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Environmental noise assessment associated with the proposed residential development at Yew Farm, Spalding

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1 OBJECTIVES

1.1 To carry out an initial site *noise risk assessment of a proposed residential development at Yew Farm, Spalding following guidance given in ProPG (Reference 1) and other relevant standards and guidance.

1.2 To recommend solutions to any problems identified by the assessment.

2 CONCLUSIONS

2.1 The dominant noise across the proposed site will be from rail traffic on the Spalding-Sleaford railway line and from road traffic on Spalding Road and the new Spalding West Relief Road. Noise emissions from the gas pumping station were also significant at the time of the survey.

2.2 Based on modelling carried out using measurements of railway noise and traffic data from the environmental statement for Spalding West Relief Road, the initial site noise risk assessment is:

- *"Negligible"* to *"Low"* in the daytime;
- *"Low"* to *"Medium"* at night-time; However, the *"Medium"* assessment only applies to the outer fringes of the site facing the road and railway.

2.3 An assessment of noise emissions from the gas pumping station to proposed residents estimated that there is likely to be a "significant adverse impact" on the nearest residents to the substation. The noise may be a result of a fault at the substation at the time of the survey and affects few dwellings. Mitigation measures are recommended in section 3.

2.4 An acceptable noise situation should occur for residents of the proposed dwellings provided recommendations in this report are carried out.

* **see Appendix 1 for a Glossary of Terms.**

3 RECOMMENDATIONS

3.1 Acoustic fences should be constructed to protect residents from road and rail traffic noise as well as emissions from the proposed gas substation. Proposed footprints of the barriers are shown in Drawing 3-1 as **blue** lines and a barrier specification is given in Appendix 4.

Drawing 3-1 – Proposed mitigation

3.2 Ventilation System 1 or 2 is recommended as an acceptable background ventilation strategy in all living rooms and bedrooms. Standard double [1]glazing and trickle [2]vents are likely to be adequate in all dwelling rooms except for bedrooms adjacent to and facing the **red** dashed line in Drawing 3-1. For these bedrooms higher specification glazing may be required and also higher specification trickle vents. Acoustic Associates (Peterborough) can advise further at design time when room layouts are available. If System 3 or 4 is selected, then any system chosen must comply with the noise requirements of Document F (Reference 2).

3.3 If windows are open to control [3] overheating, then levels will not be excessive for most of the site. An exception is bedrooms facing the **red** dashed line which may have excessive noise levels internally when windows are open.

3.4 Given the comments in sections 3.2 and 3.3 it is preferable if bedrooms which face the red line shown in Drawing 3-1 do not have openable windows facing the noise.

If they cannot be relocated, the following measures should be considered:

- Use of windows which have plenums;

[1] Standard double glazing – Specification at least R_W (C_{tr}) 29 (-4)
[2] Standard trickle vents - Total effective area 5000mm^2. Specification at least $D_{n,ew}$ (C_{tr})31 (0) dB
[3] It is not known if overheating is an issue at this site.

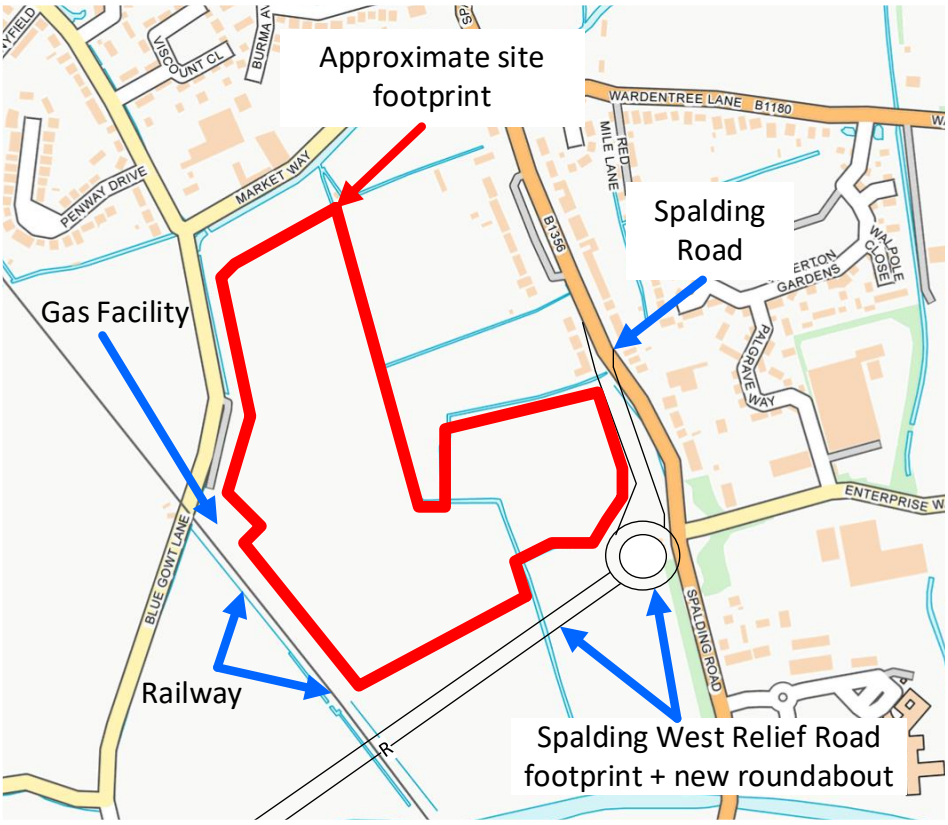
- Side-opening casement windows on a quieter façade with the windows opening away from the traffic sources.

3.5 Acoustic Associates(Peterborough) can advise further at detailed design stage when room layouts are available, but it is likely that they will not be more onerous given that this assessment considers a worst-case.

4 BACKGROUND

Ashwood homes propose a residential development on the site of Yew Farm in Spalding. The site is to the north of the proposed Spalding Western Relief Road, to the east of the northbound rail line to Sleaford and to the west of the Spalding Road. There is a gas pumping station on its western side. Given the potential impact of these noise sources, Acoustic Associates (Peterborough) were contracted to undertake a noise assessment of the proposed development and this report document the results of that assessment. The site location is shown below in Drawing 4-1.

Drawing 4-1 – Site location and noise sources



An outline view of the proposed development in shown below in Drawing 4-2.

Drawing 4-2 – Proposed layout

5 POLICY, GUIDANCE AND STANDARDS

5.1 National Planning Policy Framework

The National Planning Policy Framework (Reference 3) states the following with respect to noise (para 180).

> *"180. 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[60];*
> > *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."*

The footnote 60 in section a) refers to the Noise Policy Statement for England (NPSE – Reference 4) in order to explain what it means by "adverse impact".

5.2 Noise Policy Statement for England and National Planning Policy Guidance

The NPSE has stated that the impact of noise be classified according to an “effect level” (shown in column 3 below). The National Planning Policy Guidance (NPPG) has clarified what this effect level below means in terms of its perception by people at receptors and what action should be taken (columns 1 and 4 in Table 1 below).

Perception	Examples 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 acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability 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

Table 1 - National Planning Policy Guidance noise exposure hierarchy

5.3 ProPG: Planning and Noise (Reference 1)

This document was produced by noise professionals to offer them guidance on noise management within the planning system in England. It recommends a 2-stage approach to managing for noise:

5.3.1 ProPG: Stage 1 – Initial Site Noise Risk Assessment

5.3.1.1 The aim of this stage is to provide an indication of the likely risk of adverse effects due to noise from developing a site. Using measurement and/or prediction, indicative future noise levels on a site are estimated.

5.3.1.2 The following excerpt shows the potential effect associated with likely site noise levels for daytime and night-time.

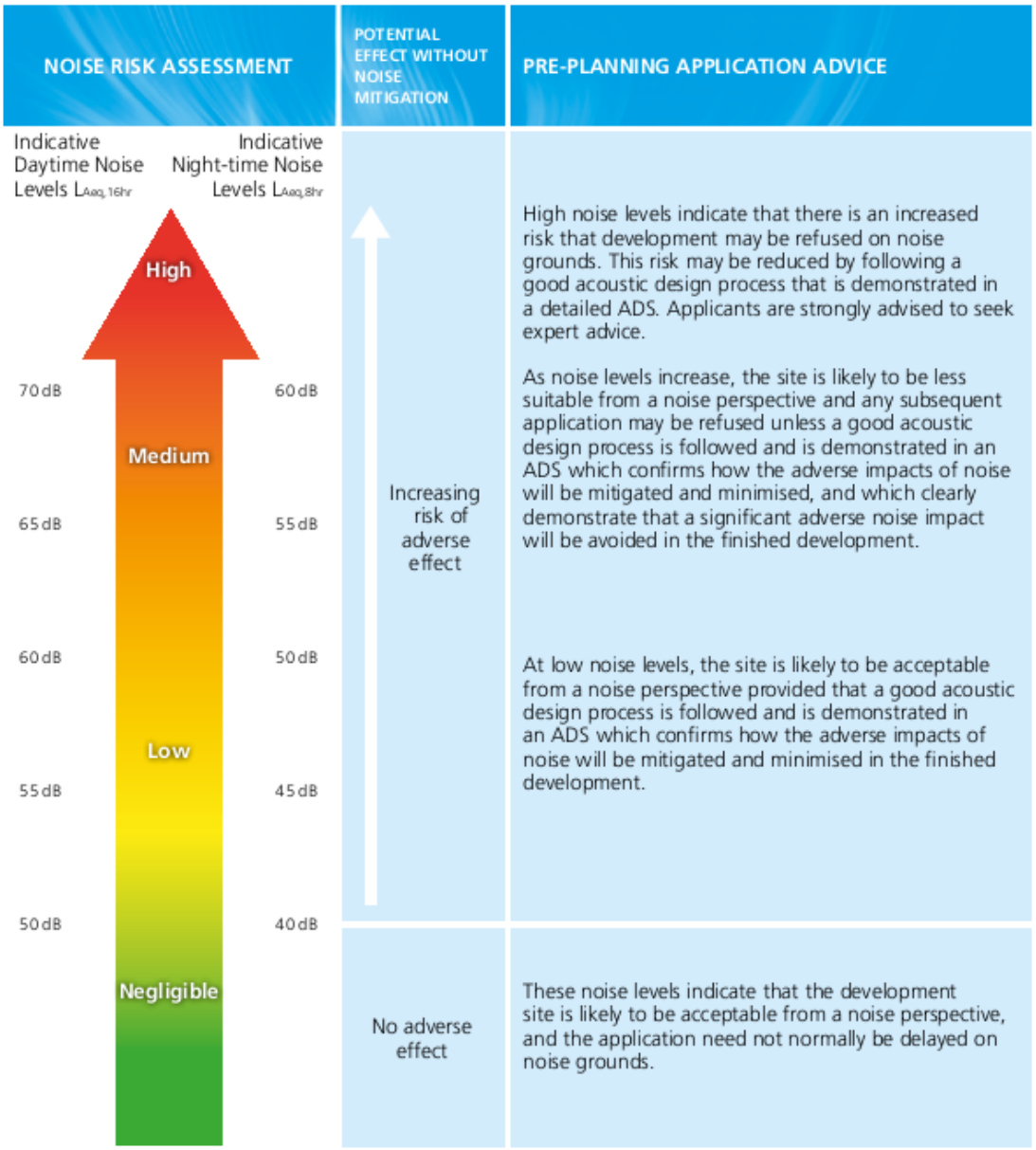


Figure 1. Stage 1– Initial Site Noise Risk Assessment

5.3.1.3 It must be noted that the initial assessment of noise risk is not the basis for the eventual recommendation of approval. Its aim is to give an early assessment of site suitability for residential development and the extent of the acoustic issues to be faced. The higher the risk the more important it is that good acoustic design is followed for the development.

5.3.2 ProPG: Stage 2 – Full Assessment

There are 4 stages to a full assessment, and these are briefly described below.

5.3.2.1 Element 1 - Good Acoustic Design Process

Provide an integrated solution whereby development avoids “unreasonable” and prevents “unacceptable” acoustic conditions. In particular the following should be considered: -

- Check the feasibility of relocating or reducing noise levels from relevant sources.
- Consider options for planning the site or building layout.
- Consider the orientation of proposed building(s).
- Select construction types and methods for meeting building performance requirements.
- Examine the effects of noise control measures on ventilation, fire regulation, health and safety, cost, CDM (construction, design, and management) etc.
- Assess the viability of alternative solutions.
- Assess external amenity area noise.

5.3.2.2 Element 2 – Internal noise level Guidelines

Seek to achieve recommended noise levels inside noise sensitive rooms in new residential development. The following excerpt from the document shows the recommended internal noise levels that should ideally be achieved.

Activity	Location	Noise criteria	
		07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16hour}$	-
Dining	Dining room / area	40 dB $L_{Aeq,16hour}$	-
Sleeping	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$ 45 dB $L_{Amax,F}$

Table 2 – ProPG Internal Noise Level Guidelines

Note 1: Figure 2 - Note 4 in ProPG states that in most circumstances the maximum noise level $L_{Amax,F}$ should not exceed 10 times per night.

Note 2: Section 2.3.3 of ProPG states the following with respect to the reduction of noise due to the building envelope *“the acoustic performance of the building envelope will be reduced in the event windows are opened for ventilation or cooling purposes, typically reducing the insulation to no more than 10 to 15 dB(A)”.*

Note 7: *Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal L_{Aeq} target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved. The more often internal L_{Aeq} levels start to exceed the internal L_{Aeq} target levels by more than 5 dB, the more that most people are likely to regard them as "unreasonable". Where such exceedances are predicted, applicants should be required to show how the relevant number of rooms affected has been kept to a minimum. Once internal L_{Aeq} levels exceed the target levels by more than 10 dB, they are highly likely to be regarded as "unacceptable" by most people, particularly if such levels occur more than occasionally. Every effort should be made to avoid relevant rooms experiencing "unacceptable" noise levels at all and where such levels are likely to occur frequently, the development should be prevented in its proposed form.*

5.3.2.3 Element 3 – External Amenity Area Noise Assessment

The acoustic environment of external amenity areas that are an intrinsic part of the overall design assessment should always be assessed and noise levels should ideally not be above the range 50-55 dB $L_{Aeq,16hours}$. However the following follow-up advice should be noted

> *"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."*

5.3.2.4 Element 4 – Assessment of Other Relevant Issues

At this stage the following should be addressed:

- compliance with relevant national and local policy
- magnitude and extent of compliance with ProPG
- likely occupants of the development
- acoustic design v unintended adverse consequences
- acoustic design v wider planning objectives

5.4 British Standard BS 4142:2014

5.4.1 BS 4142 (Reference 5) is a standard which describes a method for assessing whether the 'specific noise' from an industrial source is likely to give rise to complaints from residents of the adjacent dwellings. The 'specific noise' levels are determined outside dwellings. The specific noise level is determined for reference time periods of 1-hour for the daytime (7am to 11pm) and 15 minutes for the night-time. Tonal or impulsive characteristics of a noise are likely to increase the scope for complaints and this is taken into account by adding a value to the specific noise source level to obtain the 'rating level'. The value may be between 0 and 15 dB depending on objective and subjective measures detailed in the standard. The following table detail the values added for the subjective method (which is the method used in this assessment).

Characteristics of noise	Noise at receptor	Value to add to specific noise level for rating level
Noise has tonal characteristics	Just perceptible	+2 dB
	Clearly perceptible	+4 dB
	Highly perceptible	+6 dB
Noise has impulsive characteristics	Just perceptible	+3 dB
	Clearly perceptible	+6 dB
	Highly perceptible	+9 dB
Other - characteristics that are neither tonal nor impulsive but are readily distinctive against the residual acoustic environment,	-	+ 3 dB
Intermittency	If intermittency is readily distinctive in the residual acoustic environment	+3 dB

Table 3 – BS 4142 – Corrections to noise to calculate rating level – subjective method

5.4.2 BS 4142 requires that the rating Level of a noise is compared with the existing background noise ($L_{A90,T}$). Guidance given in the standard states the following regarding the difference between the rating Level and the background noise.

- A difference of 0 dB is indicative of a *"minor impact*";
- A difference of +5 dB is indicative of an *"adverse impact";*
- A difference of +10 dB is indicative of a *"significant adverse impact"* .

5.5 Acoustics, Ventilation and Overheating Guidance (AVOG – Reference 6)

Acoustics design considerations for dwellings may impact on the ventilation and thermal comfort of the inhabitants e.g., closing windows to prevent noise ingress may mean that alternative means are needed to provide fresh air to inhabitants and to prevent overheating. The AVOG design guide details good practice to achieve satisfactory thermal and acoustic comfort for residents. It currently addresses noise from transport sources.

In summary an assessment for a dwelling will consist of the following:

5.5.1 Based on the estimates of noise levels at the façades, advise on glazing specifications to achieve suitable internal noise levels;

5.5.2 Advise the design team on the options for a ventilation strategy team (System 1,2,3 or 4 from Document F of the Building Regulations);

5.5.3 Assess the effects of the ventilation strategy chosen and advise accordingly to prevent noise ingress. This advice could be on measures allowing natural (windows vents or open windows) or other methods such as mechanical ventilation. The following table from AVOG is useful in guiding a design choice for ventilation for outline planning permissions.

Table B-3 Summary of potential noise issues associated with ventilation strategies described in ADF

ADF System	External noise ingress considerations	Mechanical system noise considerations	Approximate guideline free-field external noise limits. [Note 1]
1 or 2	Noise ingress is likely to be defined by the performance of the background ventilators (trickle vents), windows and other façade elements. Note that use of System 1, relying on the use of open trickle vents without opening windows may give rise to poor indoor air quality in airtight dwellings outside the winter period.	For System 1, intermittent kitchen and bathroom fans should have suitable noise levels to meet the guidelines in Table 3-4. System 2 has no mechanical components.	With standard double glazing and two trickle vents: • ~$L_{Aeq,16h}$ 56 dB day • ~$L_{Aeq,8h}$ 51 dB night • L_{AFmax} not normally exceeding ~ 67 dB more than 10x per night With high performing acoustic glazing and two 'acoustic' trickle vents: • ~ $L_{Aeq,16h}$ 66 dB day • ~ $L_{Aeq,8h}$ 61 dB night • L_{AFmax} not normally exceeding ~ 80 dB more than 10x per night
3	Noise ingress is likely to be defined by the performance of the background ventilators (trickle vents), windows and other façade elements. ADF advises that: *"controllable background ventilators having a minimum equivalent area of 2,500 mm² should be fitted in each room, except wet rooms..."*	This could be a centralised or decentralised MEV system. Guideline levels are shown in Table 3-4. For a centralised system, the location of the fan is important for structure-borne and airborne noise. System noise may affect living rooms and bedrooms as well as the rooms in which the extract inlets are located i.e. wet rooms. For a decentralised system, there are individual fans extracting from each bathroom, toilet, kitchen and utility room. The noise effects on adjacent living rooms and bedrooms should be considered. [Note 2]	With standard double glazing and trickle vent: • ~$L_{Aeq,16h}$ 58 dB day • ~$L_{Aeq,8h}$ 53 dB night • L_{AFmax} not normally exceeding ~ 69 dB more than 10x per night With high performing acoustic glazing and an 'acoustic' trickle vent: • ~ $L_{Aeq,16h}$ 68 dB day • ~ $L_{Aeq,8h}$ 63 dB night • L_{AFmax} not normally exceeding ~ 83 dB more than 10x per night
4	No trickle vents required. Consider noise ingress through other facade elements.	MVHR is a centralised system ducted to supply outlets in living rooms and bedrooms as well as to extracts in wet rooms. Guideline levels are shown in Table 3-4. The unit location is important for structure-borne and airborne noise. Consider ducted noise, particularly to bedrooms. Consider also cross-talk sound transmission via ducts. [Note 2]	With standard double glazing and no trickle vent: • ~ $L_{Aeq,16h}$ 62 dB day • ~ $L_{Aeq,8h}$ 57 dB night • L_{AFmax} not normally exceeding ~76 dB more than 10x per night With high performing acoustic glazing: • ~ $L_{Aeq,16h}$ 73 dB day • ~ $L_{Aeq,8h}$ 68 dB night • L_{AFmax} not normally exceeding ~ 90 dB more than 10x per night N.B. With secondary glazing higher sound insulation may be achieved.

5.5.4 Assess the risk of overheating based on input from thermal modelling in a 2 stage assessment. Stage 1 determines whether open windows will suffice to mitigate against overheating. If so, there is no further assessment required for overheating as open windows will suffice;

Table 3-2 Guidance for Level 1 site risk assessment of noise from transport noise sources [Note 1] relating to overheating condition

Risk category for Level 1 assessment [Note 5]	Potential Effect without Mitigation	Recommendation for Level 2 assessment
$L_{Aeq,T}$ [Note 3] during 07:00 - 23:00 / $L_{Aeq,8hr}$ during 23:00 - 07:00 High: 65 dB / 55 dB Medium: 60 dB / 50 dB Low: 55 dB / 50 dB Negligible: 50 dB / 45 dB	Increasing risk of adverse effect	Recommended Optional
	Use of opening windows as primary means of mitigating overheating is not likely to result in adverse effect	Not required

Note 1 The noise levels suggested assume a steady road traffic noise source but may be adapted for other types of transport. All levels are external free-field noise levels.

Note 2 The values presented in this table should not be regarded as fixed thresholds and reference can also be made to relevant dose-response relationships, [15, 17].

Note 3 A decision must be made regarding the appropriate averaging period to use. The averaging period should reflect the nature of the noise source, the occupancy profile and times at which overheating might be likely to occur. Further guidance can be found within the 2014 IEMA Guidelines [23].

Note 4 Refer also to references [1, 17, 18, 22] for further guidance regarding individual noise events. Where 78dB LAFmax is normally exceeded during the night-time period (23:00-07:00), a Level 2 assessment is recommended.

Note 5 The risk of an adverse effect occurring will also depend on how frequently and for what duration the overheating condition occurs. Refer to Figure 3-2.

Note 6 To evaluate the risk category for a dwelling, all three aspects of external noise exposure (i.e. daytime, night-time and individual noise events) should be evaluated. The highest risk category for any of the three aspects applies.

5.5.5 If a Stage 2 assessment is required, then, with input from the design team, advise on measures to achieve acceptable noise levels while preventing overheating. These could be measures to allow natural input (e.g., plenum windows) or physical measures such as cooling fans. If the latter, then noise emissions must be limited to avoid disturbance.

6 INITIAL NOISE ASSESSMENT

6.1 Noise sources affecting the site

The proposed site will be subjected to noise from the following sources.

- Noise from traffic on the adjacent railway. This is the dominant source on the west of the site.
- Noise emissions from the gas pumping station at the west of the site.
- Noise from traffic on the proposed Spalding West relief Road and the existing Spalding Road. These are the dominant sources on the south and east of the site.
- Noise emissions from the roads which bound the west and north of the site are not significant.

The noise levels of the railway and gas pumping was estimated by measurement and the level of the proposed road and future level of the existing Spalding Road by inspection of noise data from the recent environmental statement for Spalding West Relief Road.

6.2 Noise measurements

The following sections document the noise monitoring taken at site. All monitoring was in free-field conditions and at 1.5 metres high. Calibration was checked before and after and there was no significant drift noted. The monitoring locations are shown in Drawing 6-1.

Drawing 6-1 Noise monitoring locations

6.2.1 Railway

Unattended monitoring was carried out at a location approximately 13 metres from the centre of the 2 railway tracks between the 24th February 2021 and 27th February 2021 (Drawing 6-1, Location 1). Noise was logged at 15 minute intervals in terms of "energy" average noise ($L_{Aeq,15minutes}$), background noise levels ($L_{A90,15minutes}$) and maximum noise levels ($L_{Amax,15minutes}$) , The results are summarised in Table 4 below and shown graphically in Appendix A3.1.

Start Period	End of Period	Maximum noise level $L_{Amax,15minutes}$ dB(A)	Background noise $L_{A90,15minutes}$ dB(A)		Ambient noise $L_{Aeq,15minutes}$ dB(A)
		* Count over L_{Amax} 78 dBA	Min	Max	"Energy" Average
Wednesday – 12:45	Wednesday – 23:00	15	32.1	40.7	59.3
Wednesday – 23:00	Thursday – 07:00	***10**	28.2	44.7	61.2
Thursday – 07:00	Thursday - 23:00	26	33.7	50.0	59.3
Thursday - 23:00	Friday– 07:00	7	30.9	48.1	59.7
Friday – 07:00	Friday – 23:00	15	34.2	48.4	55.9
Friday – 23:00	Saturday - 05:30	0	34.2	45.1	42.6

*** Ventilation design case to ensure noise levels do not exceed L_{Amax} 45 dB(A) at night-time (see section 5.3.2.2) more than 10 times nightly.**

Table 4 – Summary of noise measurements by railway

The ambient noise at this location was dominated by emissions from rail traffic passing on the adjacent railway.

- The "modal" background noise levels at Location 1 were **L_{A90} 41 dB(A)** in the daytime and **L_{A90} 32 dB(A)** at night-time and these are deemed to apply to all of the site.
- The highest "daily" and "nightly" average noise levels are assumed for this assessment i.e., **$L_{Aeq,16hours}$ 59.3 dB(A)** in the daytime **$L_{Aeq,8hours}$ 61.2 dB(A)** at Location 1**.** The higher night-time level is due to freight movements and has been noted previously at night-time in other local surveys of this railway by Acoustic Associates (Peterborough).
- The ventilation "design case" (the 10th loudest impulsive noise level on any night-time) was **L_{Amax} 78 dB(A)** at Location 1.
- The overheating "design case" (the highest impulsive noise level) was **L_{Amax} 92 dB(A)** at Location 1.

6.2.2 Spalding Road

Attended monitoring was carried on the 3rd March 2021 close to the Spalding Road (Drawing 6.1, Location 2). The results are detailed in Appendix A3.2.

6.2.3 Gas Substation

Attended monitoring was carried out at several locations close to the gas substation on the 3rd March 2021 (Drawing 6.1, Location 3-5). The results are detailed in Appendix A3.2.

6.3 Computer noise model of the site and surrounding area

A computer noise model of the site and surrounding area was generated using iNoise from DGMR (Reference 7) which uses the methods given in ISO 9613–2 (Reference 8) to calculate noise levels given a topographical model of the site. The following noise sources were added to the model:

- Spalding West Relief Road on the south of the site and the Spalding Road on the east were added as moving line sources. The levels of these were set using data from the environmental statement for the Relief Road (see Appendix 5).
- The railway. The levels were set using measurement data from this survey.
- The gas pumping station. The levels were set using measurement data from this survey.

6.4 ProPG - Initial site noise risk assessment

The model was run to determine the initial site noise risk assessment. The results are shown graphically in Figure 1.

Given the results shown in Figure 1, the site is classified as :

- “Negligible” to “Low” in the daytime;
- “Low” to ”Medium” at night-time

This means that *“the site is likely to be less suitable from a noise perspective and any subsequent application may be refused unless a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised, and which clearly demonstrate that a significant adverse noise impact will be avoided in the finished development.”*

6.5 Assessment of noise from the gas pumping station

The noise emissions from the gas pumping station were predicted at the nearest residential locations based on measurements taken at the site. Noise contours are shown in Figure 4. The following table assesses the noise using British Standard BS 4142:2014.

	Daytime	Night-time
Background noise level L_{A90} dB(A)	41	32
Approximate Specific Noise level L_{Aeq} dB(A) at nearest residential locations (results of computer predictions)	45	
Penalty (Assumed to be clearly audible)	+4	
"Rating Level" L_{Aeq} dB(A)	49	
Excess over background	+8	+17
Assessment	Between "adverse impact" and "significant adverse impact"	"Significant adverse impact"

Table 5 – BS 4142 Assessment at location of nearest resident

As can be seen noise levels are predicted to be excessive. However, the following should be noted:-

- Only a small portion of the proposed site is affected by this (see Figure 4);
- It is likely that the emissions were due to a fault that can be rectified by maintenance of the installation.

Nevertheless, mitigation is considered in the following sections.

7 PROPG ASSESSMENT

7.1 Noise levels over developed site

The model was run with the houses closest to the noise sources added to the topography. The results are shown in Figures 2 and 3.

7.2 Amenity areas

As can be seen in Figure 2 noise levels in the amenity areas on the outer fringes of the development are generally between a level of daytime of L_{Aeq} 55 – 60 dB(A). This exceeds the recommended ProPG level (maximum L_{Aeq} 55 dB(A)). Acoustic fences are therefore recommended. A recommended specification is given in Appendix 4 and recommended footprint in Drawing 3-1.

7.3 Internal noise

7.3.1 Acoustics

Detailed drawings are not available at outline stage so worst-case assumptions are made based on advice in AVOG. It is also assumed that all buildings will be houses of 2 or 3 stories height and that all living rooms will be on the ground floor and all the bedrooms will be on the first floor. Table B-3 from AVOG (see section 5.5.3) is referenced in recommending a ventilation strategy for the development

7.3.1.1 Ventilation and Glazing

Living rooms

Noise levels at all living rooms façades are less than $L_{Aeq\ ,16hours}$ 56 dB(A) or they exceed it marginally. (they are likely to be reduced slightly by an acoustic fence). So, System 1 is appropriate for all living rooms. It is likely that standard glazing will suffice, and standard trickle vents will suffice for all living rooms.

Bedrooms

For most of the site the bedrooms levels are below L_{Aeq} 51 dB(A) at night-time so the same assessment as for the living rooms applies. On the outer (south, west and east) fringes levels are higher but nowhere exceed $L_{Aeq,8hours}$ 61 dB(A) or a ventilation design case exceeding L_{Amax} 80 dB(A). So System 1 is acceptable though higher specification glazing and acoustic trickle may be necessary on the outer fringes.

7.3.1.2 Overheating

Comparison with the values shown in Table 3-2 of AVOG (see section 5.5.4) shows that the bedrooms on the outer fringes (southern, western, eastern) may be exposed to levels which exceed the Stage 2 criteria for internal noise.

For the rest of the site, even the most exposed properties will be able to open windows to control overheating and residents will not be exposed significantly above this criterion.

8 DISCUSSIONS

8.1 Uncertainties

The railway noise estimate correlates reasonably with other surveys Acoustic Associates (Peterborough) have carried out in the locality.

The road noise estimate is based on a 2036 estimate from an Environmental Statement for the new road and therefore likely to be robust. They assume no mitigation at source.

Computer predictions to ISO 9613-2 carry an uncertainty of +/- 3 dB but are likely to be less due to the proximity of source and receiver and the simplicity of the topography.

If noise levels were 3 dB higher than estimated in this report it would not alter the conclusions or recommendations of this assessment.

REFERENCES

1. ProPG working group. *ProPG: Planning & Noise: Professional Practice Guidance on Planning & Noise: New Residential Development;*, 2017.
2. *Document F Ventilation Regulations;* thenbs, 2010.
3. *National Planning Policy Framework;* DCLG, 2018.
4. *Noise Policy Statement for England;* DEFRA, 2010.
5. *British Standard BS 4142:2014, Methods of rating and assessing industrial and commercial sound;* BSI, 2014.
6. ANC + IOA. *Acoustics Ventilation and Overheating Guide V1.1;*, 2020.
7. DGMR Software. *iNoise V2021 Pro*.
8. *ISO 9613-2 Acoustics of sound during propagation outdoors, Part 2: General method of calculation;* ISO, 1996.

Appendix 1 – Glossary of terms

Sound Pressure	The variation of ambient pressure that is detected by the ear as sound.
Noise	Unwanted sound
deciBel (dB)	Ten times the logarithm of the square of the ratio of the Sound Pressure to a reference pressure (20 micro-Pascal's).
Sound Pressure Level (Lp)	The decibel version of the Sound Pressure.
A-Weighting	A frequency weighting which simulates the response of the ear. An A-Weighted Sound Pressure Level is denoted by L_{pA} and has units of dB(A)
$L_{Aeq,T}$	The value of the A-weighted sound pressure level, in decibels [dB(A)], of a continuous steady sound that within a specified time interval (T), for example 16 hours, has the same mean-square sound pressure as a sound that varies with time. Therefore, the average over a 16 hour period would be denoted as $L_{Aeq,16h}$
$L_{Amax,T}$	The maximum A-Weighted sound pressure level that was encountered during the measurement period.
$L_{A90,T}$	The A-Weighted sound pressure level that is exceeded for 90% of the time (T). This is usually used a measure of background noise.
Free Field	Where noise can propagate freely without any reflections from buildings etc.
Octave Band	A band of frequencies the upper limit of which is twice the lower limit. They are known by their centre frequency, e.g., 63, 125, 250, 500, 1000, 2000
Ventilation Design Case	The 10th loudest maximum noise level L_{Amax} in a night-time
Overheating Design Case	The loudest maximum noise level L_{Amax} in a night-time

NPSE Critera

NOEL	No Observed Effect Level
LOAEL	Lowest Observed Adverse Effect Level
SOAEL	Significant Observed Adverse Effect Level

BS 4142 Terms

T_r	The reference time interval over which an equivalent continuous A-weighted sound pressure is determined. Day time = 1 hour Night-time = 15 minutes
T_m	The measurement time interval over which measurements are taken.
Ambient Noise	Total sound in a given situation at a given time.
Residual Noise	The ambient noise remaining at a given position in a given situation when the specific noise is suppressed to a degree such that it does not contribute to the ambient noise.
Specific Noise Level	The dB $L_{Aeq,Tr}$ of the noise sources being assessed at a site.
Rating Level $L_{Ar,Tr}$	The specific noise level plus any correction (+5 dB) for the character of the noise, known as the Rating Level.
Assessment Level	Difference between Rating Level ($L_{Ar,T}$) and Background Noise ($L_{A90,T}$)
Sound Power Level (L_{WA})	The noise level from the source in terms of sound power, in dB(A).

Appendix 2 – Noise instrumentation

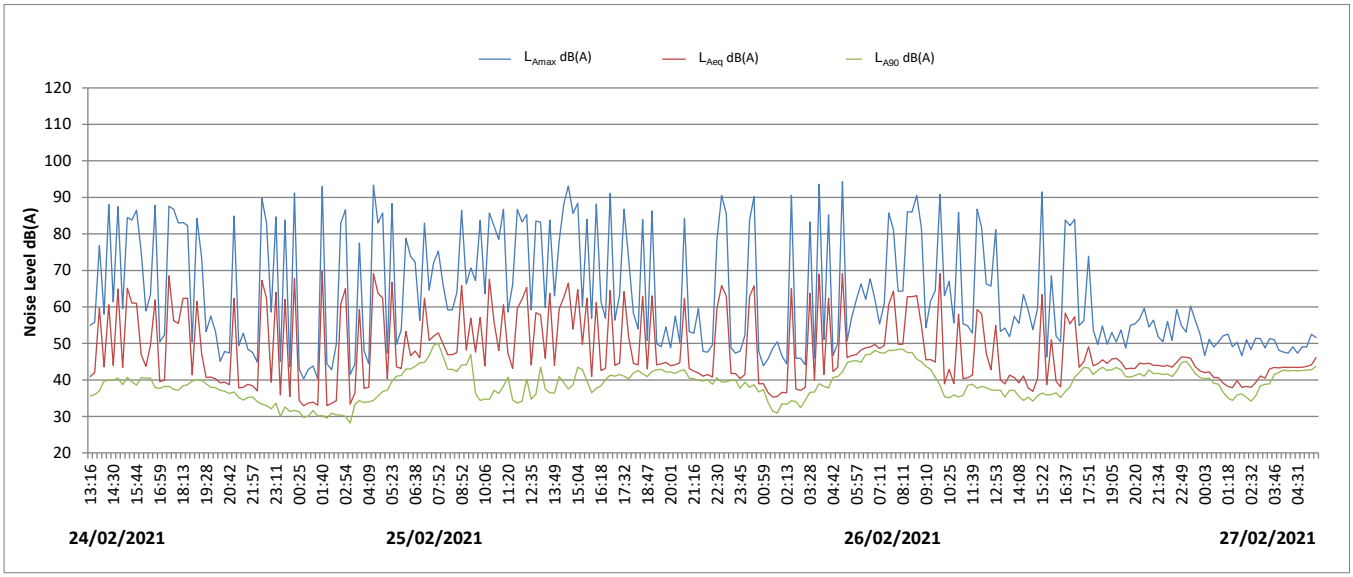
Type	Manufacturer	Description	Serial Number	Last Calibration Date	Calibration Certificate No.
Svan 957	Svantek	Sound level meter	27517	21/02/2020	197033
GA 607	Castle	Sound level calibrator	039873	27/01/2020	196161
Svan 945A	Svantek	Sound level meter	9485	01/05/2019	187795
820	Larson Davis	Sound level meter	1013	23/07/2020	1101381
Svan 979	Svantek	Sound level meter	35876	11/03/2021	1110161

The calibration of the instrumentation was checked at the start and end of the tests and there was no significant drift.

Appendix 3 – Results of Noise monitoring on site

A3.1 Results of monitoring at Location 1 (by railway)

The max events shown as likely to be the result of passing trains.



The weather was dry with temperatures between 0˚C and 12˚C.

Wind speeds were excessive on 24th February but averaged 3 m/s on other days. The direction was westerly.

A3.2 Results of attended monitoring on 3rd March 2021

The weather was sunny and dry, light westerly air <5m/s , 12˚C

Location (see Drawing 6-1).	Time	Elapsed Time hh:mm	Noise level dB(A)			Comments
			L_{Amax}	$L_{Aeq,T}$	L_{A90}	
3rd March 2021 - Measurements of gas pumping station						
10 metres from fence	-	00:01	61.5	60.7	60.1	-
		00:01	62.1	60.5	60.0	-
		00:01	61.5	60.5	59.6	-
30 metres from fence	-	00:01	55.1	53.5	52.2	-
		00:01	55.7	53.5	52.2	-
50 metres from fence	-	00:01	49.8	47.4	46.1	-
3rd March 2021 - Spalding Road measurements						
1 – ground floor	10:15	00:15	75.5	60.4	48.4	20 metres from road
	10:30	00:15	72.6	59.8	48.8	
	10:45	00:15	71.6	60.2	48.0	
	11:00	00:15	70.9	60.0	46.7	

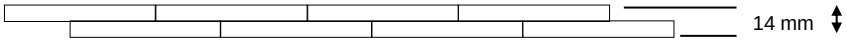
Appendix 4 – Barrier advice

Any acoustic barrier should comprise of an impervious material, e.g., close-boarded timber and be at least 2 metres high.

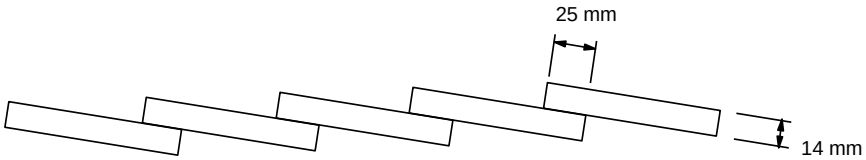
Any material can be used to construct the acoustic barrier, with a minimum surface density of 10 kg/m² **for the lifetime of the barrier (i.e. taking into account drying out)** This will give noise attenuation up to 20 dB.

It is advised that the minimum thickness of a wooden fence is at least 14mm and is overlapped as shown below.

Suitable Wooden Fence Configurations:



Plan Views



Note: All gaps should be sealed, including the area between the ground and bottom of the barrier.

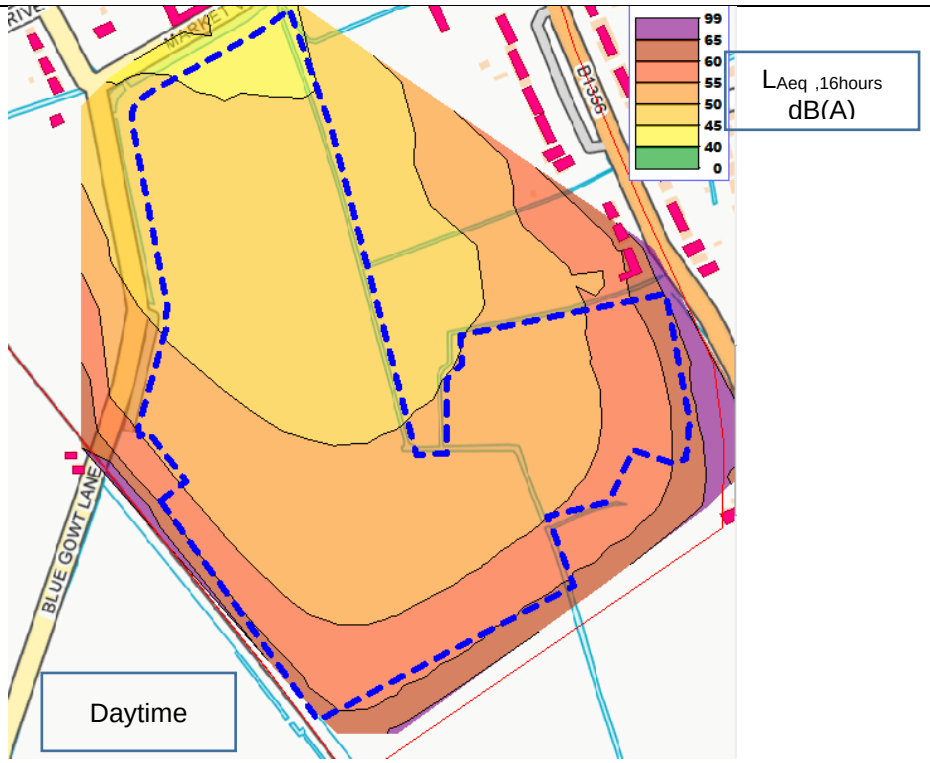
Appendix 5 – Noise data for road

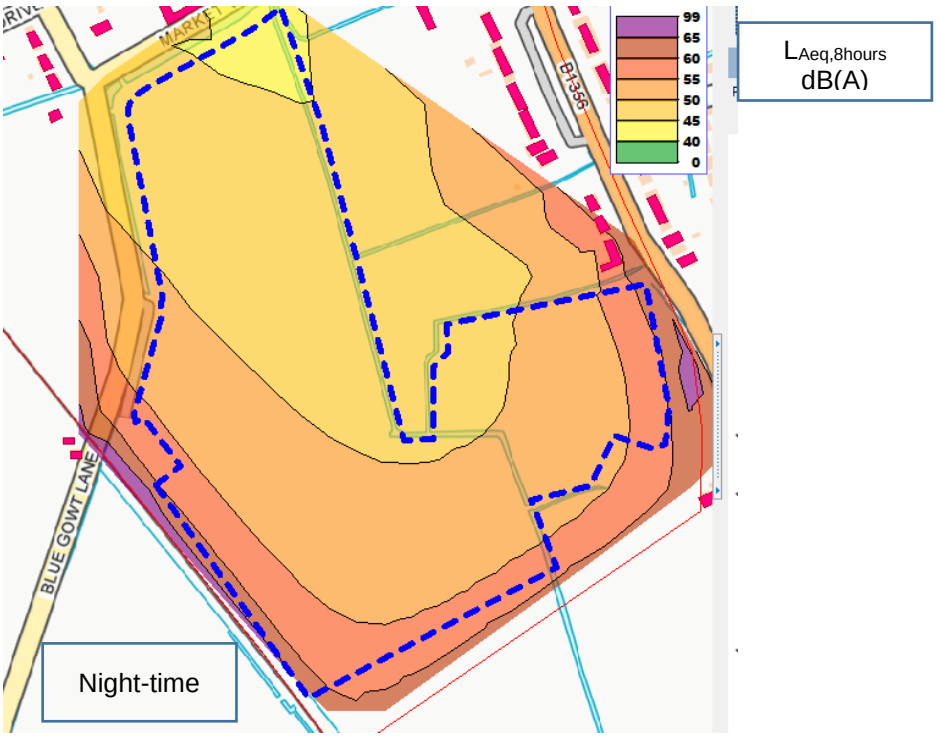
The following data from the Environmental Statement was used to set up the noise source for the South-Western Relief Road and for the Spalding Road.

Table C-8 – Forecast AADT flows for 2036 on SWRR sections.

AADT		2036 (PCUs)							
		NB				SB			
ID	Description	DS S1	DS S5	DS S1 S5	DS Full	DS S1	DS S5	DS S1 S5	DS Full
1	Distributor road	1877	-	1877	1110	2042	-	2028	1207
2	SWRR at Section 1	580	-	623	2538	1049	-	1081	3106
3	SWRR South of Bourne Road	-	-	-	2816	-	-	-	2980
4	SWRR North of Bourne Road	-	-	-	4637	-	-	-	4473
5	SWRR at Section 5	-	4279	4279	5374	-	3646	3641	4967

Figure 1 – ProPG noise contours at 1.5 metres





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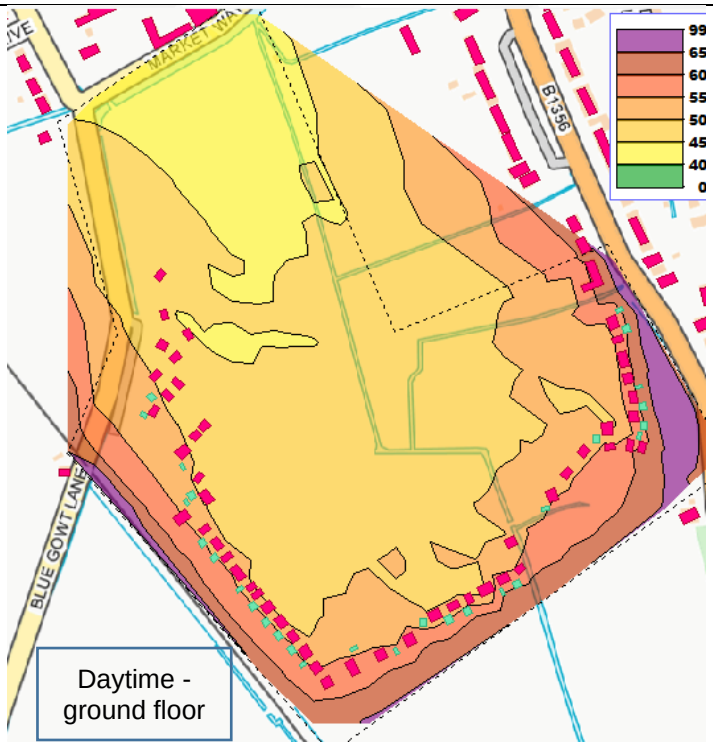
Project: Yew Farm

Noise contours for illustrative purposes only

Figure 2 – Noise Contours on developed site – Average noise levels



$L_{Aeq,16hours}$ dB(A)

$L_{Aeq,8hours}$ dB(A)

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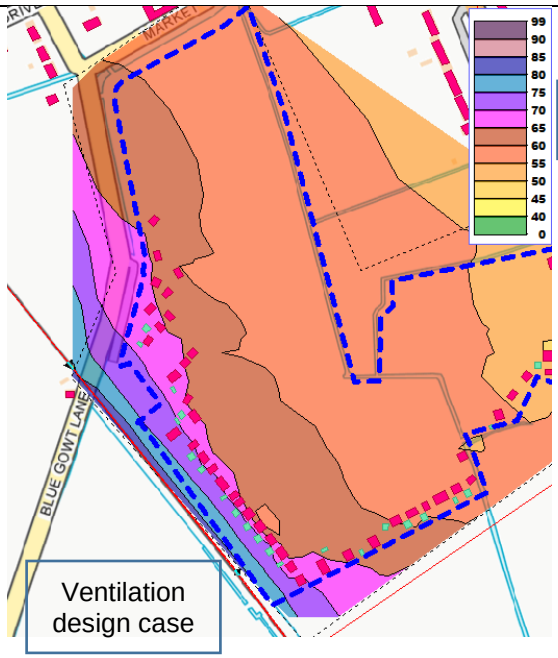
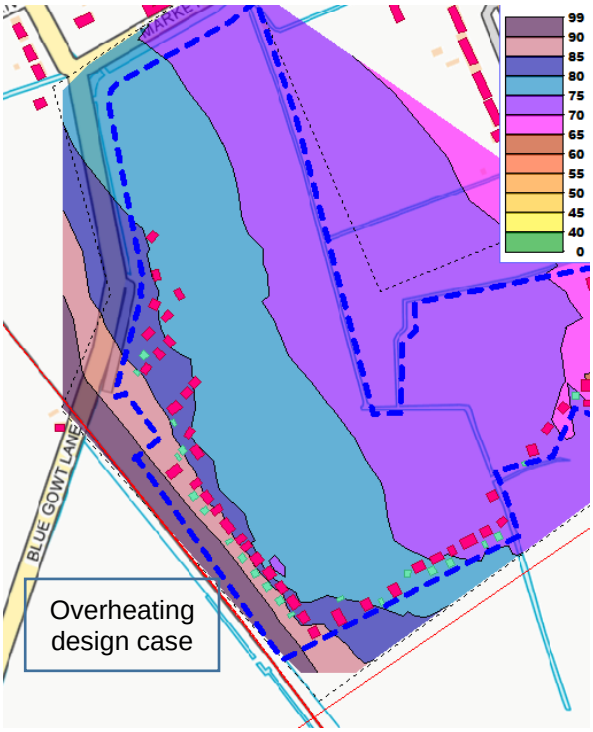
Only houses on fringe shown in model

Figure 3 – Noise Contours on developed site – Impulsive noise at night-time at first floor





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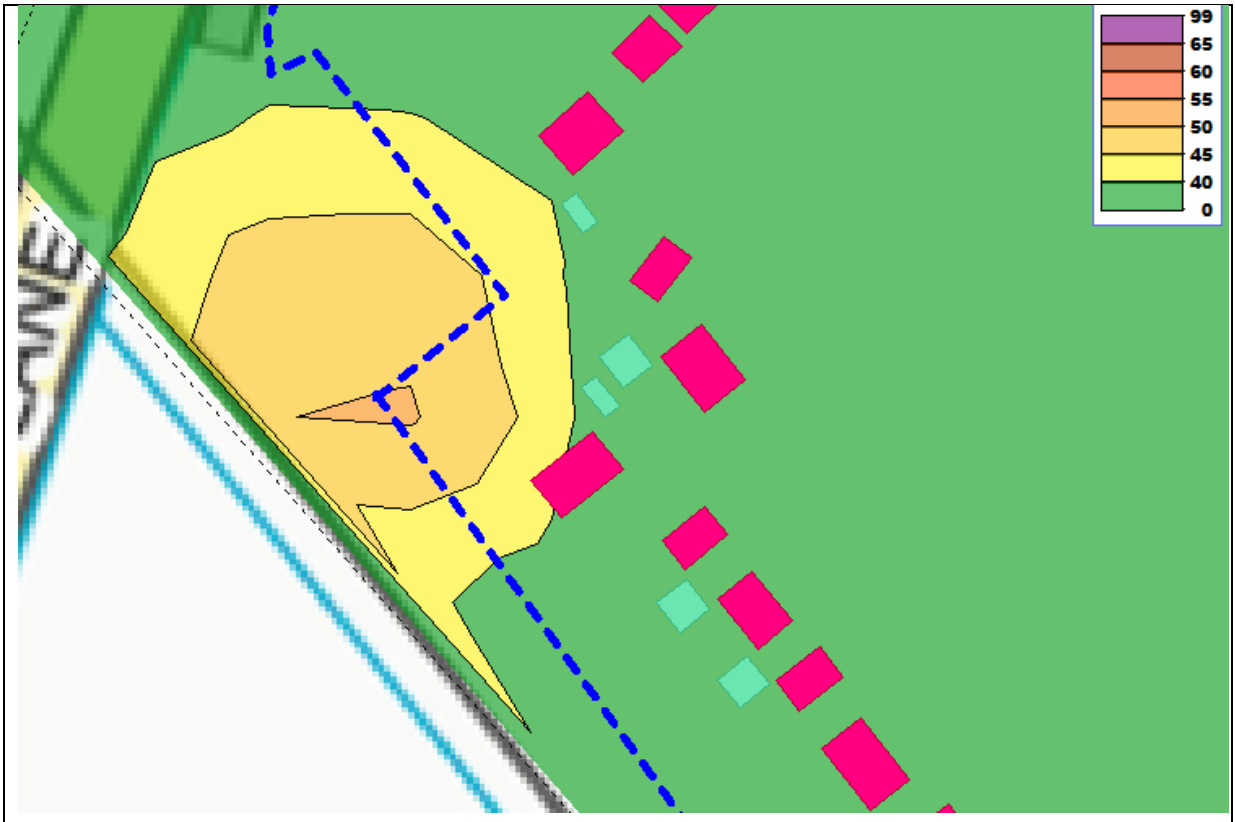
Only most exposed houses shown in model

Figure 4 – Noise Contours on developed site – Emissions from gas pumping station at ground floor level



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Project: Yew Farm

Only most exposed houses shown in model