and receptor separation distances, the potential for traffic-induced vibration to give rise to perceptible indoor vibration, annoyance or cosmetic building effects is considered extremely low. Accordingly, no significant operational vibration effects are anticipated.

8.4 On this basis, and consistent with DMRB guidance, a qualitative assessment is sufficient to characterise risk, and no further detailed vibration modelling or measurement is considered necessary.

9. Conclusion

9.1 This Noise and Vibration Impact Assessment has been undertaken in accordance with DMRB LA 111 to support the discharge of Condition 17 for the Berewood SAR. The assessment has considered the potential operational noise and vibration effects associated with the introduction of the new road corridor and has developed and evaluated an iterative package of practicable mitigation measures to ensure that nearby residential amenity is suitably protected.

9.2 The unmitigated predictions indicate that, in the absence of mitigation, the scheme would give rise to Moderate or Major adverse noise changes at White House (NSR A) and, in particular, Woodside (NSR B), reflecting their proximity to the new alignment and the introduction of a new road traffic source into locations where existing road traffic noise levels are comparatively low. In contrast, Marrels Wood Gardens (NSR C), which is already influenced by established road traffic sources, is predicted to experience only Minor or Negligible changes. The identified effects are therefore localised and receptor-specific rather than widespread in extent.

9.3 The adopted mitigation strategy was developed through an iterative acoustic design process, evaluating a range of practicable measures to reduce adverse noise effects where reasonably practicable. During detailed design, the highway authority required the originally proposed low-noise surfacing to be replaced with Hot Rolled Asphalt (HRA). The mitigation strategy was therefore re-optimised through systematic testing and refinement of alternative barrier configurations, resulting in an increased eastern barrier height that recovered the majority of the acoustic benefit previously provided by the low-noise surfacing. The resulting mitigation package represents an optimum balance between acoustic performance and wider engineering, highway, landscape and planning considerations, avoiding disproportionately greater visual, landscape and engineering impacts that would arise from further increases in barrier height.

9.4 With mitigation in place, predicted residual effects are substantially reduced across all assessed receptors, with the majority falling within Minor or Negligible classifications in both the Opening Year and Design Year scenarios. At the most affected receptor (NSR B – Woodside), mitigation achieves reductions of 6.9–7.8 dB relative to the unmitigated scenario, reducing the DMRB classification from Major to Moderate. Whilst a Moderate residual classification remains, this principally reflects the comparatively low existing road traffic noise levels rather than an elevated resulting road traffic noise level. Although the adopted HRA surfacing provides a modest reduction in source-control performance compared with the original low-noise surfacing concept, optimisation of the acoustic barrier design limits the resulting increase in predicted noise levels to no more than 0.7 dB. Elsewhere, residual changes remain below or close to the DMRB thresholds for perceptible change in road traffic noise. On this basis, the residual operational noise effects are assessed as **Not Significant** in planning terms and do not represent a constraint to the delivery of the scheme.

9.5 The health-based assessment confirms that external amenity levels remain within recognised guideline ranges and that predicted internal noise levels are either compliant with, or remain only modestly above, recognised WHO / BS 8233 guideline values under

conservative open-window assumptions. Where exceedances persist (principally at White House and Marrels Wood Gardens), these are consistent with the existing baseline environment and reflect the influence of established road traffic sources rather than the incremental contribution of the SAR. Accordingly, the assessment indicates that the scheme is not expected to materially increase the likelihood of health-related effects such as annoyance or sleep disturbance beyond those already associated with the existing baseline environment.

9.6 In relation to vibration, the scheme is not expected to give rise to perceptible operational road traffic vibration effects. The combination of relatively low HGV proportions, modern pavement construction and receptor stand-off distances of at least 40 m indicates that the potential for perceptible indoor vibration, vibration-related annoyance or cosmetic building effects is extremely low. Consequently, no significant operational vibration effects are anticipated.

9.7 Overall, this assessment demonstrates that the Berewood SAR has been designed and refined through an iterative optimisation process to minimise adverse noise effects where reasonably practicable. Subject to implementation of the identified mitigation measures, the scheme is not expected to give rise to significant operational noise or vibration effects and is therefore considered to satisfy the requirements of Condition 17. The adopted mitigation strategy is considered effective, proportionate and technically robust, thereby supporting the continued delivery of the Berewood development.

A.1 Glossary of Acoustic Terminology

The following table contains a list and explanation of the acoustic terms relevant to this report.

Term	Description
Absorptive Noise Barrier	A noise barrier that incorporates an absorptive lining to reduce reflected noise.
Ambient Sound Level ($L_{Aeq,T}$)	The totally encompassing sound in a given situation at a given time, usually composed of sound from all sources near and far, including the specific source being assessed.
A-weighting (dB(A))	A frequency weighting applied to sound measurements to approximate the human ear's sensitivity across different frequencies, particularly the reduced sensitivity to very low and very high frequencies. It provides a single-number value that correlates more closely with perceived loudness. Most environmental and building acoustics noise levels are expressed in dB(A).
Baseline Scenario	A description of the noise environment without implementation of the project, used for comparison with future scenarios.
Basic Noise Level (BNL)	A measure of source noise for road traffic, defined in Appendix A of CRTN.
CadnaA	A widely used proprietary acoustic modelling software package that allows prediction of environmental noise from sources such as road traffic, railways, and industry. In this report it is used to apply the CRTN methodology for predicting road traffic noise levels.
Calculation of Road Traffic Noise (CRTN, 1988)	The UK's standard method for calculating road traffic noise, developed by the Department of Transport. It specifies how to calculate LA10,18hr noise levels at receptors, based on traffic flow, composition, speed, road surface, and geometry.
Design Manual for Roads and Bridges (DMRB) LA 111	A national standard published by National Highways that provides the methodology for assessing noise and vibration from road projects in the UK. LA 111 (Revision 2, 2020) is the current guidance referenced in this report.
Do-Minimum Scenario (DM)	The scenario without the proposed road scheme.
Do-Something Scenario (DS)	The scenario with the proposed road scheme.
DMOY / DSOY	Do-Minimum / Do-Something scenarios for the opening year.
DMFY / DSFY	Do-Minimum / Do-Something scenarios for the future year (15 years post-opening).
Façade Noise Level	The sound level measured or predicted at the façade of a building, typically at a distance of 1 m. A +2-3 dB reflection correction is applied relative to the free-field level to account for the façade's reflective effect.
Free-field Level	A sound level measured or predicted away from any reflecting surfaces (other than the ground), usually at least 3.5 m from any structure.
Future Year	The 15th year after opening, used to estimate long-term noise change.
$L_{Aeq,T}$ (dB)	The A-weighted equivalent continuous sound level over a specified time period T. It represents the notional steady sound level that contains the same total acoustic energy as the actual fluctuating sound during that period. $L_{Aeq,T}$ is widely used for environmental noise assessment, building acoustics and compliance monitoring.
$L_{Aeq,16hr}$ (dB)	The A-weighted equivalent continuous sound level across the daytime period 07:00–23:00 hours. Used in WHO and BS 8233 guidance as a benchmark for outdoor residential amenity.
$L_{Aeq,8hr}$ (dB)	The A-weighted equivalent continuous sound level across the night-time period 23:00–07:00 hours. Used to assess potential sleep disturbance in bedrooms at night.

Term	Description
$L_{A10,T}$ (dB)	The A-weighted sound pressure level exceeded for 10% of the measurement period T. It is commonly used to describe road traffic noise and is sometimes referred to as the "average of the higher noise levels". The CRTN method for traffic noise prediction uses the $L_{A10,18hr}$ metric.
$L_{A10,18hr}$ (dB)	The A-weighted sound pressure level exceeded for 10% of the time across the 18-hour period 06:00–24:00 hours. The standard index used in the CRTN method and DMRB for assessing road traffic noise.
L_{A90T} (dB)	The A-weighted sound pressure level exceeded for 90% of the measurement period T. Often referred to as the "background sound level", it is used in BS 4142 assessments to represent the underlying, typically steady noise environment when intermittent or intrusive sources are absent.
L_{max} (L_{AFmax})	The maximum instantaneous A-weighted sound pressure level recorded during the measurement period. Unless otherwise specified, it is measured with the 'fast' (F) time weighting. LAFmax is commonly referenced in planning and compliance assessments because short-duration, high-level noise can cause disturbance or annoyance — for example, sleep disturbance at night — even though it may have little influence on the overall LAeq value but will still affect the noise environment.
$L_{AFmax,90\%}$ (dB)	The A-weighted maximum noise level with Fast (F) time weighting, exceeded for 90% of the night-time period. Represents a "typical maximum" value used to assess the risk of sleep disturbance from single noise events.
Long-Term Noise Change	Noise change based on comparison of opening year and future year scenarios, considering gradual adaptation over time.
Low-noise Surfacing	Specialised road surfacing materials (e.g. thin surface course systems) designed to reduce tyre–road interaction noise compared with conventional asphalt.
Mitigation	Measures designed to avoid, reduce or offset noise effects. Under DMRB, mitigation is prioritised using a proportionate approach.
Mitigation Hierarchy	The structured approach to controlling noise impacts: (1) Avoidance through scheme design and layout; (2) Reduction at source (e.g. low-noise surfacing); (3) Pathway control (e.g. barriers, bunds); (4) Receptor protection (e.g. enhanced glazing).
Noise Level Indices	Statistical or average measures used to describe fluctuating time-varying sound, such as $L_{Aeq,T}$, L_{A10T}, $L_{A90,T}$, and L_{AFmax}.
Noise-Sensitive Receptor (NSR)	Any building or area occupied by people where noise and/or vibration could cause disturbance, such as residential dwellings, schools, hospitals, or offices.
Noise significance	Categories (negligible, minor, moderate, major) defined in DMRB LA 111 to describe the perceptibility and planning significance of changes in noise exposure at receptors.
Residual Effects	The level of impact predicted to remain after the implementation of noise mitigation measures.
Screening Bund / Barrier	An earth embankment (bund) or constructed barrier (e.g. acoustic fence) positioned between a noise source and receptor to reduce noise propagation by interrupting the line of sight.
Short-Term Noise Change	Noise change between DM and DS in the opening year (DSOY – DMOY).

A.2 Operational Road Traffic Noise Contours

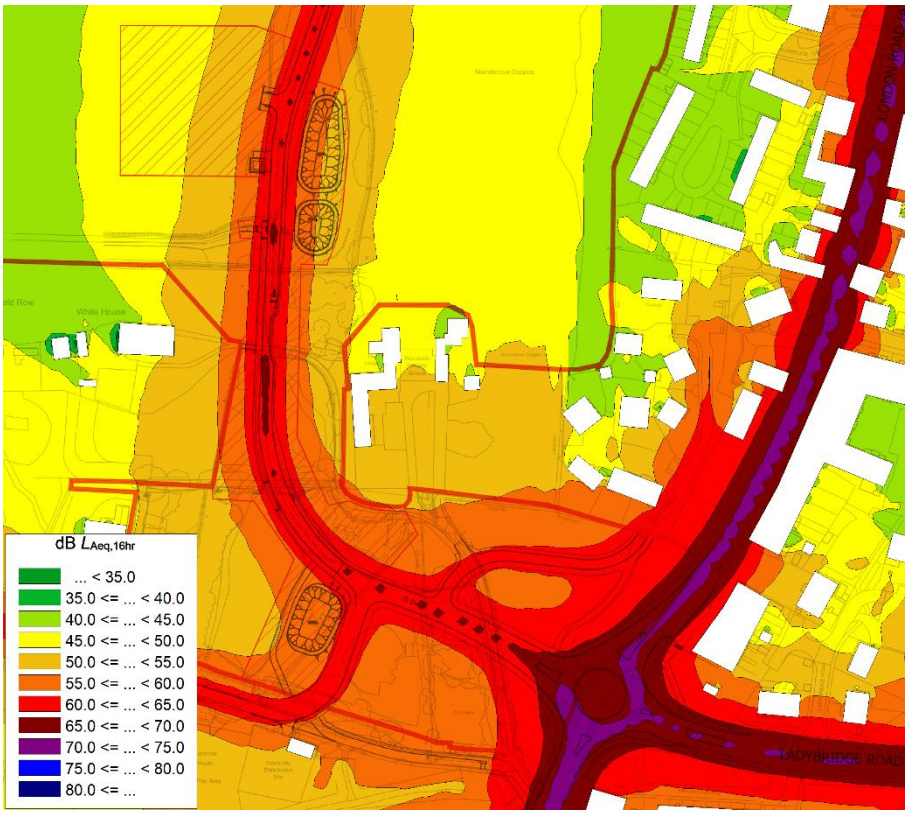

Figure A.2.1: Predicted Unmitigated Opening Year (2028) Daytime Road Traffic Noise Levels ($L_{Aeq,16hr}$)

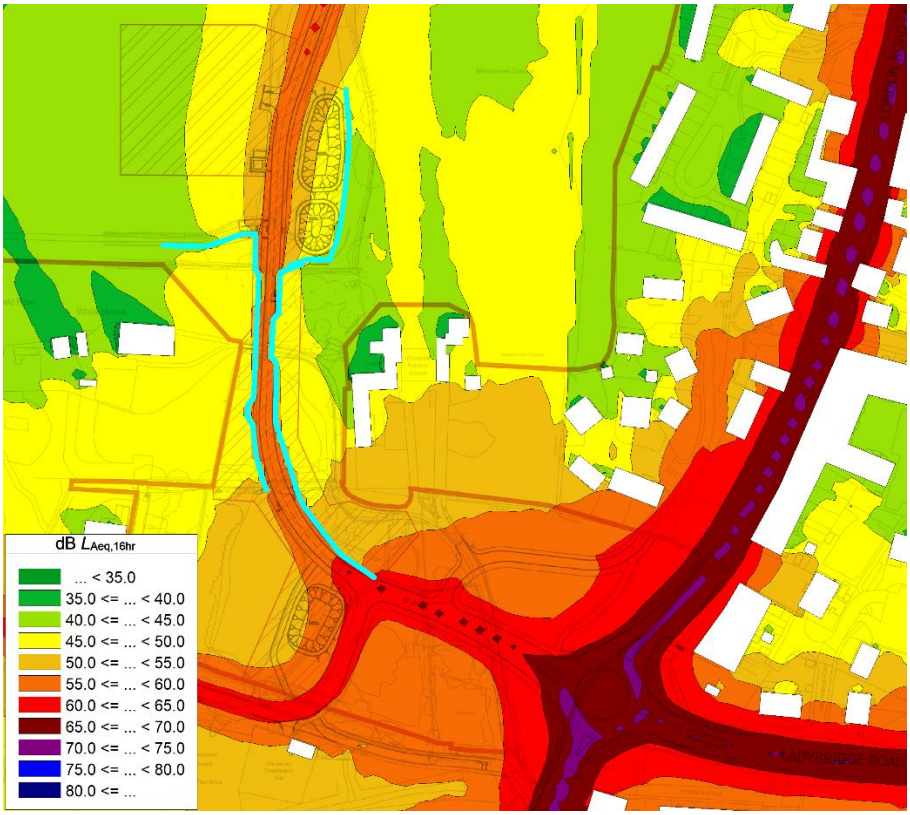

Figure A.2.2: Predicted Mitigated Design Year (2028) Daytime Road Traffic Noise Levels ($L_{Aeq,16hr}$)

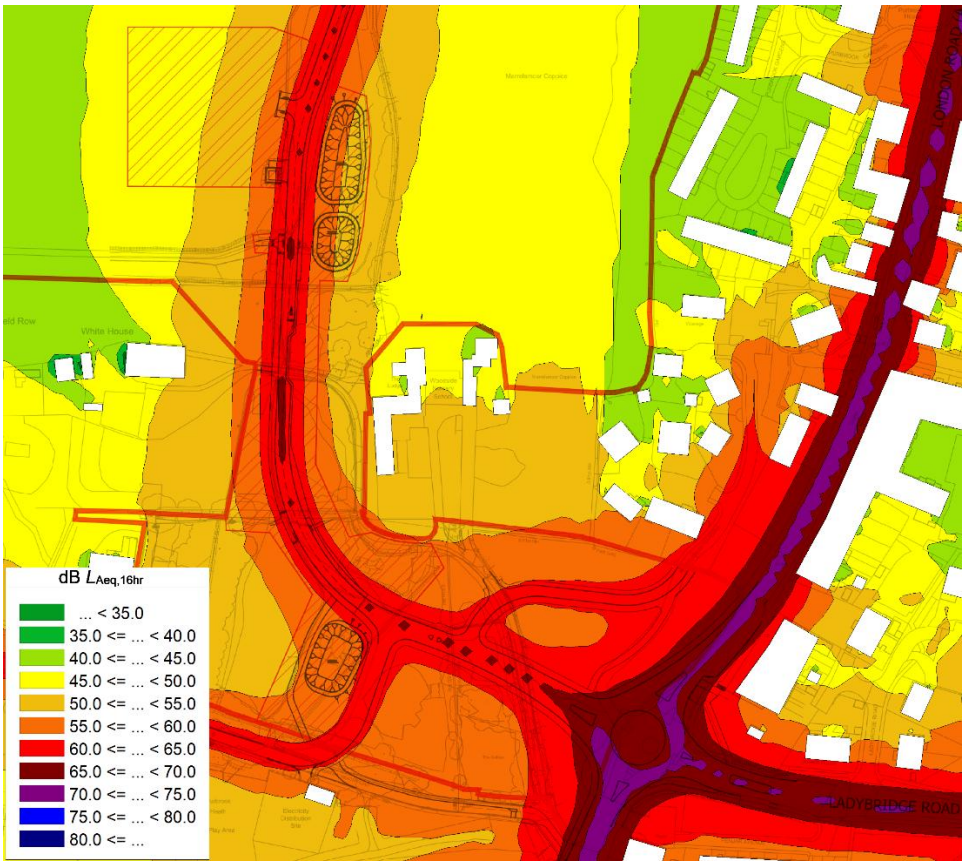

Figure A.2.3: Predicted Unmitigated Design Year (2043) Daytime Road Traffic Noise Levels ($L_{Aeq,16hr}$)

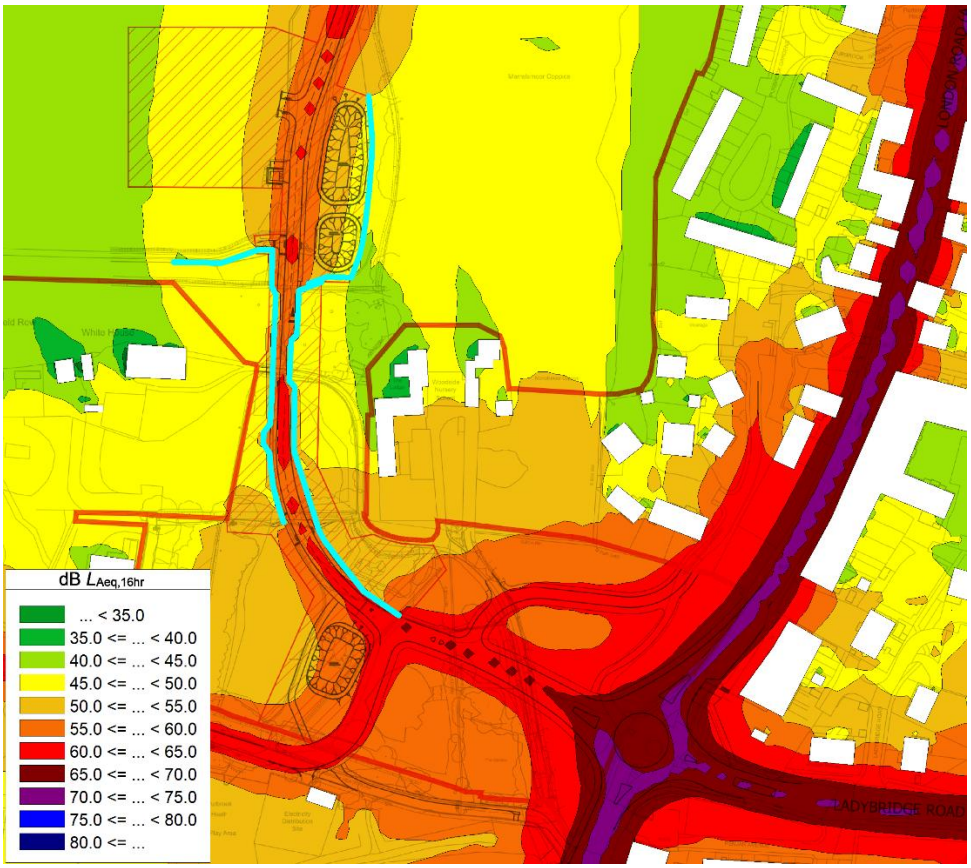

Figure A.2.4: Predicted Mitigated Design Year (2043) Daytime Road Traffic Noise Levels ($L_{Aeq,16hr}$)