

**Land West of Worthing Road,
Southwater – Phase 5**

**Prepared for Berkeley
Homes (Southern)
Limited**

by

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APPENDIX

**Appendix 1 Site Layout - Drawing Number S835/SL/001 Revision D dated
28.06.24**



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)
ABC Method	BS 5228 Method for determining the threshold of significance and associated construction impacts
°C	Degrees Celsius
BRE	Building Research Establishment
BS 5228	Code of practice for noise and vibration control on construction and open sites (2024)
BS 8233	Guidance on sound insulation and noise reduction for buildings (2014)
CIRIA	Construction Industry Research and Information Association
CRN	Calculation of Railway Noise
CRTN	Calculation of Road Traffic Noise
dB	Decibel – unit of measurement of sound
EHO	Environmental Health Officer
HDC	Horsham District Council
$L_{A10, T}$	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
ms^{-1}	Metres per second
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
NPSE	National Policy Statement for England
PPV	Peak Particle Velocity
SEL	Single Event Noise Exposure Level
SLM	Sound Level Meter
SMA	Stuart Michael Associates Limited
WHO	The World Health Organisation



1.0 INTRODUCTION

- 1.1 This Noise Assessment has been prepared by Stuart Michael Associates Limited (SMA), Consulting Engineers, on behalf of Berkeley Homes (Southern) Limited (the Applicant). The report supports the planning application for a residential development on Land West of Worthing Road, Southwater – Phase 5. Refer to **Figure F1** for the location of the development.

Scope of Assessment

- 1.2 This report has been produced in support of the planning application for 94 residential units with the associated vehicular and pedestrian access, car parking and landscaping. The *Site Layout* (drawing number S835/SL/001 Revision D dated 28.06.24) has been considered in this noise assessment and a copy is appended to this report (**Appendix 1**).
- 1.3 The constraints on the development because of the existing noise climate have been assessed in respect of the proposed site layout.
- 1.4 The potential impacts from construction noise and vibration have been assessed using the method detailed in BS5228-2009+A1:2014 “*Code of practice for noise and vibration control on construction and open sites*” Part 1: Noise and Part 2: Vibration.
- 1.5 Comments have also been provided on the likely impact that operational road traffic will have on existing noise sensitive receptors in the vicinity of the site.
- 1.6 Where necessary, mitigation measures have been suggested to help reduce internal and external noise levels to below guidance levels.

Site Description

- 1.7 The proposed development site is located approximately 150 m to the west of the existing village of Southwater. Worthing Road is located approximately 440 m to the east of the site and the A24 is located approximately 1.5 km to the east of the site.
- 1.8 The Phase 5 development site will be accessed from Worthing Road via Phases 1-4 of the Land West of Worthing Road development. Phase 4 of the wider development will be located on the land between Phase 5 and the existing village of Southwater (namely dwellings off Woodlands Way and Ash Road).



The Nature, Measurement and Effect of Noise

- 1.9 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. In order 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.
- 1.10 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.
- 1.11 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 with regard to noise and new residential developments.

National Planning Policy Framework (NPPF)

- 2.2 The revised National Planning Policy Framework (NPPF, December 2023) 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.”

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)

- 2.5 The Planning Practice Guidance for Noise (PPG-N), provides advice on how to determine the noise impact on development:

“Plan-making and decision making need to 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.”

- 2.6 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: this is the level of noise exposure above which significant adverse effects on health and quality of life occur.

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

No observed effect level: this is the level of noise exposure below which no effect at all on health and quality of life can be detected.” (Paragraph 005).

- 2.7 A fourth effect level is also introduced:

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

- 2.8 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

- 2.9 It is important to understand that as the PPG-N does not specifically provide any advice with respect to noise levels/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)

- 2.10 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

- 2.11 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.



2.12 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)*

2.13 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_{AFMAX} more than 10 times per night.

Calculation of Road Traffic Noise 1988 (CRTN)

2.14 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.”

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

2.16 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, which broadly agree with the range of human hearing.

2.17 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

- 2.18 Guidance on absolute limits for noise inside buildings is provided in BS 8233:2014 “*Guidance on sound insulation and noise reduction for buildings*”. Similar guidance can also be found in the current World Health Organisation (WHO) “*Guidelines on Community Noise*” and “*Night Noise Guidelines for Europe*” and the BRE / CIRIA document “*Sound control for homes*”. A summary of the relevant 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		Bedroom		30 dB $L_{Aeq,8hr}$

- 2.19 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.”
- 2.20 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.”

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

BS 5228-1: 2009+A1: 2014

- 2.26 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.
- 2.27 The Standard also provides a framework for good working practice and guidance on methods of mitigating noise by employing a number of different techniques.
- 2.28 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).

BS 5228-2: 2009+A1: 2014

- 2.29 BS 5228 “*Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration*” provides advice for vibration effects including vibration due to piling activities. The standard relates to a limited range of construction activities, however, there are no other British Standards that provide a methodology for predicting levels of vibration from construction activities.
- 2.30 BS 5228-2 identifies that whilst the human response to vibration is usually based on Vibration Dose Value in accordance with BS 6472, it is considered more appropriate to provide guidance for construction vibration in terms of Peak Particle Velocity (PPV) as this parameter is more likely to be measured during construction due to the usual concerns over potential building damage.
- 2.31 **Table 2.3** identifies the guidance on effects of vibration levels as provided in Table B.1 of Annex B of BS 5228-2.



Table 2.3: Guidance on Effects of Vibration Levels

Vibration Level ^{(A),(B),(C)}	Effect
0.14 mm/s	Vibration might be just perceptible in the most sensitive situation for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3 mm/s	Vibration might be just perceptible in residential environments.
1.0 mm/s	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
10.0 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments.
(A) The magnitudes of the values presented apply to a measurement position that is representative of the point of entry into the recipient. (B) A transfer function (which relates an external level to an internal level) needs to be applied if only external measurements are available. (C) Single or infrequent occurrences of these levels do not necessarily correspond to the stated effect in every case. The values are provided to give an initial indication of potential effects, and where these values are routinely measured or expected then an assessment in accordance with BS 6472-1 or -2 and/or other available guidance, might be appropriate to determine whether the time varying exposure is likely to give rise to any degree of adverse comment.	

Design Manual for Roads and Bridges (DMRB)

Magnitude of Impacts

- 2.32 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 2.4**.

Table 2.4: 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



- 2.33 The changes in noise level and the magnitude of impact presented in Table 2.4 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 2.5**.

Table 2.5: 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

- 2.34 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

- 2.35 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 2.6**.



Table 2.6: Criteria Used to Define Noise Sensitive Receptors (Watts, 1984*)

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.

2.36 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 2.4** and **Table 2.5**), the sensitivity of the receptor (**Table 2.6**) and the significance of the effect and is presented in **Table 2.7**.

Table 2.7: 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

* 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.



- 2.37 The cells within **Table 2.7** shaded grey are considered to be significant effects and mitigation may be required. The remainder of the cells in **Table 2.7** are an indication of the significance of effects below the significance threshold.

Horsham District Council

- 2.38 The Local Planning Authority (LPA) for the site is Horsham District Council. The Horsham District Planning Framework (HDPPF) was published in 2015. It provides the overall strategic plan for Horsham, setting out an integrated economic, environmental transport and social framework for the development of Horsham for the years up to 2031.

- 2.39 Paragraph 9.11 which supports Policy 24 Environmental Protection, states
“Noise pollution can have a significant impact on the quality of life and health of individuals and communities. To help avoid adverse noise impacts from development, authorities in both East and West Sussex have produced a Planning Guidance Document on this issue.”

- 2.40 Policay 33 Development Principles states that:

“In order to conserve and enhance the natural and built environment developments shall be required to... Ensure that it is designed to avoid unacceptable harm to the amenity of occupiers/users of nearby property and land, for example through overlooking or noise, whilst having regard to the sensitivities of surrounding development.”

- 2.41 The Planning Noise Advice Document: Sussex (PNAD) has been prepared by local authorities across Sussex to guide developers and consultants when making a planning application. The recommended design criteria for new noise sensitive development (residential development) *“should aim to meet the recommended standards set out in Table 4 of BS 8233:2014 and regular night time noise events such as scheduled aircraft or passing trains which can cause sleep disturbance shall be minimized and assessed as ($L_{A_{fmax}}$), as recommended in the World Health Organisation's (WHO) Night Noise Guidelines for Europe (2009)”*. The relevant recommended design criteria are presented in Table 2.2.

- 2.42 In respect of construction noise, the PNAD identifies that: “Noise and vibration associated with major development such as demolition, protracted construction or large civil engineering activities should also be considered in developing the proposal and best practice should be adopted at all times, as prescribed in BS



5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise; and BS 5228- 2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Vibration”.

Target Noise Levels

Constraints on the Proposed Development

2.43 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;
- Internal noise levels within bedroom should also not normally exceed 45 dB L_{AFmax} more than ten times during the night-time.



3.0 METHODOLOGY

- 3.1 This section describes the approach to assessing the noise constraints and potential construction and operational impacts in respect of the proposed development. The CadnaA noise modelling software has been utilised to assess noise from construction activities and road traffic noise sources. CadnaA incorporates the methodologies detailed in CRTN and BS 5228-1 for the assessment of construction noise and road traffic noise respectively.
- 3.2 A noise measurement survey was undertaken at the site to measure the existing noise profile. Refer to **Figure F1** for the measurement locations. The aforementioned noise measurements have been used to verify the CadnaA noise model.
- 3.3 The basic outline methodology employed is detailed below:
- Utilise recorded sound levels to verify the CadnaA noise model and establish the 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 on existing sensitive receptors from development generated traffic; and
 - Where necessary, detail a noise mitigation strategy on a Plot by Plot basis.



4.0 EXISTING NOISE PROFILE

Noise Measurement Survey

- 4.1 A 24-hour noise survey was undertaken between Monday 3rd and Tuesday 4th of June 2024.
- 4.2 The existing noise climate across the site comprised of contributions from a wide variety of noise sources including: distant road traffic noise from the A24, occasional vehicle movements on Church Lane/Bonfire Hill and Shaw's Lane, intermittent aircraft movements at high altitude, occasional reversing alarms from the Berkeley construction site to the north-east, birdsong and distant train horns and movements. There is no significantly dominant source of noise.
- 4.3 The site is located sufficiently far from Gatwick Airport to lie outside of the annually published noise contour maps, however, it is noted that Southwater is partially below one of the primary arrivals routes during easterly operations. During the noise measurements, Gatwick Airport was utilising westerly operations. Aircraft movements were regular and audible, however, they did not dominate the noise climate and were usually flying at a relatively high altitude. The noise contribution from aircraft during Gatwick Airport easterly operations should be marginally higher than during westerly operations as more flights are expected to fly directly over Southwater.
- 4.4 The existing noise profile of the development site was established by measurements utilising 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.
- 4.5 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.
- 4.6 In accordance with BS 7445, the weather conditions during the noise survey were recorded. The weather was dry with variable levels of cloud cover (20% to 50%). The recorded wind speeds were less than 5 m/s from a northerly direction and temperatures of between 11°C and 22°C were recorded. There were no adverse weather conditions which could significantly affect the results of the noise survey.



Equipment Used

- 4.7 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

Results from the Monitoring

- 4.8 The SLM was setup at 1100 on Monday 3rd June and ended at 1100 on Tuesday 4th June 2024. Presented in **Table 4.2** is a summary of the results from the measurements.

Table 4.2: Summary of Recorded Noise Levels

Measurement Location	Time	Ambient Noise Level (L _{Aeq,T})	Maximum Noise Level (L _{AFmax})	10 th Percentile Noise Level (L _{A10,T})	Background Noise Level (L _{A90,T})
MP1	Day	40.9	66.6	42.8	31
	Night	39	72.2	41.1	20.3

Noise Modelling

Road Traffic Noise Levels

- 4.9 Road traffic noise levels across the site have been calculated using CadnaA. The road traffic data has been obtained from Chapter 5 *Transport and Access* of the Environmental Statement and Transport Assessment submitted to HDC in support of the outline planning application for the wider Land West of Worthing Road, Southwater development site (HDC reference DC/14/0590).
- 4.10 The predicted road traffic noise levels across the site have been validated against the noise measurements carried out on Monday 3rd and Tuesday 4th June 2024 and considered in the context of the observed site conditions.



- 4.11 It should be noted that the CadnaA noise modelling software does not include the contribution of noise from aircraft (as well as sounds such as birdsong).



5.0 NOISE CONSTRAINTS ON PROPOSED DEVELOPMENT

- 5.1 The road traffic noise modelling results are presented in **Figure F2** for the daytime period (0700 to 2300) and **Figure F3** for the night time period (2300 to 0700). The daytime noise contours have been presented at a height of 1.5 m above ground level which is representative of the ground floor level of buildings and external amenity areas. The night-time noise contours have been presented at a height of 4.0 m above ground level which is representative of the first floor level of buildings.
- 5.2 **Figure F2** identifies that, during the daytime, the noise levels across the site due to road traffic are below 50 dB $L_{Aeq,16hr}$. Noise levels may be marginally higher when considering the contribution of other sources of noise such as aircraft but are unlikely to exceed a typical noise level of 50 dB $L_{Aeq,16hr}$.
- 5.3 **Figure F3** identifies that, during the night time, the noise levels across the site due to road traffic are below 45 dB $L_{Aeq,8hr}$. Noise levels may be marginally higher when considering the contribution of other sources of noise such as aircraft but are unlikely to exceed a typical noise level of 45 dB $L_{Aeq,8hr}$.
- 5.4 The maximum (L_{AFmax}) noise levels are unlikely to exceed 60 dB external to any habitable room more than ten times a night unless there is a significant increase in road traffic movement along Shaw's Lane during the night-time period or there is a significant change in Gatwick Airport night-time operations. The highest measured L_{AFmax} noise levels at MP1 were due to a low flying helicopter (62 dB L_{AFmax}) and a nearby bird (63 dB L_{AFmax}). Generally, the L_{AFmax} noise levels did not exceed 60 dB at MP1.
- 5.5 BS 8233 states that "if partially open windows were relied upon for background ventilation, the insulation would be reduced to approximately 15 dB". The WHO guidelines also state that a slightly open window would result in "a sound reduction from outside to inside of 15 dB".
- 5.6 Based on the above statements and **Figures F2** and **F3**, the internal noise levels within habitable rooms of the proposed dwellings would be below the targets of 35 dB $L_{Aeq,16hr}$, 30 dB $L_{Aeq,8hr}$ and 45 dB L_{AFmax} with open windows for ventilation and no further specific noise mitigation measures would be required.
- 5.7 No specific noise mitigation measures would be required to external amenity areas as these are expected to experience noise levels below 50 dB $L_{Aeq,16hr}$.



6.0 EFFECTS OF THE PROPOSALS DURING CONSTRUCTION

Construction Noise

- 6.1 A construction noise and vibration assessment was carried out as part of Chapter 6 *Noise and Vibration* of the Environmental Statement (ES) for the outline planning application for the wider Land West of Worthing Road, Southwater development. The assessment utilised worst-case plant and machinery assumptions to assess the significance of construction noise and vibration at nearby sensitive receptors.
- 6.2 In respect of Phase 5, the nearest noise sensitive receptors which were assessed included:
- Chase Lodge, Shaw's Lane to the south-west of the site;
 - Dwellings on Woodlands Way (represented by a receptor position at 100 Woodlands Way) to the east of the site;
 - Dwellings on College Lane (represented by a receptor at 2 College Way) to the north-east of the site; and
 - Dwellings adjacent to the Holy Innocents' Church (represented by a receptor at Vicarage Cottage) to the north of the site;
 - 89 Kensett Avenue (located in Phase 3.2).
- 6.3 In **Table 6.1** are presented the results of the construction noise assessment carried out for the ES and a new receptor at 89 Kensett Avenue within the completed and occupied Phase 3.2.



Table 6.1: Predicted Construction Noise Levels at Existing Receptors – Phase 5

Receptor	Scenario	Construction Noise Level $L_{Aeq,T}$ (dB)			
		Ground Works	Foundations	Building Erection	Infrastructure / Landscaping
The Vicarage/ Southwater House	Worst-case	62	62	58	60
	Average-case	57	56	53	53
2 College Road	Worst-case	50	49	46	47
	Average-case	45	45	41	41
Chase Lodge	Worst-case	65	63	60	63
	Average-case	56	56	52	52
100 Woodlands Way	Worst-case	51	50	46	48
	Average-case	47	47	43	43
89 Kensett Avenue (Phase 3.2)	Worst-case	65	70	66	61
	Average-case	56	60	56	52

- 6.4 The noise sensitive receptors can be identified in **Figure F4**. The assessment of construction noise assumed that all best practicable means noise mitigation measures would be applied.
- 6.5 With reference to Table 6.1, it can be identified that none of the predicted noise levels would exceed 65 dB $L_{Aeq,T}$ at any noise sensitive receptor except at 89 Kensett Avenue. The ES chapter on noise and vibration considered a construction noise level over the core working day of less than 65 dB to be negligible and a construction noise level of 70 dB to result in a minor impact. For noise levels below 70 dB, the effect of construction noise on noise sensitive receptors would not be significant.
- 6.6 A Construction Environmental Management Plan (CEMP) was submitted to HDC in 2015 to discharge an associated planning condition on the original planning application (DC/14/0590). The CEMP outlines a series of noise mitigation measures to ensure that noise levels are kept to a minimum. The CEMP bespoke to the construction of Phases 5 and 4 is proposed to be updated, retaining mitigation measures to reduce disturbance.
- 6.7 Without any new information to base a more detailed construction noise assessment on, it is assumed that the assessment carried out as part of the previous ES remains a worst-case assessment and thus construction noise impacts will not be significant with noise levels generally not exceeding 65 dB



$L_{Aeq,T}$ during typical working hours. The typical working hours for noisy activities and deliveries are stated in the CEMP as 0800 hrs to 1800 hrs Monday to Friday and 0800 hrs to 1300 hrs Saturday. The relevant noise reducing measures already implemented during the earlier phases of construction will be continued throughout the construction of Phase 5 to safeguard existing residents.

- 6.8 If dwellings on the western boundary of Phase 4 are completed and occupied prior to the commencement of construction activities on the eastern boundary of Phase 5, further noise mitigation measures may be required to ensure that construction noise levels do not adversely affect these residents.

Construction Vibration

- 6.9 **Table 6.2** provides typical maximum distances at which certain construction activities may give rise to 'just perceptible' levels of vibration (0.3 mm/s Peak Particle Velocity). These values are based on historical field measurements.

Table 6.2: Distances at which Construction Vibration may just be Perceptible

Construction Activity	Maximum Distance from Activity when Vibration may just be Perceptible (m)
Excavation	10-15
Vibratory Compaction	25-40 (depending on weight of drum and specific equipment used)
Heavy Vehicles (e.g. Dump Trucks)	5-15
Hydraulic Breaker	15-20
Auger Piling (e.g. Continuous Flight Auger Piling)	5-10
Vibratory Piling	30-40

- 6.10 The nearest existing vibration sensitive receptors to the development site (Chase Lodge to the south-west and Southwater House/The Vicarage to the north) are over 90 m away from the nearest proposed dwelling plot. With the exception of some very short term activities for landscaping purposes closer to Chase Farm than the nearest proposed dwelling, vibration due to construction activities are highly unlikely to be perceptible at these receptors.
- 6.11 The closest residential dwelling to Phase 4 and Phase 5 is 89 Kensett Avenue in the southwest corner of Phase 3.2. The dwelling is approximately 15m north of Phase 4 and 25m east Phase 5 and adjacent to the proposed site access



route. It is unlikely that construction vibration will be perceptible at 89 Kensett Avenue, however, monitoring may be required if complaints arise.

- 6.12 Phase 4 dwellings, if completed and occupied before construction activities commence at Phase 5, are located at least 40 m from the nearest Phase 5 dwelling plots. It is unlikely that construction vibration will be perceptible at occupied Phase 4 dwellings during the construction of Phase 5.



7.0 EFFECTS OF THE PROPOSALS POST-CONSTRUCTION

- 7.1 The effects of the development on the existing environment are considered in terms of modelled traffic data using CadnaA which incorporates the CRTN calculation methodology.
- 7.2 Road traffic noise levels have been predicted at existing sensitive receptors due to additional traffic movements that will be generated by the proposed Development. The traffic flow data has been used to calculate the future baseline scenario (Do Nothing) for 2028 and the future operational scenario “Future Baseline + Proposed Development” (Do Something) scenario for 2028 at representative existing receptor locations. The receptor locations are identified on **Figure F4** and the results from the calculations are presented in **Table 7.1**.

Table 7.1: Predicted Change in Road Traffic Noise levels (2028)

Receptor Location	‘Do Nothing’ (2028 Baseline)		‘Do Something’ (2028 Baseline + Proposed Development)		Change in Road Traffic Noise Level (DS – DM)	
	Daytime L _{Aeq,16hr} dB	Night Time L _{Aeq,8hr} dB	Daytime L _{Aeq,16hr} dB	Night Time L _{Aeq,8hr} dB	Daytime L _{Aeq,16hr} dB	Night Time L _{Aeq,8hr} dB
Vicarage Cottage	59.6	57.9	59.9	58.1	+0.3	+0.2
2 College Road	55.1	52.9	57.4	54.6	+2.3	+1.7
10 Church Lane	59.6	58.2	62.2	60.0	+2.6	+1.8

- 7.3 From Table 7.1 it can be identified that noise levels are predicted to increase by up to 2.6 dB at the sensitive receptors that would be affected by the additional development generated traffic.
- 7.4 The road traffic data has been obtained from the ES submitted for the outline planning application. The Do Minimum scenario assumes that none of the Land West of Worthing Road development exists and the Do Something scenarios includes road traffic associated with the entire Land West of Worthing Road development (Phases 1 to 5) including those which are already built and occupied. Therefore, this assessment is a cumulative assessment of the effect of the entire Land West of Worthing Road development on road traffic noise levels in the vicinity of Phase 5. The assessment of road traffic effects due to Phase 5 only is likely to be negligible.



Impact and Significance

- 7.5 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 7.2** is the impact assessment for the receptors outside the development for the 2025 road traffic scenarios.

Table 7.2: Impact Assessment for Development Generated Traffic

Receptor Location	Daytime		Night Time	
	Change in Noise Level, dB(A)	Magnitude of Impact	Change in Noise Level, dB(A)	Magnitude of Impact
Vicarage Cottage	+0.3	Negligible	+0.2	Negligible
2 College Road	+2.3	Minor	+1.7	Minor
10 Church Lane	+2.6	Minor	+1.8	Minor

- 7.6 As can be identified in Table 7.2, there is predicted to be a "Negligible" (0.1 to 0.9 dB) increase in road traffic noise level at Vicarage Cottage (to the west of the site access from Church Lane). At the other two receptors, which are located on or overlooking Church Lane to the east of the site access a "Minor" (1.0 to 2.9 dB) increase in road traffic noise level is predicted.
- 7.7 All receptors are residential dwellings which are considered "high" sensitivity to noise (refer to **Table 2.6**). The magnitudes of impact are predicted to be "Negligible" or "Minor" therefore the significance of road traffic noise effects are considered to be "Slight" (refer to **Table 2.7**). A "Slight" effect is not considered to be significant therefore, no noise mitigation measures are required.



8.0 SUMMARY AND CONCLUSIONS

- 8.1 Stuart Michael Associates has been engaged by Berkeley Homes (Southern) Limited to undertake an updated noise assessment for the proposed development of 94 units for Phase 5 of Land West of Worthing Road, Southwater.
- 8.2 The constraints on the development and the impacts from development generated traffic have been assessed using the computer noise model CadnaA which incorporates the CRTN calculation methodology. Also considered are the potential impacts from construction activities.
- 8.3 From on-site observations, the existing noise climate is affected by noise from a variety of sources including distant and localised road traffic movements, aircraft movements, birdsong, and distant train horns and movements. None of these sources are particularly dominant and the site is considered to be relatively quiet.
- 8.4 The assessment of constraints on the proposed development has identified that noise levels across the site due to existing sources of noise would not exceed the external target noise level range of 50 dB to 55 dB $L_{Aeq,16hr}$. Additionally, the target internal noise levels would be achievable with open windows for ventilation. Therefore, no specific noise mitigation measures are required for the proposed development.
- 8.5 The assessment of construction noise impacts has reviewed the assessment carried out to support the outline planning application (HDC reference DC/14/0590). The assessment considered worst-case plant and machinery assumptions located in worst-case and average-case locations across the site. The results of the construction noise impact assessment identified that the highest predicted noise levels would not exceed 65 dB $L_{Aeq,T}$ which was not considered to be significant. Furthermore, a series of site specific noise mitigation measures have been outlined in the Construction Environmental Management Plan and it is assumed that all appropriate noise mitigation measures will be continued into the development of Phase 5.
- 8.6 An assessment of potential effects of construction vibration has determined that construction vibration is likely to be imperceptible at either existing dwellings in the vicinity of Phase 5 or any occupied dwellings within Phase 3.2 and in the



future Phase 4 due to the distances between the construction activities and the receptors.

- 8.7 Once the proposed development is fully operational, it is noted that a slight increase in road traffic noise levels is likely at dwellings to the east of the site access on Church Lane. However, a slight (less than 3 dB change in road traffic noise level) increase is not considered to be significant and no specific noise mitigation measures are required. It is noted that the assessment of operational road traffic effects is a cumulative assessment of the road traffic impact due to the entire Land West of Worthing Road development. Therefore, the actual impact of Phase 5 only is likely to be negligible.
- 8.8 On the basis of the above, it is considered that subject to the recommendations above, there should be no objection to granting planning consent for the proposed development on noise grounds.



9.0 FIGURES

Figure F1: Site and Noise Measurement Location Plan





Figure F2: Daytime Noise Contours at a Height of 1.5 m – Illustrative Masterplan

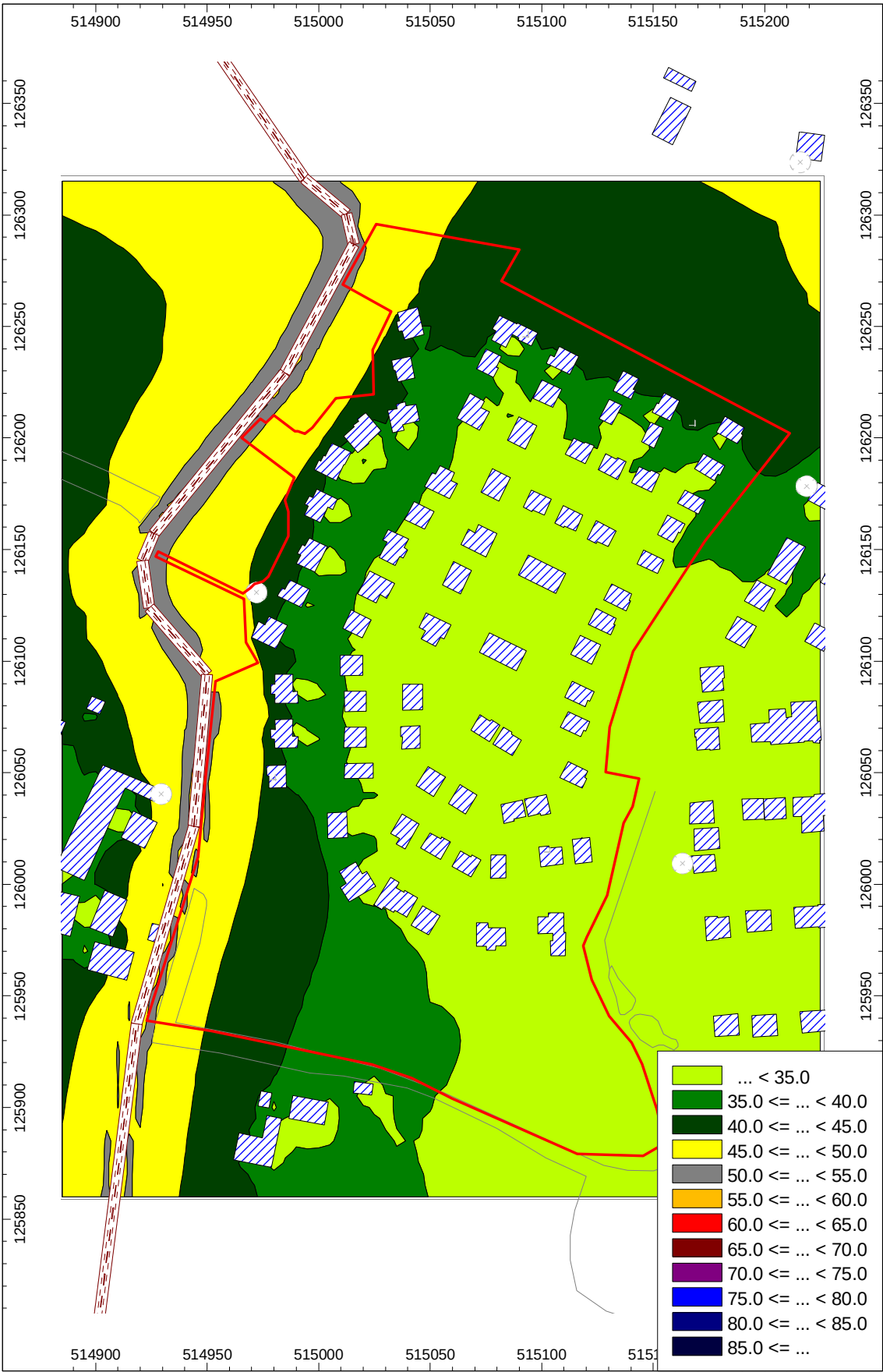




Figure F3: Night-time Noise Contours at a Height of 4.0 m– Illustrative Masterplan

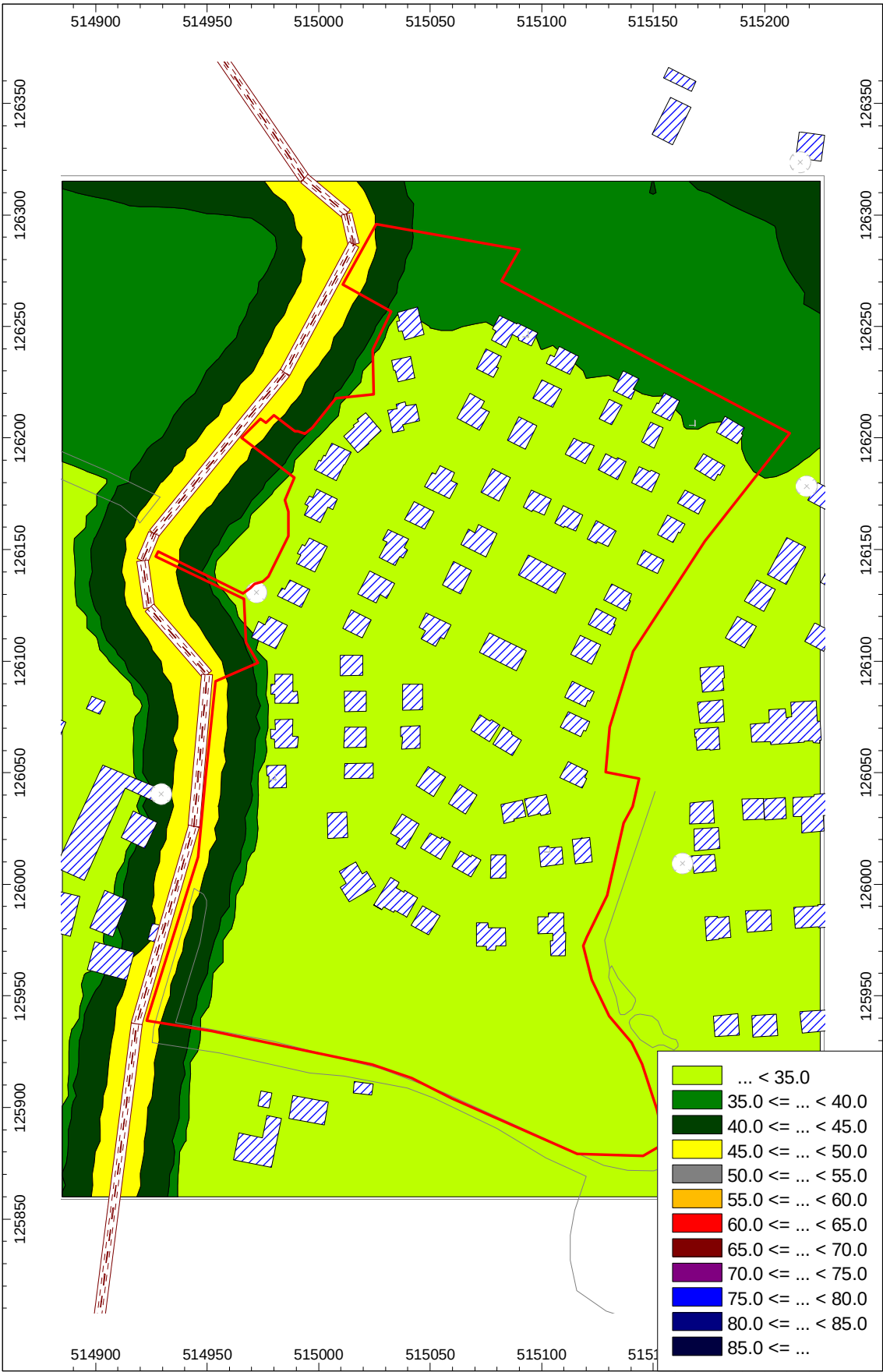




Figure F4: Noise Sensitive Receptors





10.0 APPENDIX

Site Layout (Drawing Number S835/SL/001 Revision D dated 28.06.24)

