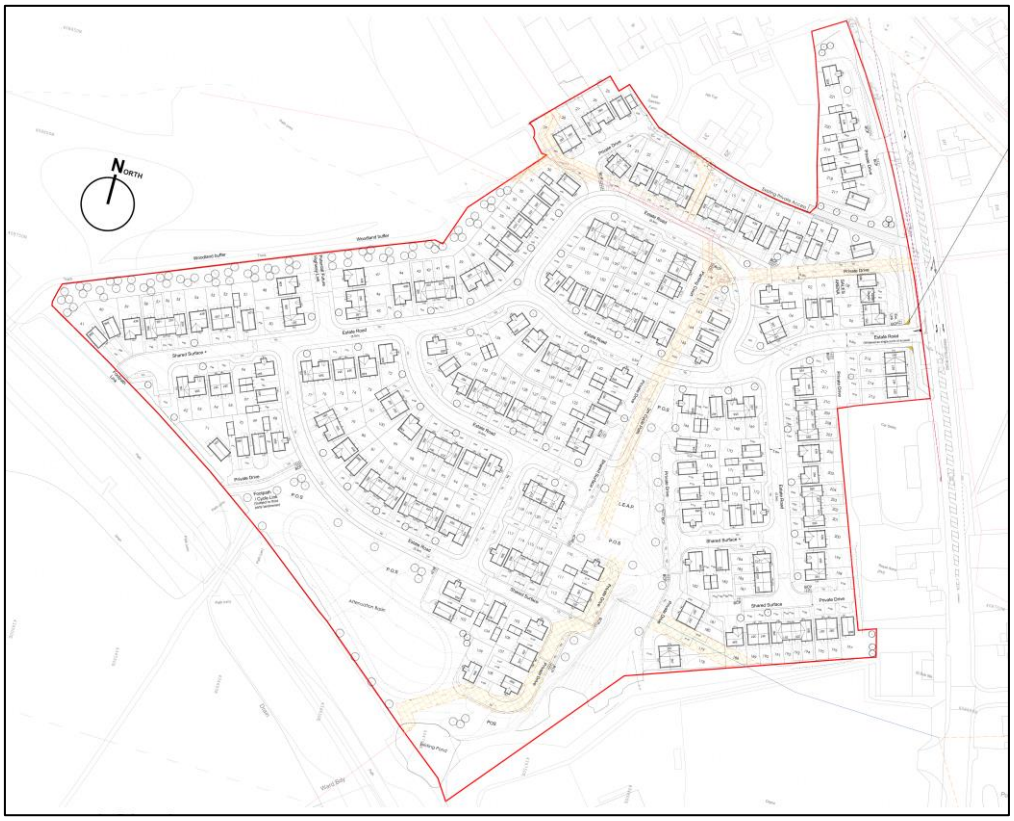
Gleeson Homes, Wakefield Road, Athersley

784-B039427



Noise Assessment

Gleeson Homes

6th November 2024

TETRA TECH

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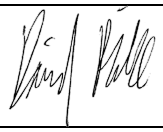
Date:	06/11/2024	**Checked by:**	David Fink Principal Consultant	
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Acronyms/Abbreviations

Acronyms/Abbreviations	Definition
CADNA	Computer Aided Noise Abatement
DMRB	Design Manual for Roads and Bridges
HGV	Heavy Goods Vehicle
PPG	Planning Practice Guidance
UDP	Unitary Development Plan
UKAS	United Kingdom Accreditation Service

Executive Summary

A noise assessment has been undertaken in support of a reserved matters planning application for a proposed residential development at land to the west of Wakefield Road, Athersley.

With no mitigation, the development exceeds BS 8233 criteria across the majority of daytime and night-time criteria, with a number of identified sensitive receptor locations falling within Unacceptable Observed Adverse Effect Levels (UOAEL). Therefore, a glazing and ventilation strategy has been recommended to achieve acceptable internal acoustic conditions based on the BS 8233:2014 and WHO criteria.

Furthermore, the results of the internal night-time $L_{Aeq,8hours}$ and L_{Amax} noise level assessments indicate that a number of facades are exceeding the Approved Document O: Overheating criteria with windows open. These rooms will therefore require closed windows to ensure reasonable internal acoustic conditions during the night-time period and would require comfort cooling to be supplied.

Daytime noise levels at all indicative private external amenity areas are below the BS8233 upper guideline value of 55 dB $L_{Aeq,16hours}$. Therefore, no additional mitigation has been proposed for the external amenity areas (aside from assumed 1.8m close boarded garden fencing).

1.0 Introduction

1.1 Purpose of this Report

This report presents the findings of a noise assessment to support a reserved matters planning application for a proposed residential development at land to the west of Wakefield Road, Athersley.

The outline planning permission for the site (ref. 2017/1451) contains Condition 7 relating specifically to Noise. For reference, Condition 7 is reproduced below:

> "*A detailed scheme of noise mitigation measures shall be submitted with the reserved matters application. The scheme shall be accompanied by a plan which clearly identifies where each type of mitigation is proposed and a programme of implementation. Thereafter the development shall be carried out in accordance with the approved measures.*
>
> *Reason: In the interests of noise mitigation in accordance with CSP40.*"

A description of the existing noise environment in and around the site is provided. Noise surveys have been undertaken and the results used to verify predictions of the short-term and long-term effects of noise.

A list of acoustic terminology used in this report is provided in Appendix A. Report Conditions are available upon request.

1.2 Legislative Context

This report is intended to provide information relevant to the local planning authority and their consultees in support of a planning application for the above proposed development. Policy guidance with respect to noise is found in the National Planning Policy Framework (NPPF), published in December 2023. With regard to noise and planning, the NPPF contains the following statement at Paragraph 191:

> "191. 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 […]

"193. 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.

"194. The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities."

Planning Practice Guidance (PPG): Noise provides further guidance with regard to the assessment of noise within the context of Planning Policy. The overall aim of this guidance, tying in with the principles of the NPPF and the Explanatory Note of the Noise Policy Statement for England (NPSE), is to **"identify whether the overall effect of noise exposure is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation."**

A summary of the effects of noise exposure associated with both noise generating developments and noise sensitive developments is presented within the PPG and repeated below in Table 1.1.

Table 1.1: NPPG Noise Exposure Hierarchy

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not present	No Effect	No Observed Effect	No Specific Measures Required
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No Specific Measures Required
Lowest Observed Adverse Effect Level (LOAEL)			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level (SOAEL)			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

The NPPF, NPSE and PPG do not, however, present absolute noise level criteria which define SOAEL, LOAEL and NOEL which is applicable to all sources of noise in all situations. Therefore, within the context of the Proposed Development, national planning policy and appropriate guidance documents including ‘BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings’ (2014) and ‘BS 4142:2014+A1:2019 Methods for Rating and Assessing Industrial and Commercial Sound’ (2014) have been used. Section 2.0 presents the noise level criteria used as a basis of this assessment.

The PPG also states that neither the NPSE nor the NPPF (which reflects the Noise Policy Statement) expects noise to be considered in isolation, separately from the economic, social and other environmental dimensions of the proposed development.

Furthermore, the PPG: Noise identifies at Paragraph: 011 Reference ID: 30-011-20190722 the requirement for developments proposals to incorporate measures to mitigating the impact of noise on residential developments. In particular:

"*Noise impacts may be partially offset if residents have access to one or more of:*

- *a relatively quiet facade (containing windows to habitable rooms) as part of their dwelling;*
- *a relatively quiet external amenity space for their sole use, (e.g. a garden or balcony). Although the existence of a garden or balcony is generally desirable, the intended benefits will be reduced if this area is exposed to noise levels that result in significant adverse effects;*
- *a relatively quiet, protected, nearby external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings; and/or*
- *a relatively quiet, protected, external publicly accessible amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minute walking distance).*

1.3 ProPG Planning and Noise

Professional Practice Guidance on Planning and Noise for new residential development (ProPG) was published in May 2017 by the Chartered Institute of Environmental Health (CIEH), the Association of Noise Consultants (ANC) and the Institute of Acoustics (IOA). The guidance has been published to provide practitioners with guidance on the management of noise within the planning system in England.

The guidance is specifically for 'new residential development' that would be exposed predominantly to noise from existing transport sources and reflects the Government's overarching Noise Policy Statement for England (NPSE), the National Planning Policy Framework (NPPF), and Planning Practice Guidance (including PPG-Noise), as well as other authoritative sources of guidance.

The guidance provides advice for Local Planning Authorities (LPAs) and developers, and their respective professional advisers which complements Government planning and noise policy and guidance and, in particular, it aims to:

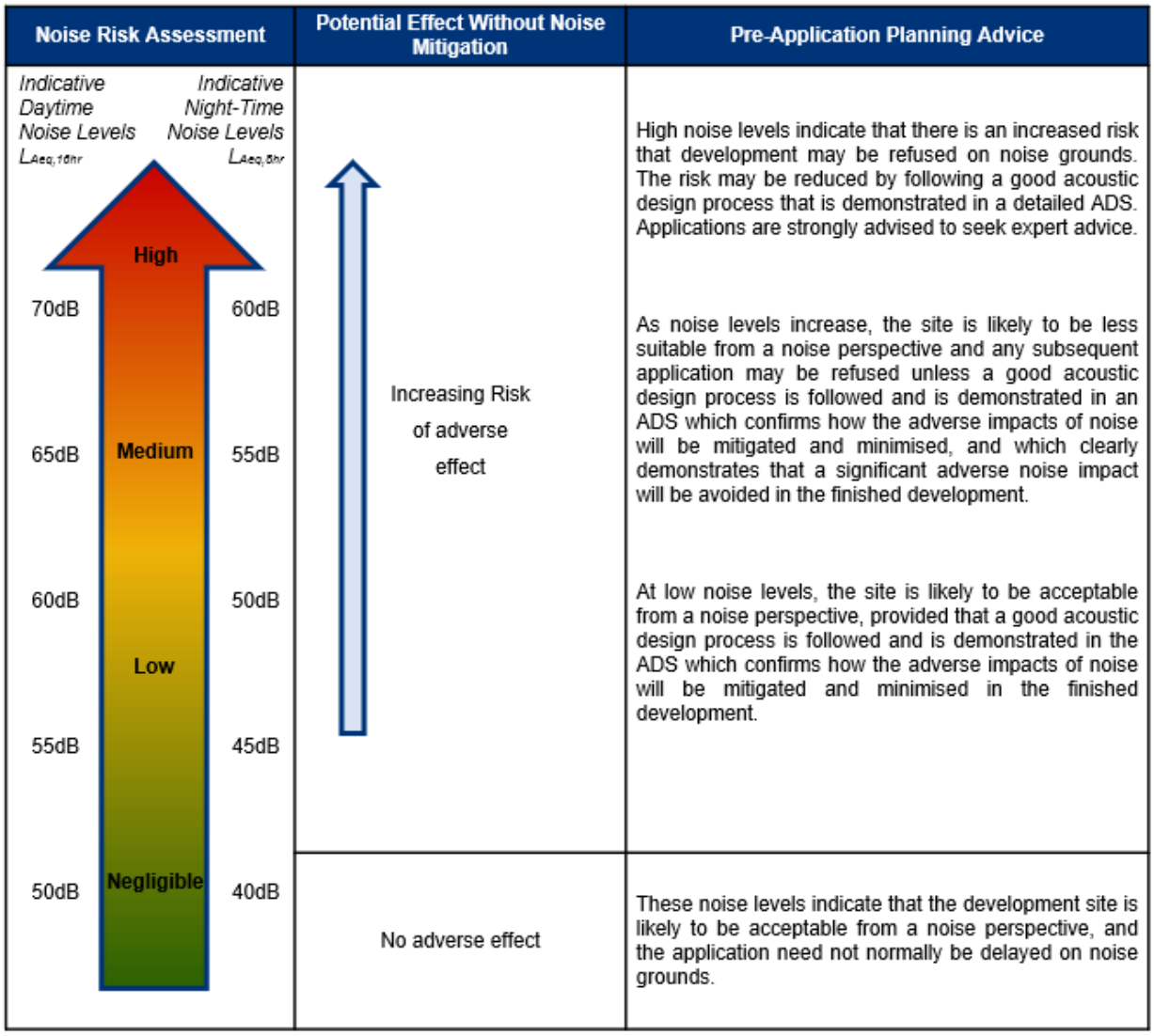
- Advocate full consideration of the acoustic environment from the earliest possible stage of the development control process;
- Encourage the process of good acoustic design in and around new residential developments;
- Outline what should be taken into account in deciding planning applications for new noise-sensitive developments;
- Promote appropriate noise exposure standards; and
- Assist the delivery of sustainable development.

There are two stages of the overall approach outlined in the ProPG:

- Stage 1 – an initial noise risk assessment of the Proposed Development site; and
- Stage 2 – a systematic consideration of 4 key elements which is underpinned by an Acoustic Design Statement (ADS).

With regard to Stage 1, the ProPG provides guidance for producing an initial site risk assessment, pre-mitigation, with regards to noise based on the prevailing daytime and night-time noise levels across the site, from which the site (or areas thereof) can be allocated a Noise Risk as shown in Figure 1.2. This shows the various Noise Risks Categories (NRC) together with their corresponding sound levels as referred to in the ProPG. It should be noted that the categories are not distinct which allows context to be included within the assessment with the purpose of the Stage 1 assessment to determine the likely acoustic challenges on the site.

Figure 1.1: ProPG Stage 1 – Noise Risk Assessment



At Stage 2, which is not required to be progressed if the Stage 1 assessment determines a negligible risk, there are 4 elements which should be undertaken in parallel. These are:

- Good Acoustic Design Process
- Internal Noise Level Guidelines
- External Amenity Area Noise Assessment
- Assessment of Other Relevant Issues

There is then the requirement to present an ADS to provide sufficient evidence that the ProPG Stage 1 and Stage 2 Elements 1 to 4 have been followed.

1.4 Acoustic Consultants' Qualifications and Professional Memberships

The lead project Acoustic Consultant is Travis Smith. The report has been checked by David Fink and verified by Dawit Abraham. Relevant qualifications, membership and experience are summarised in Table 1.2 below.

Table 1.2: Acoustic Consultants' Qualifications & Experience

Name	Education	Experience in Undertaking Noise Assessments (Start date of working in noise & acoustics)	Attained Associate Membership of the Institute of Acoustics (date)	Attained Membership of the Institute of Acoustics (date)
Travis Smith	BSc 2022	Jul 2022	-	-
David Fink	BEng 2016	Mar 2017	Jul 2017	-
Dawit Abraham	BSc 2008 MSc 2010	Oct 2010	Jan 2011	Jan 2015

2.0 Assessment Criteria

In order to enable the assessment of the proposed development in terms of LOAEL and SOAEL, Table 2.1 presents equivalent noise levels and associated actions with the target noise level criteria identified. The noise level criteria detailed below have been derived from standards and design guidance:

- BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings – Code of practice'
- BS4142:2014 'Method for rating industrial and commercial sound'
- World Health Organisations (1999) 'Guidelines for Community Noise'

A full bibliography of documents referenced within this report is provided within Appendix B.

Table 2.1: Noise Level Criteria and Actions

Noise Sources	Noise Level Criteria	Justification for Effect Level- Action Required
No Observed Adverse Effect Level (NOAEL)		
Fixed plant and equipment located externally or internally with louvered ventilation grilles	Difference between Rating Level ($L_{Ar,T}$) dB and existing background level $L_{A90,T}$ dB is less than or equal to 0dB	**Justification for Effect Level:** Below low impact threshold in BS4142:2014 **Action Required:** None
Absolute internal noise criteria for the following noise sources with windows closed: • Road traffic noise • Goods vehicle deliveries and unloading of vehicles. • Service yard noise including forklift truck movements. • Car Parks	Noise levels are below: Living Rooms: - 35 $dBL_{Aeq,16hours}$ Kitchens, Dining Rooms, and Studies: - 40 $dBL_{Aeq,16hours}$ Bedrooms: - 35 $dBL_{Aeq,16hours}$ - 30dB $L_{Aeq,8hr}$ - $L_{AFmax,2min}$ noise levels do not exceed: 45dB L_{AFmax} based on 10th highest $L_{AFmax,2min}$ sample)	**Justification for Effect Level:** Less than threshold values in Table 4 in BS8233:2014 and Table 1 in World Health Organisation (1999) Guidelines on Community Noise **Action Required:** None
Absolute external noise criteria for the following noise sources: • Road traffic noise • Goods vehicle deliveries and unloading of vehicles. • Service yard noise including forklift truck movements. • Car Parks	Noise levels are below 50$dBL_{Aeq,16hours}$	**Justification for Effect Level:** Less than 'desirable' values in BS8233:2014 Paragraph 7.7.3.2. **Action Required:** None
Lowest Observed Adverse Effect Level (LOAEL)		
Fixed plant and equipment located externally or internally with louvered ventilation grilles	Difference between Rating Level ($L_{Ar,T}$) dB and existing background sound level $L_{A90,T}$ dB is between 1-4dB.	**Justification for Effect Level:** Within less likely for adverse or significant adverse impact to

		occur low impact threshold in BS4142:2014 **Action Required:** Mitigate and reduce to a minimum the exceedance over 0dB above background threshold
Absolute internal noise criteria for the following noise sources with windows closed: • Road traffic noise • Goods vehicle deliveries and unloading of vehicles. • Service yard noise including forklift truck movements. • Car Parks	Noise levels are between: Living Rooms: - 35-40 dB$L_{Aeq,16hours}$ Kitchens, Dining Rooms, and Studies: - 40-45 dB$L_{Aeq,16hours}$ Bedrooms: - 35-40 dB$L_{Aeq,16hours}$ - 30-35dB $L_{Aeq,8hr}$ - $L_{AFmax,2min}$ noise levels do not exceed 45dB L_{AFmax} based on 10th highest $L_{AFmax,2min}$ sample)	**Justification for Effect Level:** Exceed threshold guidelines in Table 4 of BS8233:2014 and World Health Organisation (1999) Guidelines on Community Noise by no greater than 5dB to achieve reasonable internal conditions as defined by Note 7 to Table 1 in BS8233:2014 **Action Required:** Mitigate and reduce to a minimum the exceedance over the threshold
Absolute external noise criteria for the following noise sources: • Road traffic noise • Goods vehicle deliveries and unloading of vehicles. • Service yard noise including forklift truck movements. • Car Parks	Noise levels are between 50-55 dB$L_{Aeq,16hours}$	**Justification for Effect Level:** Exceed 'desirable' threshold guidelines but within upper threshold guidelines in Paragraph 7.7.3.2 of BS8233:2014
Significant Observed Adverse Effect Level (SOAEL)		
Fixed plant and equipment located externally or internally with louvered ventilation grilles	Difference between Rating Level ($L_{Ar,T}$) dB and existing background sound level $L_{A90,T}$ dB is between 5-9dB.	**Justification for Effect Level:** Within adverse impact threshold in BS4142:2014. **Action Required** Additional mitigation required to achieve effect of LOAEL or less.
Absolute internal noise criteria for the following noise sources with windows closed: • Road traffic noise • Goods vehicle deliveries and unloading of vehicles. • Service yard noise including forklift truck movements. • Car Parks	Noise levels are between: Living Rooms: - 40-45 dB$L_{Aeq,16hours}$ Kitchens, Dining Rooms, and Studies: - 45-50 dB$L_{Aeq,16hours}$ Bedrooms: - 40-45 dB$L_{Aeq,16hours}$ - 35-40dB $L_{Aeq,8hr}$ - 45-55dB $L_{AFmax,2min}$ based on 10th highest $L_{AFmax,2min}$ sample)	**Justification for Effect Level:** Exceeds BS8233:2014 $L_{Aeq,T}$ reasonable criteria by 5dB or exceeds $L_{AFmax,2min}$ (10th highest sample) **Action Required:** Additional mitigation required to achieve effect of LOAEL or less.
Absolute external noise criteria for the following noise sources: • Road traffic noise • Goods vehicle deliveries and unloading of vehicles. • Service yard noise including forklift truck movements. • Car Parks	Noise levels exceed 55 dB$L_{Aeq,16hours}$	**Justification for Effect Level:** Exceeds BS8233:2014 $L_{Aeq,16hours}$ upper criteria. **Action Required:** Additional mitigation required to achieve effect of LOAEL or less.

Unacceptable Observed Adverse Effect Level (UOAEL)		
Fixed plant and equipment located externally or internally with louvered ventilation grilles	Difference between Rating Level ($L_{Ar,T}$) dB and existing background sound level $L_{A90,T}$ dB is equal to or greater than 10dB	**Justification for Effect Level:** Within significant adverse impact threshold in BS4142:2014 **Action Required:** Additional mitigation required to achieve effect of LOAEL or less.
Absolute internal noise criteria for the following noise sources with windows closed: • Road traffic noise • Goods vehicle deliveries and unloading of vehicles. • Service yard noise including forklift truck movements. • Car Parks	Noise levels exceed: Living Rooms: - 45 $dBL_{Aeq,16hours}$ Kitchens, Dining Rooms, and Studies: - 50 $dBL_{Aeq,16hours}$ Bedrooms: - 45 $dBL_{Aeq,16hours}$ - 40dB $L_{Aeq,8hr}$ - $L_{AFmax,2min}$ noise levels exceeds 55dB L_{AFmax} based on 10th highest $L_{AFmax,2min}$ sample)	**Justification for Effect Level:** Exceeds BS8233:2014 $L_{Aeq,T}$ reasonable criteria by 10dB or exceeds $L_{AFmax,2min}$ (10th highest sample) by 10dB or more. **Action Required:** Additional mitigation required to achieve effect of LOAEL or less.
Absolute external noise criteria for the following noise sources: • Road traffic noise • Goods vehicle deliveries and unloading of vehicles. • Service yard noise including forklift truck movements. • Car Parks	Noise levels exceed 60 $dBL_{Aeq,16hours}$	**Justification for Effect Level:** Exceeds BS8233:2014 $L_{Aeq,16hours}$ upper criteria by 5dB or more. **Action Required:** Additional mitigation required to achieve effect of LOAEL or less.

2.1 Building Regulations Approved Document O: Overheating

In accordance with Building Regulations Approved Document O: Overheating (2021) (ADO), in locations where external noise may be an issue, the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (23:00 – 07:00).

Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.

- 40 dB $L_{Aeq,8hours}$ (between 23:00 and 07:00)
- 55 dB $L_{AFmax,2min}$ no more than 10 times a night (between 23:00 and 07:00)

As the guidance stipulates internal criteria within bedrooms, it is typical to assign a correction to the criteria so noise levels can be predicted external to the bedroom façade but still achieve the same internal noise level. A 15 dB reduction through an open window from outdoors to indoors has been used. Therefore, 15 dB has been added to the internal criteria to determine suitable criteria which should be implemented externally to the residential façade.

In addition to the above, for facades where the external noise level is between 45 – 54 dB $L_{Aeq,8hours}$ and 60 – 69 dB L_{AFmax}, the suitability of the proposed overheating mitigation strategy in bedrooms will depend on both the external noise level, and the length of time windows are open during the night.

This is owing to noise levels leading to exceedances over the internal ambient noise level criteria stipulated within British Standard 8233:2014 and ProPG which may be relaxed in certain circumstance based on the needs of the occupant i.e. to avoid overheating.

Table 2.2 summarises the three categories which determine whether further actions to reduce the risk of overheating at night may be required.

Table 2.2: Overheating Mitigation Strategy Category – Noise at Night

Criteria	Action	Reason
≤ 45 dB $L_{Aeq,8hr}$ or ≤ 60 dB L_{AFmax}	No further action required	Dwellings can be ventilated during the summer months using openable windows and achieve the ADO and B S8233:2014 internal ambient noise levels criteria.
46 - 55 dB $L_{Aeq,8hr}$ or 61 – 70 dB L_{AFmax}	Information required outlining the number of hours required to have windows open during the summer months, to ensure noise levels with windows open do not cause significant adverse effects	Dwellings can be ventilated during the summer months using openable windows and achieve the ADO criteria but not internal ambient noise levels stipulated within BS 8233:2014.
> 55 dB $L_{Aeq,8hr}$ or > 70 dB L_{AFmax}	Alternative ventilation/cooling strategy to mitigate summertime overheating may be required.	Dwellings cannot rely upon openable windows to achieve the ADO criteria.

3.0 Assessment Methodology

3.1 Noise Modelling Methodology

Three-dimensional noise modelling has been undertaken based on the monitoring data to predict noise levels at a number of locations both horizontally and vertically. CADNA noise modelling software has been used. This model is based on ISO 9613-2 noise propagation methodology and allows for detailed prediction of noise levels to be undertaken for large numbers of receptor points and different noise emission scenarios both horizontally and vertically. The modelling software calculates noise levels based on the emission parameters and spatial settings that are entered. Input data and model settings as given in Table 3.1 below have been used.

Table 3.1: Modelling Parameters Sources and Input Data

Parameter	Source	Details
Horizontal distances – around site	Ordnance Survey	Ordnance Survey
Ground levels – around site	DEFRA	LiDAR 1m DTM
Building heights – around site	Tetra Tech Observations	• 4.0m height for one-storey properties • 8.0 m height for two storey properties • 3.0m per additional storey
Receptor positions*	Tetra Tech	• 1.5 m for ground floor properties • 4.0m height for first-floor properties • 3.0m per additional storey • 1.5m height for monitoring validation locations
Modelling Parameters	Tetra Tech	• Ground Absorption: 0.5 • Order of Reflections: 3 • Noise Contour Plot Grid Receiver Spacing: 10.0
Proposed Plans	PRA Architecture	Drawing Title: Proposed Site Layout Drawing No: 1225.06
*All receptors modelled 1.0m from building façade unless otherwise stated.		

It is acknowledged that a number of the values of parameters chosen will affect the overall noise levels presented in this report. However, it should be noted that the values used, as identified above, are worst-case.

3.2 Model Input Data

Information regarding noise emissions from nearby operational noise sources such as the bus depot and HSS hire have been determined using site surveys and the Tetra Tech library.

Data contained within Tables 3.2 & 3.3 below presents noise information for all noise sources used within the modelling.

Table 3.2: Summary of Noise Input Data (Sound Pressure Levels)

Noise Source	Type	Sound Pressure Level (dB(A))	Distance (m)	Source
HSS Hire (Daytime Only)	Average	81.3	3	Verification (See section (3.5.2)
Bus Depot Movements	Average	48.2	33	Site Survey
Bus Depot Movements	Maximum	67.7	33	Site Survey
Car Park	Average	54.0	1.5	Tetra Tech Library
Car Park	Maximum	76.3	1.5	Tetra Tech Library
Road Traffic	Maximum	90.5	3	Tetra Tech Library

*Maximum noise level applied to moving point source to simulate vehicle movements.

Table 3.3: Summary of Noise Input Data (Sound Power Levels)

Noise Source	Type	Octave Band Sound Power Level (L_w(A))								Sound Power Level (L_w(A))	Source
		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz		
Electrical Substation (North, East and South Façade)	Average	77.0	73.0	67.5	62.7	61.3	52.2	39.8	29.2	65.9	Verification (See section (3.5.4)
Electrical Substation (West Façade)	Average	77.1	83.3	71.8	57.6	58.1	54.9	56.3	62.1	70.2	Verification (See section (3.5.4)

3.3 Modelling Inputs & Rating Correction

Table 3.4 below presents the model input information and BS4142 rating penalty corrections applied to noise data presented within Tables 3.2 & 3.3. Rating corrections have been applied as +4dB for sources considered to be otherwise readily distinctive, as per guidance within BS4142 Section 9.2.

Table 3.4: Modelling Inputs & Rating Corrections

Noise Source	Height (m)	Source Type	Speed (km/h)	Movements per Hour		BS4142 Rating Penalty
				Daytime	Night-Time	
Electrical Substation (All Facades)	3	Vertical Area	-	-	-	+4
Road Traffic	0.5	Line	10	56	19.5	-
Bus Depot Movement	1.5	Line	10	34	34	-

3.4 Sensitive Receptors

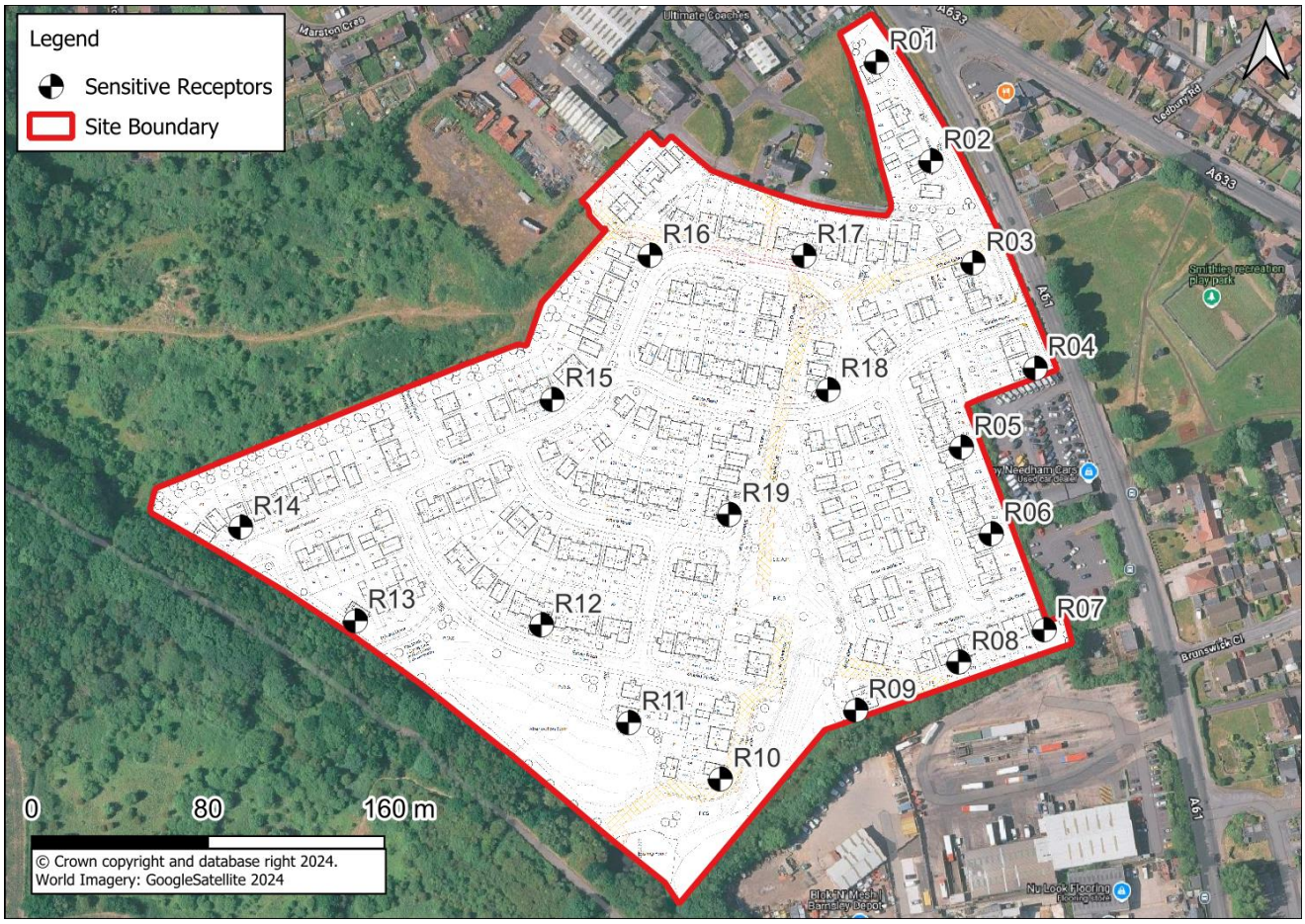
3.4.1 Proposed Sensitive Receptor Locations

Table 3.5 below summarises receptor locations that have been selected to represent worst-case proposed sensitive receptors with respect to direct ingress onto the site. Façades of the worst-case noise sensitive properties of the development site have been represented. The locations of the receptors are shown in Figure 3.1 below.

Table 3.5: Proposed Sensitive Receptor Locations

Ref.	Description	Type of Use	Height (m) Daytime / Night-time
R01	Plot 221	Residential	1.5 / 4.0
R02	Plot 218	Residential	1.5 / 4.0
R03	Plot 8	Residential	1.5 / 4.0
R04	Plot 213	Residential	1.5 / 4.0
R05	Plot 206	Residential	1.5 / 4.0
R06	Plot 200	Residential	1.5 / 4.0
R07	Plot 197	Residential	1.5 / 4.0
R08	Plot 190	Residential	1.5 / 4.0
R09	Plot 178	Residential	1.5 / 4.0
R10	Plot 108	Residential	1.5 / 4.0
R11	Plot 102	Residential	1.5 / 4.0
R12	Plot 85	Residential	1.5 / 4.0
R13	Plot 71	Residential	1.5 / 4.0
R14	Plot 59	Residential	1.5 / 4.0
R15	Plot 40	Residential	1.5 / 4.0
R16	Plot 30	Residential	1.5 / 4.0
R17	Plot 14	Residential	1.5 / 4.0
R18	Plot 165	Residential	1.5 / 4.0
R19	Plot 124	Residential	1.5 / 4.0

Figure 3.1: Sensitive Receptor Locations



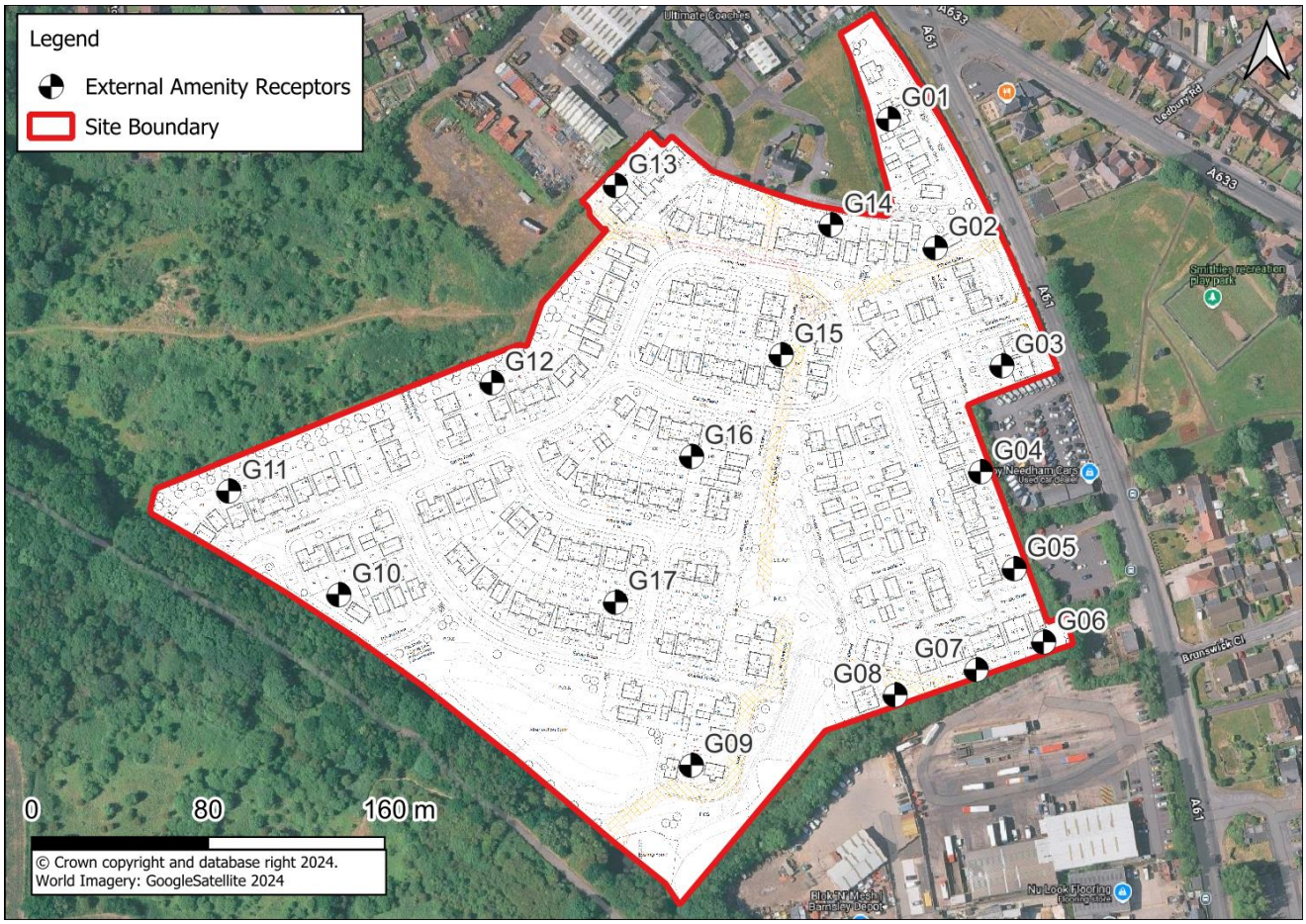
3.4.2 External Amenity Receptor Locations

Table 3.6 below summarises receptor locations that have been selected to represent worst-case external amenity receptors with respect to direct ingress onto the site. External amenity areas of the worst-case noise sensitive properties of the development site have been represented. The locations of the receptors are shown in Figure 3.2 below.

Table 3.6: External Amenity Receptor Locations

Ref.	Description	Height (m)
G01	Plot 221	1.5
G02	Plot 218	1.5
G03	Plot 8	1.5
G04	Plot 213	1.5
G05	Plot 206	1.5
G06	Plot 200	1.5
G07	Plot 197	1.5
G08	Plot 190	1.5
G09	Plot 178	1.5
G10	Plot 108	1.5
G11	Plot 102	1.5
G12	Plot 85	1.5
G13	Plot 71	1.5
G14	Plot 59	1.5
G15	Plot 40	1.5
G16	Plot 30	1.5
G17	Plot 14	1.5

Figure 3.2: External Amenity Receptor Locations



3.5 Model Verification (Existing Ambient Noise Climate)

3.5.1 Road Traffic Verification

With regards to road traffic noise, the models have been validated against the closest long term measurement position to the Wakefield Road, this being LT5. The comparison between the monitored and modelled results for the site is shown in Tables 3.7-3.9 below. The 2nd highest maximum level during the night-time was used, as the absolute max level was identified to be unrepresentative of typical events upon review of the audio.

Table 3.7: Modelled vs. Monitored Results $L_{Aeq;\ daytime\ 07:00 – 23:00}$

Location	Monitored L_{Aeq}	Modelled L_{Aeq}	Difference between Monitored and Modelled Results
LT5	58.5	58.5	0.0
All values are sound pressure levels in dB re: 2x 10-5 Pa			

Table 3.8: Modelled vs. Monitored Results $L_{Aeq;\ night\text{-}time\ 23:00 – 07:00}$

Location	Monitored L_{Aeq}	Modelled L_{Aeq}	Difference between Monitored and Modelled Results
LT5	53.9	53.9	0.0
All values are sound pressure levels in dB re: 2x 10-5 Pa			

Table 3.9: Modelled vs. Monitored Results $L_{Max;\ night\text{-}time\ 23:00 – 07:00}$

Location	Monitored L_{Aeq}	Modelled L_{Aeq}	Difference between Monitored and Modelled Results
LT5	76.2	76.2	0.0
All values are sound pressure levels in dB re: 2x 10-5 Pa			

As all verification points demonstrate a divergence between monitored and modelled results of no more than ±3 dB, the models are considered suitably verified.

3.5.2 HSS Noise Verification

To present a worst-case assessment of noise emanating from the HSS depot, which comprises engine noise / movement of plant (lifts), a source noise level of 55 dB $L_{Aeq,1hour}$ has been established following a review of the noise data at LT3. The comparison between the monitored and modelled results for the site is shown in Table 3.10 below.

Table 3.10: HSS Hire - Modelled vs. Monitored Results $L_{Aeq,T}$

Location	Monitored L_{Aeq}	Modelled L_{Aeq}	Difference between Monitored and Modelled Results
LT3	55.0	55.0	0.0

All values are sound pressure levels in dB re: 2x 10-5 Pa

At LT3, the verification point is equivalent to the worst-case source noise level and therefore the models are considered suitably verified.

3.5.3 Stagecoach Depot

To present a worst-case assessment, the noise model has been verified against the worst case measured $L_{Aeq,15mins}$ during the early morning period at ST2 with noise from the site comprising buses entering, manoeuvring around and exiting the depot. In addition, the worst-case L_{Amax} associated with vehicle movements has been used for this assessment. The comparison between the monitoring and modelling results are shown in Tables 3.11 and 3.12 below.

Table 3.11: Bus Depot - Modelled vs. Monitored Results $L_{Aeq,T}$

Location	Monitored L_{Aeq}	Modelled L_{Aeq}	Difference between Monitored and Modelled Results
ST2	48.2	48.2	0.0

All values are sound pressure levels in dB re: 2x 10-5 Pa

Table 3.12: Bus Depot - Night-time Modelled vs. Monitored Results L_{Amax}

Location	Monitored L_{Aeq}	Modelled L_{Aeq}	Difference between Monitored and Modelled Results
ST2	67.7	67.7	0.0

All values are sound pressure levels in dB re: 2x 10-5 Pa

The verification points demonstrate a divergence between monitored and modelled results of 0 dB. As such, the bus depot models are considered suitably verified. The noise levels for the existing car park associated with the bus depot have been outlined in Table 3.2.

3.5.4 Electrical Substation

With regard to noise levels from the electrical substation, the noise models have been validated against the measured noise levels based on measurements at and near the boundary of the substation. The comparison between the monitoring and modelling results are shown in Table 3.13 below.

Table 3.13: Electrical Substation - Modelled vs. Monitored Results $L_{Aeq,T}$

Location	Monitored L_{Aeq}	Modelled L_{Aeq}	Difference between Monitored and Modelled Results
Substation 1 (Northern Boundary)	54.0	55.5	1.5
Substation 2 (Western Boundary)	57.4	57.4	0.0
Substation 3 (On-site – approximately 19m from Substation)	46.0	45.7	-0.3

All values are sound pressure levels in dB re: 2x 10-5 Pa

In addition, verification across the frequency range has been undertaken based on the measurements collected at the boundary of the substation with the results presented in the table below.

Table 3.14: Modelled vs. Monitored Results $L_{Aeq,T}$

Monitoring Position		1/3 Octave Band Frequency (dB)								dB(A)
		63	125	250	500	1000	2000	4000	8000	
Substation 1	Measured	66.1	67.3	57.3	50.2	48.8	41.2	39.0	43.8	54.0
	Modelled	65.3	67.1	57.2	49.3	48.0	40.8	39.0	43.8	55.5
	Difference	0.8	0.2	0.1	0.9	0.8	0.4	0.0	0.0	1.5
Substation 2	Measured	67.2	71.0	60.0	49.4	48.2	42.9	43.5	48.7	57.4
	Modelled	66.2	70.1	59.1	48.2	47.3	42.0	42.6	47.8	57.4
	Difference	-1.0	-0.9	-0.9	-1.2	-0.9	-0.9	-0.9	-0.9	0.0

The verification points demonstrate a divergence between monitored and modelled results of less than 3dB. Therefore, models are considered suitably verified.

4.0 Noise Survey

4.1 Noise Survey Details

A monitoring survey was undertaken to characterise baseline ambient noise levels currently experienced on the site and to establish the relative local background and traffic noise levels. Equipment used during the survey included:

Norsonic 140	*Environmental Noise Analyser*	*s/n*	*1402987*
Norsonic 1251	*Sound Calibrator*	*s/n*	*31043*
Rion NL-52	*Environmental Noise Analyser*	*s/n*	*1221575*
Rion NL-52	*Environmental Noise Analyser*	*s/n*	*1221576*
Rion NL-52	*Environmental Noise Analyser*	*s/n*	*253702*
Rion NL-52	*Environmental Noise Analyser*	*s/n*	*732146*

The measurement equipment was checked against the appropriate calibrator at the beginning and end of the measurements, in accordance with recommended practice and no drift was observed. The accuracy of the calibrators can be traced to National Physical Laboratory Standards, calibration certificates for which are available on request.

A baseline monitoring survey was undertaken at five locations (as specified in Table 4.1 and shown in Figure 4.1) from Friday 2nd June 2015 to Wednesday 14th June 2017. Attended short term measurements were undertaken at seven locations during the early morning, daytime, evening, peak and night-time periods with four additional locations being measured unattended over a 140-hour period. The raw data collected from the long-term monitoring is available upon request.

Measurements were taken in general accordance with BS 7445-1:2003 The Description and Measurement of Environmental Noise: Guide to quantities and procedures. Weather conditions during the survey period were observed as being dry with scattered showers. Anemometer readings confirmed that wind speeds were less than 5 ms^{-1} at all times during the survey with a predominant westerly wind direction.

Table 4.1: Noise Monitoring Locations

Ref	Description
LT1	Eastern boundary of the site
LT2	Positioned along south-eastern edge of site perimeter opposite the bus depot
LT3	Positioned along south-eastern edge of site perimeter, opposite the HSS depot
LT4	Positioned on northern boundary of site
LT5	Positioned 20m from Wakefield Road: direct line of site onto carriageway
ST1	Located next to LT1 position
ST2	Southern part of the site opposite bus depot
ST3	Southern Part of the site opposite HSS
ST4	Northern boundary of the site
ST5	Northern section of the site
ST6	South-western section of the site
ST7	5m from Wakefield Road
Sub 1	Northern boundary of electricity substation
Sub 2	Western boundary of electricity substation
Sub 3	Approximately 19m from the boundary of the substation

Figure 4.1: Noise Monitoring Locations

4.2 Noise Survey Results

The noise climate across the site consisted mainly of road traffic noise from the A61 Wakefield Road and surrounding local road network. In addition, noise was observed from the adjacent Stagecoach bus service depot and noise from plant movements within the HSS service yard. Occasional distant rail movement was just audible from the Darton to Barnsley Rail line. During the evening and early morning periods bird song was also a prominent source of noise, in particular at positions LT2, LT3.

Ambient and background noise levels are usually described using the L_{Aeq} index (a form of energy average) and the L_{A90} index (i.e. the level exceeded for 90% of the measurement period) respectively. Road traffic noise is generally described using the L_{A10} index (i.e. the level exceeded for 10% of the measurement period).

Table 4.2: Meteorological Conditions During the Survey

Survey Location/	Date & Time	Temperature (ºC)	Wind Speed (m/s)	Wind Direction	Cloud Cover (Oktas)	Dominant Noise Source
ST1	13/06/2017 – 15:21	24	1	W	1	Traffic along Wakefield Road, low level hum from substation, noise from plant movement in HSS depot
ST2	09/06/2017 – 14:31	24	1	W	1	Traffic along Wakefield Road, prominent hum from substation, noise from plant movement in HSS depot
ST3	13/06/2017 - 15:57	24	1	W	1	Noise from plant movement in HSS depot, engine idling and distant road and rail traffic noise just perceptible
ST4	13/06/2017 – 13:04	24	1	W	1	Traffic along Wakefield Road, spoken voice from factory
ST5	13/06/2017 – 14:10	24	1	W	1	Traffic along Wakefield Road
ST6	13/06/2017 – 16:19	24	1	W	1	Noise from plant movement in HSS depot, engine idling and distant road and rail traffic noise
ST7	13/06/2017 – 20:30	21	1	W	1	Traffic along Wakefield Road, Birdsong
ST2	13/06/2017 – 21:00	20	1	W	1	Traffic along Wakefield Road, prominent hum from substation, Birdsong
ST3	13/06/2017 – 21:17	20	1	W	1	Traffic along Wakefield Road and local network, occasional distant rail movements, birdsong
ST4	13/06/2017 – 19:48	20	1	W	1	Traffic along Wakefield Road and local network, occasional distant rail movements just perceptible, birdsong
ST5	13/06/2017 – 20:07	20	1	W	1	Traffic along Wakefield Road and local network, occasional distant rail movements just perceptible, birdsong
ST2	14/06/2017 – 05:45	19	1	W	1	Traffic along Wakefield Road, vehicle movement within bus depot, hum from substation, Birdsong prominent

The results of the statistical measurements and frequency measurements conducted during the survey are summarised in the following table. All values are sound pressure levels in dB (re: 2 x 10-5 Pa). For the LT locations, the presented $L_{Aeq,T}$ and $L_{A10,T}$ are average noise

levels whilst the L_{A90} is the modal noise level of each 5-minute measurement over the stated survey period.

Table 4.3: Results of Baseline Noise Monitoring Survey

Period	Duration (T)	Monitoring Date and Times	Location	$L_{Aeq,T}$ (dB)	$L_{Amax,T}$ (dB)	$L_{Amin,T}$ (dB)	$L_{A10,T}$ (dB)	$L_{A90,T}$ (dB)
Day 07:00 - 23:00	113 hours	02/06/2017 – 14/06/2017 07:00 - 23:00	LT1	49.7	88.4	33.2	50.2	42
Night 23:00 – 07:00	56 hours	02/06/2017 – 14/06/2017 23:00 - 07:00		45.5	74.5	27.6	46.5	42
Day 07:00 - 23:00	80 hours	09/06/2017 - 14/06/2017 07:00 - 23:00	LT2	53.3	85.6	31.9	51.7	44
Night 23:00 – 07:00	40 hours	09/06/2017 - 14/06/2017 23:00 - 07:00		48.3	77.5	26.8	46.5	36
Day 07:00 - 23:00	144 hours	02/06/2017 – 14/06/2017 07:00 - 23:00	LT3	51.8	97.4	30.2	50.3	38
Night 23:00 – 07:00	63 hours	02/06/2017 – 14/06/2017 23:00 - 07:00		50.4	95.9	25.4	45.3	41
Day 07:00 - 23:00	141 hours	02/06/2017 – 14/06/2017 07:00 - 23:00	LT4	55.9	89.1	30.4	53.8	40
Night 23:00 – 07:00	64 hours	02/06/2017 – 14/06/2017 23:00 - 07:00		50.0	86.6	24.8	46.7	40
Day 07:00 - 23:00	15 hours	13/06/2017 – 14/06/2017 07:00 - 23:00	LT5	58.5	94.1	37.5	61.1	48

Period	Duration (T)	Monitoring Date and Times	Location	$L_{Aeq,T}$ (dB)	$L_{Amax,T}$ (dB)	$L_{Amin,T}$ (dB)	$L_{A10,T}$ (dB)	$L_{A90,T}$ (dB)
Night 23:00 – 07:00	8 hours	13/06/2017 – 14/06/2017 23:00 - 07:00		53.9	81.0	26.3	54.2	34
Day 07:00 - 19:00	15 Mins	09/06/2017 – 14:12	ST1	48.5	62.7	41.9	50.0	45.0
		13/06/2017 – 15:21		44.8	61.0	38.6	46.9	41.8
	15 Mins	09/06/2017 – 14:31	ST2	48.4	69.3	42.2	50.4	44.7
		09/06/2017 – 14:46		46.6	62.7	40.2	49.1	43.0
		13/06/2017 – 15:39		45.1	62.7	36.6	47.8	40.8
	15 Mins	09/06/2017 – 15:04	ST3	50.3	64.7	41.1	53.6	43.4
		09/06/2017 – 15:19		47.3	63.4	40.2	50.1	42.2
		09/06/2017 – 15:34		52.2	65.6	41.1	56.1	46.2
		09/06/2017 – 15:49		49.8	64.3	42.7	54.0	44.0
		13/06/2017 - 15:57		51.8	67.6	37.0	55.7	41.5
		14/06/2017 – 07:07		48.3	62.2	40.0	51.1	42.3
		14/06/2017 – 07:22		50.8	68.1	38.8	53.8	41.2
		14/06/2017 – 07:37		52.1	65.3	37.1	57.1	39.6
		14/06/2017 – 11:42		49.5	64.6	36.3	52.1	39.6
		14/06/2017 – 11:57		40.9	61.5	32.6	42.7	36.1
	15 Mins	13/06/2017 – 13:04	ST4	43.2	63.8	38.5	44.4	40.2
		13/06/2017 – 13:19		44.4	56.2	38.0	47.0	40.3
		13/06/2017 – 13:34		46.1	63.3	39.1	48.4	42.1
		13/06/2017 – 13:49		46.6	71.0	38.8	47.8	41.8
		14/06/2017 – 09:47		46.0	68.8	41.1	47.8	43.4
		14/06/2017 – 10:02		45.7	58.6	39.9	47.7	42.2

Period	Duration (T)	Monitoring Date and Times	Location	$L_{Aeq,T}$ (dB)	$L_{Amax,T}$ (dB)	$L_{Amin,T}$ (dB)	$L_{A10,T}$ (dB)	$L_{A90,T}$ (dB)
	15 Mins	13/06/2017 – 14:10	ST5	41.4	71.9	35.2	42.3	37.1
		13/06/2017 – 14:25		42.1	67.9	34.1	44.0	37.9
		13/06/2017 – 14:40		43.0	60.6	35.2	44.4	37.2
		13/06/2017 – 14:55		41.9	59.0	34.5	42.9	36.6
		14/06/2017 – 10:21		43.8	62.7	36.9	44.6	39.3
		14/06/2017 – 10:36		44.7	70.0	37.0	45.9	40.0
	15 Mins	13/06/2017 – 16:19	ST6	49.5	76.1	38.3	51.5	41.5
Evening 19:00 - 23:00	15 Mins	13/06/2017 – 21:00	ST2	48.0	68.3	33.3	48.6	36.4
	15 Mins	13/06/2017 – 21:17	ST3	42.7	60.7	30.7	46.3	35.2
	15 Mins	13/06/2017 – 19:48	ST4	44.1	65.0	36.9	46.4	39.6
	15 Mins	13/06/2017 – 20:07	ST5	44.0	71.5	33.2	44.9	36.5
	15 Mins	13/06/2017 – 20:30	ST7	67.4	86.0	42.5	71.5	48.4
Early Morning 05:30 - 07:00	15 Mins	14/06/2017 – 05:45	ST2	48.0	64.6	37.6	50.1	43.4
		14/06/2017 – 06:00		46.5	67.7	38.1	49.2	40.8
		14/06/2017 – 06:15		46.8	66.6	38.7	49.6	41.9
		14/06/2017 – 06:30		48.2	62.8	39.2	50.8	43.1
		14/06/2017 – 06:45		47.7	63.5	39.8	49.9	43.0

All values are sound pressure levels in dB re: $2x\ 10^{-5}$ Pa

In addition to the above, measurements of the existing electricity substation have been undertaken. The measurements were taken at the current fence line of the substation positioned in the south-eastern corner of the development site. The results are presented in Table 4.4.

Table 4.4: Results of Electric Substation Noise Monitoring

Date	Ref	L_{Aeq}	L_{AFmax}	L_{Amin}	L_{A10}	L_{A90}	L_{eq}		
							80 Hz	100 Hz	125 Hz
13/06/2017 20:51	Sub 1	54.0	66.4	49.8	56.9	50.1	64.5	63.8	49.7
13/06/2017 20:53	Sub 2	57.4	73.4	54.8	57.9	55.4	55.0	70.8	55.6
13/06/2017 20:57	Sub 3	46.0	53.1	41.6	48.4	42.7	47.3	52.9	40.9

All values are sound pressure levels in dB re: 2x 10^{-5} Pa

4.3 Representative Background Noise Levels

Using the data collected during the baseline survey, representative background noise levels have been derived for all external amenity receptor locations presented in Figure 3.2. Table 4.5 presents the representative background noise levels considered appropriate for the existing sensitive receptors within the area (the lower of the respective daytime and evening measurements have been used to represent daytime noise levels, where appropriate).

Table 4.5: Representative Background Noise Levels (All Receptors)

Receptors	Monitoring Location	Time Period	Representative Background Noise Level ($L_{A90,T}$ dB)*
G01-G03 & G14	LT5	Daytime (07:00 – 23:00)	48
		Night-time (23:00 – 07:00)	34
G04, G05 & G15	LT1	Daytime (07:00 – 23:00)	42
		Night-time (23:00 – 07:00)	42
G06 – G08	LT2	Daytime (07:00 – 23:00)	44
		Night-time (23:00 – 07:00)	36
G09, G10 & G17	LT3	Daytime (07:00 – 23:00)	38
		Night-time (23:00 – 07:00)	41
G11 – G13 & G16	LT4	Daytime (07:00 – 23:00)	40
		Night-time (23:00 – 07:00)	40

*Lowest $L_{A90,T}$ value selected from either Weekday or Weekend.

The representative noise levels presented in Table 4.5 have been used to inform the assessment presented in Section 5.0.

5.0 Assessment of Effects

5.1 ProPG Stage 1 Risk Assessment

Based on the daytime $L_{Aeq,16hours}$ and night-time $L_{Aeq,8hours}$ noise models, Figures 5.1 and 5.2 present the ProPG noise contour plots during the day and night-time periods, which provide an illustrative representation of the range of noise levels across the site.

Figure 5.1: ProPG Stage 1 – Daytime Contour Plot (Grid Height: 1.5m)

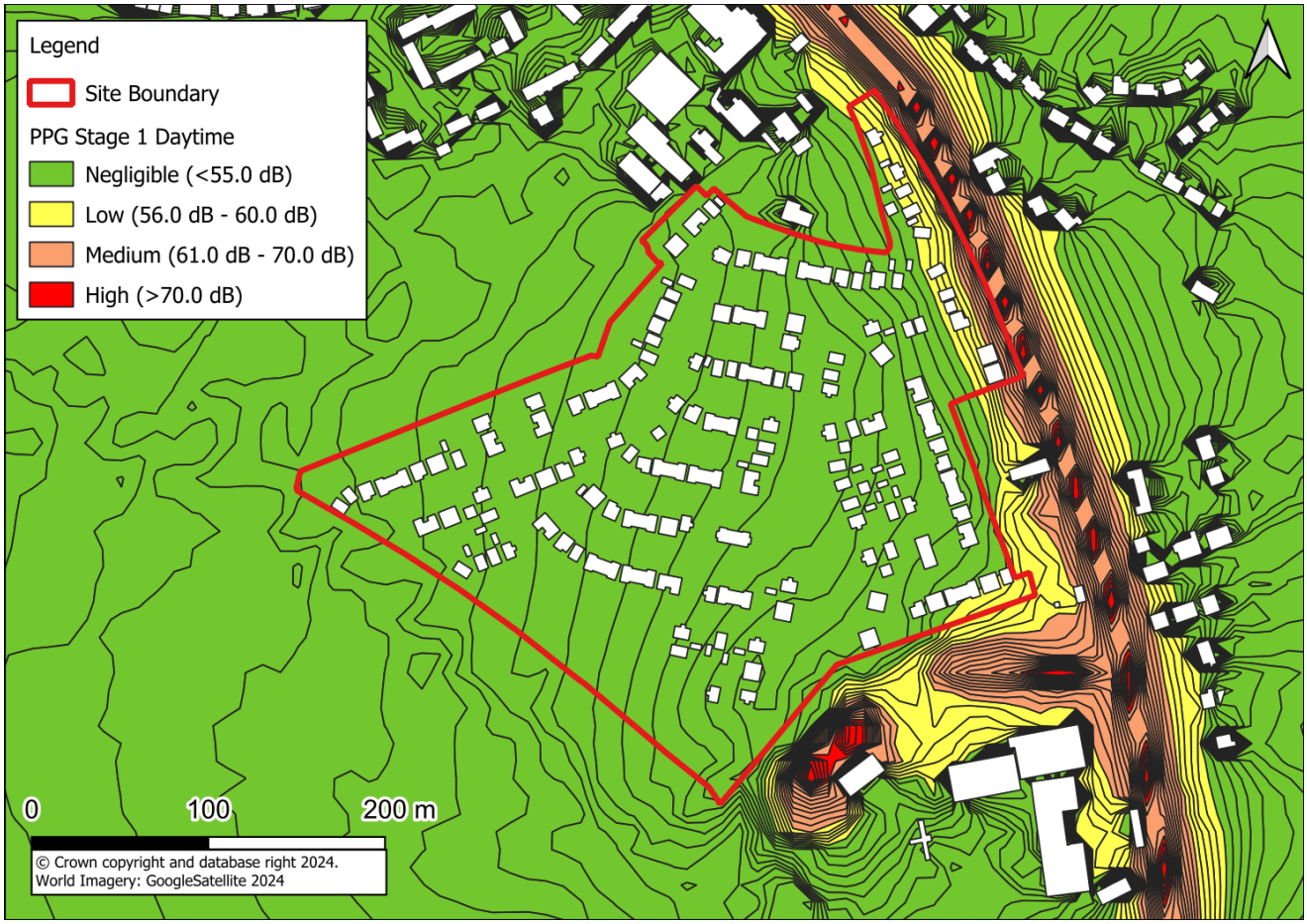


Figure 5.2: ProPG Stage 1 – Night-time Contour Plot (Grid Height: 4.0m)

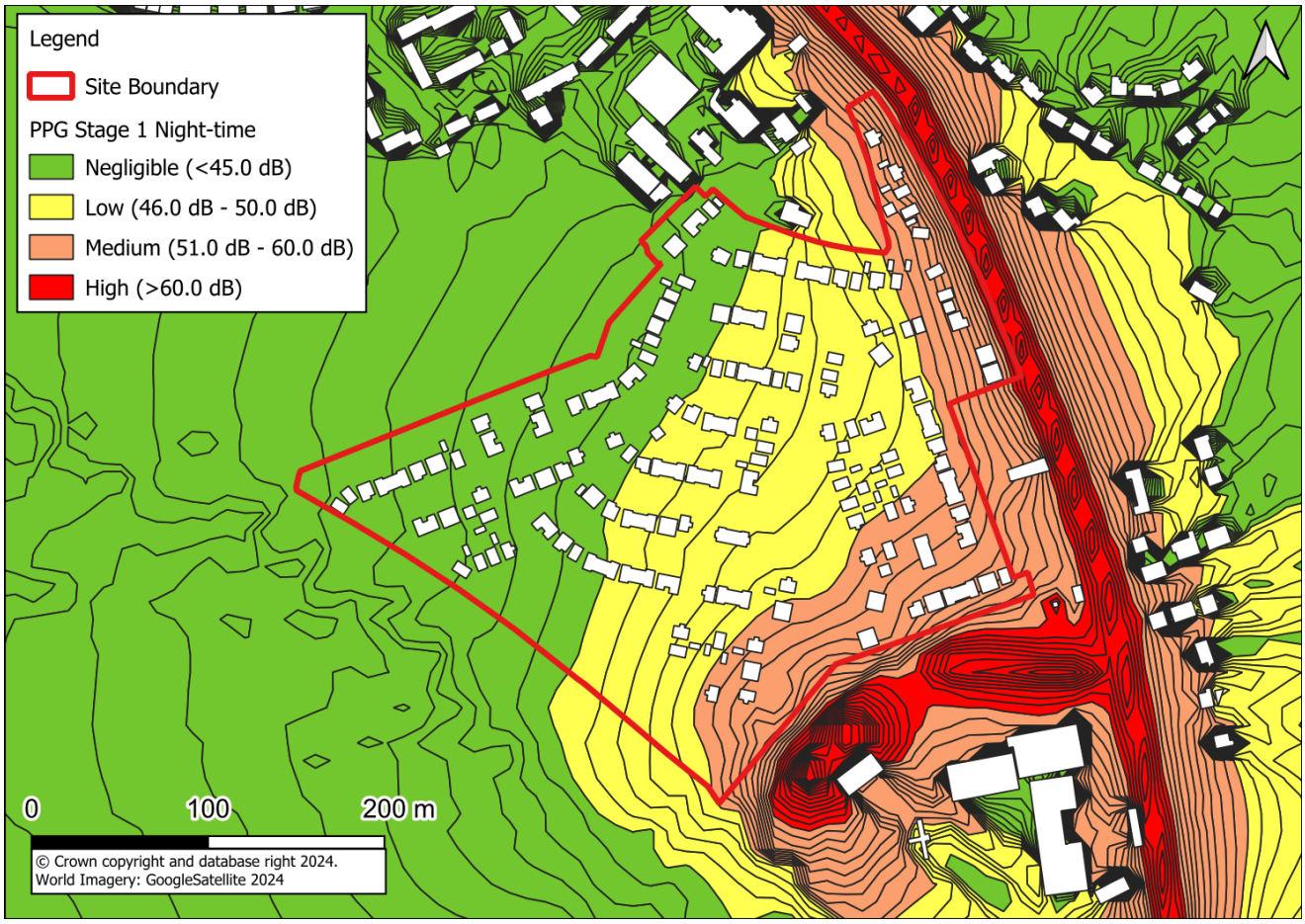


Table 5.1: ProPG Stage 1 – Results of Modelling

Period	ProPG Stage 1 Risk Assessment Noise levels
Daytime $L_{Aeq,16hr}$	Negligible - Low
Night-time $L_{Aeq,8hr}$	Low - Medium

5.2 Assessment of Electric Substation

5.2.1 Substation Noise Intrusion

An assessment of predicted internal noise from the electricity substation has been undertaken at the closest assessed dwelling (R07) during the night-time period with windows open and closed. Tables 5.2 and 5.3 below present a comparison of the predicted internal noise levels associated with the substation with windows open and closed against an

internal noise level criteria of NR20. A standard double-glazing specification of 4mm/16mm/6m has been assessed with windows open providing 15 dB attenuation.

Table 5.2: Predicted Internal Noise Level Comparison with NR 20 (Night-time: Windows Open)

Parameter	Sound pressure Level (dB)/ Frequency (Hz)						
	63	125	250	500	1000	2000	4000
External noise level	57.7	60.4	49.0	39.6	39.3	33.4	32.7
Glazing Sound Insulation Performance (4mm/16mm/6mm)	15	15	15	15	15	15	15
Interior noise level	42.7	45.4	34.0	24.6	24.3	18.4	17.7
NR 20	51.3	39.4	30.6	24.3	20.0	16.8	14.4
Noise level difference	-8.6	6.0	3.4	0.3	4.3	1.6	3.3

Table 5.3: Predicted Internal Noise Level Comparison with NR 20 (Night-time: Windows Closed)

Parameter	Sound pressure Level (dB)/ Frequency (Hz)						
	63	125	250	500	1000	2000	4000
External noise level	57.7	60.4	49.0	39.6	39.3	33.4	32.7
Glazing Sound Insulation Performance (4mm/16mm/6mm)	17	23	22	27	38	40	41
Interior noise level	40.7	37.4	27.0	12.6	1.8	-6.6	-8.3
NR 20	51.3	39.4	30.6	24.3	20.0	16.8	14.4
Noise level difference	-10.6	-2.0	-3.6	-11.7	-18.2	-23.4	-22.7

As can be seen, internal noise levels are predicted to be above the NR 20 criteria with windows open and below with windows closed at the closest receptor.

In addition to the above, as noted previously, a dominant tone was identified at 100Hz. The assessment of low frequency noise and disruption caused by such noise is limited, however guidance is available in the form of 'NANR 45: Proposed Criteria for the Assessment of Low Frequency Noise Disturbance' as published in February 2005 by University of Salford. This guidance was produced on behalf of DEFRA and provides a method to follow when complaints have been received about low frequency noise. Whilst this document is not intended for planning purposes, in the absence of other applicable guidance, the criteria outlined within the guidance is considered to be suitable for use as part of this assessment.

The guidance presents noise values above which disturbance could occur which are presented in the table below:

Table 5.4: Low Frequency Reference Curve (Linear) - Internal Noise Level Criteria

Frequency (Hz)	NANR 45 Internal Noise Level Criteria (Low Frequency Reference Curve)
100 (Fluctuating)	38
100 (Steady Noise)	43

When comparing the level of noise against the predicted internal noise level at R07 of 45.4 at 125Hz, which is dominated by noise level at 100Hz, with windows open, the predicted noise level is slightly greater than the fluctuating and steady noise criteria specified in Table 5.4. With windows closed, the predicted internal noise level is 37.4 dB and as such the criteria is met with standard double glazing.

Based upon the assessment undertaken, ventilation will be required for the closest properties to the substation. Alternative ventilation can be provided in several ways from acoustic trickle vents (which should have a comparable acoustic performance as the glazing), other passive ventilation systems or mechanical ventilations systems.

5.2.2 BS4142 External Amenity Assessment – Electrical Substation

The assessment compares the predicted noise levels from the substation with the existing measured background noise L_{A90} representative of proposed residential receptors in the absence of noise from the substation. The representative existing measured background noise level for each receptor has been established in Table 4.5. Noise from the substation was clearly audible in the south-eastern area of the site. Subjectively there was a perceptible dominant tone at 100Hz and this has been verified following a review of the 1/3 octave data. Whilst this was less dominant within the site (as demonstrated within Table 4.4), a character correction of +4dB has been included within the assessment.

Table 5.5 presents the difference between the background noise level and noise rating level associated with the electrical substation at the external amenity receptor locations. Within the model, it has been assumed the gardens will be separated by 1.8m high, close-boarded fences.

Table 5.5: BS 4142 Assessment – Electric Substation

Ref	Measured Typical Pre-Installation Background LA90	Noise Rating Level (LAeq,T)	BS 4142 Score
	Daytime	Daytime	Daytime
G01	48	17	-31
G02	48	26	-22
G03	48	25	-23
G04	42	30	-12
G05	42	37	-5
G06	44	44	0
G07	44	36	-8
G08	44	34	-10
G09	38	27	-11
G10	38	10	-28
G11	40	9	-31
G12	40	12	-28
G13	40	8	-32
G14	48	13	-35
G15	42	19	-23
G16	40	15	-26
G17	38	19	-19

The results presented above show that the noise rating level at the nearest sensitive external amenity receptors are up to +0dB above the existing background noise level, which falls within the No Observed Adverse Effect Level (NOAEL).

5.3 ProPG Stage 2 Assessment – Element 2 Internal Noise Levels

Internal noise levels at sensitive receptor locations, from all noise sources including road traffic and the electrical substation, have been assessed both with windows open, where a reduction from a partially open window of 15 dB has been used, and with windows closed where an assumption of double glazing with a sound reduction of 30 dB R_{w+Ctr} has been used.

In addition to the above, a preliminary assessment has been undertaken of locations at which internal night-time noise criteria identified within Building Regulations Approved Document O: 'Overheating' (and reproduced within Table 2.2) is likely to be exceeded. This assessment has been undertaken assuming rooms are under typical ventilation conditions

and all locations exceeding the identified criteria have been highlighted in bold within the noise intrusion assessments found within Tables 5.7 & 5.8.

Results of the noise intrusion and preliminary overheating assessments for average daytime and night-time noise levels are presented within Tables 5.6 and 5.7 respectively, with night-time noise levels presented illustratively within Figure 5.3.

Table 5.6: Daytime Noise Intrusion Levels $L_{Aeq,1hour}$

Location	External L_{Aeq}	Internal L_{Aeq} with windows open	Internal L_{Aeq} with windows closed	Criteria L_{Aeq}
R01	57.2	42.2	27.2	35
R02	57.9	42.9	27.9	35
R03	59.3	44.3	29.3	35
R04	63.0	48.0	33.0	35
R05	48.9	33.9	18.9	35
R06	50.6	35.6	20.6	35
R07	54.6	39.6	24.6	35
R08	51.9	36.9	21.9	35
R09	54.0	39.0	24.0	35
R10	52.1	37.1	22.1	35
R11	48.3	33.3	18.3	35
R12	43.8	28.8	13.8	35
R13	40.1	25.1	10.1	35
R14	37.4	22.4	7.4	35
R15	41.1	26.1	11.1	35
R16	40.3	25.3	10.3	35
R17	43.7	28.7	13.7	35
R18	42.2	27.2	12.2	35
R19	45.0	30.0	15.0	35

All values are sound pressure levels in dBA re: $2x\ 10^{-5}$ Pa.

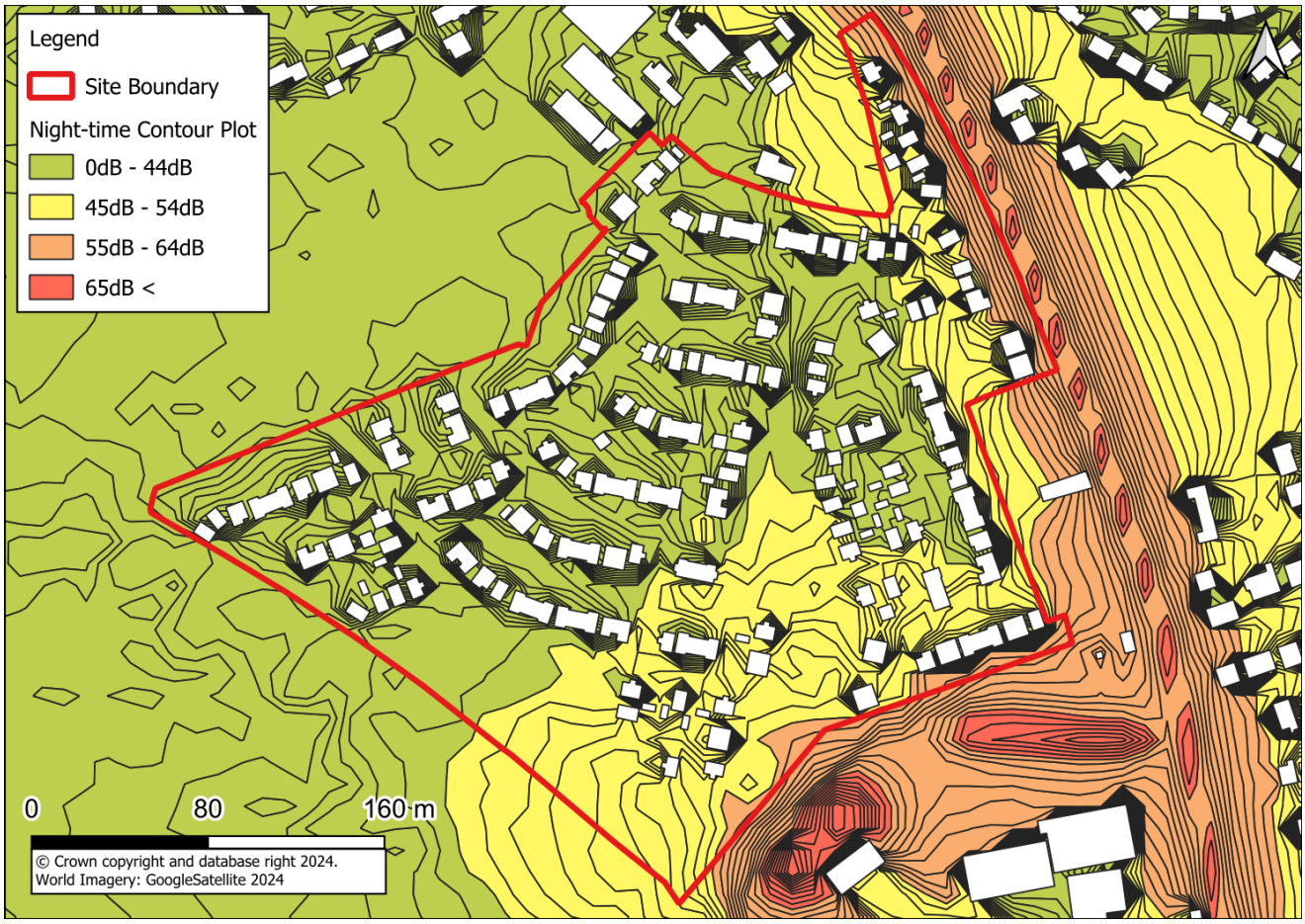
Table 5.7: Night-time Noise Intrusion Levels $L_{Aeq,15mins}$

Location	External L_{Aeq}	Internal L_{Aeq} with windows open	Internal L_{Aeq} with windows closed	Criteria L_{Aeq}
R01	**55.4**	**40.4**	**25.4**	**30**
R02	**55.8**	**40.8**	**25.8**	**30**
R03	**56.0**	**41.0**	**26.0**	**30**
R04	**59.1**	**44.1**	**29.1**	**30**
R05	48.0	33.0	18.0	30
R06	51.5	36.5	21.5	30
R07	**57.5**	**42.5**	**27.5**	**30**
R08	**55.1**	**40.1**	**25.1**	**30**
R09	54.9	39.9	24.9	30
R10	54.5	39.5	24.5	30
R11	47.4	32.4	17.4	30
R12	45.1	30.1	15.1	30
R13	40.7	25.7	10.7	30
R14	37.8	22.8	7.8	30
R15	41.6	26.6	11.6	30
R16	40.0	25.0	10.0	30
R17	43.4	28.4	13.4	30
R18	41.5	26.5	11.5	30
R19	43.1	28.1	13.1	30

All values are sound pressure levels in dBA re: $2x\ 10^{-5}$ Pa.

As demonstrated within Tables 5.6 and 5.7 above, predicted noise levels are exceeding both daytime and night-time BS 8233 criteria at a majority of the sensitive receptors with windows open, with the worst exceedances falling within an Unacceptable Observed Adverse Effect Level (UOAEL). As such, mitigation is required and will be outlined below within Section 6.0. R01-R04 and R07-R08 also exceed the internal night-time noise criteria outlined within the ADO and therefore require mitigation against both BS 8233 and ADO.

Figure 5.3: Night-time Contour Plot (Grid Height: 4.0m)



Results of the noise intrusion and preliminary overheating assessments for maximum night-time noise levels are presented within Table 5.8 below.

Table 5.8 Night-time Noise Intrusion Levels L_{Amax}

Location	External L_{Amax}	Internal L_{Amax} with windows open	Internal L_{Amax} with windows closed	Criteria L_{Amax}
R01	**77.7**	**62.7**	**47.7**	**45**
R02	**79.5**	**64.5**	**49.5**	**45**
R03	**78.3**	**63.3**	**48.3**	**45**
R04	**85.1**	**70.1**	**55.1**	**45**
R05	68.8	53.8	38.8	45
R06	69.3	54.3	39.3	45
R07	**70.4**	**55.4**	**40.4**	**45**
R08	**70.2**	**55.2**	**40.2**	**45**
R09	60	45.0	30.0	45
R10	57.3	42.3	27.3	45
R11	56.1	41.1	26.1	45
R12	53.2	38.2	23.2	45
R13	46.1	31.1	16.1	45
R14	49	34.0	19.0	45
R15	54.7	39.7	24.7	45
R16	58.5	43.5	28.5	45
R17	60.9	45.9	30.9	45
R18	61.8	46.8	31.8	45
R19	56.7	41.7	26.7	45

All values are sound pressure levels in dBA re: 2x 10^{-5} Pa.

As demonstrated within Table 5.3 above, predicted noise levels exceed night-time maximum BS 8233 criteria at the majority of sensitive receptors with windows open and at R01-R04 with windows closed. The worst exceedances fall within an Unacceptable Observed Adverse Effect Level (UOAEL) and as such, mitigation is required and will be outlined below within Section 6.0. R01-R04 and R07-R08 exceed the ADO night-time max criteria and therefore require mitigation in accordance with BS 8233 and ADO.

5.4 ProPG Stage 2 Assessment – Element 3 External Amenity Areas

An assessment of the external amenity areas within the site boundary has been undertaken to represent the external noise levels at the proposed potential private amenity areas,

indicative locations are presented in Figure 5.4. The result of the assessment is presented in Table 5.9. A 1.8m garden fences have been modelled as standard across the site.

Table 5.9: External Amenity Areas Assessment

Outdoor Amenity Area	Predicted Daytime Outdoor Amenity Noise Level (dB) $L_{Aeq,16hour}$
G01	46.3
G02	51.5
G03	47.5
G04	50.8
G05	53.1
G06	54.9
G07	54.0
G08	53.0
G09	52.2
G10	38.1
G11	33.1
G12	36.5
G13	36.6
G14	48.0
G15	42.9
G16	41.8
G17	43.8

The result shows that the noise levels within the external amenity areas within the site boundary would be within the BS 8233 guideline value of $L_{Aeq,T}$ 55 dB and is therefore within the Lowest Observed Adverse Effect Level (LOAEL).

5.5 Tranquillity Assessment

An assessment of the existing tranquillity level of the site has been based on the mapping data published by Campaign to Protect Rural England (CPRE). This uses a colour coded system and a 500m assessment grid for the whole of England, and a tranquillity rating of between 1 and 10 is assigned (1 being least tranquil and 10 being most). By reference to these maps, the site and immediate surrounding area is assessed as falling into Zone 1 and is of low tranquillity. There are no public rights of way within or adjacent to the site. As the proposed development, will not disrupt current public rights of way the development is considered to have a negligible effect on local access to areas of greater tranquillity.

6.0 Mitigation

6.1 Alternative Ventilation & Enhanced Glazing

The noise intrusion assessment undertaken within Section 5.2 indicates that BS 8233:2014 internal noise criteria are to be exceeded with windows open throughout the site during the daytime and night-time period, with max levels during the night-time exceeding the windows closed criteria at several locations.

As such, alternative ventilation is required within habitable rooms (spaces where residents may be resting) as shown on Figure 6.1, as well as the Enhanced Glazing requirements highlighted on Figure 6.2. The night-time strategy shown in Figure 6.2 is a combination of requirements where necessary against both average and maximum noise levels.

While all facades that exceed criteria have been identified, mitigation should only be applied to the windows of noise sensitive habitable rooms.

Alternative ventilation may be provided by passive window trickle vents, Positive Input Ventilation (PIV) or Mechanical Ventilation (MV). If window trickle vents are to be used, it is recommended that the minimum sound reduction performance of the ventilation ($D_{ne,w}$) is at least +7 dB greater than the glazing performance of the windows to ensure that the glazing performance is not compromised. Where enhanced glazing is specified, the performance of the alternative ventilation should still remain at +7 dB greater than the performance of the enhanced glazing.

Figure 6.1: Daytime Mitigation Strategy

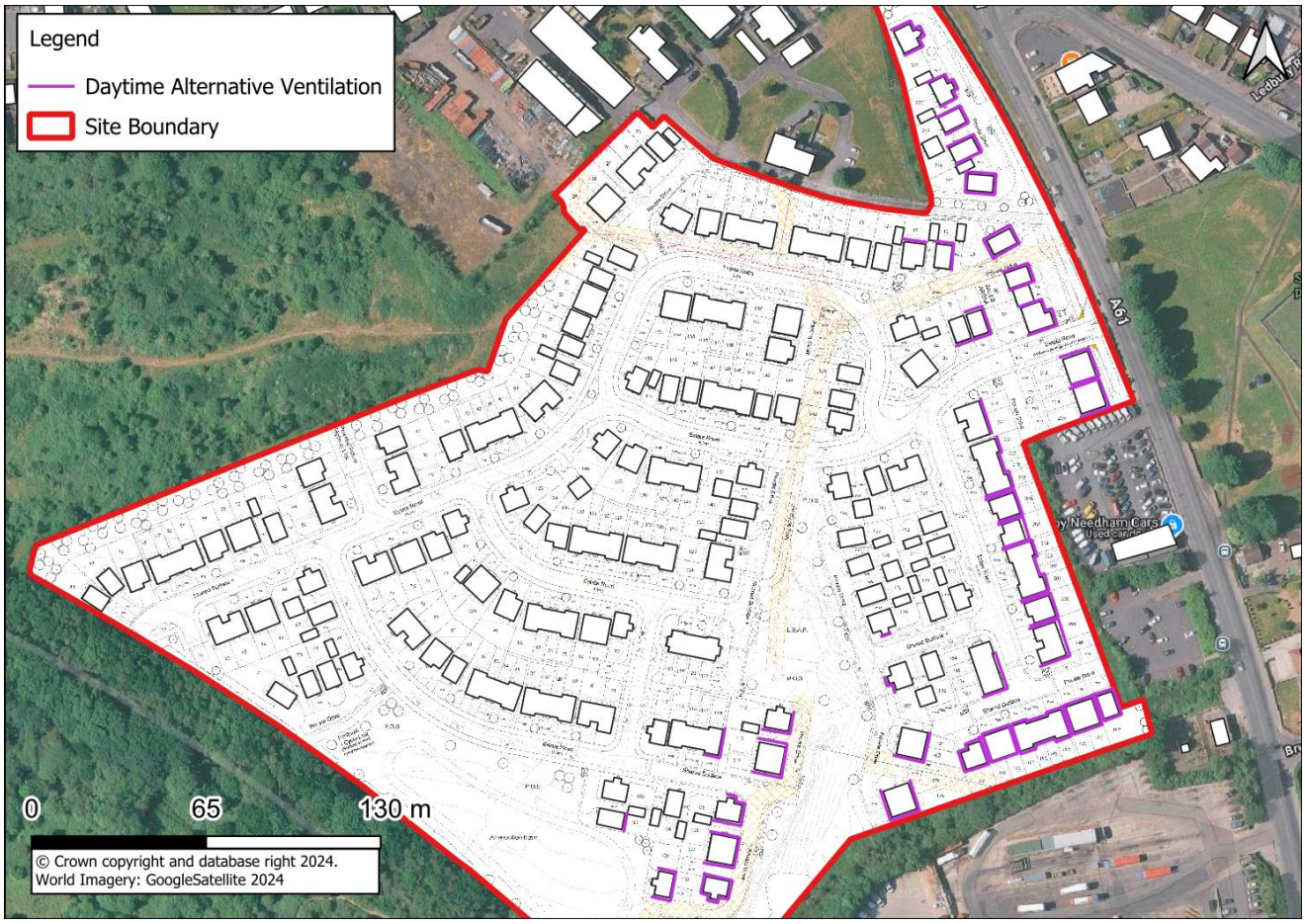
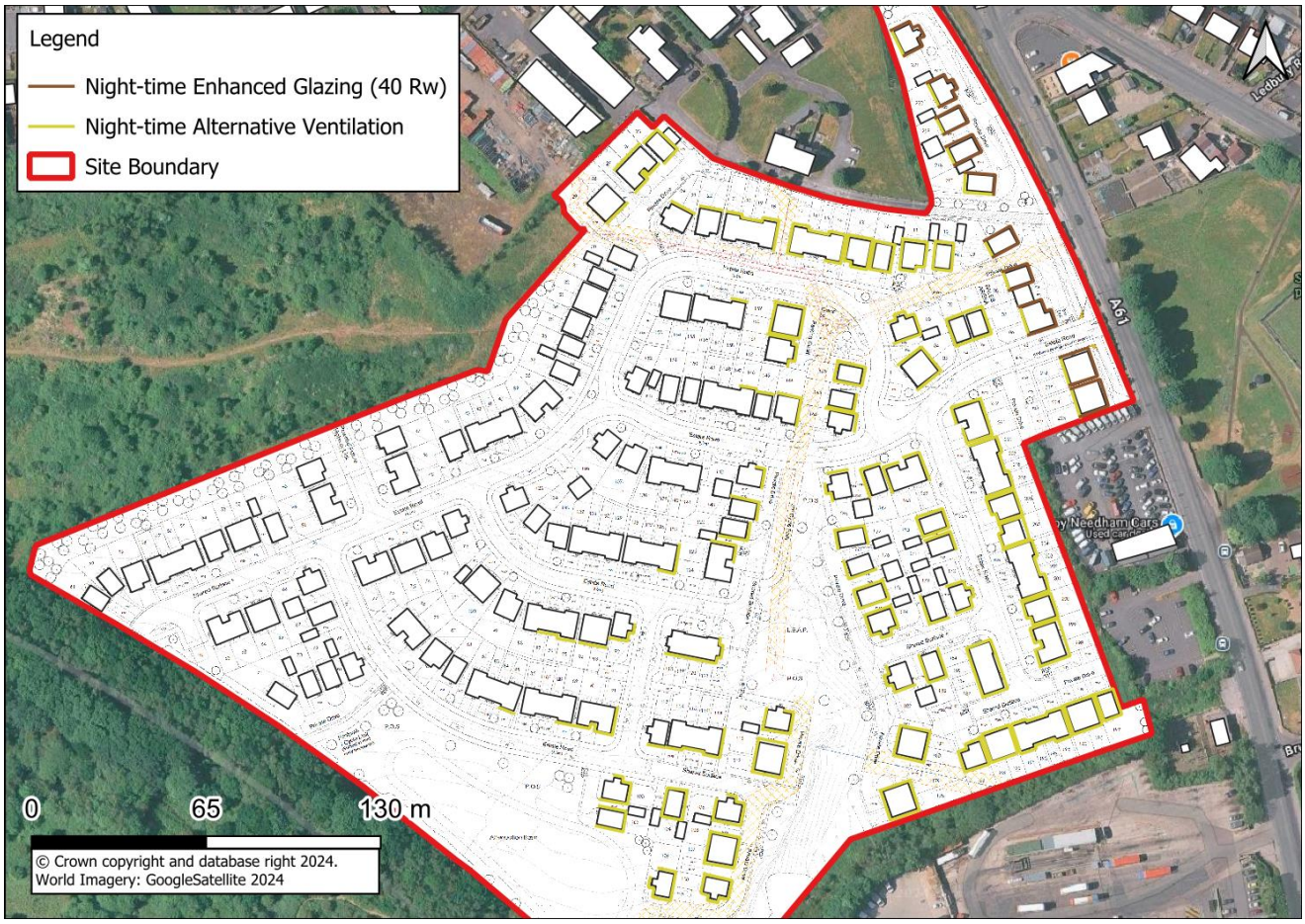


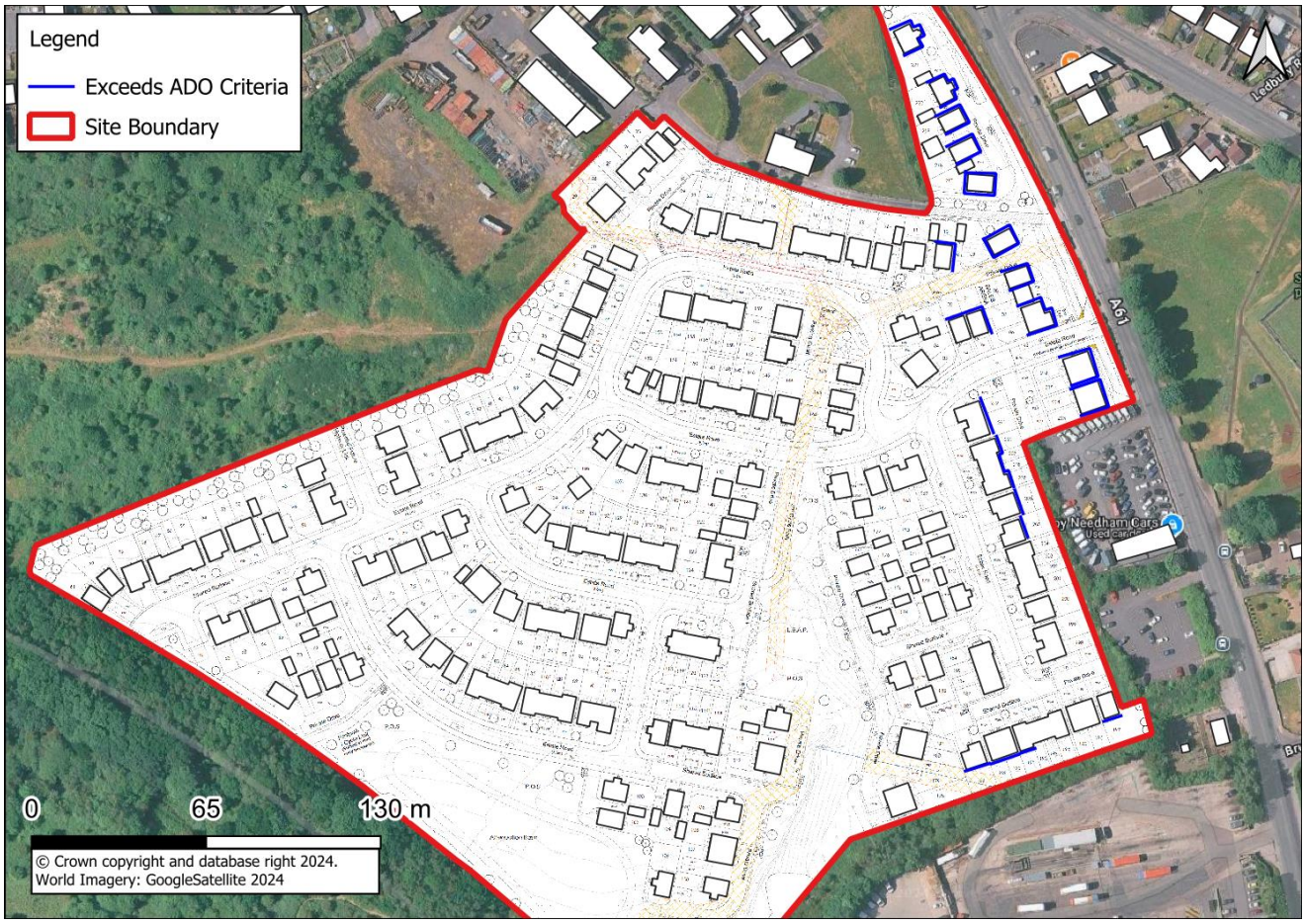
Figure 6.2: Night-time Mitigation Strategy



6.2 Approved Document O - Mitigation Requirements

Figure 6.3 below presents the facades where the internal noise levels with windows open exceed the criteria outlined within Approved Document O of 40 dB $L_{Aeq,8hours}$ and 55 dB L_{Amax}, no more than 10 times a night during sleeping hours (23:00 – 07:00). Rooms on these facades will require closed windows to ensure reasonable internal acoustic conditions during the night-time period and therefore would require comfort cooling to be supplied. The glazing specification in Section 6.1 above will remain suitable for all façades. The facades that are not highlighted all fall within the Approved Document O criteria and therefore the glazing and ventilation strategy presented in Section 6.1 would be applicable on these facades at the sensitive room locations.

Figure 6.3: Facades Exceeding Approved Document O



7.0 Conclusion

A noise assessment has been undertaken in support of a reserved matters planning application for a proposed residential development at land to the west of Wakefield Road, Athersley.

With no mitigation, the development exceeds BS 8233 criteria at a number of sensitive receptor locations during the daytime and night-time, with some receptors falling within the Unacceptable Observed Adverse Effect Level (UOAEL). Therefore, a glazing and ventilation strategy has been recommended to achieve acceptable internal acoustic conditions based on the BS 8233:2014 and WHO criteria.

Furthermore, the results of the internal $L_{Aeq,8hours}$ and L_{Amax} night-time assessments demonstrate that a number of facades are exceeding the Approved Document O: Overheating criteria with windows open. These rooms will therefore require closed windows and comfort cooling to ensure reasonable internal acoustic conditions during the night-time period.

Daytime noise levels at all indicative private external amenity areas are below the BS8233 upper guideline value of 55 dB $L_{Aeq,16hours}$. Therefore, no additional mitigation has been proposed for the external amenity areas aside from assumed 1.8m close boarded garden fencing.

The NPPF provides test points against which the proposed development has been assessed. Considering these points, the following conclusions can be drawn:

NPPF paragraphs 191 and 194

Based upon the assessments presented, it is considered that the development does not adversely affect or put sensitive receptors at risk from noise pollution, and no significant adverse effects are predicted to occur.

NPPF paragraph 193

Considering the existing use of the site and wider development site, it is not considered that any existing businesses wanting to develop would be restricted by the proposals.

Planning Practice Guidance: Noise

It has been predicted that on-site operational noise effects associated with the Development will be below the Lowest Observed Adverse Effect Level and therefore the development will have a low impact in relation to noise.

Appendices

Appendix A – Acoustic Terminology

Acoustic Terminology

dB Sound levels from any source can be measured in frequency bands in order to provide detailed information about the spectral content of the noise, i.e. whether it is high-pitched, low-pitched, or with no distinct tonal character. These measurements are usually undertaken in octave or third octave frequency bands. If these values are summed logarithmically, a single dB figure is obtained. This is usually not very helpful as it simply describes the total amount of acoustic energy measured and does not take any account of the ear's ability to hear certain frequencies more readily than others.

dB(A) Instead, the dBA figure is used, as this is found to relate better to the loudness of the sound heard. The dBA figure is obtained by subtracting an appropriate correction, which represents the variation in the ear's ability to hear different frequencies, from the individual octave or third octave band values, before summing them logarithmically. As a result the single dBA value provides a good representation of how loud a sound is.

L_{Aeq} Since almost all sounds vary or fluctuate with time it is helpful, instead of having an instantaneous value to describe the noise event, to have an average of the total acoustic energy experienced over its duration. The $L_{Aeq,\ 07:00\ –\ 23:00}$ for example, describes the equivalent continuous noise level over the 16-hour period between 7 am and 11 pm. During this time period the L_{pA} at any particular time is likely to have been either greater or lower that the $L_{Aeq,\ 07:00\ –\ 23:00}$.

L_{Amin} The L_{Amin} is the quietest instantaneous noise level. This is usually the quietest 125 milliseconds measured during any given period of time.

L_{Amax} The L_{Amax} is the loudest instantaneous noise level. This is usually the loudest 125 milliseconds measured during any given period of time.

L_n Another method of describing, with a single value, a noise level which varies over a given time period is, instead of considering the average amount of acoustic energy, to consider the length of time for which a particular noise level is exceeded. If a level of x dBA is exceeded for say. 6 minutes within one hour, then that level can be described as being exceeded for 10% of the total measurement period. This is denoted as the $L_{A10,\ 1\ hr}$ = x dB.

The L_{A10} index is often used in the description of road traffic noise, whilst the L_{A90}, the noise level exceeded for 90% of the measurement period, is the usual descriptor for underlying background noise. L_{A1} and L_{Amax} are common descriptors of construction noise.

R_w The *weighted sound reduction index* determined using the above *measurement* procedure, but weighted in accordance with the procedures set down in BS EN ISO 717-1. Partitioning and building board manufacturers commonly use this index to describe the inherent sound insulation performance of their products.

Appendix B – References

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