

**Land West of London Road,
Handcross,
Mid Sussex**

**Prepared for
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by
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Limited**

April 2026



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SMA Ref: 7409/NA

Issue Status: 02

DOCUMENT CONTROL			
Project	Land West of London Road, Handcross, Mid Sussex		
Job No.	7409		
Document Title	Noise Assessment		
File Location	N:\Admin Project\7400 to 7499\7409 - Handcross, Mid Sussex\Reports\Noise\7409 - Noise Report - 02.docx		
Prepared by	Jason Mills	Date	29/01/2026
Reviewed by	Stewart Andrews	Date	00/01/2026
Approved by	Gaetano Pellegrino	Date	00/01/2026
Document Issue	Description / Changes	Revised by	Date
DRAFT	Internal Review and Client Comment	JPM	29/01/2026
DRAFT1	Updates to Report	JPM	24/03/2026
01	Issued to Client	JPM	27/03/2026
02	Minor updates and noise survey added	JPM	29/04/2026



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ACRONYMS AND ABBREVIATIONS

'A' weighted	The weighting that is applied to measured sound pressure levels so that the levels correspond more closely to the subjective response of the human ear - expressed as dB(A)
°C	Degrees Celsius
BRE	Building Research Establishment
BS 8233	British Standard 8233 'Sound insulation and noise reduction for buildings – Code of practice' 2014
CBC	Crawley Borough Council
CIRIA	Construction Industry Research and Information Association
CRTN	Calculation of Road Traffic Noise 1988
dB	Decibel – unit of measurement of sound
DfT	Depart for Transport
EHO	Environmental Health Officer
Hertz	Frequency oscillation in cycles per second i.e. 1000 Hertz is a thousand cycles per second
$L_{A10, T}$	Noise level exceeded for 10% of the time period (T) expressed in decibels with an A weighting
$L_{Aeq, T}$	A weighted equivalent continuous noise level over a time
L_{Amax}	A weighted maximum noise level
MSDC	Mid Sussex District Council
ms^{-1}	Metres per second
NPPF	National Planning Policy Framework
SLM	Sound Level Meter
SMA	Stuart Michael Associates Limited
TPA	Transport Planning Associates
UK	United Kingdom
UKAS	United Kingdom Accreditation Service in reference to sound level meter calibration
WebTRIS	Web Traffic Reconnaissance and Incident System - National Highways
WHO	The World Health Organisation



1.0 INTRODUCTION

- 1.1 This noise assessment report has been prepared by Stuart Michael Associates Limited, Consulting Engineers, on behalf of Welbeck Strategic Land III Limited (the Applicants).
- 1.2 The report supports the planning application for a proposed residential development on land west of London Road, Handcross, Mid Sussex. Refer to **Figure 1.1** for the location of the development site.
- 1.3 The development site is located within the administrative boundary of Mid Sussex District Council (MSDC), which is the Local Planning Authority for the area. Handcross is to the south of Crawley which is within the administrative area of Crawley Borough Council (CBC).





Figure 1.1: Site Location Plan

- 1.4 From on-site observations, road traffic is the dominant noise source in the area. The A23 is a short distance (40 metres) to the west of the Site and London Road bounds the site to the east. The background noise across the site consists of road traffic noise from the local highway network, high altitude aircraft noise associated with Gatwick Airport and general domestic noise from the adjacent residential areas. Given the nature of the dominant noise source, noise levels have been measured and modelled to determine the existing noise profile of the site using the measurement method detailed in Calculation of Road Traffic Noise¹ (CRTN) and the SoundPLAN² computer model.

Site Description

- 1.5 The development site is located on the northern edge of Handcross.
- 1.6 The A23 is a short distance (40 metres) to the west of the Site and London Road bounds the site to the east. Adjacent to the Site, the A23 is in cutting and is approximately 7 metres lower than the western Site boundary. There is a private access road on the northern boundary, serving the Hyde Estate. There are existing residential dwellings to the south and a single dwelling (Hyde Lodge) to the northeast.
- 1.7 The Site consists of a parcel of land with well-established hedgerows and trees on the western, southern and eastern boundaries. The site is currently laid to rough pasture.

Development Proposals

- 1.8 This report has been produced in support of a full Planning Application for up to 55 residential dwellings on Land West of London Road, Handcross. Refer to **Appendix 1** for a copy of the Illustrative Site Layout (PL-03) which this assessment has been based.
- 1.9 The impact of noise from the A23, London Road and the broader highway network on the proposed dwellings has been assessed in accordance with British Standards, NPSE, World Health Organisation guidelines, ProPG: Planning and Noise guidance and local Planning Policy.

¹ The Department for Transport publication which contains the method for calculating road traffic noise - Calculation of Road Traffic Noise published in 1988.

² SoundPLAN v9.0 computer model incorporates the CRTN calculation method.



- 1.10 Where necessary, mitigation measures have been suggested to help reduce internal and external noise levels to below guidance levels.

The Nature, Measurement and Effect of Noise

- 1.11 Noise is often defined as sound that is undesired by the recipient. Whilst it is impossible to measure nuisance caused by noise directly, it is possible to measure the loudness of that noise. 'Loudness' is related to both sound pressure and frequency, both of which can be measured. The human ear is sensitive to a wide range of sound levels. The sound pressure level of the threshold of pain is over a million times that of the quietest audible sound. To reduce the relative magnitudes of the numbers involved, a logarithmic scale of decibels (dB) is normally used, based on a reference level of the lowest audible sound.
- 1.12 The response of the human ear is not constant over all frequencies. It is therefore usual to weight the measured frequencies to approximate the human response. The resulting 'A' weighted decibel, dB(A), has been shown to correlate closely to the subjective human response.
- 1.13 When related to changes in noise, a change of ten decibels from, for example, 60 dB(A) to 70 dB(A) would represent a doubling in 'loudness'. Similarly, a decrease in noise from 70 dB(A) to 60 dB(A) would represent a halving in 'loudness'. A change of 3 dB(A) is generally considered to be just perceptible.

Table 1.1 details typical noise levels.

Table 1.1: Typical Noise Levels

Approximate Noise Level (dB(A))	Example
0	Limit of hearing
30	Rural area at night
40	Library
50	Quiet office
60	Normal conversation at 1 m
70	In a car
80	Household vacuum cleaner at 1 m
100	Pneumatic drill at 1 m
120	Threshold of pain



2.0 LEGISLATION AND POLICY

- 2.1 It is important to consider the relevant legislation, policy and associated guidance in relation to noise effects on a proposed development. Following the revocation of Planning Policy Guidance Note 24 'Planning and Noise' (PPG24), the National Planning Policy Framework (NPPF), British and International Standards and local authority guidance have become the relevant national guidance regarding noise and new residential developments.

National Planning Policy Framework (NPPF)

- 2.2 The revised National Planning Policy Framework (NPPF, December 2024) supersedes all previous versions of the NPPF. The purpose of the planning system is to contribute to the achievement of sustainable development. There are three dimensions to sustainable development: economic, social and environmental. The environmental role is to contribute to protecting and enhancing our natural, built and historic environment; and as part of this, make effective use of land, help to improve biodiversity, use natural resources prudently, minimise waste and pollution, and mitigate to adapt to climate change including moving to a low carbon economy.
- 2.3 One of the core planning principles is to contribute to conserving and enhancing the natural environment (NPPF - Section 15). Paragraph 180 of the NPPF states:
- "Planning policies and decisions should contribute to and enhance the natural and local environment by:
- a) protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils (in a manner commensurate with their statutory status or identified quality in the development plan);
 - b) recognising the intrinsic character and beauty of the countryside, and the wider benefits from natural capital and ecosystem services – including the economic and other benefits of the best and most versatile agricultural land, and of trees and woodland;
 - c) maintaining the character of the undeveloped coast, while improving public access to it where appropriate;



- d) minimising impacts on and providing net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures;
- 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; and
- f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.”

2.4 Under the section “Ground conditions and pollution”, Paragraph 191 of the NPPF states:

“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;
- 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; and
- c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.”

2.5 Additionally, Paragraph 193 states: “Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or



community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed".

Planning Practice Guidance (PPG-N)

- 2.6 The Planning Practice Guidance for Noise (PPG-N), published March 2014 and updated in July 2019, provides advice on how to determine the noise impact on development:

"Local planning authorities' plan-making and decision taking should take account of the acoustic environment and in doing so consider:

- *whether or not a significant adverse effect is occurring or likely to occur;*
- *whether or not an adverse effect is occurring or likely to occur; and*
- *whether or not a good standard of amenity can be achieved.*

In line with the Explanatory Note of the Noise Policy Statement for England, this would include identifying whether the overall effect of the noise exposure (including the impact during the construction phase wherever applicable) is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation. As noise is a complex technical issue, it may be appropriate to seek experienced specialist assistance when applying this policy."

- 2.7 The document goes on to provide a definition for the levels of noise exposure at which an effect may occur:

"Significant observed adverse effect level (SOAEL): this is the level of noise exposure above which significant adverse effects on health and quality of life occur.

Lowest observed adverse effect level (LOAEL): this is the level of noise exposure above which adverse effects on health and quality of life can be detected.

No observed effect level (NOEL): this is the level of noise exposure below which no effect at all on health and quality of life can be detected."



2.8 A fourth effect level is also introduced:

Unacceptable Adverse Effect Level (UAEL): Extensive and regular changes in behaviour and / or an inability to mitigate the effect of noise lead to psychological stress or physical effects.

2.9 A noise exposure hierarchy is presented in the PPG-N which links the response of the noise sensitive receptors to the increasing effect levels and associated actions. The noise exposure hierarchy is summarised in **Table 2.1**.

Table 2.1: PPG(N) Noise Exposure Hierarchy

Increasing Effect Level	Response	Observed Effect	Action
Below NOEL	Not present	No effect	No specific measures
Above NOEL	Present and not intrusive	No observed effect	No specific measures
Above LOAEL	Present and intrusive	Observed adverse effect	Mitigate and reduce to a minimum
Above SOAEL	Present and disruptive	Significant observed adverse effect	Avoid
Above UAEL	Present and very disruptive	Unacceptable adverse effect	Prevent

2.10 It is important to understand that as the PPG-N does not provide any advice with respect to specific noise levels or limits for different sources of noise, it is appropriate to consider other sources of advice and guidance documents when considering whether new developments would be sensitive to the prevailing acoustic environment and the PPG-N signposts several appropriate guidance documents.

Noise Policy Statement for England (NPSE)

2.11 The National Policy Statement for England (NPSE) aims to “through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- *avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life;*
- and*



- *where possible, contribute to the improvement of health and quality of life” (Paragraph 1.8).*

ProPG: Planning & Noise

2.12 The Professional Practice Guidance on Planning and Noise (ProPG) has been produced by the Institute of Acoustics (IOA), the Association of Noise Consultants (ANC), and the Chartered Institute of Environmental Health (CIEH) to provide practitioners with guidance on the management of noise within the planning system in England.

2.13 Amongst other things, ProPG aims to:

- *“Advocate full consideration of the acoustic environment from the earliest possible stage of the development control process;*
- *encourages the process of **good acoustic design** in and around new residential developments;*
- *outline what should be taken into account in deciding planning applications for new noise-sensitive developments;*
- *promote appropriate noise exposure standards;*
- *And assist the delivery of sustainable development.” (Paragraph 1.6).*

2.14 The Guidance provides recommended approaches for new residential developments and offers recommendations to the decision maker. For example, ProPG recommends that maximum internal noise levels should not normally exceed 45 dB $L_{Amax,F}$ more than 10 times per night.

Calculation of Road Traffic Noise 1988 (CRTN)

2.15 It is common practice in the UK to assess the impacts of road traffic noise in accordance with the method prescribed in The Department for Transport document ‘Calculation of Road Traffic Noise 1988 (CRTN)’. Paragraph 1 of the introduction states that:

“These procedures are necessary to enable the entitlement under the Noise Insulation Regulations to be determined but they also provide guidance appropriate to the calculation of traffic noise for more general applications e.g. environmental appraisal of road schemes, highway design and land use planning”



2.16 Section II and Section III of CRTN outline the procedures to be followed when calculating the prediction method for future road traffic noise.

2.17 All noise levels are expressed in the terms of the index $L_{10,(T)}$ dB(A) where L_{10} is the noise level exceeded for 10% of the time period (T) expressed in decibels with an A weighting. The A weighting of sound broadly agrees with the range of human hearing.

2.18 The shortened measurement method comprises “measurement of L_{10} over any three consecutive hours between 1000 and 1700. Using L_{10} (3 hour) as the arithmetic mean of the three consecutive values of hourly L_{10} , the current value of L_{10} (18 hour) can be calculated using the formula:

$$L_{10,18 \text{ hour}} = L_{10,3 \text{ hour}} - 1 \text{ dB}$$

2.19 Chart 7 in CRTN and the associated formulae can be used to adjust the recorded / calculated sound level from road traffic with a change in distance from the source.

BS 8233:2014 and WHO Guidelines.

2.20 Guidance on absolute limits for noise inside buildings is provided in BS 8233:2014 “Sound insulation and noise reduction for buildings – Code of practice”. Similar guidance can also be found in the current World Health Organisation (WHO) “Environmental Noise Guidelines for the European Region” and the BRE / CIRIA document “Sound control for homes”. A summary of the noise criteria can be seen in **Table 2.2**.

Table 2.2: Summary of Internal Noise Criteria: BS 8233 & WHO

Criterion	Activity	Location	0700 to 2300	2300 to 0700
BS 8233:2014	Resting	Living room	35 dB $L_{Aeq,16hr}$	-
	Dining	Dining room / area	40 dB $L_{Aeq,16hr}$	-
	Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$
WHO Onset of sleep disturbance	Sleeping	Bedroom	-	30 dB $L_{Aeq,8hr}$

2.21 NOTE 4 of Section 7.7.2 in BS 8233:2014 states: Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance.



A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values. WHO recommends that noise due to individual events ($L_{MAX,F}$) should not exceed the 45 dB(A) threshold more than 10 to 15 times a night.

- 2.22 Regarding noise levels in outside amenity areas, Section 7.7.3.2 Design criteria for external noise BS 8233:2014 states that:

“For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external 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. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.”

- 2.23 Regarding the prediction of noise levels from road traffic noise, the $L_{A10,18hr}$ can be corrected to $L_{Aeq,16hr}$ by subtracting 2 dB from the $L_{A10,18hr}$ (BS 8233 paragraph 6.2.2. $L_{Aeq,16hr} = L_{A10,18hr} - 2dB$).
- 2.24 The night time noise level, $L_{Aeq,8hr}$ can be calculated from $L_{A10,18hr}$ using the conversion formula in TRL document “*Converting the UK traffic noise index $L_{A10,18hr}$ to EU noise indices for noise mapping*”.
- 2.25 Guidelines for external noise levels in public and private open space, such as gardens and parks, is also available in the WHO guidelines. According to the WHO guidelines, during the daytime ($L_{eq,16hr}$), moderate annoyance may be experienced at noise levels between 50 dB(A) and 55 dB(A) and serious annoyance may be experienced above 55 dB(A).
- 2.26 During the night-time ($L_{eq,8hr}$), an interim target (IT) level of 55 dB(A) is recommended (from WHO Night Noise Guidelines for Europe – 2009). The 55 dB(A) is the lowest observed adverse effect level (LOAEL).



- 2.27 However, it should be noted that the WHO Guidelines for Community Noise – 1999 recommend an external night-time noise level of 45 dB(A) ($L_{eq,8hr}$) in relation to the reduction in noise level through an open window to achieve an internal noise level in bedrooms of 30 dB.

BS 5228-1: 2009+A1: 2014

- 2.28 Within BS 5228 “*Code of practice for noise and vibration control on construction and open sites – Part 1: Noise*” a method for predicting noise from construction activity is provided. It is the accepted Standard employed for the assessment of noise and vibration from construction sites.

- 2.29 The Standard also provides a framework for good working practice and guidance on methods of mitigating noise by employing a number of different techniques.

- 2.30 Annex E of BS 5228 outline three approaches to the assessment of significance of noise effects which are:

- i) Significance based on fixed noise limits. Noise levels should not exceed 70 dB(A) in rural, suburban and urban areas away from main road traffic and industrial noise, or 75 dB(A) in urban areas near main roads in heavy industrial areas;

- ii) Significance based on noise change – method 1. Noise levels should not exceed thresholds determined from existing ambient noise levels using the “ABC Method”:

A - 65 dB (daytime) when ambient noise levels (when rounded to the nearest 5 dB) are less than this value,

B - 70 dB (daytime) when ambient noise levels (when rounded to the nearest 5 dB) are the same as the category A value,

C - 75 dB (daytime) when ambient noise levels (when rounded to the nearest 5 dB) are higher than the category A value.

- iii) Significance based on noise change – method 2. Construction noise levels are deemed to be significant if the total noise (ambient + construction) exceeds the pre-construction ambient noise level by 5 dB or more, subject to the lower cut-off value of 65 dB (daytime).



Design Manual for Roads and Bridges (DMRB)

Magnitude of Impacts

- 2.31 Whilst DMRB is principally used for the assessment of the environmental impacts of roads it provides a useful method for considering the noise impacts of traffic generation onto the existing highway network from new development. DMRB includes a semantic scale for the classification of the magnitude of noise impacts following the completion of a consented development. This is a useful tool for assessing noise impacts. The scale is shown in **Table 2.3**.

Table 2.3: Classification of Magnitude of Noise Impacts in the Short Term

Noise change, $L_{A10,18\text{hour}}$	Magnitude of Impact
0.0	No change
0.1 – 0.9	Negligible
1.0 – 2.9	Minor
3.0 – 4.9	Moderate
5.0+	Major

- 2.32 The changes in noise level and the magnitude of impact presented in Table 2.3 are used to assess the daytime period. At the time of writing this report, DMRB recommends using the 'classification of magnitude of noise impacts in the long term' for the assessment of night time noise levels. The 'long term' scale is shown in **Table 2.4**.



Table 2.4: Classification of Magnitude of Noise Impacts in the Long Term

Noise change, $L_{A10,18\text{hour}}$	Magnitude of Impact
0	No change
0.1 – 2.9	Negligible
3 – 4.9	Minor
5 – 9.9	Moderate
10+	Major

- 2.33 Also recommended in DMRB is the assessment of night time noise levels at sensitive receptors with an $L_{\text{night, outside}}$ exceeding 55 dB (until further research is available). The $L_{\text{night, outside}}$ 55 dB corresponds to the Interim Target level specified in the WHO Night Noise Guidelines for Europe.

Significance of Effects

- 2.34 Once the magnitude of impact is determined, the next step is to assess the significance of the effect. A commonly used method for the definition of the sensitivity of receptors is reproduced in **Table 2.5**.



Table 2.5: Criteria Used to Define Noise Sensitive Receptors (Watts, 1984³)

Sensitivity	Description	Examples of receptor use
High	Receptors where people or operations are particularly susceptible to noise	- Residential, - Quiet outdoor areas used for recreation, - Conference facilities, - Auditoria / studios, - Schools in the daytime, - Hospitals / residential care homes, - Religious institutions, e.g. churches, mosques.
Medium	Receptors moderately sensitive to noise, where it may cause some distraction or disturbance	- Offices, - Restaurants, - Sports grounds when spectator noise is not a normal part of the event and where quiet conditions are necessary, e.g. tennis, golf.
Low	Receptors where distraction or disturbance from noise is minimal	- Residences and other buildings not occupied during working hours, - Factories and working environments with existing high noise levels, - Sports grounds when spectator noise is a normal part of the event.

2.35 Based on the advice provided in HA 205/08 (DMRB) a matrix of 'overall level of significance' has been produced using the magnitude of change (Table 2.3 and Table 2.4), the sensitivity of the receptor (Table 2.5) and the significance of the effect and is presented in **Table 2.6**.

Table 2.6: Significance of Noise Effects

Magnitude of Impact	Sensitivity of receptor/resource		
	Low	Medium	High
Major	Slight / moderate	Moderate / large	Large / very large
Moderate	Slight	Moderate	Moderate / large
Minor	Neutral / slight	Slight	Slight
Negligible	Neutral / slight	Neutral / slight	Slight
No Change	Neutral	Neutral	Neutral

³ Watts, G R, (1984) *Vibration nuisance from road traffic – results of a 50 site survey*, TRL Research Report 1119, Transport Research Laboratory, Department of Transport, Crowthorne.



- 2.36 The cells within Table 2.6 which are shaded grey are considered to be significant effects and mitigation may be required. The remainder of the cells in Table 2.6 are an indication of the significance of effects below the significance threshold.

Local Policy: Mid Sussex District Council

- 2.37 Current local policy for Handcross is presented in the adopted District Plan (adopted March 2018) which covers the period up to 2031. At the time of undertaking the air quality assessment, the District Plan was under review and was submitted for Examination on 8th July 2024. Within the adopted District Plan Policy DP29 specifically relates to noise. For ease of reference, the Policy is reproduced below.

DP29: Noise, Air and Light Pollution

“Strategic Objectives: 3) To protect valued landscapes for their visual, historical and biodiversity qualities; and 12) To support sustainable communities which are safe, healthy and inclusive.

Evidence Base: Data held by Environmental Health, Air Quality Action Plan – Stonepound Crossroads, Hassocks.

The environment, including nationally designated environmental sites, nationally protected landscapes, areas of nature conservation or geological interest, wildlife habitats, and the quality of people’s life will be protected from unacceptable levels of noise, light and air pollution by only permitting development where:

Noise pollution:

- It is designed, located and controlled to minimise the impact of noise on health and quality of life, neighbouring properties and the surrounding area;
- If it is likely to generate significant levels of noise it incorporates appropriate noise attenuation measures;

Noise sensitive development, such as residential, will not be permitted in close proximity to existing or proposed development generating high levels of noise unless adequate sound insulation measures, as supported by a noise assessment are incorporated within the development.

In appropriate circumstances, the applicant will be required to provide:



- an assessment of the impact of noise generated by a proposed development; or
- an assessment of the effect of noise by an existing noise source upon a proposed development;

Light pollution:

- The impact on local amenity, intrinsically dark landscapes and nature conservation areas of artificial lighting proposals (including floodlighting) is minimised, in terms of intensity and number of fittings;
- The applicant can demonstrate good design including fittings to restrict emissions from proposed lighting schemes;

Air Pollution:

- It does not cause unacceptable levels of air pollution;
- Development on land adjacent to an existing use which generates air pollution or odour would not cause any adverse effects on the proposed development or can be mitigated to reduce exposure to poor air quality to recognised and acceptable levels;
- Development proposals (where appropriate) are consistent with Air Quality Management Plans.

The degree of the impact of noise and light pollution from new development or change of use is likely to be greater in rural locations, especially where it is in or close to specially designated areas and sites.”

Target Noise Levels

Constraints on the Proposed Development

2.38 In line with the guidance documents outlined above, the target noise levels for the proposed development are as follows:

- External noise levels within gardens and public spaces be within or below the range 50 dB to 55 dB $L_{Aeq,16hr}$;
- Internal noise levels within habitable rooms (living rooms and bedrooms) should not exceed 35 dB $L_{Aeq,16hr}$ during the daytime and 30 dB $L_{Aeq,8hr}$ during the night-time; and



- Internal noise levels within bedroom should also not normally exceed 45 dB L_{AFmax} more than 10 to 15 times during the night-time.



3.0 METHODOLOGY

- 3.1 This section describes the approach to assessing the noise constraints and likely noise and vibration impacts from the construction and operation of the Proposed Development. Impacts from construction activities have been determined for the Base year.
- 3.2 The assessment has been completed based on the Illustrative Site Layout submitted in support of the Planning Application (refer to Appendix 1 for a copy of the Illustrative Site Layout).
- 3.3 The assessment has been carried out in line with the guidance on noise contained within the NPPF, the accompanying PPG on Noise (PPG-N), and the NPSE for England.
- 3.4 It is important to understand that as the PPG-N does not provide any advice with respect to specific noise levels or limits for different sources of noise, it is appropriate to consider other sources of advice and guidance documents when considering whether new developments would be sensitive to the prevailing acoustic environment and the PPG-N signposts several appropriate guidance documents.
- 3.5 The Professional Practice Guidance on Planning and Noise (ProPG) has been produced by the Institute of Acoustics (IOA), the Association of Noise Consultants (ANC), and the Chartered Institute of Environmental Health (CIEH) to provide practitioners with guidance on the management of noise within the planning system in England.
- 3.6 The Guidance provides recommended approaches including 'good acoustic design' for new residential developments and offers recommendations to the decision maker. For example, ProPG recommends that maximum internal noise levels should not normally exceed 45 dB $L_{Amax,F}$ more than 10 times per night.
- 3.7 The basic outline methodology employed is detailed below:
- Utilise noise measurements and SoundPLAN noise model to establish the Baseline noise profile of the site;
 - Determine the constraints on proposed sensitive receptors with respect to noise standards and objectives discussed in Section 2.0;



- Determine the impacts from construction activities on local receptors using BS 5228;
- Determine the impacts from development generated on local receptors; and
- Where necessary, propose a noise mitigation strategy.

Enabling and Construction Works

- 3.8 A 'worst case' scenario for the noise and vibration impacts from construction activities has been assessed using the method detailed in BS 5228 and the principles in DMRB.
- 3.9 The following construction phase scenarios have been considered with regards to impacts on existing receptors:
- 2026 Start on Site Year.

Completed Development

- 3.10 With regards to operational road traffic, predicted flows have been distributed onto London Road and the broader highway network. The traffic flow data which underpins the assessment, and the predicted results, have been provided by the Transport Consultants (i-Transport).
- 3.11 The following assessment years have been used to determine the impacts of the Proposed Development on existing receptors:
- 2029 Future Baseline (without Proposed Development 'Do Nothing'); and
 - 2029 Proposed Development opening year ('Do Something').
- 3.12 The 2029 assessment year includes committed development traffic flows on the assessment network.
- 3.13 Regarding the prediction of noise levels from road traffic noise, the $L_{A10,18hr}$ can be corrected to $L_{Aeq,16hr}$ by subtracting 2 dB from the $L_{A10,18hr}$ (BS 8233 paragraph 6.2.2. $L_{Aeq,16hr} = L_{A10,18hr} - 2dB$).
- 3.14 The night time noise level, $L_{Aeq,8hr}$ can be calculated from $L_{A10,18hr}$ using the conversion formula in TRL document "*Converting the UK traffic noise index LA10,18hr to EU noise indices for noise mapping*".



- 3.15 Guidelines for external noise levels in public and private open space, such as gardens and parks, is also available in the WHO guidelines. According to the WHO guidelines, during the daytime ($L_{eq,16hr}$), moderate annoyance may be experienced at noise levels between 50 dB(A) and 55 dB(A) and serious annoyance may be experienced above 55 dB(A).
- 3.16 During the night-time ($L_{eq,8hr}$), an interim target (IT) level of 55 dB(A) is recommended (from WHO Night Noise Guidelines for Europe – 2009). The 55 dB(A) is the lowest observed adverse effect level (LOAEL).
- 3.17 However, it should be noted that the WHO Guidelines for Community Noise – 1999 recommend an external night-time noise level of 45 dB(A) ($L_{eq,8hr}$) in relation to the reduction in noise level through an open window to achieve an internal noise level in bedrooms of 30 dB.
- 3.18 The resultant changes in noise levels at sensitive receptors due to Proposed Development generated traffic is assessed against the magnitude of impacts from the DMRB in relation to the sensitivity of the receptor resulting in a significance of effect. Where required, appropriate mitigation will be recommended.
- 3.19 The assessment has determined noise levels on the ground and first floors of the receptors and, where relevant, on multiple facades of the receptors to determine how noise levels would vary and how different parts of the receptors would be affected.



4.0 EXISTING NOISE PROFILE

- 4.1 To determine the existing noise profile of the Site, a combination of noise monitoring and noise modelling has been used. Presented below are the results of the noise survey which was undertaken over 24 hours starting on 27 April 2026 and the noise modelling of the base year 2026. Refer to **Figure 4.1** for the monitoring location.



Figure 4.1: Noise Monitoring Location – April 2026

Noise Level Survey

- 4.2 The existing noise profile of the development site was established by modelling and measurement which utilised the environmental noise measurement method detailed in British Standard 7445:1991. Sound levels were recorded with an 'A' weighting. Where relevant, the ambient ($L_{eq,T}$), maximum ($L_{max,T}$), background ($L_{90,T}$) and 10th percentile ($L_{10,T}$) were recorded.



- 4.3 The sound level meter's (SLM) microphone was mounted at grazing incidence at an appropriate height above ground level. The SLM was calibrated before and after the measurement periods using an acoustic calibrator. The acoustic calibrator was set to 94 dB at a frequency of 1000 Hertz.
- 4.4 In accordance with BS 7445, the weather conditions during the noise survey were recorded. There were no adverse weather conditions which could significantly affect the results of the noise survey.

Equipment Used

- 4.5 The equipment used during the field measurements on site are listed in **Table 4.1**. The SLM and acoustic calibrator have been calibrated at an UKAS accredited centre (certificates available on request).

Table 4.1: Equipment Used During the Field Measurements

Equipment	Type	Serial Number
Sound Level Meter	Brüel and Kjær Type 2250 Light	3004648
Microphone	Brüel and Kjær Type 4950	2913913
Calibrator	Brüel and Kjær Type 4321	2388830
Anemometer/thermometer	Kestrel 2000	449331
Tripod	Star 62 – 1.5 metre	

Results from the Monitoring

- 4.6 The SLM was setup at 13:00 on 27 April 2026. The survey ended at 13:00 on 28 April 2026. Presented in **Table 4.2** is a summary of the results from the measurements.

Table 4.2: Summary of Recorded Noise Levels at SLM1 (April 2026)

Measurement Location	Time	Ambient Noise Level ($L_{Aeq,T}$)	Maximum Noise Level ($L_{Amax,T}$)	10 th Percentile Noise Level ($L_{A10,T}$)	Background Noise Level ($L_{A90,T}$)
SLM1	Monday 27 th April 2026				
	Day	60.4	90.6 (09:03)	57.2	53.4
	Night	51.3	69.5 (06:48)	NA	42.7



Noise Modelling

Development Site

- 4.7 To determine the noise profile of the development site, noise levels across the site have been calculated using SoundPLAN. The proposed site layout, road traffic flows and LiDAR data have been used to predict the noise levels and produce noise contour plots for the development site. The noise levels are adjusted from $L_{A10,18hr}$ to $L_{Aeq,16hr}$ and $L_{Aeq,8hr}$ using the conversion formula detailed in the TRL document “Converting the UK traffic noise index $L_{A10,18hr}$ to EU noise indices for noise mapping”.
- 4.8 The results are presented on **Figure 4.2** (daytime 0700 to 2300) and **Figure 4.3** (night time 2300 to 0700).

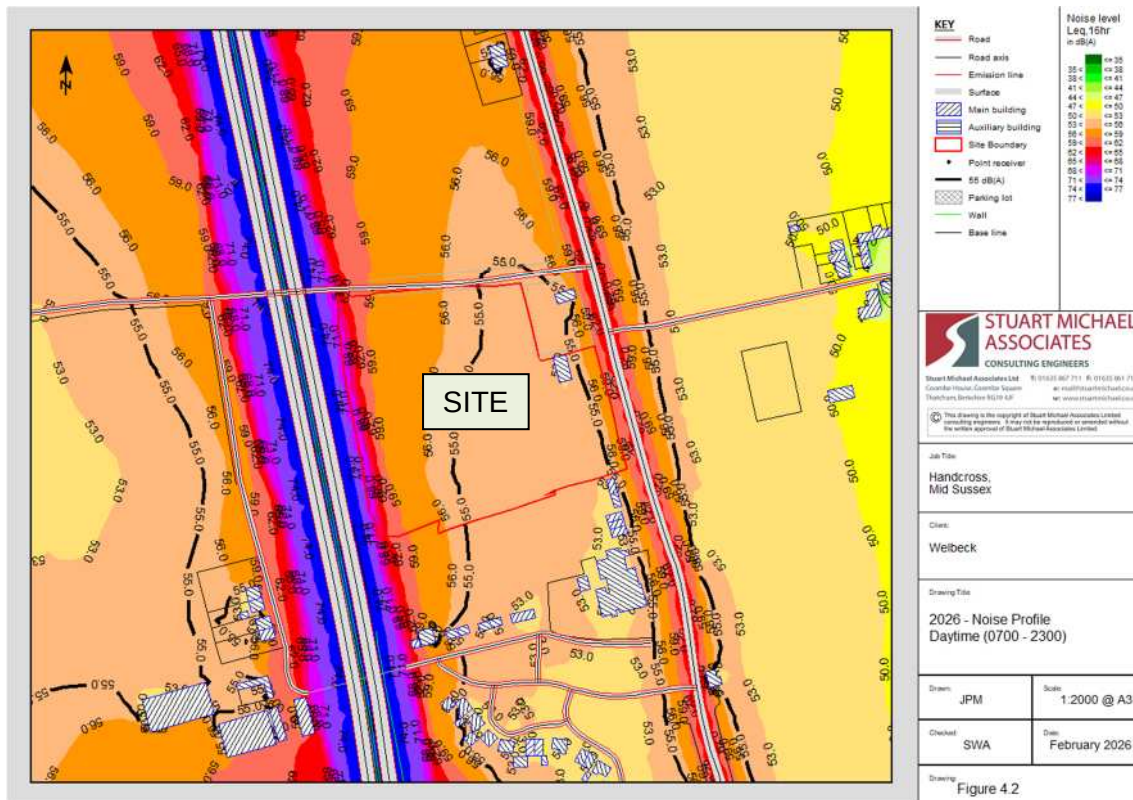


Figure 4.3: Daytime Noise Profile – 2026

- 4.9 During the daytime, the western part of the Site is above 55 dB $L_{Aeq,16hr}$ (refer to Section 2) and a commensurate level of mitigation is required.

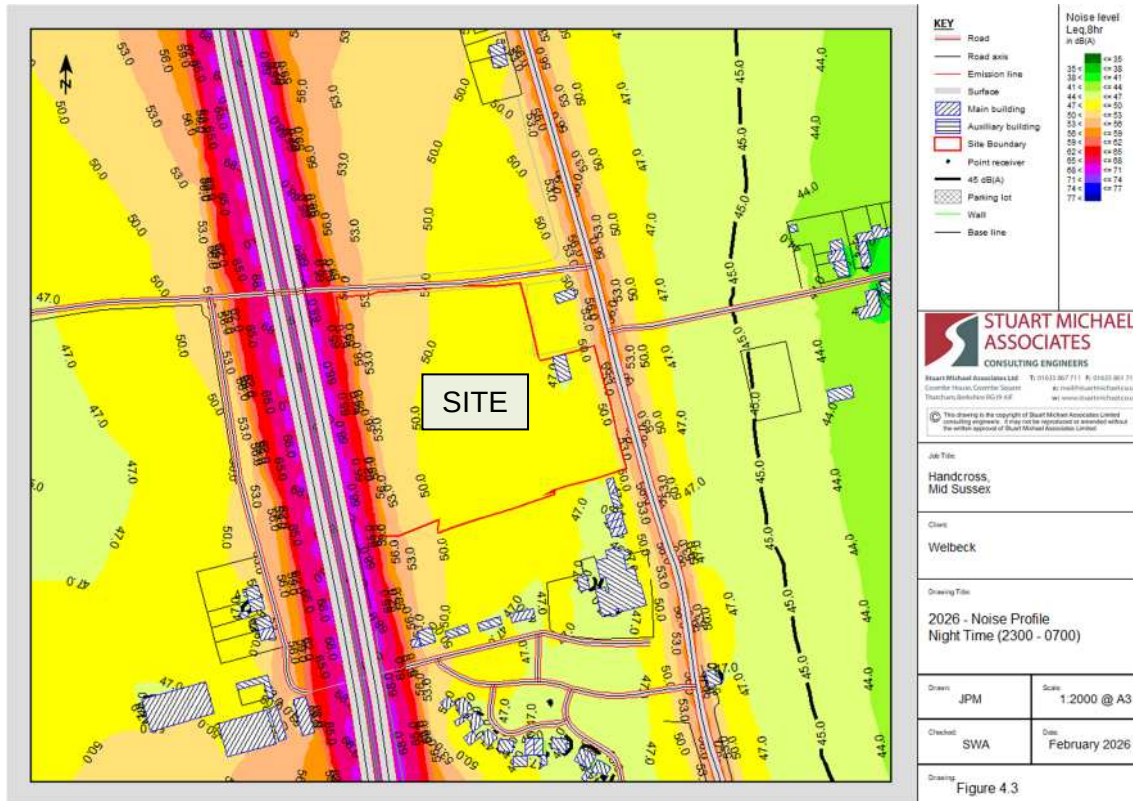


Figure 4.3: Night Time Noise Profile – 2026

- 4.10 During the night time, the whole of the Site is above 45 dB $L_{Aeq,8hr}$ (refer to Section 2) and a commensurate level of mitigation is required.

Sensitive Receptors

- 4.11 Existing façade noise levels have been calculated using the modelling software SoundPLAN which utilises the method detailed in CRTN. Road traffic data for the local highway network has been obtained from the DfT website, WebTRIS and the Transport Consultants. Where traffic data was not available for the 18-hour period used in the traffic noise modelling, locally derived factors have been utilised to convert the available traffic flows to 18-hour flows.
- 4.12 Receptors sensitive to changes in noise levels from road traffic have been identified to the north and south of the site access on London Road. Further afield on the highway network the impacts will be less due to traffic distribution at junctions. Therefore, the chosen receptors represent a 'worst case' for noise impacts. The receptor locations are provided on **Figure 4.4**.

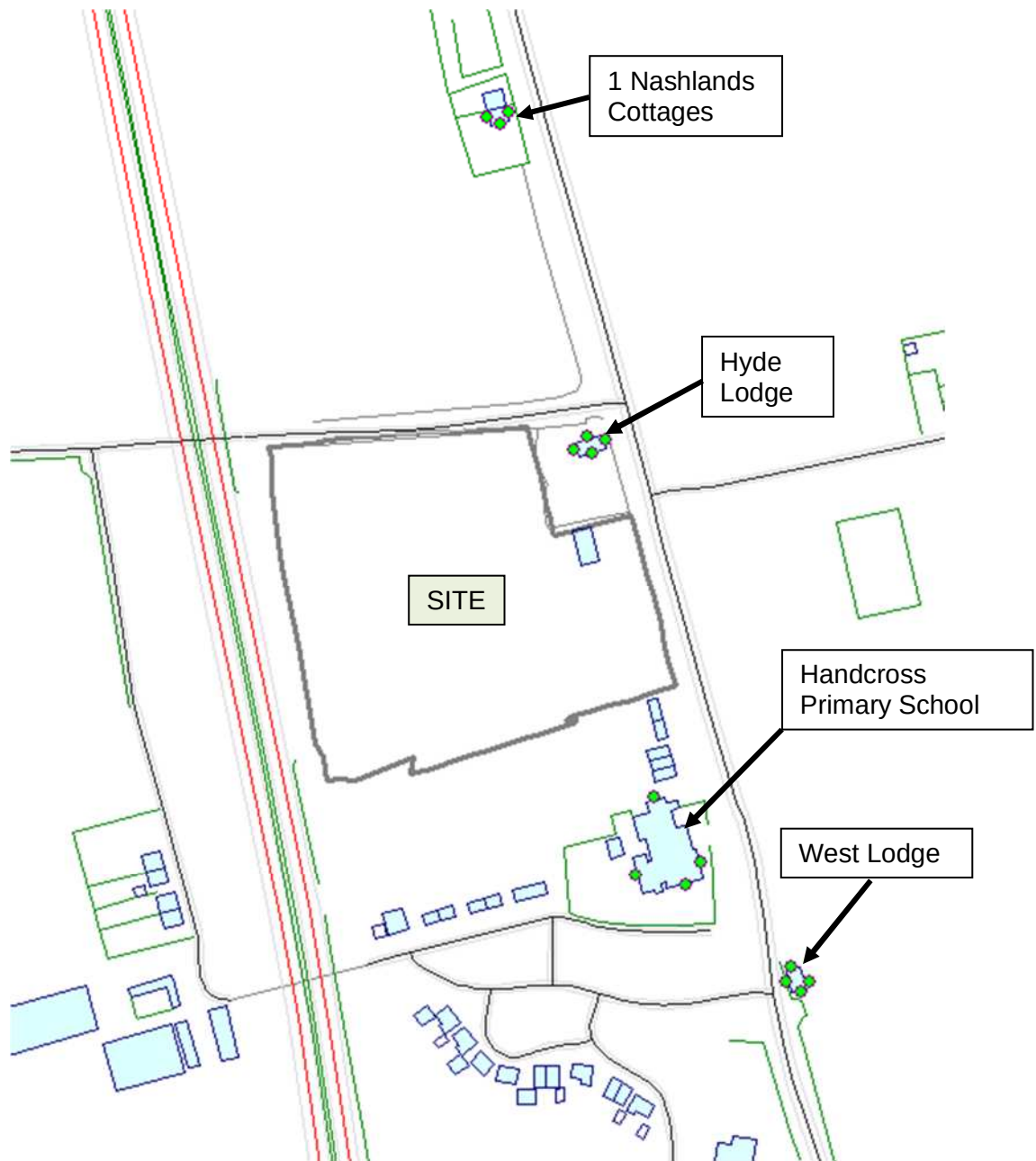


Figure 4.4: Sensitive Receptor Locations

4.13 The results from the noise modelling of the 'Existing' situation are presented in **Table 4.3.**



Table 4.3: Façade Noise Levels outside the Development for the 'Existing' Situation

Receptor Location	Floor Level	Façade Direction	'Existing' situation	
			Daytime L _{eq,16hr} dB(A)	Night Time L _{eq 8hr} dB(A)
1 Nashlands Cottages	GF	E	60	54
1 Nashlands Cottages	F 1	E	62	56
1 Nashlands Cottages	GF	S	57	50
1 Nashlands Cottages	F 1	S	59	53
1 Nashlands Cottages	GF	W	57	51
1 Nashlands Cottages	F 1	W	59	52
Handcross Primary School	GF	S	55	49
Handcross Primary School	GF	E	57	51
Handcross Primary School	GF	W	55	48
Handcross Primary School	GF	N	55	49
Hyde Lodge	GF	N	58	51
Hyde Lodge	F 1	N	59	53
Hyde Lodge	GF	E	60	54
Hyde Lodge	F 1	E	62	56
Hyde Lodge	GF	W	56	50
Hyde Lodge	F 1	W	57	51
Hyde Lodge	GF	S	56	50
Hyde Lodge	F 1	S	58	52
West Lodge	GF	S	58	52
West Lodge	GF	W	64	57
West Lodge	GF	E	53	46
West Lodge	GF	N	60	53
Key: GF = ground floor; F 1 = first floor; N = north; S = south; E = east and W = west				

4.14 From Table 4.3 it can be seen that buildings outside of the development experience noise levels between 55 dB and 64 dB at ground floor and between 57 dB and 62 dB at first floor level during the daytime and between 51 dB and 56 dB at first floor level during the night time.

Constraints

4.15 Using the results of the SoundPLAN noise modelling, the future noise levels across the site are assessed against the WHO and BS 8233 for internal noise levels and local noise policy.

4.16 From analysing the 'Existing' noise profile of the site, the levels across site from traffic traveling on the A23 and the broader highway network are above 55 dB in



the western part of the site during the daytime and above 45 dB across the whole site during the night time.

- 4.17 Therefore, a commensurate level of mitigation is required to achieve daytime internal and external noise levels and night time noise levels in bedrooms.



5.0 NOISE ASSESSMENT

- 5.1 A 'good' acoustic design process firstly explores other methods of mitigating noise which does not wholly rely on using the building envelope. Presented in **Table 5.1** is the feasibility of the suggested mitigation measures for the site as recommended in ProPG Planning and Noise.

Table 5.1: Analysis of noise mitigation measures as part of a 'good' acoustic design process

Mitigation Method	Analysis
Maximising the spatial separation of noise source(s) and receptor(s)	The development area is set back from the A23 as much as is practicably possible within the Site
Investigating the necessity and feasibility of reducing existing noise levels and relocating existing noise sources	Reducing road traffic or relocating the noise source is not possible in this instance
Using existing topography and existing structures (that are likely to last the expected life of the noise-sensitive scheme) to screen the proposed development site from significant sources of noise	There are no existing buildings between the noise source (A23). Adjacent to the site, the A23 is in cutting and the existing topography is included in the noise modelling
Incorporating noise barriers as part of the scheme to screen the proposed development site from significant sources of noise	No purpose-built noise barrier is proposed at this site
Using the layout of the scheme to reduce noise propagation across the site	The juxtaposition of proposed buildings will provide a reduction in sound propagation across the site. Having rear gardens facing away from the noise source will be beneficial and help reduce noise in these areas. In the "shadow zone", sound levels can be reduced by 10 dB or more
Using the orientation of buildings to reduce the noise exposure of noise sensitive rooms	As far as practicably possible, noise sensitive rooms will be orientated away from the A23
Using the building envelope to mitigate noise to acceptable levels	See the following section

- 5.2 The results of the noise measurements and baseline modelling demonstrate that daytime noise levels are above 55 dB(A) $L_{eq,16hr}$ in the western part of the site and night time noise levels are above 45 dB(A) $L_{eq,8hr}$ across the whole site. Therefore, to achieve noise levels below the internal and external noise levels presented in



the WHO guidelines, BS 8233:2014 and local planning policy a commensurate level of mitigation is required.

- 5.3 Internal noise levels of any habitable room during the night time period should not exceed 30 dB to comply with BS 8233:2014 and the Local Authority's guidance.



6.0 EFFECTS OF THE PROPOSALS DURING CONSTRUCTION

Effect of Construction Noise on Nearby Sensitive Receptors

6.1 The magnitude of construction noise impacts can be predicted by considering noise emissions data for typical construction equipment based on the expected methods of construction for each phase of work on each worksite. The prediction method follows that recommended in BS 5228 Noise and Vibration Control on Construction and Open Sites, Part 1:2009+A1:2014.

6.2 The guidance contained in BS 5228 does not extend to provide criteria against which to assess construction noise. However, the Department of Environment (DoE) Advisory Leaflet (AL) 72 (1976) "Noise Control on Building Sites" gives advice on the maximum levels of construction site noise at residential locations during daytime hours based on levels associated with speech interference. This publication states that during daytime hours (07:00 to 19:00 hours) the L_{Aeq} noise level at the building façade should not exceed:

- 75 dB in urban areas, near main roads or in heavy industrial areas: and
- 70 dB in rural, suburban and urban areas away from main road traffic and industrial noise.

6.3 During construction the potential impact from activities within the site has been assessed using the "ABC" method described in BS 5228. At this stage, the timetable for construction and landscaping is not known. An approximation has been made as to what type of plant will be used for each year / phase. The closest existing residential properties are to the northeast and south of the site.

6.4 An assessment has been undertaken using generic construction machinery and operation at distances from 23.5 to 216.9 metres from the noise source. The construction noise assessment is presented in **Appendix 2** and the results are summarised on the following page.

6.5 Six 'Sensitive Receptors' near to the Site have been assessed:

- R1: 10 London Road (residential) which is 23.5m southeast of Site activities;
- R2: Hyde Lodge (residential) which is 26.4m northeast of the Site activities;

- R3: Handcross Primary School which is 79.6m southeast of the Site activities;
- R4: Meadow Cottage (residential) which is 92.9 m south of the Site activities;
- R5: 14 Hoadlands Cottages (residential) which is 179.5m southwest of the Site activities; and
- R6: 10 College Close (residential) which is 216.9m east of the Site activities.

6.6 Refer to **Figure 6.1** for the locations of the receptors. According to the BS 5228 'ABC' method, the daytime ($L_{Aeq,16hr}$) façade threshold of significance at the six receptors is 65 dB(A) due to the noise levels being 60 dB when rounded to the nearest 5 dB (refer to Table 4.3 for 2026 noise levels).



Figure 6.1: Construction Noise Sensitive Receptors Location Plan

6.7 The results from the 'Construction' noise calculations and the BS 5228 threshold of significance at the nearest location (worst-case scenario) for each receptor are summarised in **Table 6.1**.



Table 6.1: Construction Noise Levels at Sensitive Receptors (No Mitigation)

Receptor Number	Receptor Location (distance from site in metres)	Existing Ambient dB(A)	Predicted Noise level dB(A)				BS 5228 Threshold of Significance dB(A)
			Site Preparation	Earthworks	Construction	Landscaping	
R1	23.5	54	68	70	71	69	65
R2	26.4	54	67	69	70	69	65
R3	79.6	52	58	60	61	60	65
R4	92.9	53	61	62	60	59	65
NA	100	54	61	62	59	58	65
R5	179.5	60	50	61	61	61	65
R6	216.9	50	52	53	61	53	65

6.8 Noise from some construction activities will be audible at the nearest sensitive receptor locations and the calculations indicate that site preparation, earthworks, construction and landscaping noise impacts are approaching the threshold of significance and may be significant for a short period of time. However, if Best Practical Means (BPM) is implemented then noise impacts can be minimised.

6.9 Presented in **Table 6.2** are the predicted noise levels following the implementation of BPM.

Table 6.2: Construction Noise Levels at Sensitive Receptors (After Mitigation)

Receptor Number	Receptor Location (distance from site in metres)	Existing Ambient dB(A)	Predicted Noise level dB(A)				BS 5228 Threshold of Significance dB(A)
			Site Preparation	Earthworks	Construction	Landscaping	
R1	23.5	54	59	61	62	60	65
R2	26.4	54	59	60	61	60	65
R3	79.6	52	53	54	54	54	65
R4	92.9	53	54	54	55	54	65
NA	100	54	54	54	54	54	65
R5	179.5	60	60	60	60	60	65
R6	216.9	50	50	50	51	50	65

6.10 As shown in Table 6.2, applying BPM would reduce the impacts from the earthworks and construction activities and results in 'Negligible' significance



effect to a negligible magnitude of impact at all receptors due to construction activities.

- 6.11 It should be noted that construction activities are temporary, and people are generally more tolerant of higher noise levels if they know they are only going to be of a temporary duration, although they do present direct effects on the sensitive receptors.



7.0 EFFECTS OF THE PROPOSALS POST-CONSTRUCTION

Introduction

- 7.1 To consider the effects of the proposals during the operational phase it is necessary to split the assessment into constraints and impacts. As mentioned previously constraints deal with the effect of the existing environment on the development and impacts deal with the effect of the development on the existing environment.
- 7.2 The internal noise levels of the proposed residential development have been assessed by using calculated façade noise levels with the mitigation from both a closed window and an open window in the façade. The resultant internal noise levels have been assessed against British Standards and WHO guidelines.
- 7.3 External noise levels in the amenity areas have been calculated including the mitigation provided by the proposed residential buildings. The resultant external noise levels have also been assessed against British Standards and WHO guidelines.
- 7.4 It should be noted that to establish potential façade noise levels within the development site, an Illustrative Site Layout (refer to Appendix 1) has been used to locate the dwellings. The Illustrative Site Layout is not the final proposal, but the final layout is expected to follow the parameters plan.

Constraints

- 7.5 The constraints of the proposal post-construction on sensitive receptors within the development have been examined. The constraints are assessed at sensitive receptors at the approximate location of proposed dwellings within the development site.
- 7.6 The SoundPLAN model has been used to predict the daytime and night time noise levels with the development in place. From the results, noise levels across the site are determined and assessed against current guidelines and British Standards. The noise levels for road traffic are adjusted from an $L_{A10,18hr}$ to $L_{Aeq,16hr}$ and $L_{Aeq,8hr}$ using the conversion formula in the TRL document "*Converting the UK traffic noise index $L_{A10,18hr}$ to EU noise indices for noise mapping*".
- 7.7 An 'Illustrative Site Layout' (refer to Appendix 1) has been used to establish the approximate location of the proposed buildings and the daytime and night time



noise profiles of the development area are provided on **Figure 7.1** and **Figure 7.2** respectively. As with Figure 4.2 and Figure 4.3 the contour plots are displayed as 5 dB coloured bands with a key in the top right-hand corner.

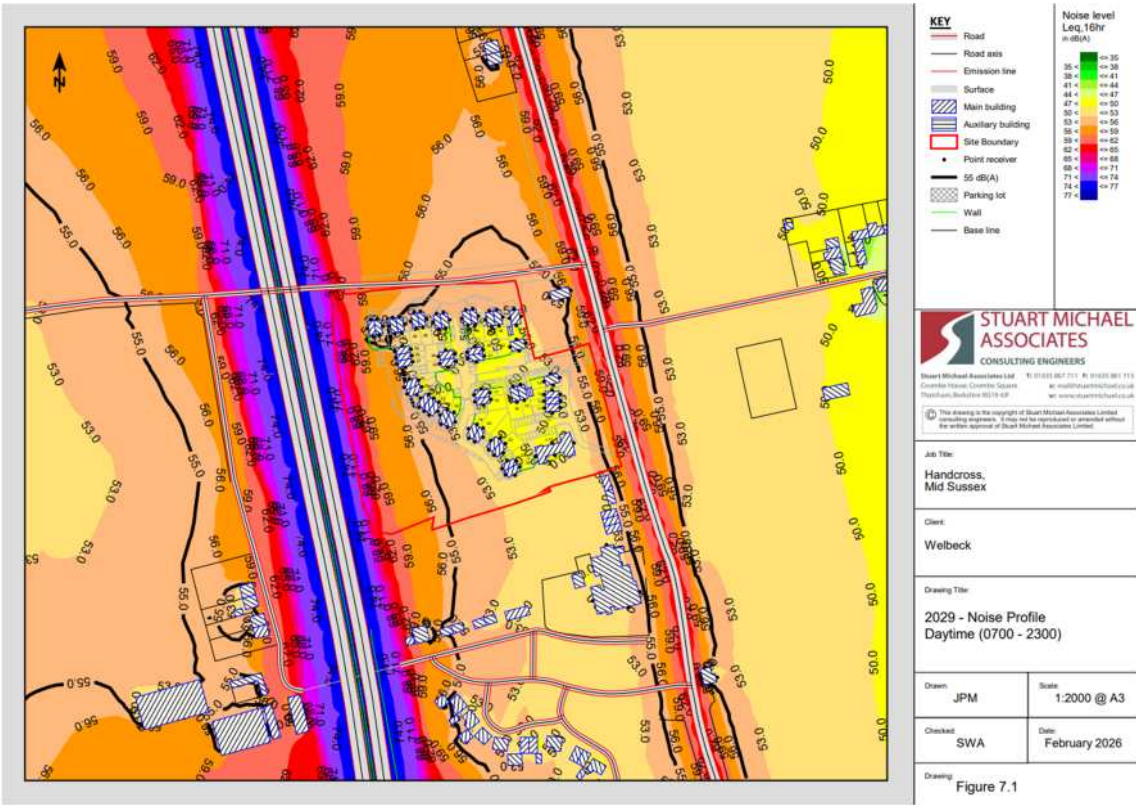


Figure 7.1: Daytime Noise Profile + Development

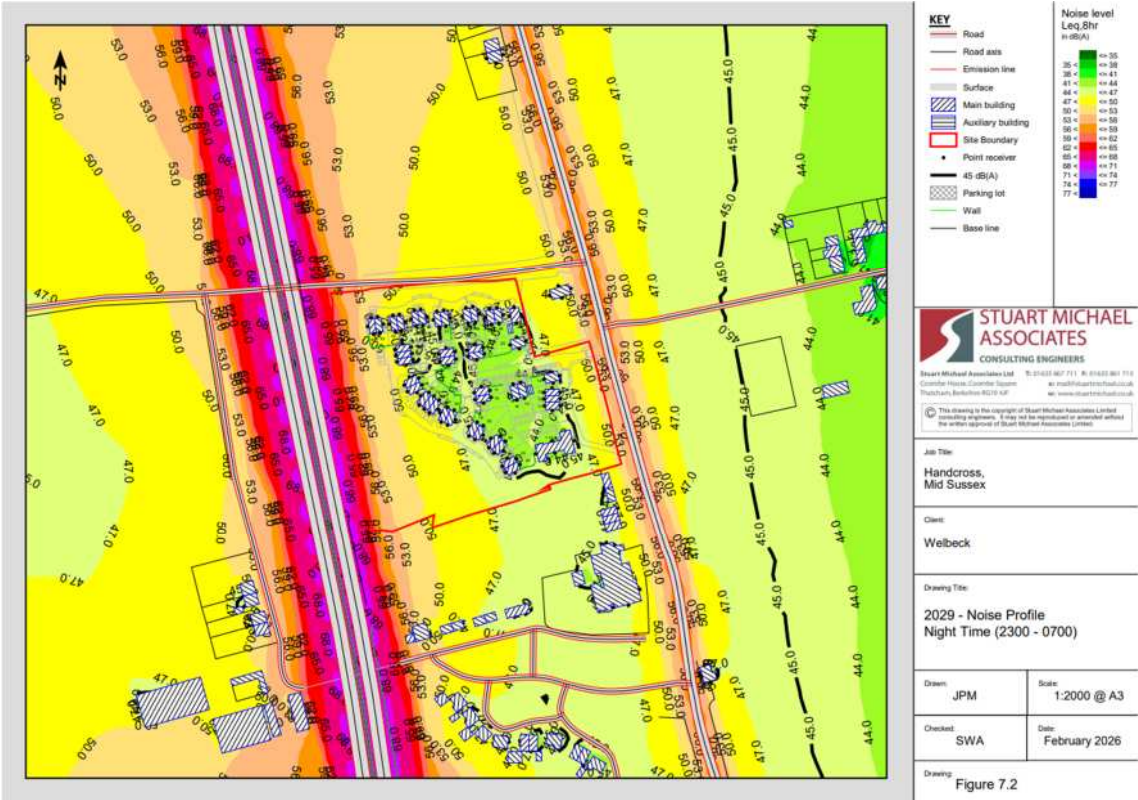


Figure 7.2: Night time Noise Profile + Development

7.8 This section of the report has been split into two sections. The first section addresses the predicted façade noise levels at the proposed dwellings and the second section addresses the predicted free field noise levels with the proposed buildings in place.

Façade Noise Levels

7.9 All façades at the approximate locations of the proposed dwellings which are illustrated on the “Illustrative Site Plan” (refer to Appendix 1) have been modelled within SoundPLAN. The Illustrative Development receptors are presented in Figure 7.3.



Figure 7.3: Illustrative Development Receptors

7.10 All the façades indicated in Figure 7.3 have been modelled within SoundPLAN and maximum and minimum results are presented in the following tables. A full set of modelling results are presented in **Appendix 3**. The development has been split into: North, South, East, West, Southwest and Centre.

North

7.11 Predicted façade noise levels at Plots 37 to 43 and 46 to 49 are presented in **Table 7.1**.



Table 7.1: Illustrative Development Maximum and Minimum Façade Noise Levels – Plots 37 to 43 and 46 to 49

Plot Number	Floor Level	Lday		Lnight	
		Min	Max	Min	Max
37 to 43	GF	51	59	45	52
	F 1	53	61	47	55
46 to 49	GF	50	57	44	50
	F 1	52	58	46	51
Key: GF = ground floor; F 1 = first floor					

7.12 With reference to Table 7.1, daytime noise levels are predicted to be between 50 dB and 59 dB at ground floor level and between 52 dB and 61 dB at first floor level.

7.13 During the night time, first floor façade noise levels are predicted to be between 46 and 55 dB.

South

7.14 Predicted façade noise levels at Plots 1 to 10 and 24 are presented in **Table 7.2**.

Table 7.2: Illustrative Development Maximum and Minimum Façade Noise Levels – Plots 1 to 10 and 24

Plot Number	Floor Level	Lday		Lnight	
		Min	Max	Min	Max
1 to 10	GF	51	53	45	47
	F 1	53	55	47	48
24	GF	49	55	42	48
	F 1	51	56	45	49
Key: GF = ground floor; F 1 = first floor					

7.15 With reference to Table 7.2, daytime noise levels are predicted to be between 49 dB and 55 dB at ground floor level and between 51 dB and 56 dB at first floor level.

7.16 During the night time, ground floor first floor façade noise levels are predicted to be between 42 and 48 dB and between 45 dB and 49 dB at first floor level.



East

- 7.17 Predicted façade noise levels at Plots 11 to 14, 45 and 52 are presented in **Table 7.3**.

Table 7.3: Illustrative Development Maximum and Minimum Façade Noise Levels – Plots 11 to 14, 45 and 52

Plot Number	Floor Level	Lday		Lnight	
		Min	Max	Min	Max
11 to 14	GF	51	55	44	49
	F 1	53	57	46	51
45	GF	52	56	46	50
	F 1	54	57	47	51
52	GF	51	52	45	46
	F 1	53	54	47	48
Key: GF = ground floor; F 1 = first floor					

- 7.18 With reference to Table 7.3, daytime noise levels are predicted to be between 51 dB and 56 dB at ground floor level and between 53 dB and 57 dB at first floor level.
- 7.19 During the night time, first floor façade noise levels are predicted to be between 45 and 51 dB.

West

- 7.20 Predicted façade noise levels at Plots 25 to 32 and 44 are presented in **Table 7.4**.

Table 7.4: Illustrative Development Maximum and Minimum Façade Noise Levels – Plots 25 to 32 and 44

Plot Number	Floor Level	Lday		Lnight	
		Min	Max	Min	Max
25 to 32	GF	50	59	44	53
	F 1	52	61	46	55
44	GF	52	62	46	55
	F 1	54	64	47	58
Key: GF = ground floor; F 1 = first floor					



7.21 With reference to Table 7.4, daytime noise levels are predicted to be between 50 dB and 62 dB at ground floor level and between 52 dB and 64 dB at first floor level.

7.22 During the night time, first floor façade noise levels are predicted to be between 46 and 58 dB.

Southwest

7.23 Predicted façade noise levels at Plots 19 to 23 and 33 & 34 are presented in **Table 7.5**.

Table 7.5: Illustrative Development Maximum and Minimum Façade Noise Levels – Plots 19 to 23 and 33 & 34

Plot Number	Floor Level	Lday		Lnight	
		Min	Max	Min	Max
19 to 23	GF	49	55	43	49
	F 1	51	56	45	50
33 & 34	GF	50	57	44	50
	F 1	53	58	46	51
Key: GF = ground floor; F 1 = first floor					

7.24 With reference to Table 7.5, daytime noise levels are predicted to be between 49 dB and 57 dB at ground floor level and between 51 dB and 58 dB at first floor level.

7.25 During the night time, first floor façade noise levels are predicted to be between 45 and 51 dB.

Centre

7.26 Predicted façade noise levels at Plots 15 to 18, 35 & 36 and 50 & 51 are presented in **Table 7.6**.



Table 7.6: Illustrative Development Maximum and Minimum Façade Noise Levels – Plots 15 to 18, 35 & 36 and 50 & 51

Plot Number	Floor Level	Lday		Lnight	
		Min	Max	Min	Max
15 to 18	GF	49	53	43	47
	F 1	52	55	45	49
35 & 36	GF	49	54	43	48
	F 1	51	56	45	49
50 & 51	GF	49	55	43	49
	F 1	52	57	45	50
Key: GF = ground floor; F 1 = first floor					

- 7.27 With reference to Table 7.6, daytime noise levels are predicted to be between 49 dB and 55 dB at ground floor level and between 51 dB and 57 dB at first floor level.
- 7.28 During the night time, first floor façade noise levels are predicted to be between 45 dB and 50 dB.
- 7.29 In summary, the highest noise levels are predicted to be in the north western corner of the site, which is closest to the A23. Noise levels are predicted to decrease with an increase in distance from the A23 with the lowest noise levels being in the centre of the site.
- 7.30 The above assessment demonstrates that the juxtaposition of the buildings helps reduce the façade noise levels and with appropriate mitigation measures, internal noise levels will meet or be lower than British Standards and WHO guideline levels.

Free Field Noise Levels

- 7.31 With reference to Figure 4.1, existing daytime free field noise levels within the development site are above 55 dB in the western part of the site. The highest levels are towards the western boundary and the A23.
- 7.32 The WHO guidance recommends free field noise levels in gardens and public open space should not be above 55 dB(A) during the daytime to limit the potential for annoyance.

- 7.33 The positioning of buildings within the site between the noise source (A23) and private / public open space help reduce noise levels within these areas and the results from the Illustrative Site Layout are presented in **Figure 7.4**.

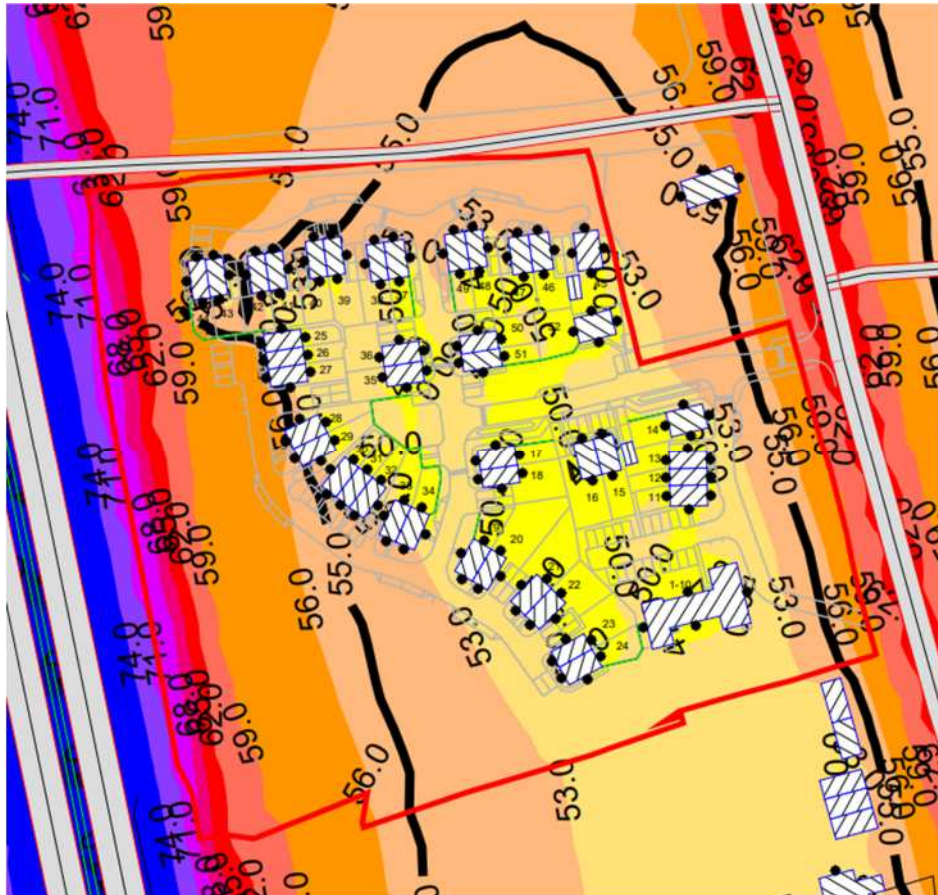


Figure 7.4: Predicted Garden Noise Levels

- 7.34 With the proposed buildings in place, free field noise levels in the gardens will be reduced. With reference to Figure 7.4, private gardens associated with the Illustrative Site Layout buildings will benefit from areas within the gardens where noise levels are less than 55 dB during the daytime and the majority will be below 50 dB.

Impacts – Operation (development generated traffic)

- 7.35 The effects of the development on the existing environment are considered in terms of modelled traffic data using SoundPLAN which incorporates the CRTN method. In line with the Transport Assessment, additional development generated traffic has been added to the local highway network road traffic and the impacts from the change has been assessed.



7.36 Façade noise levels have been predicted at existing sensitive receptors because of additional traffic movements that will be generated by the proposed Development. The traffic flow data for 2030 has been used to calculate the future scenario “Future” (Do Nothing) and the future scenario “Future + Proposed Development” (Do Something) at representative existing receptor locations. The receptor locations are identified on Figure 4.4 and the results from the calculations are presented in **Table 7.7**.

Table 7.7: Predicted Change in Road Traffic Noise levels (2029)

Receptor Location	Floor	Façade Direction	'Do Nothing' Scenario		'Do Something' Scenario		Difference (dB)	
			Day	Night	Day	Night	Day	Night
1 Nashlands Cottages	GF	E	60.6	54.1	60.7	54.2	0.1	0.1
1 Nashlands Cottages	F 1	E	62.9	56.3	63	56.4	0.1	0.1
1 Nashlands Cottages	GF	S	57.3	50.9	57.2	50.8	-0.1	-0.1
1 Nashlands Cottages	F 1	S	59.4	53	59.4	52.9	0	-0.1
1 Nashlands Cottages	GF	W	57.5	51.1	57.3	50.9	-0.2	-0.2
1 Nashlands Cottages	F 1	W	58.9	52.4	58.7	52.3	-0.2	-0.1
Handcross Primary School	GF	S	55.7	49.4	55.7	49.4	0	0
Handcross Primary School	GF	E	57.3	51	57.4	51	0.1	0
Handcross Primary School	GF	W	55	48.7	54.6	48.3	-0.4	-0.4
Handcross Primary School	GF	N	55.3	49	54.3	48	-1	-1
Hyde Lodge	GF	N	58	51.6	58	51.6	0	0
Hyde Lodge	F 1	N	59.7	53.2	59.7	53.2	0	0
Hyde Lodge	GF	E	60.8	54.3	60.9	54.4	0.1	0.1
Hyde Lodge	F 1	E	63	56.4	63.1	56.5	0.1	0.1
Hyde Lodge	GF	W	56.4	50	56	49.6	-0.4	-0.4
Hyde Lodge	F 1	W	57.5	51.1	57.3	50.9	-0.2	-0.2
Hyde Lodge	GF	S	56.8	50.5	56.5	50.1	-0.3	-0.4
Hyde Lodge	F 1	S	58.7	52.3	58.6	52.1	-0.1	-0.2
West Lodge	GF	S	58.8	52.4	58.9	52.5	0.1	0.1
West Lodge	GF	W	64.6	57.9	64.7	58	0.1	0.1
West Lodge	GF	E	53.2	47.2	53.2	47.2	0	0
West Lodge	GF	N	60.2	53.7	60.3	53.8	0.1	0.1
Key: GF = ground floor; F 1 = first floor; N = north; S = south; E = east and W = west								

7.37 With reference to Table 7.7, daytime and night time façade noise levels are predicted to change by a 0.4 dB **decrease** and a 0.1 dB **increase**.



- 7.38 The predicted decrease in noise levels at existing receptors is due to the construction of the buildings within the proposed development.
- 7.39 The predicted increase of 0.1 dB is due to development generated traffic using the local highway network and passing existing sensitive receptors.

Impact and Significance

- 7.40 To assess the impact, it is necessary to use the criteria outlined in Section 2. The impact from the development is determined by calculating the noise level difference between the 'Do Nothing' (without development) and 'Do Something' (with development) scenarios to identify the change in noise level at each receptor location. Outlined in **Table 7.8** is the impact assessment for the receptors outside the development for the 2030 road traffic scenarios.



Table 7.8: Impact Assessment for Development Generated Traffic – 2029

Receptor Location	Floor	Façade Direction	Daytime		Night Time	
			Change in Noise Level, dB(A)	Magnitude of Impact	Change in Noise Level, dB(A)	Magnitude of Impact
1 Nashlands Cottages	GF	E	0.1	Negligible	0.1	Negligible
1 Nashlands Cottages	F 1	E	0.1	Negligible	0.1	Negligible
1 Nashlands Cottages	GF	S	-0.1	Negligible	-0.1	Negligible
1 Nashlands Cottages	F 1	S	0	No Change	-0.1	Negligible
1 Nashlands Cottages	GF	W	-0.2	Negligible	-0.2	Negligible
1 Nashlands Cottages	F 1	W	-0.2	Negligible	-0.1	Negligible
Handcross Primary School	GF	S	0	No Change	0	No Change
Handcross Primary School	GF	E	0.1	Negligible	0	No Change
Handcross Primary School	GF	W	-0.4	Negligible	-0.4	Negligible
Handcross Primary School	GF	N	-1	Negligible	-1	Negligible
Hyde Lodge	GF	N	0	No Change	0	No Change
Hyde Lodge	F 1	N	0	No Change	0	No Change
Hyde Lodge	GF	E	0.1	Negligible	0.1	Negligible
Hyde Lodge	F 1	E	0.1	Negligible	0.1	Negligible
Hyde Lodge	GF	W	-0.4	Negligible	-0.4	Negligible
Hyde Lodge	F 1	W	-0.2	Negligible	-0.2	Negligible
Hyde Lodge	GF	S	-0.3	Negligible	-0.4	Negligible
Hyde Lodge	F 1	S	-0.1	Negligible	-0.2	Negligible
West Lodge	GF	S	0.1	Negligible	0.1	Negligible
West Lodge	GF	W	0.1	Negligible	0.1	Negligible
West Lodge	GF	E	0	No Change	0	No Change
West Lodge	GF	N	0.1	Negligible	0.1	Negligible

7.41 As can be identified in Table 7.8, there is predicted to be a “Negligible” (0.1 to 0.5 dB) increase or “No Change” in noise levels during the daytime and a “Negligible” (0.1 to 2.9 dB) increase or “No Change” in noise levels at all receptors during the night time.

7.42 It should be noted that there is predicted to be a “Negligible” **decrease** in noise levels during the daytime and night time.

7.43 All receptors are residential dwellings which considered “high” sensitivity to noise (refer to Table 2.5) and where levels increase the following effects have been



determined: Negligible (Not Significant) at all receptors due to the increase in noise levels typically being imperceptible. Where there is predicted to be “No Change” in noise levels, this is also considered to be Not Significant.



8.0 MITIGATION MEASURES

- 8.1 Proposed mitigation measures have been split into two sections. The first deals with the constraints on development and the second deals with potential construction noise impacts.

Constraints on Development

- 8.2 With reference to Appendix 3 and Table 7.1 to Table 7.6, daytime façade noise levels within the site are predicted to be 62 dB or less at ground floor level and 64 dB or less at first floor level. Night time façade noise levels are predicted to be 58 dB or less at first floor level.
- 8.3 To comply with BS 8233:2014 and WHO guidelines internal noise levels of living rooms and bedrooms should not exceed 35 dB and internal noise levels of dining rooms should not exceed 40 dB during the daytime period. Internal noise levels of bedrooms should not exceed 30 dB during the night-time period.
- 8.4 Dwellings with façade noise levels greater than 50 dB during the daytime and above 45 dB during the night time will require a commensurate level of mitigation to adhere to daytime and night-time BS 8233:2014 guidelines for living rooms and bedrooms (35 dB $L_{Aeq,16hrs}$ and 30 dB $L_{Aeq,8hrs}$).
- 8.5 Plots adjacent to and / or facing towards the A23 have habitable rooms with levels above 50 dB during the daytime and 45 dB during the night-time and therefore mitigation will be required.
- 8.6 There are many ways for sound to enter a building. The routes are through the roof, the doors and the main route is through the windows. If the roof is built to current Building Regulations and is of sufficient mass, it will provide an adequate barrier to the passage of sound. For example, tiles on felt, pitched roof with 100mm mineral wool on plasterboard ceiling have a weighted sound reduction of approximately 43 dB. Doors with adequate mass and minimal gaps between the door and door frame can provide sound reduction of approximately 35 dB when fitted to manufacturers' specification.
- 8.7 Regarding windows, thermal double-glazed units should be fitted in accordance with Building Regulations as a minimum standard. Units are normally of the configuration 6 – 12 – 6 (glass, air gap and glass) with a weighted sound reduction of approximately 33 dB. Presented in **Table 8.1** are sound reduction values for window systems utilising various air gap and window thickness.



Table 8.1: Example Window Systems

Material	Configuration glass/air gap/glass (mm)	Total Thickness (mm)	Sound Reduction (dB)
Sealed Unit	4/12/4	20	27
Sealed Unit	6/12/6	24	33
Sealed Unit	4/12/12	28	36
Sealed Unit	6/12/10	28	37
Laminated glass	6/12/11	29	40
Laminated glass	10/12/16	38	42
Laminated glass	13/12/13	38	45
Sealed Unit	6/20/12	38	41

- 8.8 It should be noted that the sound reduction presented in Table 8.1 does not consider the adjusted factor for road traffic noise (C , C_{tr}). Usually, 1 to 2 dB is subtracted for highway road traffic > 80 kmph (C) and between 3 and 6 dB for urban road traffic (C_{tr})⁴ depending on window configuration.
- 8.9 With the windows and doors closed, the internal **night-time** noise level of 30 dB ($58 - 33 = 25$ dB) will be achieved at all the proposed dwellings across the development site. Also achieved are internal **daytime** noise levels for living rooms of 35 dB ($62 - 33 = 29$ dB) and bedrooms (35 dB resting) ($64 - 33 = 31$ dB) as recommended in BS8233.
- 8.10 If the doors and windows are manufactured to a high standard and installed to the manufacturers' specification, the above sound reduction should be achieved.
- 8.11 If any of the windows or doors is open in the façade, the sound reduction for the façade containing the window or door will be an approximate 15 dB reduction. The effect of having the window or door open is a reduction in transmission loss through the façade and results in a higher internal noise level within the room.
- 8.12 Façades with a noise level of greater than 45 dB during the night time and 50 dB during the daytime and a window or door open will not meet the BS 8233 internal noise levels for bedrooms and sitting rooms.

⁴ BS EN ISO 717-1:1997, Acoustics – Rating of sound insulation in buildings and of building elements – Part 1: Airborne sound insulation, Annex A, Table A.1 – Relevant spectrum adaptation term for different types of noise source



- 8.13 Where façade noise levels are above the aforementioned levels, another method of ventilating the rooms will have to be provided without opening the windows or doors.
- 8.14 Acoustically attenuated background / trickle vents are available with sound reduction properties equal to and greater than levels provided by windows and doors. For example, window mounted and wall mounted trickle vents are available with a sound reduction of approximately 42 dB and 38 dB respectively. Window trickle vents can be mounted in the window frame or above or below the window and provide adequate cross ventilation within the room or hallway.
- 8.15 To satisfy the Building Regulations purge ventilate requirement, all windows will be provided with the ability to be opened and extract ventilation will be provided in bathrooms and kitchens. Apartments with single façades will require a source of air extraction to provide adequate cross flow of air within the apartment.
- 8.16 Taking the above into account, internal noise levels can meet or be better than the guideline level of 30 dB (bedrooms at night) and 35 dB (living rooms and bedrooms during the daytime) can be achieved with the use of double glazing and background ventilation (where applicable).
- 8.17 Regarding mitigation to noise levels in outside amenity areas, the construction of the proposed buildings, boundary treatments such as brick walls and high density closed board fences help reduce noise levels in these areas. For example, in the shadow zone of a building or brick wall, noise levels could be reduced by up to 10 dB.
- 8.18 Within the proposed residential development, there are no areas that require purpose built acoustic barriers to achieve external noise levels below 55 dB(A) during the daytime.

Impacts – Construction

- 8.19 Best practicable means (BPM) will be used to minimise construction noise through the implementation of the recommendations set out in BS 5228. In particular, the following noise mitigation measures would be implemented and secured by the anticipated Construction and Environmental Management Plan (CEMP):



- Proper use of plant with respect to minimising noise emissions and regular maintenance will be required. All vehicles and mechanical plant will be fitted with effective exhaust silencers and will be maintained in good efficient order;
- The use of inherently quiet plant where appropriate – all major compressors and generators will be 'sound reduced' models fitted with properly lined and sealed acoustic covers, which will be kept closed whenever the machines are in use, and all ancillary pneumatic percussive tools will be fitted with mufflers or silencers of the type recommended by the manufacturers;
- Machines in intermittent use will be shut down in the intervening periods between work or throttled down to a minimum;
- All ancillary plant such as generators and pumps will be positioned so as to cause minimum noise disturbance, and where necessary, acoustic enclosures will be provided;
- Where practicable the use of noisy plant will be limited to core daytime periods;
- Channels of communication will be established between the contractor / developer, Local Authority and residents;
- A site representative will be appointed responsible for matters relating to noise;
- Typical levels of noise will be monitored during critical periods and at sensitive locations;
- A 2m high solid site hoarding along the site boundaries will be erected where practical and feasible;
- Localised noise barriers can be erected as necessary around items such as generators or heavy-duty compressors;
- Construction compounds will be laid out to minimise noise impacts to neighbouring noise sensitive receptors, by locating noisy operations well away from receptors and using on-site structures and materials to screen noise where practicable and necessary.



9.0 SUMMARY AND CONCLUSIONS

- 9.1 Stuart Michael Associates Limited has been appointed by Welbeck Strategic Land V Land (the Applicants) to undertake a noise assessment for the proposed development on land west of London Road, Handcross, Mid Sussex.
- 9.2 This noise assessment has considered the constraints on the proposed residential development site and the impacts from construction activities and development generated traffic. From on-site observations, the dominant noise source in the local area is from the A23 and the broader highway network.
- 9.3 Within the development site, façade noise levels have been calculated at the approximate locations of the proposed dwellings. Façades facing west are predicted to experience the highest noise levels.
- 9.4 At Plots adjacent to the A23 and / or with an unobstructed view of the A23, noise levels are predicted to be above 50 dB during the daytime and 45 dB during the night time. Mitigation measures are proposed to ensure internal noise levels meet BS 8233, WHO guidelines and local planning policy.
- 9.5 With the windows and doors closed, the internal **night-time** noise level of 30 dB ($58 - 33 = 25$ dB) will be achieved at all the proposed dwellings across the development site. Also achieved are internal **daytime** noise levels for living rooms of 35 dB ($62 - 33 = 29$ dB) and bedrooms (35 dB resting) ($64 - 33 = 31$ dB) as recommended in BS8233.
- 9.6 The use of double-glazed windows incorporating acoustically attenuated ventilation with comparable sound reduction will reduce internal noise to within guideline levels.
- 9.7 Regarding noise levels in private gardens, Plots will benefit from gardens with noise levels are less than 55 dB and the majority will be below 50 dB during the daytime.
- 9.8 The report has also calculated the potential worst-case impacts of construction noise at nearby sensitive receptors. Best practical means should be adopted to minimise construction noise insofar as possible. Impacts from construction traffic along the proposed construction traffic route are predicted to be negligible.
- 9.9 Although there is predicted to be a Negligible increase in noise levels at local sensitive receptors north and south of the site, there is predicted to be a decrease



in noise levels adjacent to the site due to the screening effect of the proposed noise barrier and residential buildings.

- 9.10 Taking all the above into account, the proposed development is in accordance with NPSE, British Standards, WHO Guidelines, and MSDC local policy. Thus, noise should not be a reason for withholding the granting of planning permission for this site.



10.0 APPENDICES

Appendix 1 – Illustrative Site Layout





Appendix 2 – Construction Noise Calculations

Proposed Development

No Mitigation			Site Preparation							
Receptors adjacent to the site		Ambient Noise Level (dB(A))	Distance from source to receptor (metres)	23.5	26.4	79.6	92.9	100	179.5	216.9
			Specific construction noise level (dB)	68	67	57	56	55	50	48
R1	10 London Road (residential)	54	Total noise level (dB(A))	68	67	59	58	57	55	55
R2	Hyde Lodge (residential)	54		68	67	59	58	57	55	55
R3	Handcross Primary School	52		68	67	58	57	57	54	53
R4	Meadow Cottage (residential)	53		68	67	58	61	57	55	53
R5	14 Hoadlands Cottages (residential)	60		68	68	62	61	61	50	61
R6	10 College Close (residential)	50		68	67	58	57	56	53	52
Earthworks										
Receptors adjacent to the site		Ambient Noise Level (dB(A))	Distance from source to receptor (metres)	23.5	26.4	79.6	92.9	100	179.5	216.9
			Specific construction noise level (dB)	70	69	59	58	57	52	50
R1	10 London Road (residential)	54	Total noise level (dB(A))	70	69	60	59	59	56	55
R2	Hyde Lodge (residential)	54		70	69	60	59	59	56	55
R3	Handcross Primary School	52		70	69	60	59	58	55	54
R4	Meadow Cottage (residential)	53		70	69	60	62	58	55	55
R5	14 Hoadlands Cottages (residential)	60		70	69	62	62	62	61	60
R6	10 College Close (residential)	50		70	69	59	58	58	54	53
Construction										
Receptors adjacent to the site		Ambient Noise Level (dB(A))	Distance from source to receptor (metres)	23.5	26.4	79.6	92.9	100	179.5	216.9
			Specific construction noise level (dB)	71	70	60	59	58	53	51
R1	10 London Road (residential)	54	Total noise level (dB(A))	71	70	61	60	60	57	56
R2	Hyde Lodge (residential)	54		71	70	61	60	60	57	56
R3	Handcross Primary School	52		71	70	61	60	59	56	55
R4	Meadow Cottage (residential)	53		71	70	61	60	59	56	55
R5	14 Hoadlands Cottages (residential)	60		72	71	63	63	62	61	61
R6	10 College Close (residential)	50		71	70	61	60	59	61	61
Landscaping										
Receptors adjacent to the site		Ambient Noise Level (dB(A))	Distance from source to receptor (metres)	23.5	26.4	79.6	92.9	100	179.5	216.9
			Specific construction noise level (dB)	69	69	59	58	57	52	50
R1	10 London Road (residential)	54	Total noise level (dB(A))	69	69	60	59	59	56	55
R2	Hyde Lodge (residential)	54		69	69	60	59	59	56	55
R3	Handcross Primary School	52		69	69	60	59	58	55	54
R4	Meadow Cottage (residential)	53		69	69	60	59	58	55	55
R5	14 Hoadlands Cottages (residential)	60		69	69	62	62	62	61	60
R6	10 College Close (residential)	50		69	69	59	59	58	54	53



With Mitigation

Site Preparation

Receptors adjacent to the site		Ambient Noise Level (dB(A))	Distance from source to receptor (metres)	23.5	26.4	79.6	92.9	100	179.5	216.9
			Specific construction noise level (dB)	58	57	47	46	45	40	38
R1	10 London Road (residential)	54	Total noise level (dB(A))	59	59	55	55	54	54	54
R2	Hyde Lodge (residential)	54		59	59	55	55	54	54	54
R3	Handcross Primary School	52		59	58	53	53	53	52	52
R4	Meadow Cottage (residential)	53		59	58	54	54	54	53	53
R5	14 Hoadlands Cottages (residential)	60		62	62	60	60	60	60	60
R6	10 College Close (residential)	50		58	58	52	51	51	50	50

Earthworks

Receptors adjacent to the site		Ambient Noise Level (dB(A))	Distance from source to receptor (metres)	23.5	26.4	79.6	92.9	100	179.5	216.9
			Specific construction noise level (dB)	60	59	49	48	47	42	40
R1	10 London Road (residential)	54	Total noise level (dB(A))	61	60	55	55	55	54	54
R2	Hyde Lodge (residential)	54		61	60	55	55	55	54	54
R3	Handcross Primary School	52		60	60	54	53	53	52	52
R4	Meadow Cottage (residential)	53		61	60	54	54	54	53	53
R5	14 Hoadlands Cottages (residential)	60		63	62	60	60	60	60	60
R6	10 College Close (residential)	50		60	59	52	52	52	51	50

Construction

Receptors adjacent to the site		Ambient Noise Level (dB(A))	Distance from source to receptor (metres)	23.5	26.4	79.6	92.9	100	179.5	216.9
			Specific construction noise level (dB)	61	60	50	49	48	43	41
R1	10 London Road (residential)	54	Total noise level (dB(A))	62	61	56	55	55	54	54
R2	Hyde Lodge (residential)	54		62	61	56	55	55	54	54
R3	Handcross Primary School	52		62	61	54	54	54	53	52
R4	Meadow Cottage (residential)	53		62	61	55	55	54	53	53
R5	14 Hoadlands Cottages (residential)	60		64	63	60	60	60	60	60
R6	10 College Close (residential)	50		62	61	53	53	52	51	51

Landscaping

Receptors adjacent to the site		Ambient Noise Level (dB(A))	Distance from source to receptor (metres)	23.5	26.4	79.6	92.9	100	179.5	216.9
			Specific construction noise level (dB)	59	59	49	48	47	42	40
R1	10 London Road (residential)	54	Total noise level (dB(A))	60	60	55	55	55	54	54
R2	Hyde Lodge (residential)	54		60	60	55	55	55	54	54
R3	Handcross Primary School	52		60	60	54	53	53	52	52
R4	Meadow Cottage (residential)	53		60	60	54	54	54	53	53
R5	14 Hoadlands Cottages (residential)	60		62	62	60	60	60	60	60
R6	10 College Close (residential)	50		59	59	52	52	52	51	50



Appendix 3 – Predicted Façade Noise Levels

Plot No.	Floor Level	Facade Direction	2029 + Development	
			Lday	Lnight
			[dB(A)]	
1 to 10	GF	S	51.3	45.1
1 to 10	F 1	S	53.1	46.8
1 to 10	GF	E	52.3	46.0
1 to 10	F 1	E	54.6	48.3
1 to 10	GF	N	51.0	44.8
1 to 10	F 1	N	52.8	46.6
1 to 10	GF	W	53.1	46.8
1 to 10	F 1	W	54.6	48.3
11	GF	W	52.5	46.2
11	F 1	W	54.1	47.7
11	GF	S	51.7	45.4
11	F 1	S	53.4	47.1
11	GF	E	52.4	46.1
11	F 1	E	54.6	48.3
12	GF	E	52.5	46.2
12	F 1	E	54.7	48.4
12	GF	W	52.7	46.4
12	F 1	W	54.3	48.0
13	GF	E	52.8	46.5
13	F 1	E	55.0	48.6
13	GF	N	50.6	44.4
13	F 1	N	52.6	46.3
13	GF	W	52.8	46.6
13	F 1	W	54.5	48.1
14	GF	S	50.8	44.6
14	F 1	S	52.9	46.6
14	GF	W	52.8	46.5
14	F 1	W	54.5	48.2
14	GF	E	55.2	48.9
14	F 1	E	57.0	50.6
14	GF	N	54.3	48.0
14	F 1	N	55.8	49.5
15	GF	S	50.8	44.6
15	F 1	S	52.5	46.3
15	GF	N	51.9	45.7
15	F 1	N	53.7	47.4
KEY: GF =Ground Floor; F 1 = First Floor; N = North; S = South; E = East; and W = West				



Plot No.	Floor Level	Facade Direction	2029 + Development	
			Lday	Lnight
			[dB(A)]	
16	GF	S	51.0	44.7
16	F 1	S	52.7	46.4
16	GF	N	51.8	45.6
16	F 1	N	53.8	47.5
17	GF	N	50.9	44.6
17	F 1	N	52.7	46.5
17	GF	W	53.4	47.1
17	F 1	W	54.9	48.6
17	GF	E	49.0	42.9
17	F 1	E	51.6	45.4
18	GF	W	53.4	47.1
18	F 1	W	54.8	48.5
18	GF	S	51.5	45.2
18	F 1	S	53.2	46.9
18	GF	E	50.2	44.0
18	F 1	E	52.6	46.4
19	GF	NW	54.0	47.7
19	F 1	NW	55.3	49.0
19	GF	SW	55.0	48.6
19	F 1	SW	56.2	49.8
19	GF	NE	50.3	44.1
19	F 1	NE	52.4	46.1
20	GF	SW	54.8	48.4
20	F 1	SW	55.9	49.6
20	GF	SE	51.9	45.6
20	F 1	SE	53.7	47.4
20	GF	NE	49.6	43.5
20	F 1	NE	51.7	45.4
21	GF	NE	49.5	43.3
21	F 1	NE	51.6	45.4
21	GF	NW	52.0	45.7
21	F 1	NW	53.6	47.3
21	GF	SW	54.6	48.3
21	F 1	SW	55.8	49.5
KEY: GF =Ground Floor; F 1 = First Floor; N = North; S = South; E = East; and W = West				



Plot No.	Floor Level	Facade Direction	2029 + Development	
			Lday	Lnight
			[dB(A)]	
22	GF	SW	54.6	48.2
22	F 1	SW	55.7	49.3
22	GF	NE	49.4	43.2
22	F 1	NE	51.7	45.4
22	GF	SE	51.8	45.6
22	F 1	SE	53.4	47.1
23	GF	SW	54.6	48.3
23	F 1	SW	55.7	49.3
23	GF	NW	52.0	45.7
23	F 1	NW	53.3	47.0
23	GF	NE	48.8	42.6
23	F 1	NE	51.1	44.9
24	GF	NE	48.5	42.3
24	F 1	NE	50.9	44.7
24	GF	SW	54.7	48.3
24	F 1	SW	55.7	49.3
24	GF	SE	52.9	46.6
24	F 1	SE	54.2	47.9
25	GF	E	51.3	45.1
25	F 1	E	53.2	46.9
25	GF	N	52.8	46.6
25	F 1	N	54.8	48.4
25	GF	W	59.1	52.6
25	F 1	W	61.4	54.8
26	GF	W	59.2	52.7
26	F 1	W	61.3	54.8
26	GF	E	50.9	44.6
26	F 1	E	52.8	46.6
27	GF	E	50.5	44.3
27	F 1	E	52.7	46.4
27	GF	S	55.5	49.2
27	F 1	S	57.2	50.7
27	GF	W	59.1	52.7
27	F 1	W	61.3	54.7
KEY: GF =Ground Floor; F 1 = First Floor; N = North; S = South; E = East; and W = West				



Plot No.	Floor Level	Facade Direction	2029 + Development	
			Lday	Lnight
			[dB(A)]	
28	GF	NE	50.4	44.2
28	F 1	NE	52.5	46.2
28	GF	NW	55.0	48.6
28	F 1	NW	56.5	50.1
28	GF	SW	58.8	52.3
28	F 1	SW	60.8	54.2
29	GF	SE	55.8	49.5
29	F 1	SE	57.7	51.3
29	GF	SW	58.4	52.0
29	F 1	SW	60.2	53.7
29	GF	NE	50.3	44.1
29	F 1	NE	52.4	46.2
30	GF	NE	51.1	44.9
30	F 1	NE	53.4	47.1
30	GF	NW	54.3	48.0
30	F 1	NW	55.9	49.5
30	GF	SW	57.4	51.0
30	F 1	SW	59.0	52.5
31	GF	SW	57.0	50.6
31	F 1	SW	58.5	52.0
31	GF	NE	51.4	45.2
31	F 1	NE	54.2	47.9
32	GF	SW	56.7	50.3
32	F 1	SW	58.2	51.7
32	GF	SE	54.3	47.9
32	F 1	SE	56.0	49.6
32	GF	NE	51.4	45.1
32	F 1	NE	54.2	47.9
33	GF	SW	56.5	50.1
33	F 1	SW	57.9	51.4
33	GF	NE	50.6	44.4
33	F 1	NE	53.1	46.8
33	GF	NW	54.0	47.6
33	F 1	NW	55.4	49.0
KEY: GF =Ground Floor; F 1 = First Floor; N = North; S = South; E = East; and W = West				



Plot No.	Floor Level	Facade Direction	2029 + Development	
			Lday	Lnight
			[dB(A)]	
34	F 1	SW	57.3	50.8
34	GF	SE	52.4	46.2
34	F 1	SE	54.3	47.9
34	GF	NE	50.0	43.8
34	F 1	NE	52.5	46.2
34	GF	E	49.5	43.3
35	F 1	E	51.9	45.7
35	GF	S	52.1	45.9
35	F 1	S	54.0	47.7
35	GF	W	53.9	47.6
35	F 1	W	55.5	49.1
35	GF	E	49.1	43.0
36	F 1	E	51.4	45.2
36	GF	W	54.0	47.7
36	F 1	W	55.6	49.2
36	GF	N	51.8	45.6
36	F 1	N	53.8	47.5
36	GF	S	51.3	45.1
37	F 1	S	53.1	46.8
37	GF	E	52.0	45.8
37	F 1	E	53.6	47.3
37	GF	N	56.9	50.5
37	F 1	N	58.1	51.6
37	GF	S	52.0	45.7
38	F 1	S	53.8	47.5
38	GF	W	56.2	49.8
38	F 1	W	57.7	51.3
38	GF	N	57.0	50.6
38	F 1	N	58.2	51.8
38	GF	N	57.6	51.1
39	F 1	N	58.8	52.3
39	GF	E	52.8	46.5
39	F 1	E	54.3	47.9
39	GF	S	52.0	45.7
39	F 1	S	54.0	47.7
39	F 1	SW	57.3	50.8
KEY: GF =Ground Floor; F 1 = First Floor; N = North; S = South; E = East; and W = West				



Plot No.	Floor Level	Facade Direction	2029 + Development	
			Lday	Lnight
			[dB(A)]	
40	GF	S	52.2	46.0
40	F 1	S	54.3	47.9
40	GF	W	56.9	50.5
40	F 1	W	58.6	52.1
40	GF	N	57.7	51.2
40	F 1	N	58.9	52.4
41	GF	S	54.2	47.9
41	F 1	S	55.9	49.5
41	GF	E	53.2	46.9
41	F 1	E	54.6	48.3
41	GF	N	57.9	51.5
41	F 1	N	59.3	52.8
42	GF	N	58.1	51.6
42	F 1	N	59.6	53.1
42	GF	S	56.1	49.7
42	F 1	S	59.2	52.7
42	GF	W	58.5	52.1
42	F 1	W	61.2	54.6
43	GF	S	57.0	50.6
43	F 1	S	60.6	54.1
43	GF	E	55.2	48.8
43	F 1	E	59.1	52.6
43	GF	N	58.7	52.2
43	F 1	N	60.7	54.1
44	GF	S	57.6	51.1
44	F 1	S	61.4	54.8
44	GF	W	61.6	55.0
44	F 1	W	64.2	57.6
44	GF	N	59.3	52.9
44	F 1	N	61.6	55.1
45	GF	S	51.7	45.5
45	F 1	S	53.5	47.2
45	GF	E	52.9	46.6
45	F 1	E	54.8	48.5
45	GF	N	55.9	49.5
45	F 1	N	57.2	50.8
45	GF	W	54.8	48.4
45	F 1	W	56.4	50.0
KEY: GF =Ground Floor; F 1 = First Floor; N = North; S = South; E = East; and W = West				



Plot No.	Floor Level	Facade Direction	2029 + Development	
			Lday	Lnight
			[dB(A)]	
46	GF	S	50.7	44.5
46	F 1	S	52.8	46.5
46	GF	E	51.2	45.0
46	F 1	E	53.0	46.7
46	GF	N	56.0	49.6
46	F 1	N	57.3	50.9
47	GF	N	56.1	49.7
47	F 1	N	57.3	50.9
47	GF	W	55.0	48.6
47	F 1	W	56.6	50.2
47	GF	S	50.3	44.1
47	F 1	S	52.4	46.1
48	GF	S	50.5	44.2
48	F 1	S	52.2	45.9
48	GF	E	51.6	45.3
48	F 1	E	53.3	47.0
48	GF	N	56.3	49.9
48	F 1	N	57.6	51.1
49	GF	S	51.9	45.6
49	F 1	S	53.8	47.5
49	GF	W	56.2	49.8
49	F 1	W	57.8	51.3
49	GF	N	56.5	50.1
49	F 1	N	57.7	51.3
50	GF	E	49.2	43.0
50	F 1	E	51.6	45.3
50	GF	N	52.4	46.1
50	F 1	N	54.8	48.4
50	GF	W	55.0	48.7
50	F 1	W	56.7	50.3
KEY: GF =Ground Floor; F 1 = First Floor; N = North; S = South; E = East; and W = West				



Plot No.	Floor Level	Facade Direction	2029 + Development	
			Lday	Ln timer
			[dB(A)]	
51	GF	S	52.2	46.0
51	F 1	S	53.9	47.5
51	GF	E	49.4	43.3
51	F 1	E	51.9	45.6
51	GF	W	54.6	48.3
51	F 1	W	56.3	49.9
52	GF	E	52.0	45.8
52	F 1	E	54.1	47.8
52	GF	S	51.8	45.5
52	F 1	S	53.4	47.1
52	GF	W	52.1	45.8
52	F 1	W	53.8	47.5
52	GF	N	51.3	45.0
52	F 1	N	53.9	47.6
KEY: GF =Ground Floor; F 1 = First Floor; N = North; S = South; E = East; and W = West				