



**Woodgate Centre
Oak Tree Lane
Woodgate**

Noise Assessment Report

28 October 2021

For
Pye Homes Ltd
Langford Locks
Kidlington
Oxfordshire
OX5 1HZ

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SUMMARY

A new residential development is proposed on land at the Woodgate Centre on Oak Tree Lane in Woodgate.

A noise assessment has been requested as part of the planning submission for the proposals.

auricl has therefore undertaken an assessment of external noise affecting the proposed residential development site in relation to Arun District Council's requirements.

Based on noise measurements and noise modelling, calculations have been undertaken to assess the acoustic requirements of the residential façades as well as the impact of external noise levels on garden areas.

It was concluded that suitable internal noise levels can be achieved using standard, non-specialist constructions for the external façade elements.

When assessing the effect on internal noise levels when windows are open, it has been concluded that *"use of opening windows as a primary means of mitigating overheating is not likely to result in adverse effect"*.

In addition, external noise levels at the site are an acceptable level in the proposed gardens.

Noise measurements have been undertaken to assess noise levels associated with the substation located closed to the southern site boundary. It was concluded that noise levels associated with the substation are unlikely to represent an adverse noise impact on the occupants of the proposed dwellings.

Measures have been proposed to mitigation noise and vibration emissions during the construction stage of the development.

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Report Produced by	Nicholas Jones BEng(Hons) CEng MIOA	T: 07739 715411 E: njones@auricl.com	
auricl Limited www.auricl.com hello@auricl.com	107 Cheapside London EC2V 6DN	9 Greyfriars Road Reading RG1 1NU	

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1.0 Introduction

A new residential development is proposed on land at the Woodgate Centre on Oak Tree Lane in Woodgate.

A noise assessment has been requested as part of the planning submission for the proposals.

This report presents the methodology and results of noise measurements to determine the existing noise levels affecting the site, as well as an assessment in relation to Arun District Council's requirements.

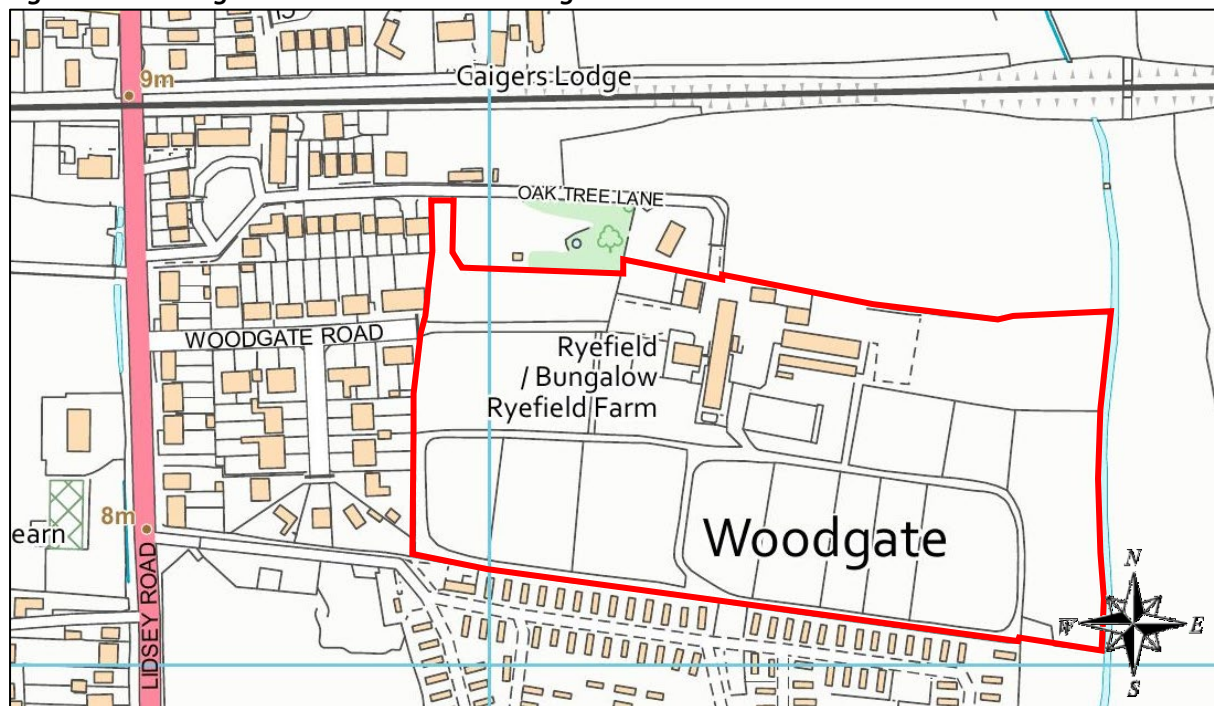
2.0 Description of Site and Proposals

The proposed development site is located to the south-east of Oak Tree Lane on the eastern side of Woodgate.

The site is occupied by a residential property, small storage buildings and open farmland and is bounded by open farmland to the north and east, a holiday park to the south and residential properties to the west/north-west. A railway line runs roughly parallel to the northern site boundary, at a distance of approximately 100m from the site.

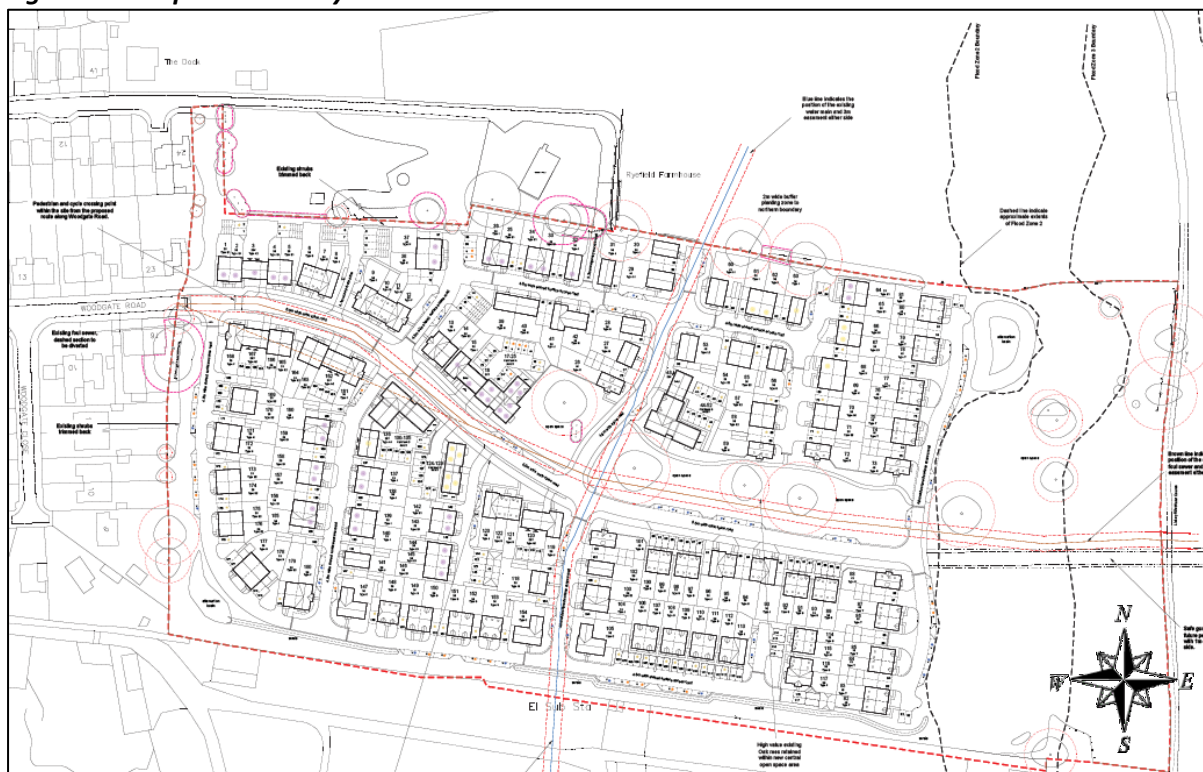
Figure 2.1 shows the approximate existing site extent in red in relation to the surrounding area.

Figure 2.1 Existing Site Extent and Surroundings



It is proposed to develop the site to create 180 new residential dwellings. Figure 2.2 shows the proposed site layout.

Figure 2.2 Proposed Site Layout



3.0 Arun District Council Requirements

We have considered the following standards in our measurements and assessments.

3.1 Internal Noise Levels with Dwellings

We understand Arun District Council typically require internal noise levels within residential dwellings to conform to the guideline values specified in Table 4 of Section 7.7.2 of BS 8233: 2014.

British Standard 8233: 2014 “*Guidance on sound insulation and noise reduction for buildings*” is the current industry standard document specifying internal noise levels in residential dwellings and presents the ‘desirable’ internal noise levels shown in Table 3.1.

Table 3.1 BS 8233 Recommended Internal Noise Levels

Activity	Location	07:00 to 23:00 hours	23:00 to 07:00 hours
Resting	Living room	35 dB $L_{Aeq,16hour}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

In addition, the World Health Organisation (WHO) document “*Guidelines for Community Noise*” (1999) advises the following:

“For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45dB L_{Amax} more than 10-15 times per night (Vallet & Vernet 1991).”

A two-stage noise risk assessment is then proposed, based upon the levels of external noise affecting the site as shown in Figure 3. and the subsequent internal noise levels shown Figure 3.2.

Figure 3.1 Level 1 Noise Risk Assessment – External Noise Levels

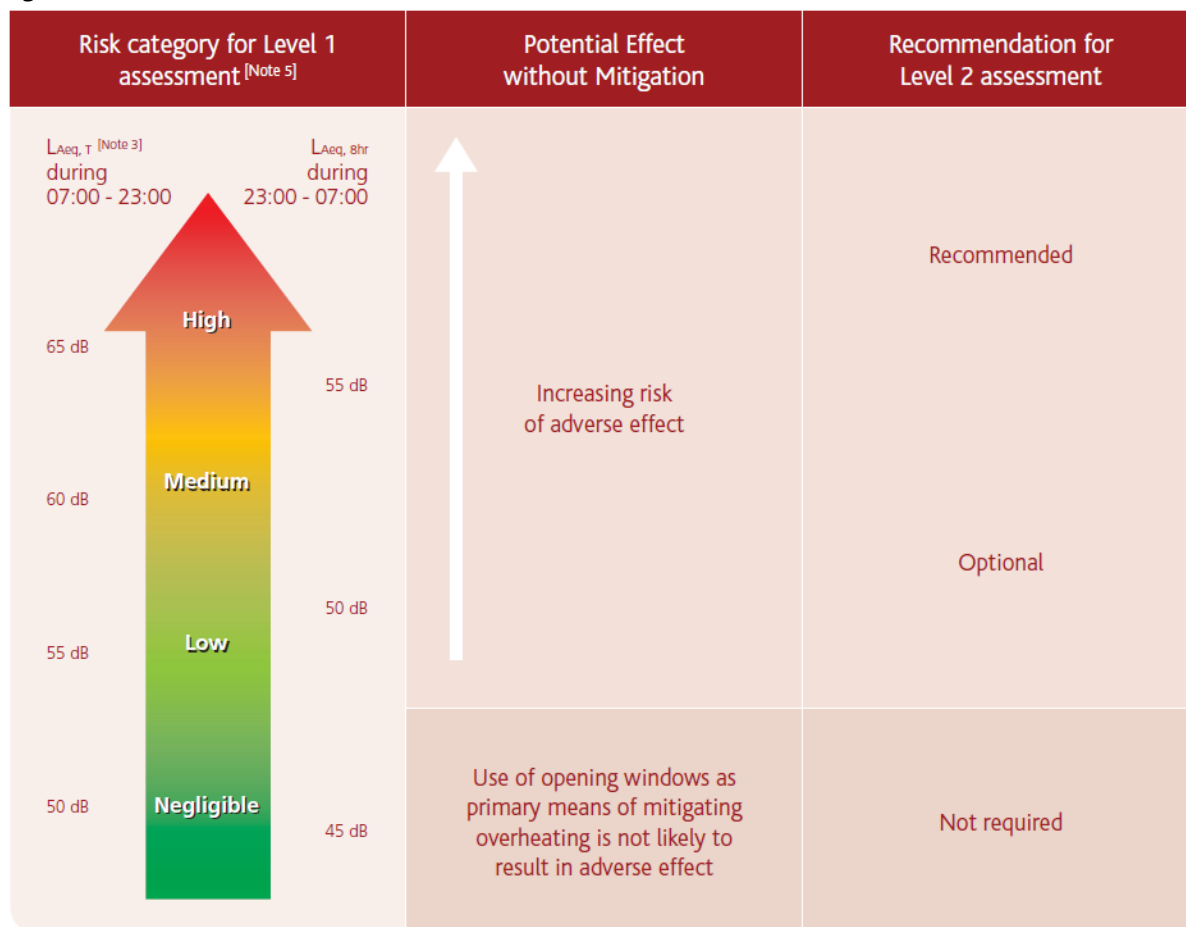
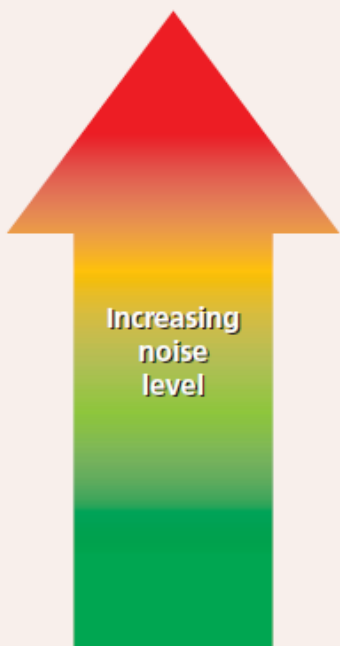


Figure 3.2 Level 2 Noise Risk Assessment – Internal Noise Levels

Internal ambient noise level [Note 2]			Examples of Outcomes [Note 5]	
$L_{Aeq,T}$ [Note 3] during 07:00 – 23:00 [Note 6]	$L_{Aeq,8h}$ during 23:00 – 07:00	Individual noise events during 23:00 – 07:00 [Note 4]		
> 50 dB	> 42 dB	Normally exceeds 65 dB $L_{AF,max}$	Noise causes a material change in behaviour e.g. having to keep windows closed most of the time	Avoiding certain activities during periods of intrusion. 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.
			Increasing likelihood of impact on reliable speech communication during the day or sleep disturbance at night	At higher noise levels, more significant behavioural change is expected and may only be considered suitable if occurring for limited periods. As noise levels increase, small behaviour changes are expected e.g. turning up the volume on the television; speaking a little more loudly; having to close windows for certain activities, for example ones which require a high level of concentration. Potential for some reported sleep disturbance. Affects the acoustic environment inside the dwelling such that there is a perceived change in quality of life. At lower noise levels, limited behavioural change is expected unless conditions are prevalent for most of the time. [Note 8]
≤ 35 dB	≤ 30 dB	Do not normally exceed $L_{AF,max}$ 45 dB more than 10 times a night	Noise can be heard, but does not cause any change in behaviour	Noise can be heard, but does not cause any change in behaviour, attitude, or other physiological response [Note 9]. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.

Figures 3.1 and 3.2 are related by the 13 dB attenuation typically provided by an open window.

For noisier sites, the risk of an adverse effect increases with increasing noise level and further consideration may be required.

3.2 External Noise Levels in Gardens

We understand Arun District Council typically require external noise levels within gardens of residential dwellings to conform to the upper guideline value of 55 dB $L_{Aeq, T}$ as specified in Section 7.7.3.2 of BS 8233: 2014.

3.3 Substation Noise Emissions

An electrical substation is located at the southern boundary of the proposed development site, accessed via the adjacent caravan site to the south. Arun District Council has commented as follows in this regard:

“For residential accommodation, the scheme shall ensure that the low frequency noise emitted from the substation is controlled so that it does not exceed the ‘Low Frequency Criterion Curve’ for the 10 to 16 – 160 Hz third octave bands inside residential accommodation as described in the DEFRA funded University of Salford Manchester guidance document entitled ‘Procedure for the Assessment of Low Frequency Noise Complaints’ (NANR45 Rev.1 – December 2011).”

4.0 Noise Survey Methodology

An unmanned environmental noise survey was undertaken at the site over a 4-day period between Thursday 19 November 2020 and Monday 23 November 2020. This period was selected to assess typical daytime and night-time noise levels over weekday and weekend periods, when the proposed dwellings will be occupied.

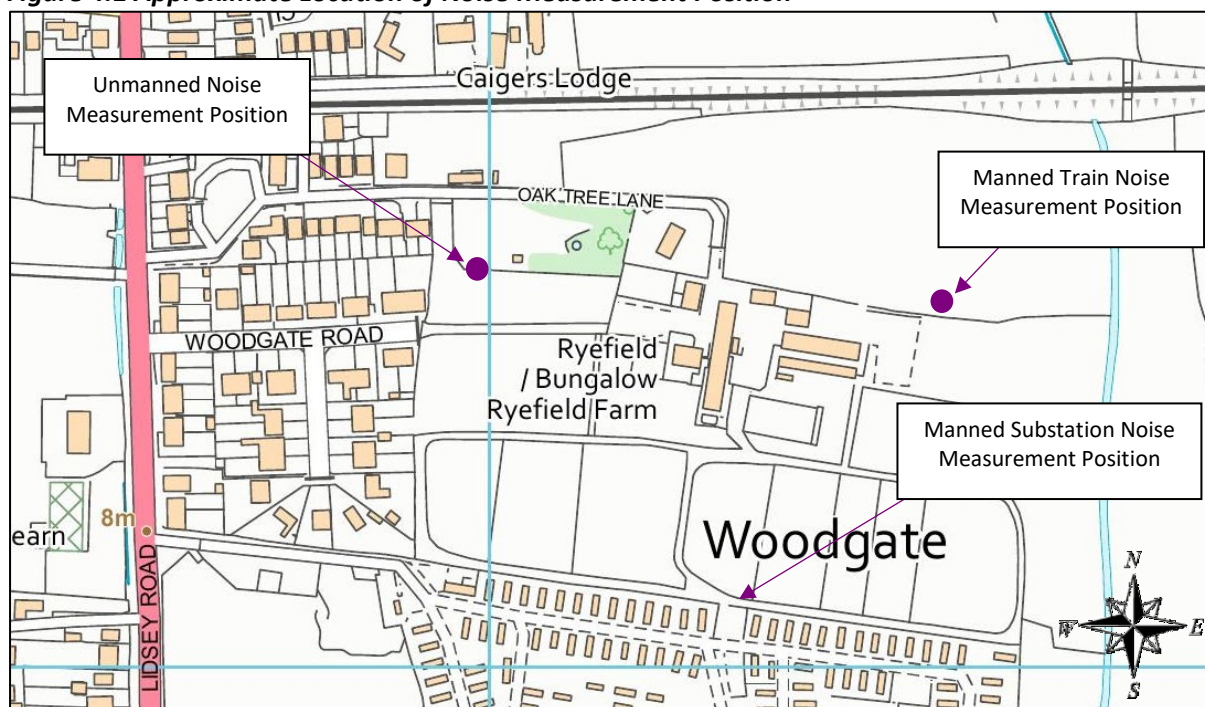
Noise measurements were captured at one worst-case measurement position, with the measurement microphone attached to the top of an open wire fence in free-field on the northern site boundary towards the north-western corner of the site.

The measurement position was considered to represent a worst-case in terms of environmental noise affecting the proposed development site, being the closest point at the site to the main transportation noise sources nearby – the railway to the north of the site and the A29/Lidsey Road to the west of the site.

Additional manned noise measurements were undertaken at the site on Thursday 21 October 2021 to assess noise levels in free-field positions due to an electrical substation located on the southern site boundary, and to assess any change in train noise levels since the original November 2020 noise survey.

The approximate locations of the measurement positions are shown in **purple** on Figure 4.1.

Figure 4.1 Approximate Location of Noise Measurement Position



The equipment used for the noise survey is summarised in Table 4.1.

Table 4.1 Description of Equipment used for Noise Survey

Item	Make & Model	Serial Number
Type 1 automated logging sound level meter	SVAN 945A	11906
Type 1 ½" microphone	GRAS 40AN	56012
Calibrator	01dB CAL31	86020

L_{Aeq} and L_{Amax} sound pressure levels were measured throughout the noise survey over contiguous 15-minute intervals.

The noise monitoring equipment was calibrated before and after the survey. No significant change was found. Laboratory equipment calibration certificates can be provided upon request.

Due to the nature of the noise survey, i.e. unmanned, we are unable to comment on the weather conditions throughout the entire noise survey period, however at the beginning and end of the survey period, there was noted to be no rainfall, a clear sky and only light wind. These conditions are understood to be representative of the majority of the survey period and are considered appropriate for undertaking environmental noise measurements.

5.0 Noise Survey Results

Appendix B presents a time history graph showing the L_{Aeq} and L_{Amax} sound pressure levels measured throughout the noise survey.

As a result of the Covid-19 pandemic during 2020/21 and subsequent government restrictions, motor vehicle use across the UK (and hence road traffic noise) has been affected. To assess the potential effect of this, the Department for Transport (DfT) are currently publishing daily transport use data, relative to more typical conditions in early 2020.

The DfT data for all motor vehicle use during the noise survey period (Thursday 19 November 2020 to Monday 23 November 2020) indicates that usage was at 73% of typical conditions on average, resulting in current road traffic noise levels being 1.4 dB less than typical. This is a negligible change in noise levels that is unlikely to be subjectively noticeable. Nonetheless, we have applied this correction to the measured noise levels to approximate 'typical' conditions.

Additionally, the DfT data indicates that national rail use during the noise survey period was at 23% of typical conditions. It should be noted that 'usage' is not the same as the quantity of trains (which in our experience was much higher during the pandemic), however we have taken 23% as a worst-case.

Our manned measurements and observations of train movements on Thursday 21 October 2021 indicated 8 train pass-bys per hour (4 in each direction) with a typical noise level of 70 dB L_{AE} at the measurement position for each train.

The DfT data indicates that train usage is currently at 63% of typical conditions, therefore it could be concluded that there were only 3 train movements per hour during the original noise survey in November 2020 and that typical conditions (i.e. 100%) would be 13 train movements per hour.

As an absolute worst-case, we have undertaken calculations based on 100% typical conditions, which indicate a 0.7 dB increase in the overall daytime L_{Aeq} (16 hour) ambient noise level. This is a negligible change in noise levels that is unlikely to be subjectively noticeable. Nonetheless, we have applied this correction to the measured daytime and night-time noise levels to approximate 'typical' conditions.

Table 5.1 presents a summary of the main noise parameters which will be used for subsequent assessments of internal and external noise, including the corrections described above.

Table 5.1 Measured External Noise Levels

Daytime L_{Aeq} (16 hour) (dB)	Night-time L_{Aeq} (8 hour) (dB)	Night-time L_{Amax} (dB)*
54	44	60

* 10th highest

During our site visits, the dominant noise sources affecting the measurement position were noted to be distant road traffic noise and occasional distant passing trains on the railway line to the north.

We would consider the measured noise levels to be reasonable, taking into account the location of the measurement position and the dominant nearby noise sources.

6.0 Site Noise Model

Figures 6.1 to 6.6 show noise modelling images of the existing and proposed site, based on the measured noise data.

Figure 6.1 Existing Site – Daytime L_{Aeq} (16 hour)

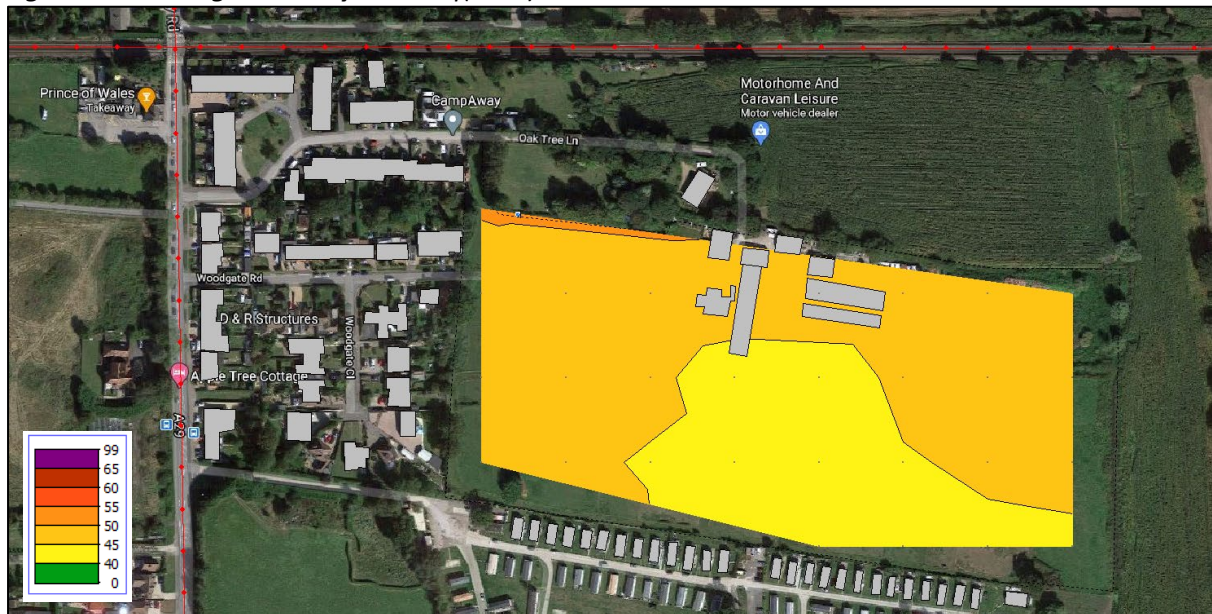


Figure 6.2 Existing Site – Night-time L_{Aeq} (8 hour)

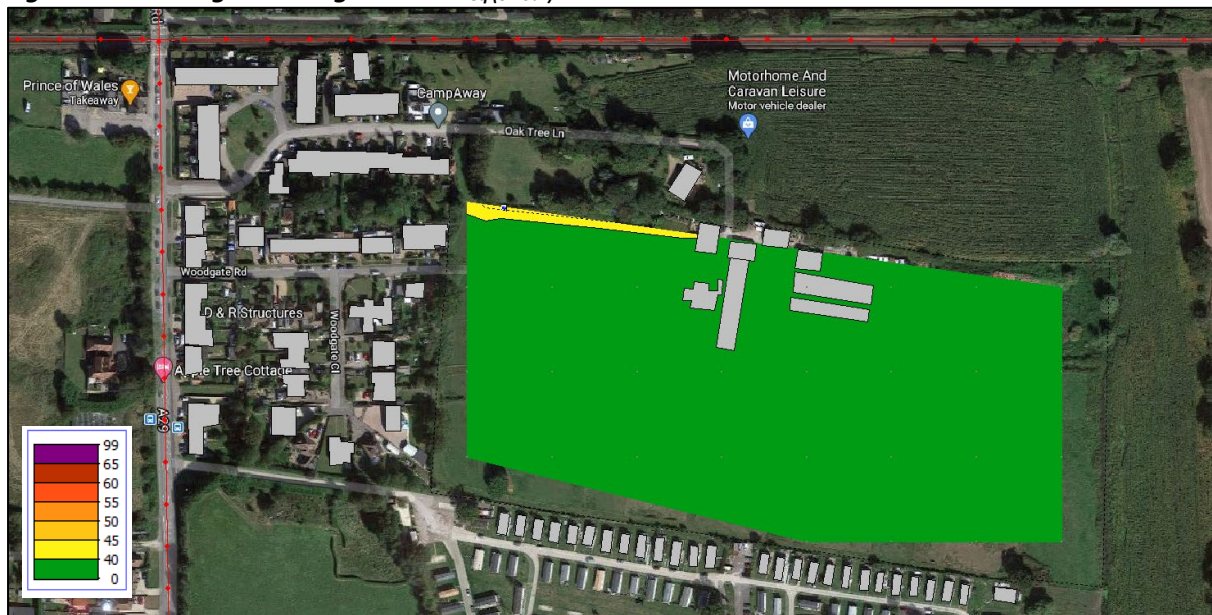


Figure 6.3 Existing Site – Night-time L_{Amax}

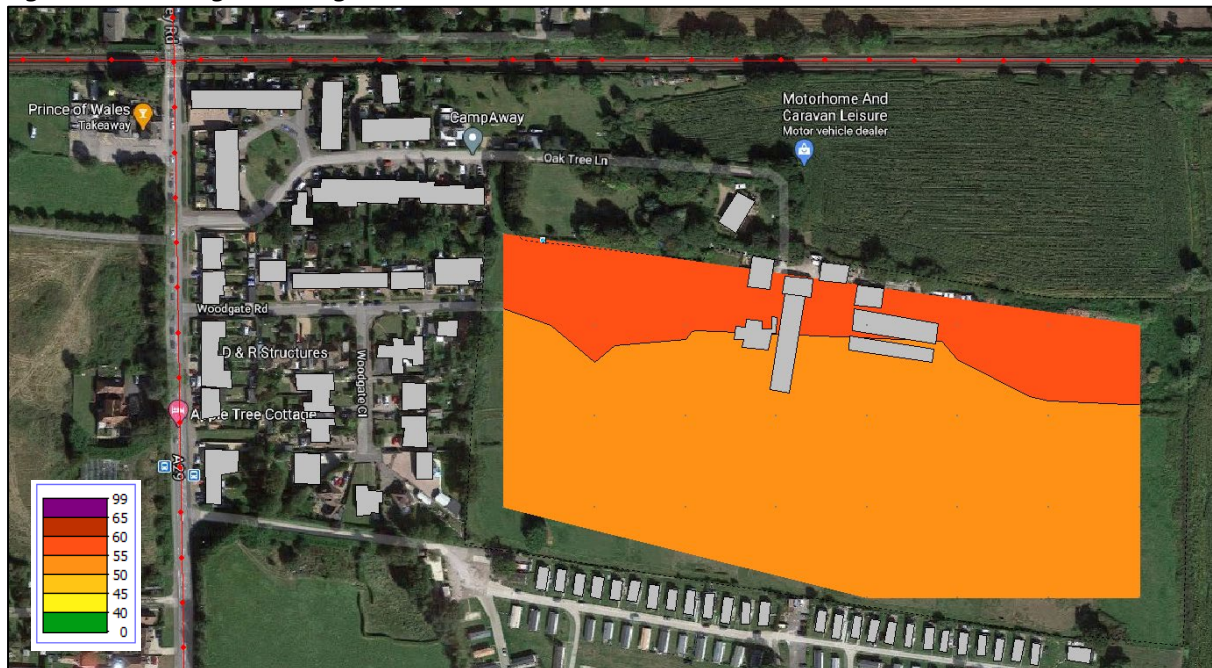


Figure 6.4 Proposed Site – Daytime L_{Aeq} (16 hour)



Figure 6.5 Proposed Site – Night-time L_{Aeq} (8 hour)



Figure 6.6 Proposed Site – Night-time L_{Amax}



The modelling results therefore indicate the following:

- Daytime noise levels for the existing and proposed site are generally less than 55 dB L_{Aeq} (16 hour)
- Night-time noise levels for the existing and proposed site are generally less than 45 dB L_{Aeq} (16 hour) and less than 60 dB L_{Amax}

7.0 External Noise Intrusion

7.1 External Façade Constructions

Our calculations indicate that the target BS 8233: 2014 internal noise levels specified by Arun District Council are achievable in the proposed residential dwellings through the use of suitable external façade constructions, described as follows:

- **Glazing** specified to achieve a laboratory sound insulation performance of at least R_w 31 dB – typically non-acoustic thermal double glazing e.g. 4mm glass / 12mm cavity / 4mm glass
- Background **ventilators** to achieve a laboratory sound insulation performance of at least $D_{n,e,w}$ 37 dB – typically non-acoustic trickle ventilators fitted into the window frame
- Non-glazed **façade** areas achieve at least R_w 52 dB (e.g. brick/block cavity wall)

The above constructions are conventional, non-specialist materials and the specified sound insulation values should not be difficult to achieve.

Our detailed calculations to predict internal noise levels, based on the above constructions, are presented in Appendix C.

7.2 Open Windows and Overheating

Comparing the measured external noise levels with the ANC criteria in Section 3.1 above gives the daytime and night-time noise risk categories shown in Table 7.1.

Table 7.1 Noise Risk Categories

Period	Measured External Noise Level	Noise Risk Category
Daytime	54 dB L_{Aeq} (16 hour)	Negligible
Night-time	44 dB L_{Aeq} (8 hour)	Negligible

When assessing the effect on internal noise levels when windows are open, it can therefore be concluded that no further consideration is required and “*use of opening windows as a primary means of mitigating overheating is not likely to result in adverse effect*”.

Our calculations to predict internal noise levels, based on the above, are presented in Appendix C.

8.0 Gardens

It can be seen from the noise modelling figures in Section 6 that daytime noise levels across the existing and proposed site are less than 55 dB L_{Aeq} (16 hour), which achieves the BS 8233: 2014 standard specified by Arun District Council. It is therefore concluded that external noise levels at the site are an acceptable level in the proposed gardens.

9.0 Substation Noise

Manned measurements and observations of noise associated with the substation were undertaken on Thursday 21 October 2021 in the location shown on Figure 4.1. The measurements were carried out in free-field at a distance of approximately 0.5 to the north of the substation.

The measured **external** noise levels L_{eq} noise levels, corrected for the additional distance to the nearest proposed dwelling (20m), are compared with the NANR45 reference curve in Table 9.1.

Table 9.1 Substation Noise Assessment

Element	Level (dB) at One Third Octave Band Frequency (Hz)												
	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
Measured L_{eq} Sound Pressure Level at 0.5m	55	53	51	48	51	50	49	48	48	45	45	41	39
Distance Correction to Nearest Proposed Dwelling	-16	-16	-16	-16	-16	-16	-16	-16	-16	-16	-16	-16	-16
Predicted Sound Pressure Level Outside Nearest Proposed Dwelling	38	37	35	32	35	34	33	32	32	28	29	25	23
NANR Reference Curve	92	87	83	74	64	56	49	43	42	40	38	36	34

It can therefore be seen that the measured substation noise is predicted to be less than the NANR reference curve, when assessed **outside** the nearest residential dwelling.

The reference curve applies to low frequency sound “inside residential accommodation”, therefore the measured external noise levels will be further reduced by attenuation due to the building envelope (even with windows open). Internal noise levels due to the substation will therefore be even more comfortably less than the NANR reference curve.

As a result, noise levels associated with the substation are unlikely to represent an adverse noise impact on the occupants of the proposed dwellings.

10.0 Construction Noise & Vibration Mitigation

Measures that will be implemented in order to minimise the noise and vibration impact on surrounding properties are described in the following sections.

10.1 Liaison

Site neighbours which may be affected by noise and vibration will be identified and informed of:

- The proposed start date of the works
- The proposed duration of the works
- The nature of the works
- Contact details for appropriate site personnel and project personnel

During construction works, regular communication will be maintained with site neighbours, informing them of site progress and forthcoming works. A display board will be erected outside the site presenting contact details of appropriate site and project personnel.

10.2 Working Hours

Construction activities shall be undertaken within the following working hours:

- 08:00 – 16:00 hours (Monday to Friday)
- 09:00 – 01:00 hours (Saturdays)
- No works on Sundays or Bank Holidays.

Any activities outside these hours will only be undertaken with prior agreement with the local authority planning and environmental health department.

10.3 Construction Works Methodology

At all times, construction works will be undertaken by best practicable means so as to reduce construction activity noise and vibration levels affecting neighbouring properties. As far as is practicable, it will be ensured that:

- Site activities only take place during the agreed operating hours when local ambient noise levels are generally higher, and not during quieter periods
- Noise from equipment and activities is attenuated at source, through the use of low-noise, well-maintained machinery, so as to minimise noise emissions
- Solid imperforate site hoarding (minimum surface density 5kg/m²) will be erected around the area of the works (minimum 2 metres tall), which will provide significant screening and acoustic attenuation of site activities
- Acoustic attenuation due to distance and screening of site activities will be maximised, via works programming, site hoarding and the new external façades

In particular, the following measures will be adopted where practicable:

- All deliveries/removals of materials and plant etc. will be undertaken during the working hours presented in Section 4.3.2 above
- The noisiest items of plant (e.g. generators) will be located away from neighbouring properties, and if necessary acoustic enclosures will be erected around them, in order to minimise noise emissions
- Temporary acoustic enclosures or shields will be constructed around noisy plant where necessary, in order to provide significant screening and acoustic attenuation

- Works will be programmed so as to reduce the duration of noisy activities close to neighbouring properties
- Equipment will be electrically powered from mains supply where possible, removing the need for noisy generators. If required at all, low-noise generators will be used
- Materials will be moved carefully (both manually and by machinery) in order to avoid dropping
- Screws and drills will be used as opposed to nails for erecting hoardings/enclosures etc, which will generate lower levels of noise
- Plant engines will be switched off whilst not in use, in order eradicate unnecessary noise emissions (i.e. idling will be minimised on-site)

10.4 Noise Monitoring

Noise monitoring of site activities shall be undertaken at a location that is representative of the nearest noise sensitive properties. Monitoring shall be undertaken using a Type 1 sound level meter fixed to a tripod at a height of approximately 1.2 metres above ground level in free-field.

L_{Aeq} sound pressure levels shall be recorded at the monitoring position during site operating hours for an agreed duration that gives a suitable sample of the activity in question.

A report shall be prepared presenting the measured noise levels and a comparison with the agreed noise level limit.

10.5 Vibration Monitoring

Monitoring of vibration associated with site activities shall be undertaken at a location that is representative of the nearest sensitive properties.

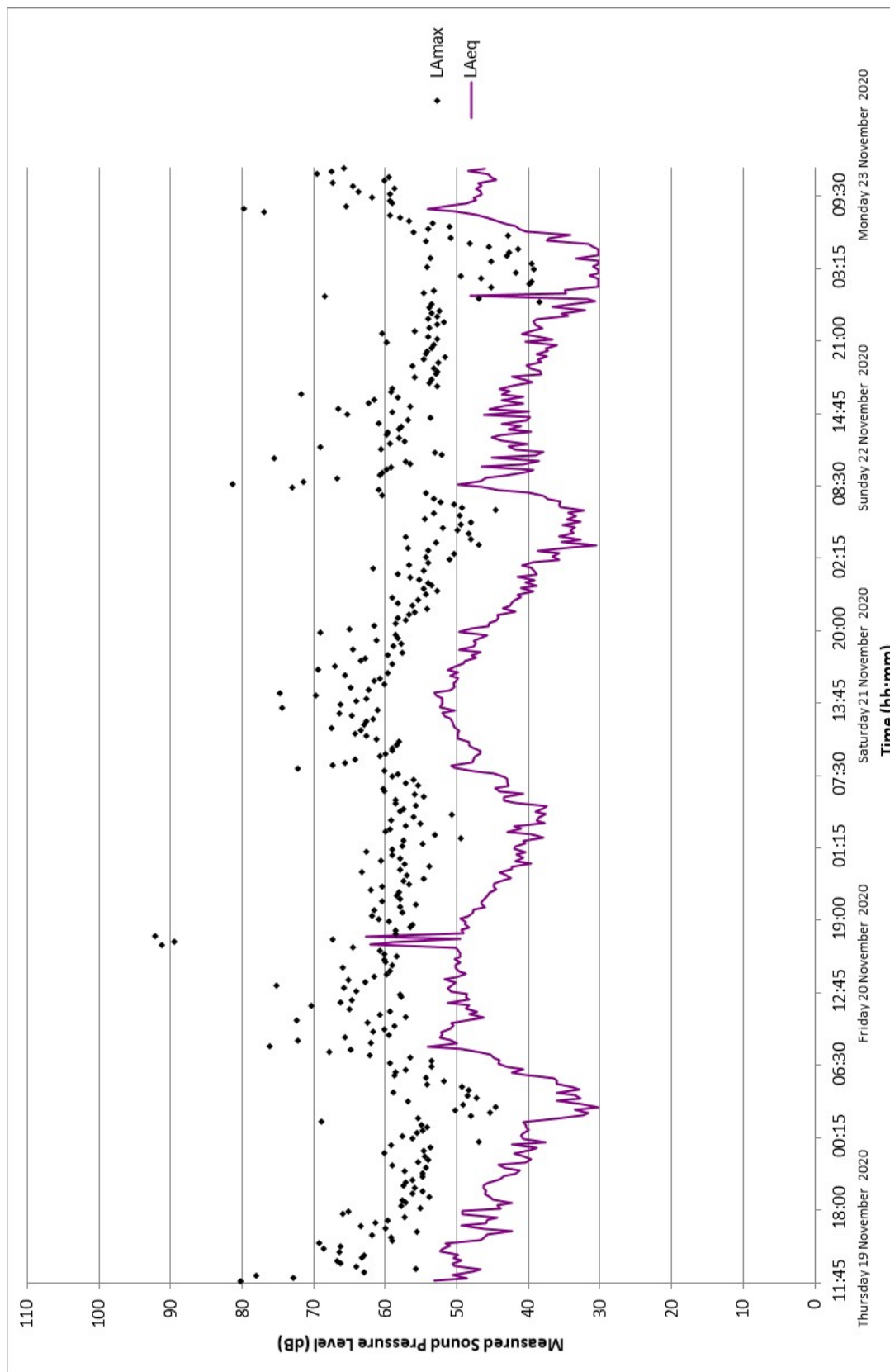
Peak Particle Velocity (PPV) vibration levels (in mm/s) shall be recorded continuously at the monitoring position during the activity in question.

A report shall be prepared presenting the measured vibration levels and a comparison with the agreed noise level limits.

Appendix A – Acoustic Terminology

Parameter	Description
Decibel (dB)	A logarithmic scale representing the sound pressure or power level relative to the threshold of hearing (20×10^{-6} Pascals).
Sound Pressure Level (L_p)	The sound pressure level is the sound pressure fluctuation caused by vibrating objects relative to the threshold of hearing.
A-weighting (L_A or dBA)	The sound level in dB with a filter applied to increase certain frequencies and decrease others to correspond with the average human response to sound.
L_{Amax}	The A-weighted maximum noise level measured during the measurement period.
$L_{Aeq,T}$	The A-weighted equivalent continuous noise level over the time period T (typically T= 16 hours for daytime periods, T = 8 hours for night-time periods). This is the sound level that is equivalent to the average energy of noise recorded over a given period.
R_w	The weighted (w) sound reduction index (R), a single figure rating of the laboratory airborne sound insulation performance of a construction, usually measured across the frequency range 100-3150Hz. The higher the value, the greater the sound insulation, and the more onerous the requirement.
$D_{n,e,w}$	The weighted (w) element (e) normalised (n) level difference (D), a single figure indicator of the ability of a small building element (such as a trickle ventilator) to reduce sound. The higher the value, the greater the sound reduction, and vice versa.

Appendix B – Time History Graph



Appendix C – External Noise Intrusion Calculations

Closed Windows – Daytime L_{Aeq} (16 hour)

Element	Level (dB) at Octave Band Centre Frequency (Hz)						L_{Aeq} (dB)
	125	250	500	1k	2k	4k	
External Noise Level	56	52	50	50	47	41	54
Glazing Sound Reduction	21	17	24	35	37	30	
Trickle Ventilator Sound Reduction	37	37	36	36	36	30	
Non-Glazed Area Sound Reduction	41	45	45	54	58	58	
Room Sound Absorption	10	8	7	12	14	15	
Predicted Internal Noise Level	33	33	25	16	13	6	27

Closed Windows – Night-time L_{Aeq} (8 hour)

Element	Level (dB) at Octave Band Centre Frequency (Hz)						L_{Aeq} (dB)
	125	250	500	1k	2k	4k	
External Noise Level	46	42	40	40	37	31	44
Glazing Sound Reduction	21	17	24	35	37	30	
Trickle Ventilator Sound Reduction	37	37	36	36	36	30	
Non-Glazed Area Sound Reduction	41	45	45	54	58	58	
Room Sound Absorption	8	6	6	10	12	12	
Predicted Internal Noise Level	24	24	16	7	4	<0	18

Closed Windows – Night-time L_{Amax}

Element	Level (dB) at Octave Band Centre Frequency (Hz)						L_{Amax} (dB)
	125	250	500	1k	2k	4k	
External Noise Level	62	58	56	56	53	47	60
Glazing Sound Reduction	21	17	24	35	37	30	
Trickle Ventilator Sound Reduction	37	37	36	36	36	30	
Non-Glazed Area Sound Reduction	41	45	45	54	58	58	
Room Sound Absorption	8	6	6	10	12	12	
Predicted Internal Noise Level	40	40	32	23	20	13	34

Open Windows

Period	Measured External Noise Level	Open Window Sound Reduction	Predicted Internal Noise Level
Daytime	54 dB L_{Aeq} (16 hour)	-13	41
Night-time	44 dB L_{Aeq} (8 hour)	-13	31