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Noise Assessment

Proposed Residential Development

Land off Station Road, Wombwell, Barnsley

for:

Hartwood Estates Limited

CRM.1122.005.NO.R.001

'Experience and expertise working in union'

enzygo.com

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Noise Assessment for a Proposed Residential Development

Project:	Station Road, Wombwell
For:	Hartwood Estates Limited
Status:	Final
Date:	March 2019
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1 Introduction

1.1 Project Introduction

1.1.1 Enzygo Limited has been instructed by Hartwood Estates Limited to undertake an environmental noise assessment to support an outline planning application for the proposed development of land off Station Road, Wombwell. The site is intended for residential use.

1.1.2 The assessment has been undertaken to assess the suitability of the site for the proposed use in accordance with the relevant standards and guidance. The report presents the results of baseline noise surveys undertaken at four locations at the site, the results of 3D noise mapping based on the survey results and suggested mitigation measures where required to ensure that the proposed development is suitable for residential use.

1.2 Site Description

1.2.1 The site is currently undeveloped land and is situated to the north of Station Road, approximately 6.5km south-east of Barnsley town centre and is centred at grid reference SE 40508 03630 approximately.

1.2.2 The area surrounding the site is a mixture of residential and commercial with areas of woodland. The proposed development site comprises land to the north of Station Road and to the East of Low Valley Industrial Estate as shown in Figure 1-1. To the north of the site, beyond the woodland, are Netherwood Academy's playing fields. To the east is residential development on Stonyford Road and George Street; the south features more residential development and a public playing field containing a playground. To the west is Low Valley Industrial Estate containing Naylor Industries, GK Cars, Safestyle UK Glass Processing and others.

1.2.3 The Bulling Dike (part of the River Dove) runs along the western border of the site, there is a small portion of land between the industrial estate and the Bulling Dike containing a footpath. It is considered that any development at the site would not encroach of this area and therefore this report assesses the development of the land to the east of the Bulling Dike only.

1.2.4 Potential existing noise sources which may impact on the proposed development considered within this report are:

- Industrial and road noise from Low Valley Industrial Estate to the west of the site; and
- Road traffic noise on Station Road, on the southern boundary of the site.

1.2.4 The site location is shown in Figure 1-1.

Figure 1-1: Site Location

1.3 Noise Assessment Methodology

1.3.1 To consider, assess and mitigate the potential noise impacts at the site, the following assessment methodology has been followed:

- Baseline noise surveys undertaken close to the roads bordering the site;
- 3D noise propagation modelling of noise from the existing road infrastructure to determine noise levels across the site;
- An assessment of the outline suitability of the site for residential development; and
- Where necessary, consideration of suitable acoustic mitigation measures and strategies that could be employed within the design of the site to control noise has been made.

2 Standards and Guidance

2.1 National Planning Policy Framework (NPPF, February 2019)

2.1.1 The NPPF determines the government's planning policy for England. The NPPF states that, with respect to noise, planning policies and decisions should aim to:

- Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;
- Mitigate and reduce to a minimum, other adverse impacts on health and quality of life arising from noise from a new development, including through the use of conditions;
- Recognise that development will often create some noise and existing business wanting to develop in continuance of their business should not have unreasonable restrictions put upon them because of changes in nearby land uses since they were established; and
- Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

2.1.2 The guidance contained within the NPPF further determines that consideration should be given to the Noise Policy Statement for England (DEFRA, March 2010).

2.2 Noise Policy Statement for England (NPSE, March 2010)

2.2.1 The NPSE attends to three types of noise;

- "Environmental noise" which includes noise from transportation sources;
- "Neighbour noise" which includes noise from inside and outside people's homes; and
- "Neighbourhood noise", which includes noise arising from within the community such as industrial and entertainment premises, trade and business premises, construction sites and noise in the street.

2.2.2 In line with the aims determined in the NPPF, the NPSE determines three aims;

1. Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development;
2. Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development; and,
3. Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

2.2.3 The guidance detailed within the NPSE relates a number of key phrases with regards to adverse effects which can be applied to noise impacts as used by the World Health Organisation.

NOEL – No Observed Effect Level

The level below which no health effect or detrimental impact on the quality of life is observed.

LOAEL – Lowest Observed Adverse Effect Level

The level at which adverse effects on health and quality of life can be detected

SOAEL – Significant Observed Adverse Effect Level

The level above which significant adverse effects on health and quality of life occur.

2.2.4 The guidance indicates that it is not possible to have a single objective noise-based measure that defines SOAEL, and as such the SOAEL is likely to be different for different noise sources and receptors. The document indicates that further research is required to establish what may constitute a significant adverse impact on health and quality of life from noise.

2.2.5 While the NPSE determines the NOEL, LOAEL and SOAEL descriptions the document indicates that, unlike other environmental disciplines, there are currently no European or national noise limits which must be met although the NPSE states that "*there can be specific local limits for specific developments*" allowing for negotiation.

2.3 Planning Practice Guidance - Noise

2.3.1 The Planning Practice Guidance (PPG) for noise (updated December 2014) broadly considers the same issues as demonstrated within both the NPPF and the NPSE with regards to noise within the planning realm.

2.3.2 The information detailed within the PPG indicates that noise should be considered when:

- New developments may create additional noise; and/ or,
- New developments would be sensitive to the prevailing acoustic environment.

2.3.3 The guidance indicates that Local Planning Authorities should take account of the acoustic environment and in doing so consider:

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

2.3.4 The impact of noise is rated within the policy document in terms of the relative '*Observed Effect Level*', defined in line with the criteria summarised within paragraph 2.3.3 above. Based on this the Planning Practice Guidance provides a matrix of likely average response (Table 2-1).

Table 2-1: Planning Practice Guidance – Noise; Exposure Hierarchy

Perception	Example of Outcomes	Increasing Effect Level	Action
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Noticeable and Intrusive	Noise can be heard and causes small changes in behaviour and/ or attitude, 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 perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Noticeable and disruptive	The noise causes a material change in behaviour and/ or attitude, 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 character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/ or an ability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/ awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

2.4 British Standard 8233:2014 – 'Guidance on Sound Insulation and Noise Reduction for Buildings'

2.4.1 When internal noise levels are required to be considered, suitable guidance can be found within BS8233:2014.

2.4.2 This Standard provides guidance values within Section 7.7 relating to a range of design criteria levels for certain building types. Section 7.7.1 covers "*Dwelling Houses, flats and rooms in residential use (when unoccupied)*" and the appropriate values are presented within Table 2-2.

Table 2-2: BS8233:2014 Guidance Values

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

2.4.3 Note 7 to the above table within BS8233 details that "Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5dB and reasonable internal conditions still achieved".

2.4.4 With regard to external noise levels the Standard states that "For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50dB $L_{Aeq,T}$, with an upper guideline value of 55dB $L_{Aeq,T}$ which would be acceptable in noisier environments". However, the Standard recognises that these levels are not achievable in all situations and further states that "In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces but should not be prohibited".

2.4.5 In terms of the PPG impact effect level thresholds, the following assessment criteria of BS8233 are considered appropriate to the following assessment of residential suitability.

Table 2-3: Effect level thresholds in accordance with BS8233

Threshold	Daytime External Threshold limit	Daytime Internal Threshold Limit	Night time Internal Threshold Limit
NOEL	<50dB	<30dB $L_{Aeq,16hr}$	
LOAEL	50dB	35dB $L_{Aeq,16hr}$	30dB $L_{Aeq,\ 8hr}$
SOAEL	>55dB	>40dB $L_{Aeq,16hr}$	

2.4.6 The internal values detailed within the scope of BS8233 generally accord well with the recommendations of the WHO guidance.

2.5 The World Health Organisation Guidelines for Community Noise (1999)

2.5.1 The World Health Organisation's (WHO) '*Guidelines for Community Noise*' report for external environmental noise levels states that;

> *"4.2.7 Annoyance responses*
>
> *During the daytime, few people are seriously annoyed by activities with L_{Aeq} levels below 55dB; or moderately annoyed with L_{Aeq} levels below 50dB. Sound pressure levels during the evening and night should be 5-10dB lower than during the day…."*

2.5.2 For night-time noise sources the WHO guidelines recommend a night-time (23:00 – 07:00) 8-hour noise level of 30dB L_{Aeq} inside bedrooms (for reasonably steady noise source) to avoid sleep disturbance. However, this has been somewhat superseded by the more recent Night Noise Guidelines for Europe (2009) as detailed in Section 2.7.

2.5.3 For internal noise levels during the daytime and evening period it is suggested that a noise level of 35dB $L_{Aeq,16hr}$ (07:00 – 23:00hrs) be achieved within habitable rooms to avoid adverse speech intelligibility impacts and moderate annoyance.

2.6 World Health Organisation: Night Noise Guidelines for Europe (2009)

2.6.1 The '*Night Noise Guidelines for Europe*' were published by the WHO in 2009 and works in association with the 2000 Guidelines for Community Noise.

2.6.2 The guidance states that;

"Considering the scientific evidence on the thresholds of night noise exposure indicated by $L_{night,\ outside}$ as defined in the Environmental Noise Directive (2002/49/EC), an $L_{night,\ outside}$ of 40dB should be the target of the night noise guidelines (NNG) to protect the public, including the most vulnerable groups such as children, the chronically ill and the elderly."

2.6.3 The document accords well with the 'Good' internal design criteria as defined within BS8233 when windows are open for ventilation.

2.7 Local Planning Authority Considerations

2.7.1 Enzygo recently consulted with the Environmental Health Team at Barnsley Metropolitan Borough Council. The council reviewed the work instruction before the baseline measurements were undertaken and agreed that the assessment criteria should be in line with NPPF and use current guidance (BS4142, BS8233, and CRTN) in our assessment of the scheme.

3 Noise Monitoring Survey

3.1 Baseline Survey Details

3.1.1 Baseline noise monitoring was undertaken at the proposed development site on Friday 22nd February 2019 to determine the ambient noise levels of the surrounding area, road noise from Station Road and the commercial noise levels from Low Valley Industrial Estate.

3.1.2 The monitoring was carried out in accordance with the requirements of British Standard 7445:1996 '*Description and measurement of environmental noise*', by a suitably qualified and experienced acoustic consultant.

3.1.3 Measurements were taken over periods considered adequate to obtain representative noise data over the daytime and night-time periods. The noise monitoring durations are shown in Table 3-2.

3.1.4 The noise monitoring locations are described in Table 3-1 and shown in Figure 3-1.

Table 3-1: Noise Monitoring Locations

Location Reference	Description
Station Road	12m from the centre of Station Road
Footpath - Point 1	One third of the way down the footpath off Station Road
Footpath - Point 2	Halfway point down the footpath off Station Road
Valley Road	2m from the centre of Valley Road and 5.5m from the gate at the end of Valley Road

3.1.5 The onsite noise monitoring durations are listed in Table 3-2. Overnight noise measurements were timed to represent a worst-case, i.e. loudest, overnight period.

Table 3-2: Noise Monitoring Durations

Time Period	Station Road	Footpath Point 1	Footpath Point 2	Valley Road
Daytime	10:12 – 13:12	10:30 – 10:45	11:15 – 11:30	11:35 – 11:50
Night-time	06:00 – 07:00	-	-	06:12 – 06:27

3.1.6 Noise measurements were attended throughout, to describe noise sources incident at the measurement locations, changes in noise climate and weather conditions.

3.2 Weather

Friday 22nd February 2019

3.2.1 Weather conditions throughout Friday 22nd February 2019 were suitable for environmental noise monitoring and are detailed in Table 3-3 below.

Figure 3-1: Noise Monitoring Locations

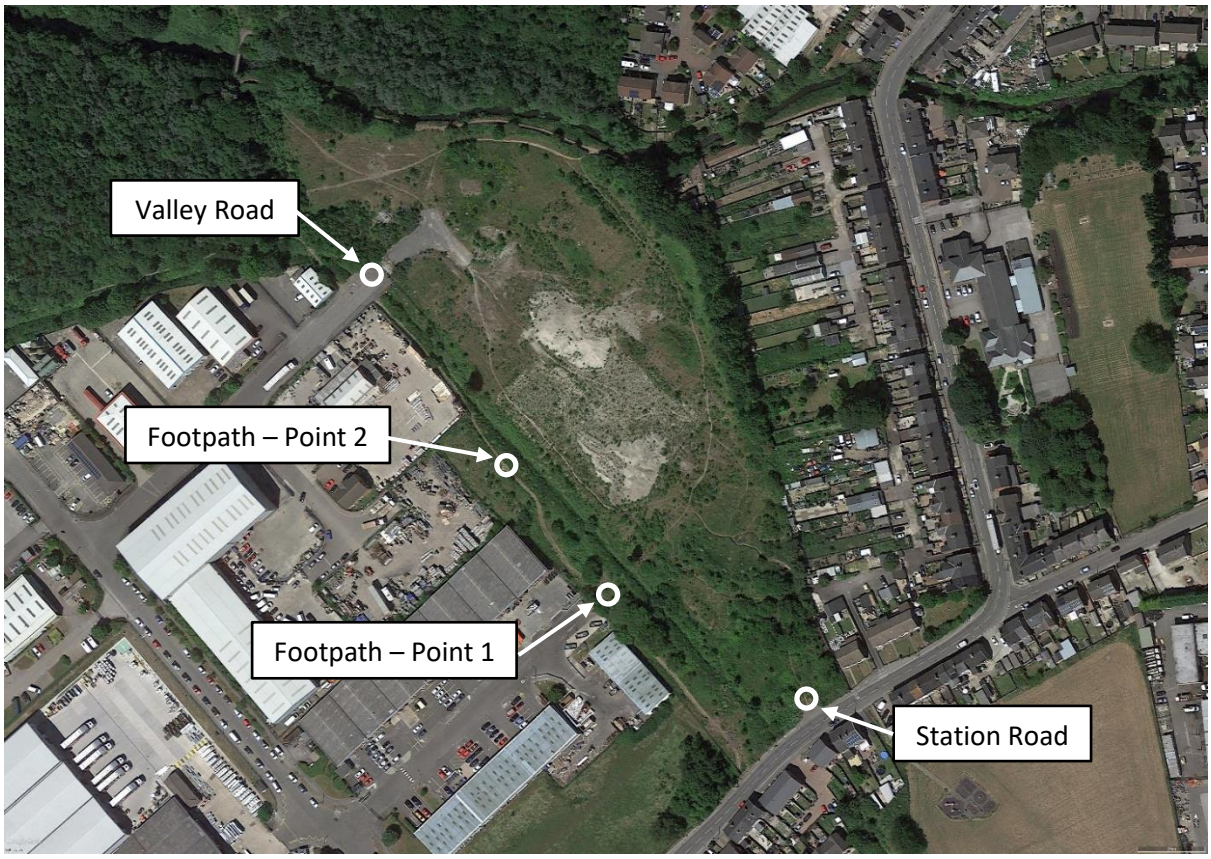


Table 3-3: Weather Conditions

Period	Precipitation	Cloud Cover	Wind	Temperature
Daytime	None, dry roads	60%	<5.0ms^{-1} in a southerly direction	12°C
Night-time	None, dry roads	0%	<5.0ms^{-1} in a southerly direction	6°C

3.3 Monitoring Equipment

3.3.1 Table 3-4 lists the noise monitoring equipment used to undertake the survey work.

Table 3-4: Noise Monitoring Equipment

Equipment	Serial Number	Calibration Date
01dB Solo Class 1 sound level meter	065396	09/03/2018
01dB Solo Class 1 sound level meter	065445	11/01/2018
Cirrus CR:515 Acoustic calibrator	59522	29/01/2019
Cirrus CR:515 Acoustic calibrator	67243	29/01/2019

3.3.2 The following set-up parameters were used on the sound level meters during all the noise measurements undertaken:

- Time Weighting: Fast

- Frequency Weighting: "A"

3.3.3 The sound level meter was locally calibrated using an electronic calibrator both prior to commencement of the survey and upon completion of the overall survey, no significant drift in calibration was observed. The external calibration documentation for the equipment used is available upon request.

3.4 Baseline Noise Survey Results

3.4.1 Table 3-4 summarises the results of the baseline survey undertaken on Friday 22nd February 2019. The full results are included in Appendix A.

Table 3-4: Summary of Measured Noise Levels

Location	Period	dB $L_{Aeq, T}$	dB $L_{A90, T}$	dB $L_{A10, T}$	dB L_{AFmax}
Station Road	Daytime	61.9	50.2	65.0	85.6
	Night-time	63.3	50.8	67.8	78.8
Footpath Point 1	Daytime	62.3	45.0	65.2	80.9
	Measurement not necessary – No commercial noise				
Footpath Point 2	Daytime	48.0	42.4	49.8	61.5
	Measurement not necessary – No commercial noise				
Low Valley	Daytime	50.1	44.1	53.1	66.6
	Night-time	56.6	50.9	60.9	68.0

3.5 Subjective Field Notes

3.5.1 The subjective notes recorded by the on-site acoustic consultant during the surveys in February 2019 are summarised as follows:

Daytime – Station Road

Noise climate consisted of road noise from Station Road, background road traffic noise, birdsong and a dog barking occasionally. There was also audible noise from the industrial estate consisting of reverse alarms, heavy machinery and the sound of banging metal.

Night-time – Station Road

Noise climate consisted of road noise from Station Road and background road traffic noise. There was no audible noise being emitted from any of the industrial units however there was lots of birdsong.

Daytime – Footpath Point 1

Noise climate consisted of background road noise from Station road and lots of birdsong. This monitoring point is next to Safestyle UK's material sorting area, the noise from the yard consisted of crushing sounds, banging sounds, materials emptied into skips, reverse alarms and engine noise from forklift trucks and a JCB. It was also noted that each time a vehicle enters or leaves the factory it sounds the horn twice to notify workers there is a new vehicle in the zone.

Daytime – Footpath Point 2

Background noise climate was made up of road noise from Station Road, surrounding roads on Low Valley Industrial Estate, engine sounds and a lorry being unloaded. The noise from the material sorting area described in the 'Footpath Point 1' notes was still audible but far less intense. At this monitoring point there is a raised section of land approximately 2 metres high running parallel to the sites western boundary that provides some acoustic shielding.

Daytime – Valley Road

Noise climate consisted of distant road noise from Station Road, and vehicles further along Valley Road on the industrial estate, forklift engines, reverse alarms, lots of birdsong and music coming from Safestyle UK's yard. No industrial noise was being emitted from the adjacent unit Europa Truck Parts.

Night-time – Valley Road

Noise climate consisted of distant road noise from Station Road and multiple other surrounding roads, occasional vehicle movement further along Valley Road and plenty on birdsong with one particular bird call being very noticeable. One of the yards at Safestyle UK has staff starting from 06:00, in the scaffolding storage area there were people talking and a van driving around the yard. The adjacent unit Europa Truck Parts had no noise or extractor fans running overnight.

4 Noise Contour Modelling

4.1 Noise Modelling Protocols

4.1.1 A noise model was constructed using the proprietary noise modelling software CadnaA. The propagation of noise from the local road network was predicted in accordance with the calculation methodology set out in ISO9613 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation.*

4.1.2 The resulting noise contours are designed to indicate the rate of decay of the continuous equivalent sound pressure (L_{Aeq}) over the proposed development site. The primary noise sources used for the purposes of noise modelling is road traffic on Station Road and commercial noise from Low Valley Industrial Estate.

4.2 Noise Contours

4.2.1 The noise model was constructed utilising the following information:

- Google Earth aerial imagery; and
- Topographical information obtained from OpenStreetMap.

4.3 Assumptions

4.3.1 The model assumes wind- and temperature-gradient-assisted propagation in all directions.

4.3.2 Road (line) sources sit 0.5m above the relative ground height.

4.3.3 Receptors are shown at 1.5m (Ground Floor living/dining rooms) and 4m (1st Floor bedrooms) heights.

4.3.4 Ground absorption is set to the default value with a coefficient level of 0.9α applied to represent 90% soft ground.

4.4 Calibration

4.4.1 Noise sources were modelled based on free-field measurements least affected by local building mass. These are balanced in the model and are presented according to the results in Table 4-1.

Table 4-1: Noise Model Calibration

Location Reference	Period	Modelled Source Level dB L_{A10}	Measured Noise Level dB $L_{Aeq,T}$	Modelled Noise Level dB $L_{Aeq,T}$	Tolerance ±dB
Station Road	Daytime	65.9	61.7	61.7	0.0
	Night-time	67.5	63.3	63.3	0.0
Footpath Point 1	Daytime	100.9	62.3	62.3	0.0
Footpath Point 2	Daytime	86.2	48.0	48.0	0.0
Valley Road	Daytime	93.2	50.1	50.1	0.0
	Night-time	100.1	56.6	56.6	0.0

4.4.2 All noise modelling outcomes are equal to the measured levels therefore, it is deemed that the model is representative of the noise climate at the site.

5 Noise Assessment

5.1 Noise Modelling Results

5.1.1 The noise assessment was undertaken against the current internal (living room/dining room/bedroom) and external (garden/patio/terrace) noise guidance criteria outlined in BS8233:2014 as described in Section 2.

5.1.2 The noise modelling exercise has shown (refer to Figures 5-1 and 5-2) that road traffic noise from Station Road and commercial noise from Low Valley Industrial Estate would impact upon the development site. Therefore, the assessment concentrates on road traffic noise being the primary noise sources.

5.1.3 Figure 5-1 and 5-2 show the contour plot results for the daytime and night-time periods respectively.

Figure 5-1: Daytime Noise Contour Plot

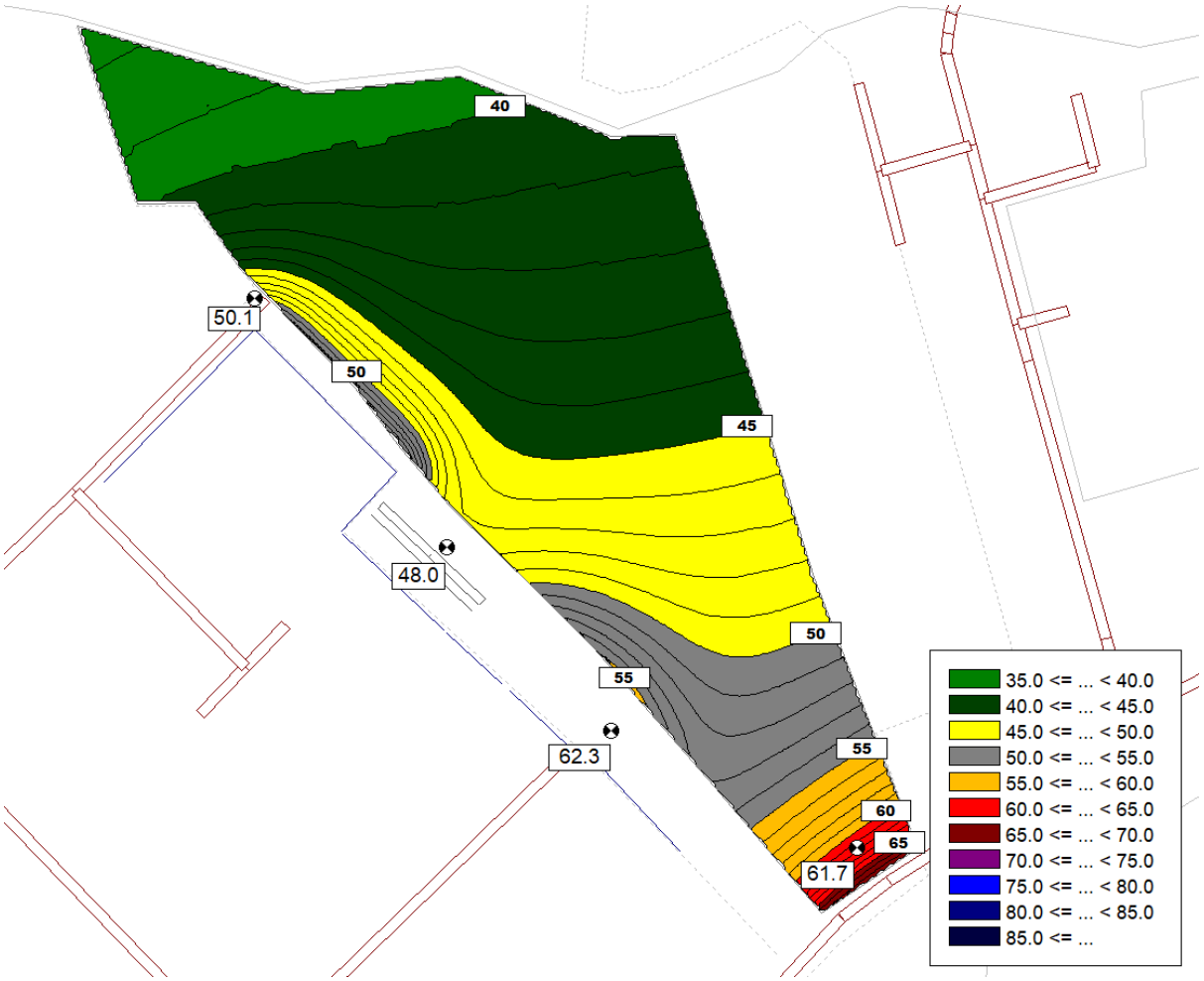
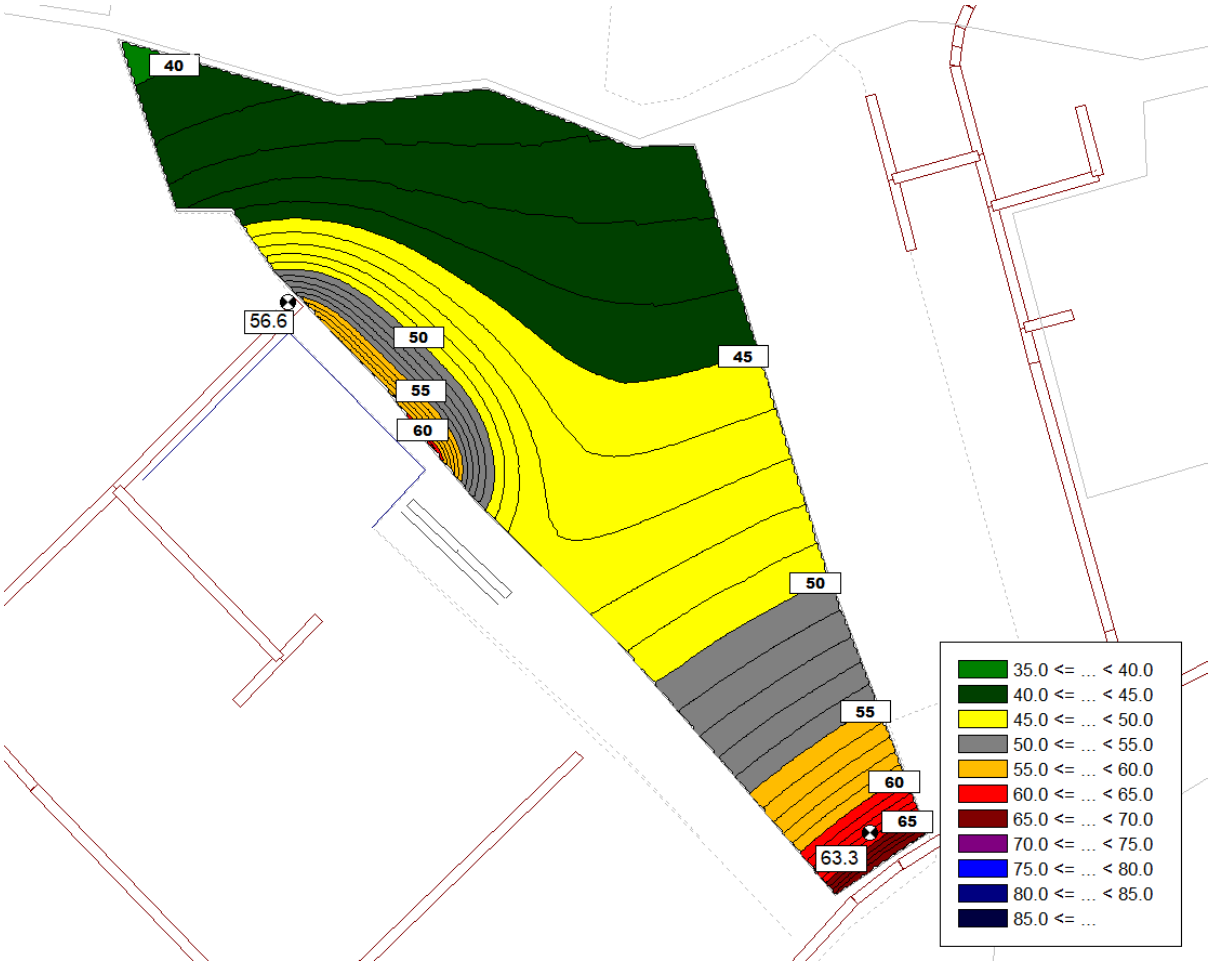


Figure 5-2: Worst-case Night-time Noise Contour Plot



5.2 External Amenity Area Noise Assessment

5.2.1 In accordance with the NPPF, noise within the ≤55dB L_{Aeq} contour for external spaces would be considered below the LOAEL threshold (Lowest Observed Adverse Effect Level) and where noise is ≤50dB L_{Aeq}, noise is considered below the NOEL threshold (No Observed Effect Level).

5.2.2 Figure 5-1 shows that the majority of the site lies within the 55dB contour for external noise during the daytime except the southern area of the site.

5.2.3 External amenity areas within the 55dB contour would not require mitigation. However, properties lying outside the 55dB contour would require some form of mitigation to ensure that noise levels within outdoor amenity spaces would meet the guideline noise levels outlined in BS8233/WHO guidance.

5.2.4 Where noise levels are likely to be in excess of 55dB $L_{Aeq,16hr}$, in the southern area of the site adjacent to Station Road, it is recommended that properties are planned with appropriate standoff distances from Station Road to naturally reduce the external noise level within the outdoor amenity areas.

5.2.5 Detailed layout drawings of the planned development would identify which amenity spaces would need mitigation to meet the criterion.

5.3 Internal Noise Assessment – Daytime (07:00 to 23:00 hrs)

5.3.1 Table 5-1 details the predicted internal noise levels and the requirement for mitigation for the day-time period (07:00 to 23:00 hrs). The predicted internal noise levels assume the attenuation of 15dB provided by a window, left partially open for natural ventilation, as advised by the guidance in BS8233.

Table 5-1: Daytime Internal Noise Levels & Mitigation Requirements

External Noise Level dB $L_{Aeq,16hr}$	Ventilation Strategy	Façade Reduction dB R_W	Predicted Internal Noise Level, dB $L_{Aeq,16hr}$	Mitigation Required for Living Rooms?	Mitigation Required for Dining Rooms?	Mitigation Required for Bedrooms
≤50dB	Open Windows	15	≤35dB	No	No	No
≤55dB			≤40dB	Yes	No	Yes
≤60dB			≤45dB	Yes	Yes	Yes
≤65dB			≤50dB	Yes	Yes	Yes
≤70dB			≤55dB	Yes	Yes	Yes

5.3.2 Where the predicted internal noise levels are ≤35dB when using slightly open windows to ventilate, noise levels would be suitable for living rooms without the need for additional mitigation. This area makes up approximately two-thirds of the developable site. Noise at this level would be considered to fall below the NOEL threshold of impact. Areas near Safestyle UK's material sorting yard and areas near Station Road would have internal living room noise levels above 35dB therefore mitigation is required to achieve levels within the LOAEL threshold.

5.3.3 Guideline internal noise levels for dining areas should be ≤40dB, when using slightly open windows to ventilate, to avoid the need for additional mitigation. The majority of the site would be below 55dB and therefore dining rooms in this area would not require mitigation. Where internal noise levels are above this, i.e. adjacent to Station Road, mitigation for the dining areas is required to achieve levels within the LOAEL threshold.

5.3.4 Daytime bedroom internal noise levels should be ≤35dB to avoid the need for additional mitigation. Approximately two-thirds of the site would meet these conditions without requiring mitigation. All of the southern area of the site and sections of the western border lie above the 50dB noise contour indicating that internal bedroom levels would be above 35dB and mitigation is therefore required to achieve levels within the LOAEL threshold.

5.3.5 The mitigation for properties falling into contour areas above the guidelines is in the form of glazing elements and acoustic trickle vents to meet internal noise guidance levels. Detailed design stage façade modelling would identify which properties would require higher specification glazing to ensure that internal criteria are met. Outline façade reductions are discussed in Section 6 of this report.

5.4 Internal Noise Assessment – Night-time (23:00 to 07:00 hrs)

5.4.1 Table 5-2 details the predicted internal noise levels and the mitigation requirements for the night-time period (23:00 to 07:00 hrs). As for the daytime, the predicted internal noise levels

assume attenuation of 15dB provided by a window left partially open for natural ventilation, as advised by the guidance in BS8233.

Table 5-2: Night-time Internal Noise Levels & Mitigation Requirements

External Noise Level dB $L_{Aeq,16hr}$	Ventilation Strategy	Façade Reduction dB R_W	Predicted Internal Noise Level, dB $L_{Aeq,16hr}$	Mitigation Required for Bedrooms?
≤45dB	Slightly Open Window	15	≤30dB	No
≤50dB			≤35dB	Yes
≤55dB			≤40dB	Yes
≤60dB			≤45dB	Yes
≤65dB			≤50dB	Yes
≤70dB			≤55dB	Yes

5.4.2 Figure 5-2 shows that approximately one third of the site would meet the night-time noise criterion of 45dB $L_{Aeq,8hr.}$ Mitigation would be required for properties lying within noise contours above 45dB. The most affected area is at the southern boundary adjacent to Station Road where frontline properties could potentially be subject to worst-case night-time noise levels of between 65 and 70dB.

5.4.3 The majority of properties will require bedroom window façade mitigation in order to meet the indoor night-time noise level requirements. Detailed design stage façade modelling would identify which properties may need additional higher specification glazing to ensure that the internal criteria are achieved. Outline façade reductions are discussed in the mitigation section of this report.

5.5 Further Considerations

5.5.1 Based on the assessment undertaken, the noise climate at the site appears generally suitable for the development of residential premises. Noise within habitable rooms and spaces, even at the most-exposed areas of the site, would be controllable to compliant levels using typical means (double glazing, supplementary ventilation, acoustic fences).

5.5.2 Properties adjacent to Station Road are likely to be the most exposed to road noise and properties on the western border are most likely to be most exposed to commercial noise from Safestyle UK. Properties in the interior of the site and in the north-east of the site would be exposed to lower noise levels, and intervening building mass is likely to result in further reduction of noise as it propagates across the site.

5.5.3 Noise in and around any proposed residential unit can be controlled with appropriate façade build-up details, layout/design mitigation. It is recommended that, at the detailed planning stage, façade noise levels are remodelled to determine a glazing/ventilation schedule to achieve acoustic standards detailed in BS8233. At the Low Valley monitoring point the night-time noise measurement was higher than the daytime. This was due to the persistent loud bird calls present which elevated the recorded noise levels.

6 Outline Mitigation

6.1.1 The assessment has shown that the site is suitable for residential development subject to the implementation of appropriate mitigation measures.

6.1.2 As previously discussed, the proposed development would occupy land to the east of Bulling Dike. Figure 6-1 and 6-2 show the noise contour plots with the inclusion of a 2.5m high close-boarded fence along the entire western border of the site.

Figure 6-1 Daytime Noise Contour Plot – Mitigated Using Close-Boarded Fencing

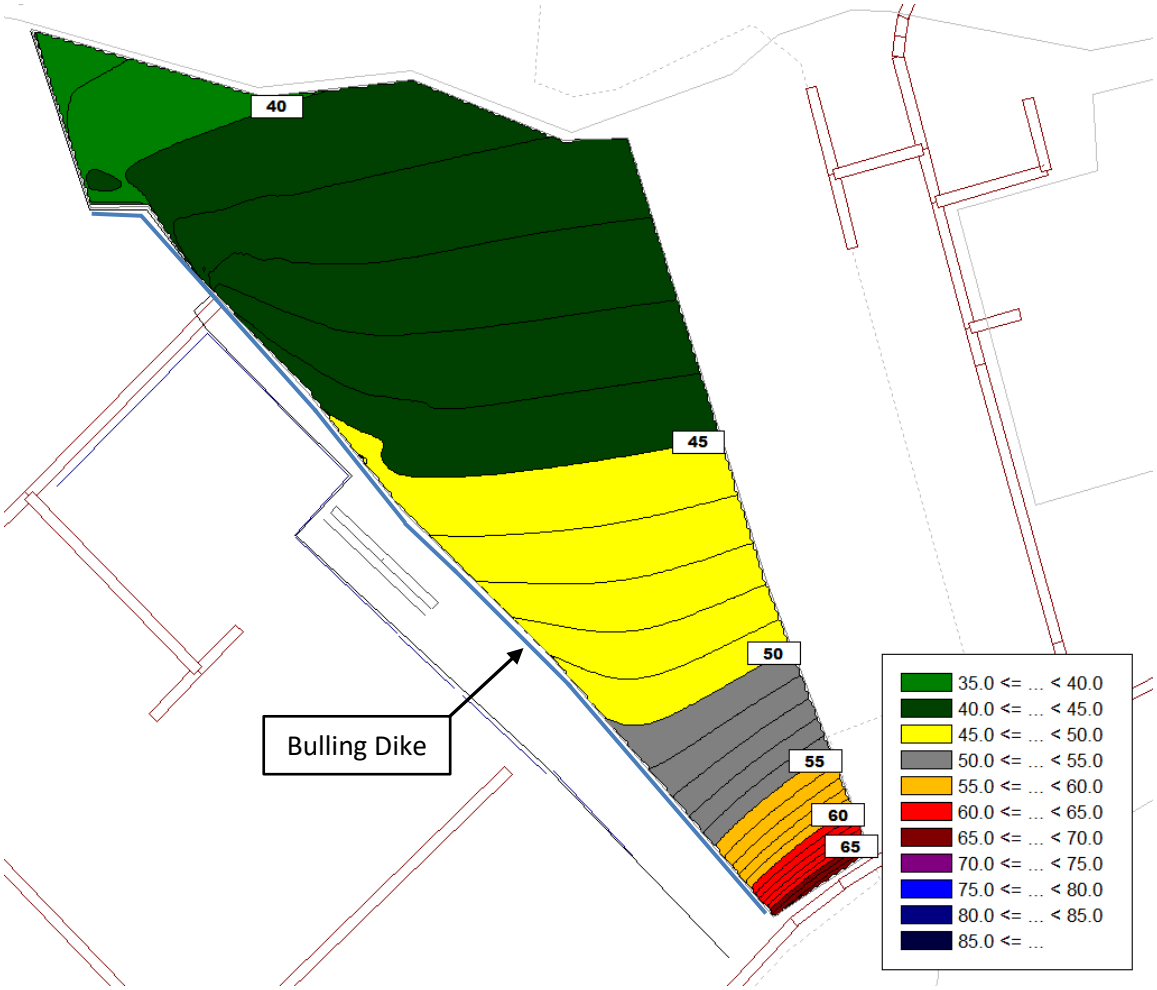
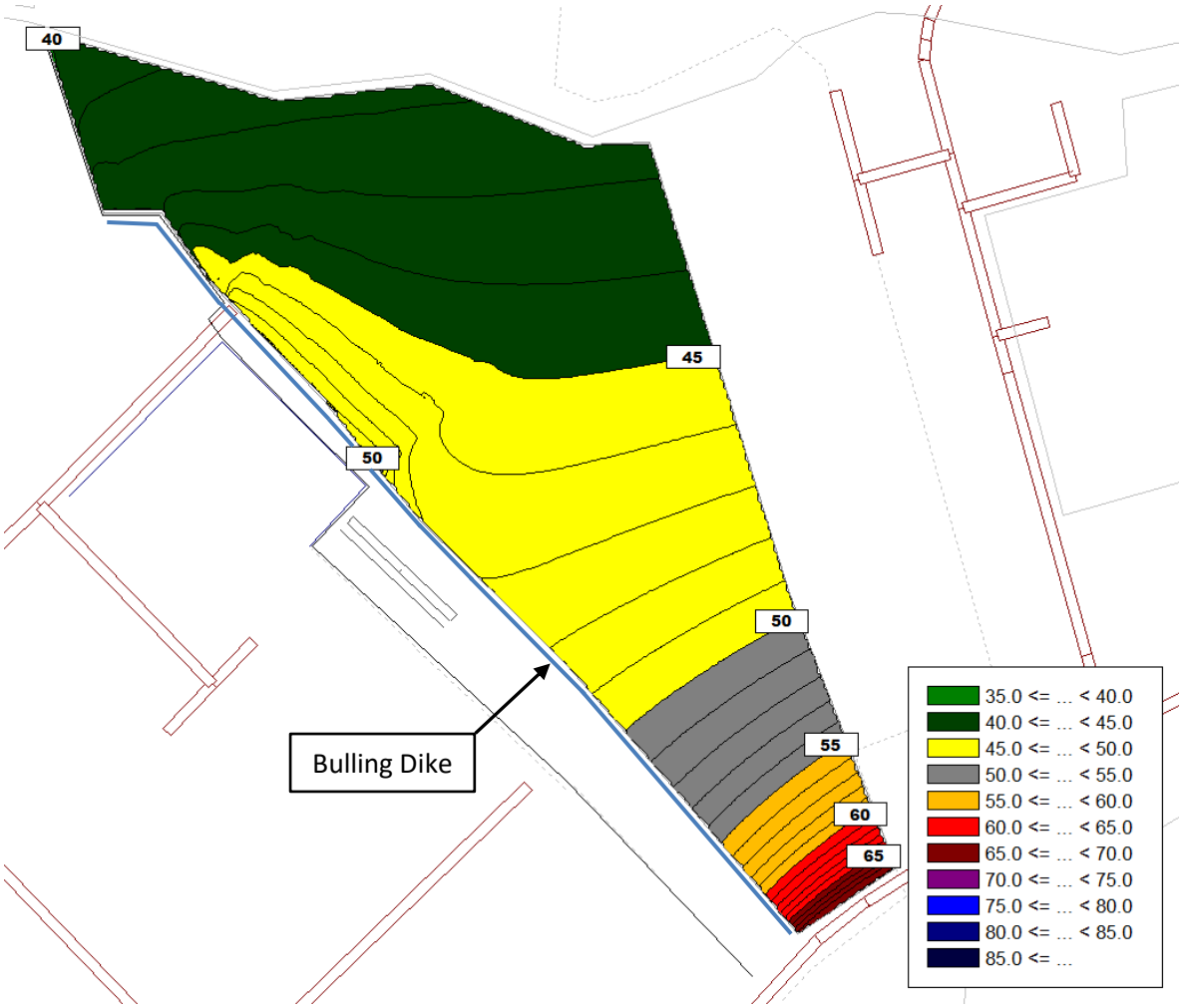


Figure 6-2 Worst-case Night-time Noise Contour Plot – Mitigated Using Close-Boarded Fencing



6.2 External Noise Levels

6.2.1 The assessment has shown that with the inclusion of the close-boarded fence along the western border of the site, the majority of the developable land lies within the 55dB $L_{Aeq,16hrs}$ noise contour. This means no further external amenity area mitigation would be required for most properties after the fence installation.

6.2.2 Properties in the south of the site near or fronting Station Road would have outdoor amenity spaces which would be subject to noise levels in excess of 55dB $L_{Aeq,16hrs}$. The inclusion of a standoff distance from Station Road and property orientation at the planning stage is recommended. Frontline properties should be positioned such that habitable rooms and outdoor amenity spaces are located on the lee side of the properties where possible and suitable stand-off distances from Station Road are employed thereby minimising the impact of road traffic noise.

6.2.3 It is suggested that once the detailed layout is finalised and property standoff distances from the road and property orientations are confirmed the noise model is reviewed to ensure all outdoor amenity spaces are under 55dB $L_{Aeq,16hrs.}$

6.3 Internal Noise Levels

6.3.1 The assessment has shown that mitigation in the form of the close-boarded fence on the western border results in approximately two-thirds of the developable site meeting the guidance levels for daytime resting and one-third of the developable site meeting the guidance levels for night-time sleeping conditions in accordance with BS8233.

6.3.2 Mitigation in the form of window glazing elements will be required to reduce the internal noise levels. Trickle ventilation should also be included where necessary in the façade construction to provide the necessary background ventilation, without the need to open windows.

6.3.3 Tables 6-1 and 6-2 summarise suggested outline façade insulation levels to mitigate daytime and night-time internal noise levels respectively, together with an indicative performance overview of suggested glazing elements to meet the guideline internal noise levels.

Table 6-1: Daytime Internal Noise Levels

Predicted External Noise Level, $L_{Aeq,16hr}$ dB	Internal Guideline Noise Level, $L_{Aeq,16hr}$ dB	Mitigation Required, dB R_{A+Ctr}	Typical Saint Gobain Double Glazing Element Configuration Pane/Gap/Pane ($R_{A,Ctr}$)
70	35	35	8mm/12mm/8.4mm (35dB)
65	35	30	8mm/16mm/8mm (30dB)
60	35	25	4mm/12mm/4mm (27dB)
55	35	20	4mm/12mm/4mm (27dB)
50	35	15	Partially open window

Table 6-2: Night-time Internal Noise Levels

Predicted External Noise Level, $L_{Aeq,8hr}$ dB	Internal Guideline Noise Level, $L_{Aeq,8hr}$ dB	Mitigation Required, dB R_{A+Ctr}	Typical Saint Gobain Double Glazing Element Configuration Pane/Gap/Pane ($R_{A,Ctr}$)
60	30	30	8mm/16mm/8mm (30dB)
55	30	25	4mm/12mm/4mm (27dB)
50	30	20	4mm/12mm/4mm (27dB)
45	30	15	Partially open window

6.3.4 As previously mentioned, properties fronting Station Road and alongside the industrial estate would provide screening to properties farther into the development. Therefore, it is suggested that once the detailed layout is finalised and property standoff distances from the road and the Bulling Dike are confirmed, the above information should be reviewed to confirm the specific glazing requirement for each plot and revised as necessary.

6.3.5 During the detailed design stage frontline properties should be positioned such that habitable rooms and outdoor amenity spaces are located on the lee side of the properties where possible and suitable stand-off distances from Station Road are employed thereby minimising the impact of road traffic noise.

6.3.6 Consideration could also be given to properties nearest Station Road being orientated so that gable ends face the road with acoustic fences to protect gardens. This could result in a reduction in the window specification for bedrooms and living rooms.

6.3.7 Additionally, ventilation should be provided by way of supplementary means, i.e. acoustic-treated trickle vents where necessary, to avoid the need for open windows and therefore compromised internal acoustic conditions. However, glazing should retain the ability to open, to prevent overheating, for rapid/purge ventilation and for safety purposes.

7 Conclusion

7.1 Background

7.1.1 Enzygo Limited has been instructed by Hartwood Estates Limited to undertake an environmental noise assessment to support an outline planning application for the proposed development of land to the east of Low Valley Industrial Estate, Wombwell, Barnsley. The general character of the area has been quantified as being mostly residential and commercial. The site is intended for residential use.

7.2 Noise Assessment Conclusions

7.2.1 Noise levels from existing road traffic movements on Station Road and noise generated by the existing businesses within Low Valley Industrial Estate have been predicted using the proprietary noise modelling software CadnaA. Assessments have been made in accordance with the guidance contained BS8233. Reference has also been made to the noise exposure hierarchy described in the planning practice guidance.

7.2.2 A site visit has been made to establish the prevailing ambient noise levels at the site. Based on observations at site, the two main noise sources in the area are; commercial noise from the industrial estate, specifically Safestyle UK (double glazing manufacturer) and road traffic noise from Station Road.

7.2.3 To reduce the noise levels reaching the site from the industrial estate the installation of a 2.5m high close-boarded acoustic fence along the full length of the western border of the site is advised.

7.3 External Noise Assessment

7.3.1 The assessment has shown that the majority of the developable site lies within the 55dB noise contour. In accordance with BS8233/WHO guidance outdoor amenity spaces with noise levels ≤55dB $L_{Aeq,16hr}$ do not require mitigation.

7.3.2 The southern section of the developable site would lie outside of the 55dB noise contour during the daytime. External amenity spaces within this area would require mitigation. It is recommended that properties adjacent to Station Road are given appropriate standoff distances from the road with gardens positioned to the lee-side of the property thereby screening outdoor spaces from road traffic noise.

7.3.3 Consideration could also be given to orientating frontline properties with gable ends facing Station Road with acoustic fences to protect gardens. This could result in a reduction in the window specification for bedrooms and living rooms.

7.3.4 At the detailed design stage, the noise model should be reviewed to determine the level of mitigation required. Detailed-stage layout drawings would help identify more accurate noise levels of private garden spaces, provide appropriate standoff distances and recommend any changes to property/garden orientations.

7.4 Internal Noise Assessment

7.4.1 The assessment has shown that approximately one-third of the site would not meet the required daytime resting internal noise levels and approximately over two-thirds of the site would not meet the required night-time internal noise levels.

7.4.2 Where habitable rooms are expected at façades in areas that do not meet the requirements it is advised that façade mitigation, in the form of glazing and trickle vents to prevent the need for open windows to ventilate, be applied. Windows should still retain the ability to open to provide rapid/purge ventilation, avoid overheating and/or for safety purposes.

7.4.3 During the detailed design stage frontline properties should be positioned such that habitable rooms and outdoor amenity spaces are located on the lee side of the properties where possible and suitable stand-off distances from Station Road are employed thereby minimising the impact of road traffic noise. Consideration could also be given to properties nearest Station Road being orientated such that gable ends face the road with acoustic fences installed to protect gardens. This could result in a reduction in the window specification for bedrooms and living rooms.

7.5 General Conclusion

7.5.1 Based on the results of the assessment it is considered that the site could be suitable for residential development subject to the implementation of suitable mitigation measures including close-boarded fencing along the western border.

7.5.2 Following completion of a final layout, a façade noise map would help determine noise levels at each dwelling and provide detailed fencing and/or glazing requirements to control noise within frontline dwellings.

7.5.3 Provided appropriate façade elements are selected, it is considered that the whole site would be able to demonstrate a compliant noise climate in habitable spaces.

REFERENCES

Department for Communities and Local Government – National Planning Policy Framework, February 2019.

Department for Environment, Food and Rural Affairs – Noise Policy Statement for England, March 2010.

British Standards Institution. British Standard 8233: 'Guidance on Sound Insulation and Noise Reduction for Buildings', 2014.

British Standards Institution. British Standard 7445-2 (ISO 1996-2:1987): 'Description and measurement of environmental noise. Guide to the acquisition of data pertinent to land use', 1991.

The World Health Organisation (WHO) Guidelines for Community Noise, 2000

World Health Organisation (WHO) Night Noise Guidelines for Europe, 2009

GLOSSARY OF TERMS

Noise is defined as unwanted sound. The range of audible sound is taken to be from 0dB to 140dB. Examples of typical noise levels relating to 'everyday' occurrences are presented within Table G-1 below:

Table G-1: Typical Noise Levels

Source	Sound Pressure Level in dB(A)	Subjective Level
Gun shot	160	Perforation of eardrum
Military Jet take-off	140	Threshold of pain
Jet Aircraft at 100m	120	Very Loud
Rock Concert, front seats	110	Threshold of Sensation
Pneumatic Drill at 5m	100	Very Loud
Heavy goods vehicle from pavement	90	
Traffic at kerb edge	70 – 85	Loud
Vacuum Cleaner, Hair Dryer	70	
Normal conversation at 1m	60	Moderate
Typical Office	50-60	
Residential area at night	40	Quiet
Rural area at night, still air	30	
Leaves Rustling	20	
Rubbing together of fingertips	10	
	0	Threshold of hearing

The frequency response of the human ear to noise is usually taken to be about 18Hz (number of oscillations per second) to 18,000Hz. However, the human ear does not respond equally to different frequencies at the same level, it is more sensitive in the mid-frequency range than the lower and higher frequencies and, because of this, when undertaking the measurement of noise the low and high frequency components of any given sound are reduced in importance by applying a filtering (weighting) circuit to the noise measuring instrument. The weighting which is widely accepted to correlate best with the subjective nature of human response to noise and is most widely used to quantify this is the A-weighted filter set. This is an internationally accepted standard for noise measurements.

For variable noise sources within an area an increase of 3dB(A) would be considered to be the minimum perceptible to the human ear under normal conditions. It is generally accepted that an increase/decrease of 10dB(A) corresponds to a doubling or halving in perceived loudness. The 'loudness' of a noise is a purely subjective parameter, dependant not only upon the sound pressure of the event but also on the dynamics of the listener's ear, the time of the day and the general mood of the person.

With regard to environmental noise levels (in the open air), these are rarely steady but rise and fall according to the activities being undertaken within the surrounding area at any given time. In an attempt to produce a figure that relates this variable nature of noise to human subjective response, a number of statistical noise metrics have been developed. These and other useful terminology and descriptors are presented in Table G-2 below.

Table G-2: Terminology

Term	Definition
Sound	Pressure fluctuations in a fluid medium within the audible range of amplitudes and frequencies which stimulate the organs of hearing.
Noise	Unwanted sound emitted from a source and received by the sensitive receptor.
Decibel (dB)	Unit most often used to describe the sound pressure level. A logarithmic number, it correlates closely to the way in which humans perceive sound. Its wide range of values helps quantify sound pressures from a large variety of magnitudes.
A-Weighting (dB(A))	Human perception of sound is frequency dependant. A-weighting applies a range of corrections at each frequency in order to provide a 'human-averaged'. Can be frequency band or broadband values.
Frequency (Hz)	The number of cycles per second, for sound this is closely related (and often mistaken for) pitch.
Frequency Spectrum	A more detailed analysis of the frequency components that comprise a sound source.
$L_{A10,T}$	The 10th statistical percentile of a measurement period, i.e. the level that is exceeded for 10% of the measurement duration. Closely correlates with traffic sources, A-weighted.
$L_{A90,T}$	The 90th statistical percentile of a measurement period, i.e. the level that is exceeded for 90% of the measurement duration. Used to describe background sound levels, as this value is affected less by short, transient sound sources, A-weighted.
L_{Amax}	The root mean square (RMS) maximum sound pressure level within a measurement period, A-weighted.
Ambient Sound	The total sound climate of all sources incident at one location, both in the near- and far-field (*The ambient sound comprises the residual sound and the specific sound when present)*.
Ambient Sound Level $L_a = L_{Aeq,T}$	Equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T.
Background Sound Level $L_{A90,T}$	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.
Equivalent Continuous A-weighted Sound Pressure Level $L_{Aeq,T}$	Value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, $T = t_2 - t_1$, has the same mean-squared sound pressure as a sound that varies with time, and is given by the following equation: $$L_{Aeq,T} = 10lg_{10}\left\{\left(\frac{1}{T}\right)\int_{t1}^{t2}\left[p_A\frac{(t)^2}{{p_0}^2}\right]dt\right\}$$ Where p_0 is the reference sound pressure (20µPA); and $P_A(t)$ is the instantaneous A-weighted sound pressure level at time t.

Term	Definition
Measurement Time Interval T_m	Total time over which measurements are taken (*This may consist of the sum of a number of non-contiguous, short-term measurement time intervals)*
Rating level $L_{Ar,Tr}$	Specific sound level plus any adjustment for the characteristic features of the sound, over a period of time, T.
Reference Time Interval, T_r	Specified interval over which the specific sound level is determined (*This is 1 h during the day from 07:00 h to 23:00 h and a shorter period of 15 min at night from 23:00 h to 07:00 h*).
Residual Sound	Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.
Residual sound level $L_r = L_{Aeq,T}$	Equivalent continuous A-weighted sound pressure level of the residual sound in a given situation at the assessment location over a given time interval, T.
Sound Pressure Level	The level of fluctuation in air pressure, caused by airborne sound sources. Measured in Pascals (Pa).
Sound Power Level	The rate at which sound is radiated by a source. This parameter is useful as it describes sound energy before environmental or decay factors. Quantified in dB and notated usually as L_w or SWL.
Specific sound level $L_s = L_{Aeq,Tr}$	Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given time interval, T.
Specific Sound Source	Sound source being assessed.

Table A-1: Noise Level Data Measured at Station Road - Daytime

Start Time	Duration	dB $L_{Aeq, T}$	dB $L_{A90, T}$	dB $L_{A10, T}$	dB L_{AFmax}
22/02/2019 10:12	0:15:00	63.5	50.5	67.2	79.6
22/02/2019 10:27	0:15:00	62.3	49.3	66.0	77.1
22/02/2019 10:42	0:15:00	60.4	49.2	64.1	74.4
22/02/2019 10:57	0:15:00	61.1	51.4	64.6	76.0
22/02/2019 11:12	0:15:00	61.0	50.0	64.5	74.1
22/02/2019 11:27	0:15:00	61.0	50.9	64.9	71.6
22/02/2019 11:42	0:15:00	61.4	49.3	64.7	75.1
22/02/2019 11:57	0:15:00	60.4	49.2	64.2	70.5
22/02/2019 12:12	0:15:00	62.1	48.3	65.3	77.4
22/02/2019 12:27	0:15:00	61.3	51.5	64.9	73.7
22/02/2019 12:42	0:15:00	62.7	50.8	64.1	85.6
22/02/2019 12:57	0:15:00	61.9	51.6	65.1	76.8
Overall		**61.7**	**50.2**	**65.0**	**85.6**

Table A-2: Noise Level Data Measured at Station Road – Night-time

Start Time	Duration	dB $L_{Aeq, T}$	dB $L_{A90, T}$	dB $L_{A10, T}$	dB L_{AFmax}
22/02/2019 06:00	0:15:00	63.1	49.1	67.6	78.1
22/02/2019 06:15	0:15:00	63.3	50.6	68.4	76.5
22/02/2019 06:30	0:15:00	62.9	51.6	67.6	74.6
22/02/2019 06:45	0:15:00	63.9	52.5	67.5	78.8
Overall		**63.3**	**50.8**	**67.8**	**78.8**

Table A-3: Noise Level Data at Footpath Point 1 - Daytime

Start Time	Duration	dB $L_{Aeq, T}$	dB $L_{A90, T}$	dB $L_{A10, T}$	dB L_{AFmax}
22/02/2019 10:30	0:01:00	61.9	53.3	66.2	72.6
22/02/2019 10:31	0:01:00	57.5	48.5	61.9	65.8
22/02/2019 10:32	0:01:00	60.7	50.8	64.2	68.6
22/02/2019 10:33	0:01:00	61.5	54.4	64.9	68.8
22/02/2019 10:34	0:01:00	63.5	55.2	66.6	70.9
22/02/2019 10:35	0:01:00	63.5	54.9	66.7	70.7
22/02/2019 10:36	0:01:00	62.6	56.5	65.3	67.8
22/02/2019 10:37	0:01:00	64.0	55.2	66.9	72.3
22/02/2019 10:38	0:01:00	69.4	53.6	74.8	80.9
22/02/2019 10:39	0:01:00	63.6	47.4	67.7	75.2
22/02/2019 10:40	0:01:00	56.9	47.4	61.9	68.0
22/02/2019 10:41	0:01:00	49.3	44.4	53.2	54.7
22/02/2019 10:42	0:01:00	45.5	42.3	47.5	53
22/02/2019 10:43	0:01:00	48.9	44.1	52.2	56.7
22/02/2019 10:44	0:01:00	47.0	42.7	48.6	55.4
Overall		**62.3**	**45.0**	**65.2**	**80.9**

Table A-4: Noise Level Data at Footpath Point 2 - Daytime

Start Time	Duration	dB $L_{Aeq, T}$	dB $L_{A90, T}$	dB $L_{A10, T}$	dB L_{AFmax}
22/02/2019 11:15	0:15:00	46.4	42.6	48.5	56.2
22/02/2019 11:16	0:15:00	47.3	43.7	50.8	54.1
22/02/2019 11:17	0:15:00	47.4	42.5	50.8	53.8
22/02/2019 11:18	0:15:00	48.4	44.5	49.7	57.1
22/02/2019 11:19	0:15:00	49.2	44.5	51.2	60.4
22/02/2019 11:20	0:15:00	48.3	43.1	50.0	59.5
22/02/2019 11:21	0:15:00	46.8	43.3	49.3	55.9
22/02/2019 11:22	0:15:00	43.7	41.5	45.8	50.2
22/02/2019 11:23	0:15:00	44.7	41.2	46.9	49.3
22/02/2019 11:24	0:15:00	45.5	40.8	49.8	51.8
22/02/2019 11:25	0:15:00	46.2	42.1	49.0	50.6
22/02/2019 11:26	0:15:00	46.4	42.8	48.7	51.8
22/02/2019 11:27	0:15:00	52.9	43.7	57.3	61.5
22/02/2019 11:28	0:15:00	46.6	42.5	49.9	53.1
22/02/2019 11:29	0:15:00	50.6	43.8	55.3	59.6
Overall		**48.0**	**42.4**	**49.8**	**61.5**

Table A-5: Noise Level Data Low Valley - Daytime

Start Time	Duration	dB $L_{Aeq, T}$	dB $L_{A90, T}$	dB $L_{A10, T}$	dB L_{AFmax}
22/02/2019 11:35	0:00:01	43.9	41.5	45.8	48.2
22/02/2019 11:36	0:00:01	55.9	45.6	59.3	60.8
22/02/2019 11:37	0:00:01	50.5	45.6	54.0	56.1
22/02/2019 11:38	0:00:01	50.1	46.0	52.8	54.9
22/02/2019 11:39	0:00:01	49.8	47.2	52	55.6
22/02/2019 11:40	0:00:01	53.5	46.7	58	60.3
22/02/2019 11:41	0:00:01	47.2	44.3	49.9	52.5
22/02/2019 11:42	0:00:01	47.4	44.6	49.5	52.1
22/02/2019 11:43	0:00:01	52.5	44.6	52.9	66.6
22/02/2019 11:44	0:00:01	46.4	44.0	47.2	56.3
22/02/2019 11:45	0:00:01	44.9	43.7	45.7	49.5
22/02/2019 11:46	0:00:01	45.6	44.1	47.7	48.9
22/02/2019 11:47	0:00:01	50.1	44.4	55.3	57.8
22/02/2019 11:48	0:00:01	46.7	44.4	49.2	51.2
22/02/2019 11:49	0:00:01	46.7	44.6	48.9	52.1
Overall		**50.1**	**44.1**	**53.1**	**66.6**

Table A-6: Noise Level Data Low Valley – Night-time

Start Time	Duration	dB $L_{Aeq, T}$	dB $L_{A90, T}$	dB $L_{A10, T}$	dB L_{AFmax}
22/02/2019 06:12	0:00:01	57.6	50.0	61.3	64.3
22/02/2019 06:13	0:00:01	56.6	50.5	59.9	65.1
22/02/2019 06:14	0:00:01	57.9	50.7	62.8	64.4
22/02/2019 06:15	0:00:01	58.2	50.6	63.5	65.2
22/02/2019 06:16	0:00:01	57.7	51.1	61.6	65.2
22/02/2019 06:17	0:00:01	57.1	49.8	60.5	64.7
22/02/2019 06:18	0:00:01	59.3	51.4	64.4	68.0
22/02/2019 06:19	0:00:01	57.6	51.7	62.2	64.2
22/02/2019 06:20	0:00:01	55.6	51.7	56.8	64.8
22/02/2019 06:21	0:00:01	53.0	51.8	53.8	54.6
22/02/2019 06:22	0:00:01	53.6	52.0	54.6	56.3
22/02/2019 06:23	0:00:01	52.9	51.1	53.9	55.5
22/02/2019 06:24	0:00:01	58.1	50.4	62.7	64.5
22/02/2019 06:25	0:00:01	53.6	51.0	55.2	61.4
22/02/2019 06:26	0:00:01	52.9	51.5	54.2	55.5
Overall		**56.6**	**50.9**	**60.9**	**68.0**

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