Noise Constraints Assessment

Wrexham Road, Holt

Reference: 50-256-R1-3

Date: June 2022

NOISE IMPACT ASSESSMENT

Wrexham Road
Holt

Prepared for:

Pridding Farming Partnership

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EXECUTIVE SUMMARY

BACKGROUND

Site Address	Wrexham Road, Holt LL13 9TS
National Grid Reference	E 340574 N 353382
Proposed Development	Proposed residential development along with access and associated car parking and landscaping.
Report Objectives	The objectives of this report are to: • Identify, measure and assess the potential impact of any existing noise sources in the immediate vicinity of the Site upon proposed residential receptors. The report follows current and relevant British Standards to provide a robust assessment.

ASSESSMENT

Surveys Completed	E3P has utilised previously measured data from the adjacent site, road traffic data from the Department for Transport and undertaken our measurements for the A534 to inform the assessment. Given the national lockdown in force at the time, this approach is considered robust and worst-case.
Assessments	A 3D noise model has been constructed to assess road traffic sound upon the development site. With regards road traffic sound, this is assessed in accordance with the criterion, for day and night, given in BS 8233:2014. Consideration has also been given to the WHO (2018) Guidelines.
Mitigation Requirements	The report has provided a recommendation on suitable Site layout, along with any potential mitigation solutions to control road traffic sound. Furthermore, higher specification glazing and/or whole dwelling ventilation may be required in certain areas of the Site due to the impact of sound internally. A proposed site plan has been produced with good acoustic design and this has been considered with reocmmendations on likely mitigation measures.

CONCLUSIONS

With good acoustic design and mitigation measures in place, this assessment has shown that no adverse impact is predicted day or night at the receptors due to road traffic sound. This is further supported in the site layout considered.

As such, noise need not be a material consideration in the granting of planning permission if the recommendations of this report are followed and included within the design stage.

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1. INTRODUCTION

1.1. BACKGROUND

E3P was commissioned by Pridding Farming Partnership to undertake a Noise Impact Assessment for a proposed residential development on land off Wrexham Road in Holt, to be referred to hereafter as '*the Site*'.

This assessment looks to determine the key noise sources in the immediate vicinity of the Site and to assess their impact, if any, upon proposed residential receptors and to specify mitigation measures, where required.

1.2. PROPOSED DEVELOPMENT

Pridding Farming Partnership intends to develop the Site for residential use along with access and associated car parking and landscaping.

The key sources of sound impacting upon the Site is road traffic associated with Wrexham Road (A534) to the south and Wrexham Road to the north-west.

This assessment has been undertaken in accordance with the following supplied drawings:

- Red Line Boundary.

The Red Line Boundary is shown in Figure 1 of Appendix II.

1.3. LIMITATIONS

Where a noise or vibration survey is required to inform an assessment, E3P will endeavour to ensure that all noise and vibration measurements taken are robust, representative and reliable in order to inform an accurate assessment.

Where mitigation measures are specified in this report, it should be noted that these measures are relative to a specific sound or vibration source, both in terms of the measured sound pressure and vibration level and the character of the sound source. Where either the sound pressure level or the character of the sound varies following completion of the sound survey, E3P cannot be held responsible for any subsequent variations in the proposed mitigation performance.

2. ASSESSMENT METHODOLOGY

2.1. PLANNING POLICY WALES (2014)

Noise can affect people's health and well-being and have a direct impact on wildlife and local amenity. Noise levels provide an indicator of local environmental quality. The objective of a policy for noise is to minimise emissions and reduce ambient noise levels to an acceptable standard. Noise Action Plans, drawn up by the Welsh Ministers in relation to Wales under the Environmental Noise Directive, and the Wales Regulations, aim to prevent and reduce environmental noise where necessary and preserve environmental noise quality where it is good.

Noise-sensitive developments, such as hospitals, schools and housing, that need to be located close to the existing transportation infrastructure to facilitate access, should be designed in such a way as to limit noise levels within and around those developments. Such development should be located away from existing sources of significant noise including air transport and some industrial activities or programmed development such as improved or new roads. Policies should also be designed to ensure, as far as possible, that potentially noisy developments are in areas where noise will not be such an important consideration or where its impact can be minimised.

Noise can be a material planning consideration, for example in proposals to use or develop land near an existing source of noise or where a proposed new development is likely to generate noise. Local planning authorities should make a careful assessment of likely noise levels and have regard to any relevant Noise Action Plan before determining such planning applications and in some circumstances, it will be necessary for a technical noise assessment to be provided by the developer.

Special consideration is required where noise-generating development is likely to affect a protected species or is proposed in or near statutorily designated areas, including urban 'quiet areas' designated in Noise Action Plans. The effect of noise on the enjoyment of other areas of landscape, wildlife and historic value should also be considered.

2.2. NOISE AND SOUNDSCAPE ACTION PLAN 2018-2023

The noise action plan for Wales has a broader focus than simply controlling the level of noise. It links to the notion of creating appropriate soundscapes, meaning the right acoustic environment in the right time and place. The towns and cities serve us in a variety of ways, and it is believed should therefore contain a variety of soundscapes appropriate to the land use.

The Action Plan draws from information provided in Professional Practice Guidance (ProPG) and the relevant British Standards to recommend that placemaking, soundscapes and good acoustic design are considered and incorporated into the design and development of any new sites. It provides guidance on numerous sources of sound but does not set any guidelines, beyond those given in the British Standards.

It does relate to the European noise indices of the day-evening-night level, L_{den}, and the night level, L_{night}, which are used in the World Health Organisation's Environmental Noise Guidelines for the European Region (2018) but does not go so far as to stipulate the criterion from the guidelines. As such, and following discussions with Wrexham County Borough Council, the assessment that follows will primarily focus on the British Standards.

2.3. PLANNING GUIDANCE (WALES), TECHNICAL ADVICE NOISE (WALES) 11, NOISE (1997)

This note provides advice on how the planning system can be used to minimise the adverse impact of noise without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens of business. It outlines some of the main considerations which local planning authorities should consider in drawing-up development plan policies and when determining planning applications for development which will either generate noise or be exposed to existing noise sources.

Noise Exposure Categories (NECs) have been derived to assist local planning authorities in their consideration of planning applications for residential development near transport related noise sources.

A recommended range of noise levels is given in Table 2.1 for each of the NECs for dwellings exposed to noise from road, rail, air and mixed sources. However, in some cases, it may be appropriate for local planning authorities to determine the range of noise levels they wish to attribute to the various NECs. Where there is a clear need for new residential development in an already noisy area some or all NECs might be increased by up to 3 dB(A) above the recommended levels. In other cases, a reduction of up to 3 dB(A) may be justified.

TABLE 2.1 NOISE EXPOSURE CATEGORIES FOR DWELLINGS

NOISE SOURCE	ASSESSMENT PERIOD	NOISE EXPOSURE CATEGORY, $L_{Aeq,T}$ dB(A)[1]			
		A	B	C	D
Road Traffic	Daytime 07:00-23:00	<55	55-63	63-72	>72
	Night-time 23:00-07:00[2]	<45	45-57	57-66	>66
Rail Traffic	Daytime 07:00-23:00	<55	55-66	66-74	>74
	Night-time 23:00-07:00[2]	<45	45-59	59-66	>66
Air Traffic [3]	Daytime 07:00-23:00	<57	57-66	66-72	>72
	Night-time 23:00-07:00[2]	<48	48-57	57-66	>66
Mixed Sources [4]	Daytime 07:00-23:00	<55	55-63	63-72	>72
	Night-time 23:00-07:00[2]	<45	45-57	57-66	>66

Notes:

*[1] **Noise levels:** the noise level(s) ($L_{Aeq,T}$) used when deciding the NEC of a site should be representatives of typical conditions.*

*[2] **Night-time noise levels (2300-0700):** sites where individual noise events regularly exceed 82dBL_{Amax} (S time weighting) several times in any hour should be treated as being in NEC C, regardless of the $L_{Aeq,8H}$ (except where the $L_{Aeq,8H}$ already puts the site in NEC D).*

*[3] **Aircraft noise:** daytime values accord with the contour values adopted by the Department of Transport which relate to levels measured 1.2m above open ground. For the same amount of noise energy, contour values can be up to 2 dB(A) higher than those of other sources because of ground reflection effects.*

*[4] **Mixed sources:** this refers to any combination of road, rail, air and industrial noise sources. The "mixed source" values are based on the lowest numerical values of the single source limits in the table. The "mixed source" NECs should only be used where no individual noise source is dominant.*

To check if any individual noise source is dominant (for the purposes of this assessment) the noise level from the individual sources should be determined and then combined by decibel addition (remembering first to subtract 2 dB(A) from any aircraft noise contour values). If the level of any one source then lies within 2 dB(A) of the calculated combined value, that source should be taken as the dominant one and the site assessed against the appropriate NEC for that source, rather than using the "mixed source" NECs. If the dominant source is industrial noise see paragraph B17 of Annex B.
If the contribution of the individual noise sources to the overall noise level cannot be determined by measurement and/or calculation, then the overall measured level should be used and the site assessed against the NECs for "mixed sources".

When assessing a proposal for residential development near a source of noise, local planning authorities should determine into which of the four NECs the proposed site falls, taking account of both day and night-time noise levels. Local planning authorities should then have regard to the advice in the appropriate NEC, as below:

- **A** - Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as desirable.
- **B** - Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection.
- **C** - Planning permission should not normally be granted. Where it is considered that permission should be given, for example, because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.
- **D** - Planning permission should normally be refused.

2.4. BRITISH STANDARD BS 8233:2014 – GUIDANCE ON SOUND INSULATION AND NOISE REDUCTION FOR BUILDINGS

2.4.1. NOISE CRITERIA LIMITS

The scope of this standard is the provision of recommendations for the control of noise in and around buildings including residential dwellings. It suggests appropriate criteria and limits for different situations, which are primarily intended to guide the design of new buildings or refurbished buildings changing use, rather than to assess the effect of changes in the external noise climate.

The standard suggests suitable internal noise levels within different types of buildings, including residential dwellings, as shown in Table 2.2.

TABLE 2.2 BS 8233:2014 RECOMMENDED INTERNAL NOISE LEVELS

CRITERION	TYPICAL SITUATION	DESIGN CRITERION, $L_{Aeq,T}$ (dB)
Suitable Resting and Sleeping Conditions	Living Room	35
	Bedroom	30

BS 8233 goes on to recommend noise levels for gardens:

> *It is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognised that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors might be warranted.*

BS 8233 goes on to say:

> *In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces but should not be prohibited.*

2.4.2. VENTILATION REQUIREMENTS

Where a partially open window cannot be relied upon to provide an adequate level of façade sound insulation performance, it is necessary to consider alternative ventilation for habitable rooms. Section 8.4.5.4 within BS 8233 states:

> *The Building Regulations' supporting documents on ventilation [48, 49, 50] recommend that habitable rooms in dwellings have background ventilation. Where openable windows cannot be relied upon for this ventilation, trickle ventilators can be used and sound attenuating types are available. However, windows may remain openable for rapid or purge ventilation, or at the occupant's choice.*
>
> *Alternatively, acoustic ventilation units (see 7.7.2 below) are available for insertion in external walls. These can provide sound reduction comparable with double glazed windows. However, ducted systems with intakes on the quiet side of the building might be required in very noisy situations, or where appearance rules out through-the-wall fans.*

Section 7.7.2 states:

> *NOTE 5 If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level.*

2.5. WORLD HEALTH ORGANISATION (WHO) (1999) – GUIDELINES FOR COMMUNITY NOISE

The WHO gives guidance on desirable levels of environmental noise. The levels presented in the WHO Community Guidelines are those at which adverse effects become measurable. The 1980 WHO document suggested that *"general daytime outdoor noise levels of less than 55 dB(A) $L_{eq,16hr}$ are desirable to prevent any significant community annoyance."* This level is an external free-field noise level. The 1980 document also stated in relation to internal levels, *"that night-time noise levels of 35 dB(A) $L_{eq,8hr}$ or less will not interfere with the restorative process of sleep"*.

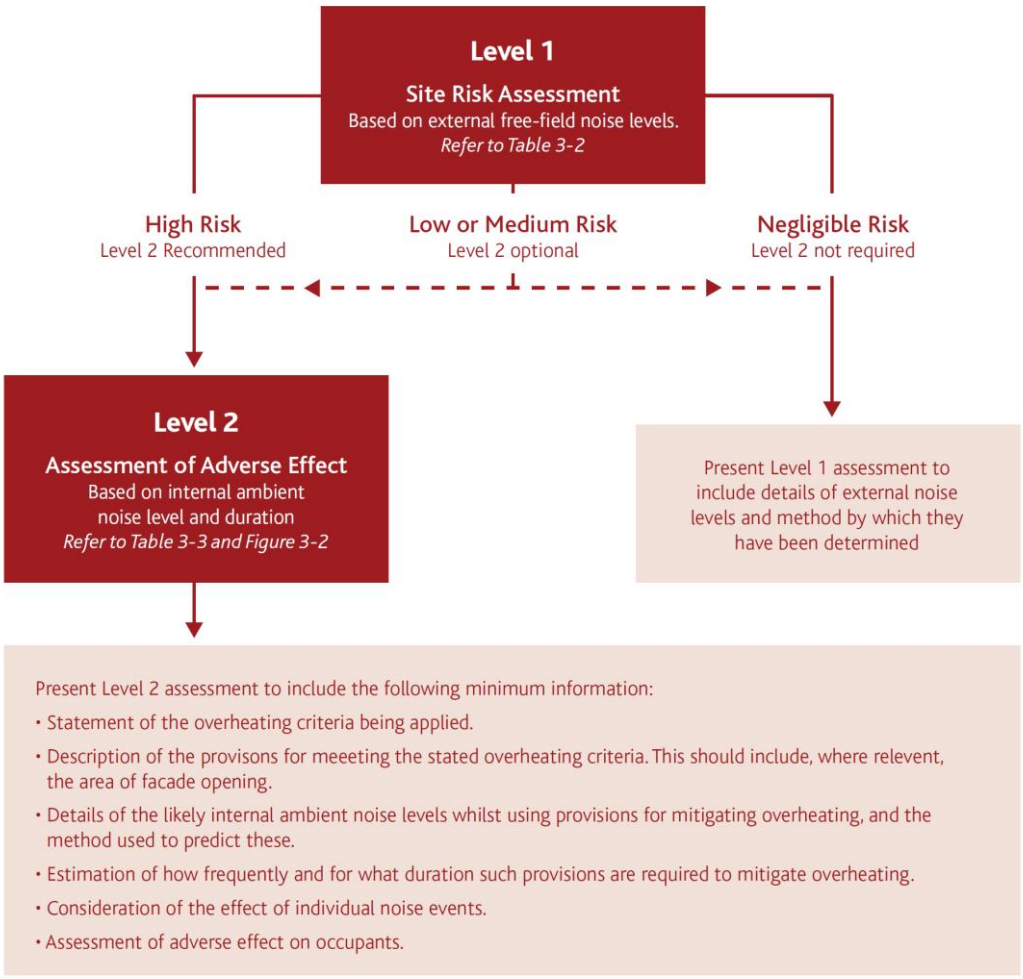
A report was submitted to the WHO in 1995 for consideration as a revision to the 1980 document and revised community guidelines were issued in 2000. In the 2000 guidelines, it is considered that the sleep disturbance criteria should be taken as an internal noise level of 30 dB $L_{Aeq,8\ hr}$ or an external level of 45 dB $L_{Aeq,8\ hr}$. It also recommends that internal L_{Amax} levels of 45 dB and external L_{Amax} levels of 60 dB should be limited where possible.

2.6. INSTITUTE OF ACOUSTICS AND ASSOCIATION OF NOISE CONSULTANTS (2020) ACOUSTICS VENTILATION AND OVERHEATING: RESIDENTIAL DESIGN GUIDE

The Acoustics Ventilation and Overheating (AVO) Residential Design Guide provides an approach as to how the competing aspects of thermal and acoustic comfort can be managed. The AVO Guide aims to assist designers to adopt an integrated approach to the acoustic design within the context of the ventilation and thermal comfort requirements.

The AVO Guide provides a method for assessing the impact of opening windows and providing whole house ventilation due to the impact of noise via a two-level noise assessment procedure, as below:

DIAGRAM 2.1 TWO LEVEL NOISE ASSESSMENT PROCEDURE – OVERHEATING CONDITION



A level 1 risk assessment is based on external free-field noise levels with the assumption of a partially opened window in use for mitigation of overheating. A level 1 assessment is appropriate for scenarios where the risk to a development is deemed 'Negligible'. 'Low' and 'Medium' risk sites only require a level 2 assessment on an optional basis in order to give further confidence in the suitability of internal noise conditions.

The noise levels suggested in Table 2.3 and 2.4 assume a steady road traffic noise source but can be adapted for other transport sources.

TABLE 2.3 GUIDANCE FOR LEVEL 1 SITE RISK ASSESSMENT OF NOISE FROM TRANSPORT NOISE SOURCES RELATING TO OVERHEATING CONDITION

RISK CATEGORY FOR LEVEL 1 ASSESSMENT - EXTERNAL		**RISK LEVEL**	**POTENTIAL EFFECT WITHOUT MITIGATION**	**RECOMMENDATION FOR LEVEL 2 ASSESSMENT**
$L_{Aeq,T}$ during 07:00 - 23:00	**$L_{Aeq,8hr}$ during 23:00 - 07:00**			
≥65dB	≥55dB	**High**	Increasing risk of adverse effect	Recommended
>55 dB and <63 dB	>45 and <55 dB	**Medium**		Optional
>50dB and <55 dB		**Low**		
≤50 dB	≤45 dB	**Negligible**	Use of opening window as means of mitigating overheating is not likely to result in adverse effect	Not Required

A level 2 assessment will be carried out when the risk of adverse effect is 'High' or it is deemed appropriate for a 'low' or 'medium' risk site. An increase in internal ambient noise level can cause a change in human behaviour. At high levels this creates situations where occupants can no longer open windows for ventilation due to high external noise levels. A level 2 assessment identifies these situations and allows for appropriate alternative ventilation systems to be recommended.

TABLE 2.4 GUIDANCE FOR LEVEL 2 ASSESSMENT OF NOISE FROM TRANSPORT NOISE SOURCES RELATING TO OVERHEATING CONDITION

INTERNAL AMBIENT NOISE LEVEL AT FAÇADE LOCATIONS			**EXAMPLE OF OUTCOMES**
$L_{Aeq,T}$ during 07:00 - 23:00	**$L_{Aeq,8hr}$ during 23:00 - 07:00**	**Individual noise events during 23:00 - 07:00**	
>50 dB	>42 dB	Normally exceeds 65 dB $L_{AF,max}$	Noise causes a material change in behaviour e.g. having to keep windows closed most of the time
Increasing noise levels			Increasing the likelihood of impact on reliable speech communication during the day or sleep disturbance at night
≤35 dB	≤30 dB	Do not normally exceeds $L_{AF,max}$ 45 dB more than 10 times a night	Noise can be heard but does not cause any change in behaviour

3. SURVEY RESULTS

The measurement positions are detailed in Figure 1 of Appendix II.

E3P have used previously measured data undertaken for the adjacent MacBryde Homes Site as detailed in the Hepworth Acoustics Report (P19-440-R01-V2) dated February 2020. The surveys were undertaken in October 2019, before any lockdown measures. As such, the measurements are considered robust and representative, especially for Wrexham Road. However, for Wrexham Road (A543) E3P has relied upon Department for Transport traffic flow information and measurement data, undertaken in January 2021.

3.1. ROAD TRAFFIC SOUND SURVEY – A543 WREXHAM ROAD

E3P has conducted a 24-hour road traffic sound measurement for Wrexham Road (A543) to measure the level of noise generated by the road but specifically night-time levels and maximum instantaneous noise levels. The survey was carried out over the following periods:

- 09:30 Tuesday 26th January to 10:00 Thursday 28th January 2021.

The following noise measurement position was chosen for the Road Traffic Noise Survey:

- Noise Measurement Position 1 (NMP1): Located on the southern boundary of the Site approximately 9 m from the nearside edge of the A543. The microphone was located at a height of 1.5 m above ground level and in free-field conditions. The sound climate was dominated by road traffic sound on the A543.

A summary of the measured sound pressure levels from the Road Traffic Noise Survey is presented in Table 3.1. Full tabulated hourly data is shown in Appendix II.

TABLE 3.1 SUMMARY OF MEASURED NOISE LEVELS FOR NMP3 – A543

MEASUREMENT PERIOD	MEASURED SOUND PRESSURE LEVELS (dB)	
	$L_{Aeq,T}$	10th Highest $L_{Amax,fast}$
Tuesday 26th January Daytime	65	-
Tuesday 26th January Night-time	59	81
Wednesday 27th January Daytime	65	-
Wednesday 27th January Night-time	59	81

The derived $L_{Aeq,16hr}$ and $L_{Aeq,8hr}$ from the measured data were 4 dB lower than the daytime and night-time measured levels for the MacBryde Site and resultant from the traffic data. This would be expected due to a large reduction in traffic flow. However, the maximum noise level information is considered representative and will be used to inform the assessment.

During the survey, conditions remained dry and wind speeds rarely exceeded 5 m/s.

The equipment outlined in Table 3.2 was used for the noise survey.

TABLE 3.2 NOISE MEASUREMENT EQUIPMENT AND CALIBRATION DATES

MEASUREMENT POSITION	EQUIPMENT DESCRIPTION	MANUFACTURER & TYPE NUMBER	SERIAL NUMBER	CALIBRATION DUE DATE
NMP3 and NMP4	Sound Level Meter	Cirrus Cr: 171B	G301925	27th November 2022
	Pre-amplifier	Cirrus MV:20F	10730F	
	Microphone	Cirrus MK:224	213437D	
	Calibrator	Cirrus CR:515	93700	27th November 2021

The sound level meter was field calibrated on-site using the above-mentioned calibrator before and after noise measurements were taken. No significant drift was witnessed as noted above. Calibration certificates are available upon request.

4. NOISE CONSTRAINTS ASSESSMENT

For this assessment, E3P has used noise modelling software, CadnaA 2019 MR1, to determine the impact of noise from road traffic.

The following inputs have been included in the model:

- Red Line Boundary.
- Site elevations have been taken as existing by way of a 2 m grid Digital Terrain Model (DTM) which contains public sector information licensed under the Open Government Licence v3.0.
- Existing buildings that provide shielding from any of the noise sources have been included in the model.
- A reflection order of 2 has been used in all calculations.
- Noise levels generated using ISO 9613-1 and ISO 9613-2 "*Acoustics – Attenuation of sound during propagation outdoors*" as incorporated into CadnaA software.

4.1. INITIAL SITE RISK ASSESSMENT

Figures 2 and 3 determine the noise levels across the Site during the daytime and night-time periods, respectively, due to road traffic associated with Wrexham Road (A543) and Wrexham Road in accordance with the Welsh Government NECs.

The grids determine that, during the daytime and night-time periods, most of the Site falls within NEC B with only partial areas of the southern boundaries of the Site falling within NEC C. As such, noise should be considered when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection. For areas close to the A543 falling within NEC C, a commensurate level of protection should be provided and could be set by way of conditions.

As such, it is recommended that good acoustic design is incorporated into the development, particularly along the southern boundary. This is discussed below.

4.2. GOOD ACOUSTIC DESIGN PROCESS

A good acoustic design should avoid "unreasonable" acoustic conditions and prevent "unacceptable" acoustic conditions and is not just compliance with recommended internal and external noise exposure standards. It should provide an integrated solution, whereby the optimum acoustic outcome is achieved, without design compromises that will adversely affect living conditions and the quality of life of the inhabitants or other sustainable design objectives and requirements.

Given the potential for most of the Site to fall within NEC B, good acoustic design is not necessary across the entire site. However as the southern areas along the A543 are subject to NEC C, good acoustic design is essential in these areas. Specifically, the following will need to be considered when designing the site and plot layouts:

- Potential for barrier along the boundary with the A543. This will be discussed and assessed on its suitability and benefit in Section 6.0.

- Plots along the boundary facing the A543 should be orientated such that the garden areas are protected by the building envelope and buildings should wrap around the sides, where possible, especially in the southwestern corner to protect the gardens. L-shaped dwellings can be deployed at the edges of groups of plots.

- Gaps between dwellings along the southern boundary with the road should be kept to a minimum to avoid noise creep into the gardens behind. Where gaps are larger, garages should be incorporated between dwellings.

- Public open space or nature corridors along the boundary with the A543 would be advantageous as these provide a buffer to the plots, as would internal roads or private driveways.

- Wherever possible, windows for habitable rooms should face away from the noise sources so that opening windows does not necessarily result in an exceedance of the criteria. However, where this is not possible, internal levels can be controlled by way of mitigation.

The advice above looks to incorporate good acoustic design to allow for the maximum potential of the site rather than incorporating stand-off distances which would be of little use here. However, measures that increase stand-off but incorporate essential areas for the development are highly recommended and beneficial, such as green space, private driveways or internal roads.

4.3. INTERNAL NOISE LEVEL ASSESSMENT

Due to the outline nature of the application, detailed assessments are not possible. Accordingly, it is assumed that habitable rooms are located along the boundaries with the A543 and Wrexham Road, with minimal stand-off to inform a worst-case assessment.

With regards to internal noise levels, E3P has assumed a standard double-glazed unit with a configuration of 4 mm glass/20 mm air space/4 mm glass. It is assumed that this configuration would afford a sound insulation performance in the order of 29 dB; however, this is for a pink noise spectrum. The same unit, weighted for road traffic noise using the "$+C_{t,r}$" correction, has a sound insulation performance value of approximately 25 dB and so this value has been used to calculate internal noise levels. The recently published AVO Guide recommends that a partially open window provides approximately 13 dB attenuation.

During the daytime period, the highest predicted level along the southern boundary with the A543 is 66 dB $L_{Aeq,16hr}$ and 63 dB $L_{Aeq,16hr}$ along the northwestern boundary with Wrexham Road. When considering standard glazing, the internal noise level in living rooms would be 41 dB adjacent to the A543 and 38 dB adjacent to Wrexham Road. Both levels exceed the internal criterion by 6 and 3 dB respectively. As such, higher specification glazing will be required for living rooms immediately along the southern and northwestern boundaries. Any plots further into the development, after the first row of plots, will benefit from lower noise levels and standard glazing is likely to be sufficient.

With a partially open window, it is likely that most plots will exceed the internal criterion. Accordingly, a whole dwelling ventilation system would be required for any living rooms with a line of sight to the A543 and/or Wrexham Road. Where alternative ventilation is not preferred, please revert to the good acoustic design section, which recommends that habitable rooms face away from the noise source. Where levels of less than 48 dB are predicted, i.e. dwellings behind the initial row closest to the roads, it is likely that a whole dwelling ventilation system would not be required.

During the night-time period, the highest predicted level along the southern boundary is 61 dB $L_{Aeq,8hr}$ and 53 dB $L_{Aeq,8hr}$ along the northwestern boundary. When considering standard glazing, the internal noise level in living rooms would be 36 dB adjacent to the A543 and 28 dB adjacent to Wrexham Road. Only internal levels along the A543 would exceed the internal criterion by 6 dB. As such, higher specification glazing will be required for bedrooms along the southern boundary. Any plots further into the development, after the first row of plots, will benefit from lower noise levels and standard glazing is likely to be sufficient. Again, whole dwelling ventilation system would be required as per the above.

During the night-time, it is also important to consider $L_{Amax,fast}$ level within bedrooms. The 10th highest level (81 dB), as measured in January 2021, along the A543 has been used to inform the assessment along the southern boundary and the highest level of 73 dB as measured by Hepworth Acoustics along Wrexham Road has been used for the northwestern boundary. Considering windows will not be located at the boundary, as measured, a 6 dB reduction for double distance from road edge to window has been applied. This is considered the worst case. When considering a sound reduction of 29 dB for standard glazing, internal maximum noise levels in bedrooms would be 46 dB along the southern boundary and 38 dB along the northwestern boundary. As such, higher specification glazing is required for southern facing bedrooms windows. However, the level of exceedance of 1 dB is much lower than that due to average noise levels. As such, no additional measures are required.

With regards to whole dwelling ventilation, it has been assumed that the opening of windows would be required for fresh air flow and background ventilation. If windows are opened, it has been shown, that the internal criteria would be exceeded for certain habitable rooms. Therefore, a system would be required that provides fresh airflow and background ventilation to any habitable rooms facing and along the roads with windows remaining openable for purge ventilation. This would also be subject to an overheating condition at the detailed design stage. However, this report suggests appropriate systems based on the information provided but should not be used as a definitive guide.

4.4. EXTERNAL AMENITY AREA NOISE LEVEL ASSESSMENT

Figure 2 determined noise levels across the Site would range between 54 and 67 dB. Accordingly, areas along the roads will experience an exceedance of the 50–55 dB criteria given in BS 8233:2014 without any good acoustic design and/or mitigation measures in place. First and foremost it is understood that 50 dB and below should be achieved with provision for the 50 dB criteria to be exceeded, up to 55 dB, but this must be justified and is usually reserved for developments close to main roads and motorways and in urban areas.

Accordingly, it is recommended that good acoustic design is followed, which should achieve levels below the 50 dB criterion for the worst-affected areas, once paired with mitigation measures.

Where good acoustic design is not possible and is justified, mitigation measures in the form of acoustic barriers along the boundary and at the gardens will be required in order to achieve, at least, the lowest practicable levels. This is discussed further in Section 6.0. Given that no detail is available, the exact location and height of the barriers cannot be determined at this time. However, their requirement should be considered and included in any decision-making for areas facing the central area.

4.5. OTHER RELEVANT ISSUES

The above primarily seeks to encourage a good acoustic design process for new residential development. It is recognised that it may not always be possible to achieve the internal noise level guidelines in all rooms within noise-sensitive developments. Where it is not possible to achieve the recommended standards in every respect, regard should be had to the number of dwellings and number of habitable rooms in each of the dwellings where the recommended standard cannot be achieved. Similarly, regard should be had to the extent to which the guidance on the external amenity area noise assessment has been followed, including whether access to quiet or relatively quiet external amenity areas is considered necessary, and the extent of any adverse impacts on external amenity areas that are an intrinsic part of the overall design.

Design measures taken to reduce intrusion by noise may have unintended adverse consequences for the building or the nearby environment and may affect the attractiveness of the living environment for the occupants. Examples include roadside barriers that remove views or prevent crossing roads and sealed facades that affect personal control over the internal environment. Wherever possible, such unintended adverse consequences should be obviated by good acoustic design.

Some wider planning objectives may have unforeseen acoustic implications. For example, the encouragement of “active facades”, which overlook public footpaths etc. to ensure “safe by design” could result in some residential units facing noisy streets or railways. The encouragement of active outdoor lifestyles may require the careful protection of amenity spaces from sources of transport noise. The creation of vibrant mixed-use commercial and residential neighbourhoods can introduce particular challenges that will need to be overcome by careful acoustic design.

5. FULL ASSESSMENT

E3P have been provided with an example site layout and, as such, this has been run through the noise model. Good aocutsic design, as recommended above, has been followedd.

The following inputs have been included in the model:

- Proposed Site Layout 100_82_SP 01 dated 10th December 2021.
- Site elevations have been taken as existing by way of a 2 m grid Digital Terrain Model (DTM) which contains public sector information licensed under the Open Government License v3.0.
- Existing buildings are included.
- Soft ground coverage is set at 50%.
- A reflection order of 2 has been used in all calculations.
- Noise levels generated using ISO 9613-1 and ISO 9613-2 "*Acoustics – Attenuation of sound during propagation outdoors*" as incorporated into CadnaA software.

Figures 4 and 5 determine the noise levels across the Site during the daytime and night-time periods, respectively, due to road traffic sound with the proposed buildings in place.

As can be seen, good acoustic design is incorporated into the layout especially along the southern boundary to counter the impact of noise associated with the A543.

5.1. EXTERNAL AMENITY AREA NOISE LEVEL ASSESSMENT

The noise model has been used to predict noise levels in external amenity areas. Only rear garden areas are considered and noise levels range between 37 and 61 dB without any mitigation measures and, as such, acoustic barriers will be required for plots bounding Wrexham Road to the north and garden edges exposed along the southern boundary.

However, the vast majority of plots experience noise levels of below 50 dB in rear gardens due to good acoustic design.

Acoustic barriers are outlined in Section 5.1.

5.2. INTERNAL NOISE LEVEL ASSESSMENT

With regards internal noise levels, E3P has assumed a standard glazing specification of 4 mm glass/20 mm air space/4 mm glass affords sound insulation performance in the order of 31 dB however this is for a pink noise spectrum. The same unit, weighted for road traffic noise using the '+C_{tr}' correction, has a sound insulation performance value of approximately 25 dB and so this value has been used to calculate internal noise levels. The recently published AVO has found that a common reduction for an open window is 13 dB based on research undertaken. As such, a figure of 13 dB is applied here.

The model has been used to predict façade noise levels at ground and first floors. In order to determine any requirements for mitigation, E3P has added the reduction provided by the glazing (25 dB) to the relevant criterion for day (35 dB) and for night (30 dB). As such, any facades subject to noise levels higher than 60 dB during the day and/or 55 dB during the night will require higher specification glazing. As can be seen from the Figures, the following plots will required higher specification glazing:

- 1.
- 6 to 12.
- 18 and 19; and
- 28 to 30.

All plots not listed will experience acceptable internal noise levels with standard thermal double glazing.

With regards opening windows, there is a requirement to consider the need to open windows for ventilation and the mitigation of overheating. At this stage, the assessment assumes that ventilation would be provided by way of extract fans in kitchens and bathrooms and openable windows.

5.2.1. VENTILATION CONDITION

When considering a partially open window for ventilation purposes, E3P has assessed whether the BS 8233:2014 internal criterion can be achieved with windows open for ventilation. Here ventilation is defined as:

> *To provide fresh air to the building and to dilute and disperse residual water vapour not dealt with by extract ventilation as well as removing other pollutants which are released throughout the building.*

Thermal comfort and overheating are considered in Section 4.2.2. Purge ventilation is provided by an open window regardless of the ventilation strategy.

As such, a comparison of predicted internal noise levels, with windows open, with the BS 8233:2014 criterion is required. This results in an allowable external noise level of 48 dB during the day and 43 dB during the night in order to achieve the internal criteria with windows open.

As can be seen from the Figures, all pltos will experience an exceedance on at least one façade during day and/or night-time periods and, as such, the dwelling will require a whole dwelling ventilation system as, when windows are opened for ventilation, the internal ambient noise levels are not considered acceptable and exceed the required criterion. Section 5.0 discusses the requirements and provides necessary advice.

The exact system will also be dependent on the outcome of the overheating condition below.

5.2.2. OVERHEATING CONDITION

E3P has undertaken a level 1 assessment in accordance with the AVO Guide and adopted the noise levels outlined for negligible and low risk. Any plots that pass this test will not require whole dwelling ventilation to control the overheating as external noise levels would be sufficiently low enough that an open window can provide the overheating mitigation without compromising internal noise levels. As such, the allowable façade noise levels are 55 dB during the day and 50 dB during the night. Any facades experiencing higher noise levels than these may be subject to an optional level 2 assessment.

As can be seen from the Figures, only plots 1 to 12, 18 to 23, 28 to 30 and 37 to 39 are in exceedance of these noise levels. Of these pltos, only plots 6 to 12, 18 and 19 would be considered medium risk, with the other plots above considered low risk. As such, a Level 2 assessment has been undertaken for plots 7 to 12, 18 and 19 only.

An overheating assessment of the site has been undertaken as per the method provided by Good Homes Alliance. The assessment determined a medium risk of overheating. Secondly, it is important to consider the predicted internal noise levels with windows open. The anticipated internal levels with a partially open window (13 dB attenuation) to control overheating would be 52 dB during the day and 47 dB at night for the worst affected facade, with overheating design case L_{AFmax} levels up to 62 dB.

Considering these levels on the AVO diagrams, these levels are above the "SOAEL" level in living rooms and bedrooms, and above a level at which noise causes a material change in behaviour. However, given the medium risk of overheating and that quieter facades are available for openable windows to mitigate overheating, a mechanical system is not considered to be required for these plots.

The exact requirements are detailed in Section 5.0.

6. MITIGATION

6.1. GOOD ACOUSTIC DESIGN

Given the potential for plots to fall within NEC C along the southern boundary, good acoustic design is essential in these areas. Specifically, the following will need to be considered when designing the site and plot layouts:

- Plots bounding the road will need to be orientated such that the garden areas are protected by the building envelope and buildings should wrap around the sides, where possible, to protect the gardens.
- Gaps between dwellings along the boundaries with the roads should be kept to a minimum to avoid noise creep into the gardens behind.
- Where possible, mews dwellings would be ideal along the road.
- Public open space or nature corridors along the road would be advantageous as these provide a buffer to the plots. This is already shown in the design with well planted bunds along the eastern boundary.
- Wherever possible, windows for habitable rooms should face away from the noise sources so that opening windows does not necessarily result in an exceedance of the criteria. However, where this is not possible, internal levels can be controlled by way of mitigation.

The above has been shown to be implemented into the masterplan design.

6.2. ACOUSTIC BARRIERS

The previous section determined that unacceptable external noise levels certain gardens are predicted within the example layout. As such, an additional grid noise map, Figure 6, to determine the required barriers heights needed to achieve levels of 50 dB and below in all gardens. The following fences would be required:

- 3.2 m high fence at plots 1 to 4.
- 2.1 m high fence at plots 5 and 6.
- 2.8 m high fence at plots 11, 12 and 13.
- 2.8 m high fence at plots 118 and 119.
- 2.1 m high fence at plot 23.
- 2.1 m high fence at plot 37; and
- 3 m high barrier at plot 30.

In order to achieve levels of below 55 dB, the following barriers are sufficient:

- 1.8 m high fence at plots 1 to 4.
- 1.8 m high fence at plots 12 and 18; and
- 2.1 m high fence at plot 30.

Given the significant difference in fence heights and numbers of fences to achieve 50 dB, the achieving of 55 dB in the worst-affected gardens is considered acceptable and a compromise between excessive barriers and heights and slightly elevated noise levels.

The barriers can be of wooden fence or brick wall construction but must be sealed at the base, be free from holes and have a minimum mass of 10 kg/m^2.

6.3. FAÇADE INSULATION

The previous section determined that certain facades would require higher specification glazing and whole dwelling ventilation. Specifically, the following glazing specifications are required, per facade, along with details on whole dwelling ventilation.

It is worth noting that the below is based on an example layout as part of an outline planning application and it should be used for indicative purposes only to ascertain general requirements for the Site.

The worst-case required glazing is chosen per facade. For example, where a glazing needed due to night-time noise is higher than for daytime periods, the night-time requirements are recommended. In the absence of an internal layout, assumptions have been made that habitable room windows can be located on any façade.

TABLE 5.1 GLAZING AND VENTILATION REQUIREMENTS

PLOT	REQUIRED GLAZING REDUCTION, $R_w + C_{t,r}$ (dB)	EXAMPLE GLAZING (GLASS/AIR SPACE/GLASS) (mm)	WHOLE DWELLING VENTILATION SYSTEM
1	**26**	**6 / 6 to 20 / 4**	**System 1 or 2 ventilation that provides background ventilation and fresh air flow**
2 to 5	Standard	4/20/4	
6	**26**	**6 / 6 to 20 / 4**	
7	**28**	**6 / 6 to 20 / 4**	
8	**29**	**10 / 6 to 20 / 4**	
9	**30**	**10 / 6 to 20 / 4**	
10	**30**	**10 / 6 to 20 / 4**	
11	**30**	**10 / 6 to 20 / 4**	
12	**30**	**10 / 6 to 20 / 4**	
13 to 17	Standard	4/20/4	
18	**27**	**6 / 6 to 20 / 4**	
19	**27**	**6 / 6 to 20 / 4**	
20 to 27	Standard	4/20/4	
28	**26**	**6 / 6 to 20 / 4**	

29	**26**	**6 / 6 to 20 / 4**	
30	**27**	**6 / 6 to 20 / 4**	
31 to 39	Standard	4/20/4	

The above glazing units would achieve the required reduction due to average noise levels as well as those resultant from maximum instantaneous noise levels. It is also recommended that a glazier is consulted to ensure any system installed achieves the above reduction as a minimum.

Where background ventilators form part of the system, the reduction provided by the vent in the open position should, at least, match the attenuation provided by the glazing unit. The number of background ventilators per room will be dependent on the requirements given in Building Regulations Part F.

7. CONCLUSION AND RECOMMENDATIONS

E3P was commissioned by Pridding Farming Partnership in order to undertake a Noise Impact Assessment for a proposed residential development on land off Wrexham Road in Holt.

A sound survey has been undertaken for the A543 to support the 3rd party data taken from the Department for Transport and the Noise Assessment from the neighbouring site. A 3D noise model has been constructed to assess road traffic sound impact, this is assessed in accordance with the NEC bands and criteria, for day and night, given in BS 8233:2014.

The assessment has recommended various good acoustic design measures and mitigation measures that can be incorporated into the design of the development.

The report has recommended good acoustic design and the implementation of mitigation measures, which are reasonable and achievable. When followed, these measures will result in no adverse impact day or night at the receptors due to road traffic sound.

Indeed, this report has also considered the proposed site layout and assessed accordingly. The layout accounts for the above good acoustic design measures resulting in minimal on-site mitigation measures which consist of 1.8 and 2.1 m high barrier for a handful of gardens, higher specification glazing up to 30 dB $R_w + C_{t,r}$ only and System 1 or 2 ventilation.

As such, noise need not be a material consideration in the granting of planning permission as long as the recommendations of this report are followed and included within the design stage of the Reserved Matters.

END OF REPORT

APPENDIX I
GLOSSARY OF ACOUSTIC TERMINOLOGY

NOISE

Noise is defined as unwanted sound. Human ears are able to respond to sound in the frequency range 20 Hz (deep bass) to 20,000 Hz (high treble) and over the audible range of 0 dB (the threshold of perception) to 140 dB (the threshold of pain). The ear does not respond equally to different frequencies of the same magnitude but is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates the response of the human ear, a weighting mechanism is used. This reduces the importance of lower and higher frequencies, in a similar manner to the human ear.

Furthermore, the perception of noise may be determined by a number of other factors, which may not necessarily be acoustic. In general, the impact of noise depends upon its level, the margin by which it exceeds the background level, its character and its variation over a given period of time. In some cases, the time of day and other acoustic features such as tonality or impulsiveness may be important, as may the disposition of the affected individual. Any assessment of noise should give due consideration to all of these factors when assessing the significance of a noise source. The most widely used weighting mechanism that best corresponds to the response of the human ear is the "A"-weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or L_{Aeq}, L_{A90} etc., according to the parameter being measured.

The decibel scale is logarithmic rather than linear, and hence a 3 dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective but, as a general guide, a 10 dB(A) increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3 dB(A) is generally regarded as the minimum difference needed to perceive a change under normal listening conditions. An indication of the range of sound levels commonly found in the environment is given in the following table.

TABLE A1 TYPICAL SOUND PRESSURE LEVELS

SOUND PRESSURE LEVEL	LOCATION/EXAMPLE
0	Threshold of hearing
20–30	Quiet bedroom at night
30–40	Living room during the day
40–50	Typical office
50–60	Inside a car
60–70	Typical high street
70–90	Inside a factory
100–110	Burglar alarm at 1 m away
110–130	Jet aircraft on take off
140	Threshold of pain

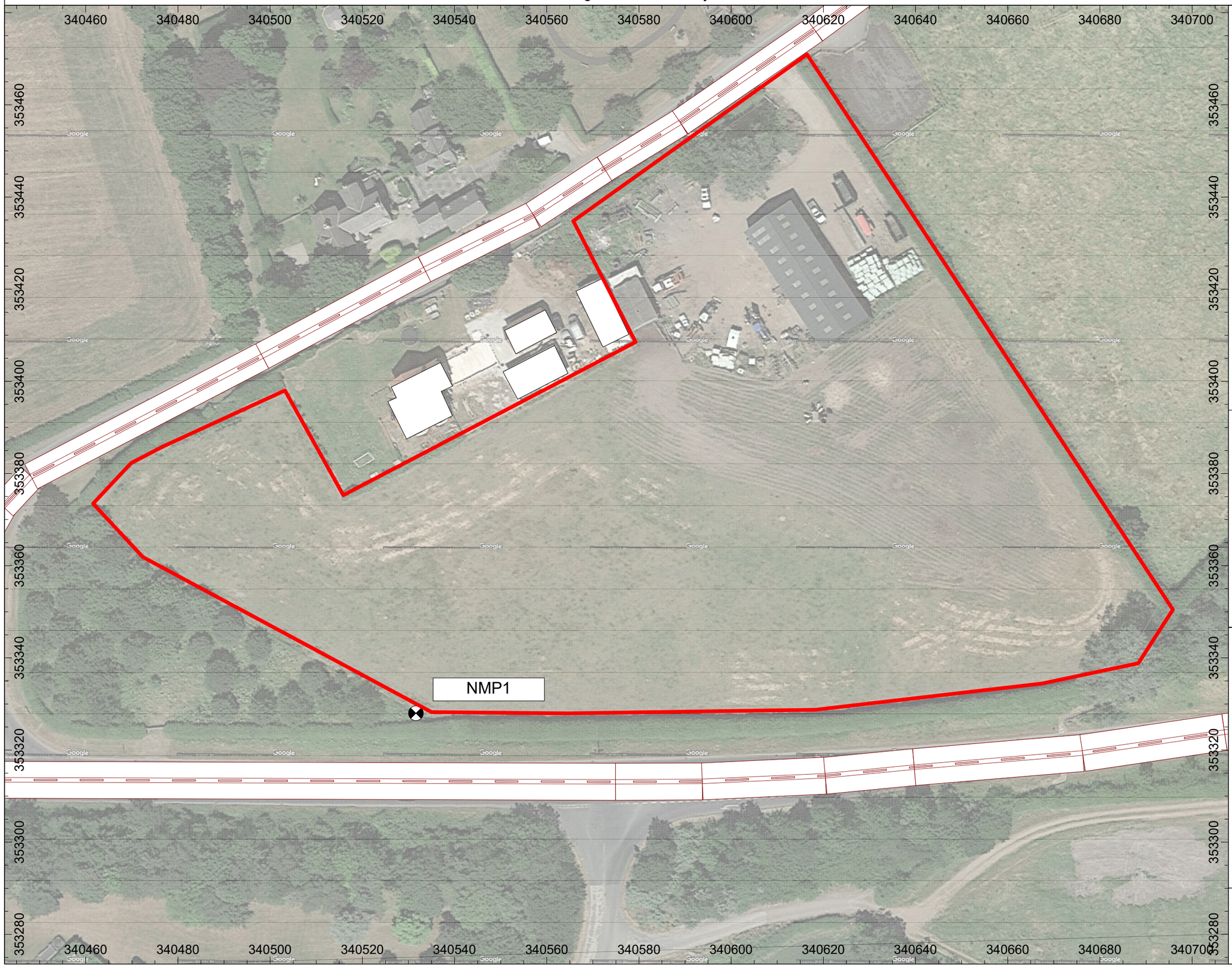
ACOUSTIC TERMINOLOGY

TABLE A2 TERMINOLOGY

DESCRIPTOR	EXPLANATION
dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure (2E-05 Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. "A" weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
$L_{Aeq, T}$	L_{Aeq} is defined as the notional steady sound level which, over a stated period of time (T), would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period.
L_{Amax}	L_{Amax} is the maximum A-weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the "fast" sound level meter response.
L_{10} and L_{90}	If a non-steady noise is to be described, it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L_{10} is the level exceeded for 10% of the time and as such can be regarded as the "average maximum level". Similarly, L_{90} is the "average minimum level" and is often used to describe the background noise. It is common practice to use the L_{10} index to describe traffic noise.
Free-field Level	A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other reflective surfaces. Generally, as measured outside and away from buildings.
Fast	A time weighting used in the root-mean-square section of a sound level meter with a 125-millisecond time constant.
Slow	A time weighting used in the root-mean-square section of a sound level meter with a 1000-millisecond time constant.

APPENDIX II
FIGURES

Figure 1 - Noise Survey Measurement Positions



Project:
Wrexham Road, Holt

Project-No:
50-256

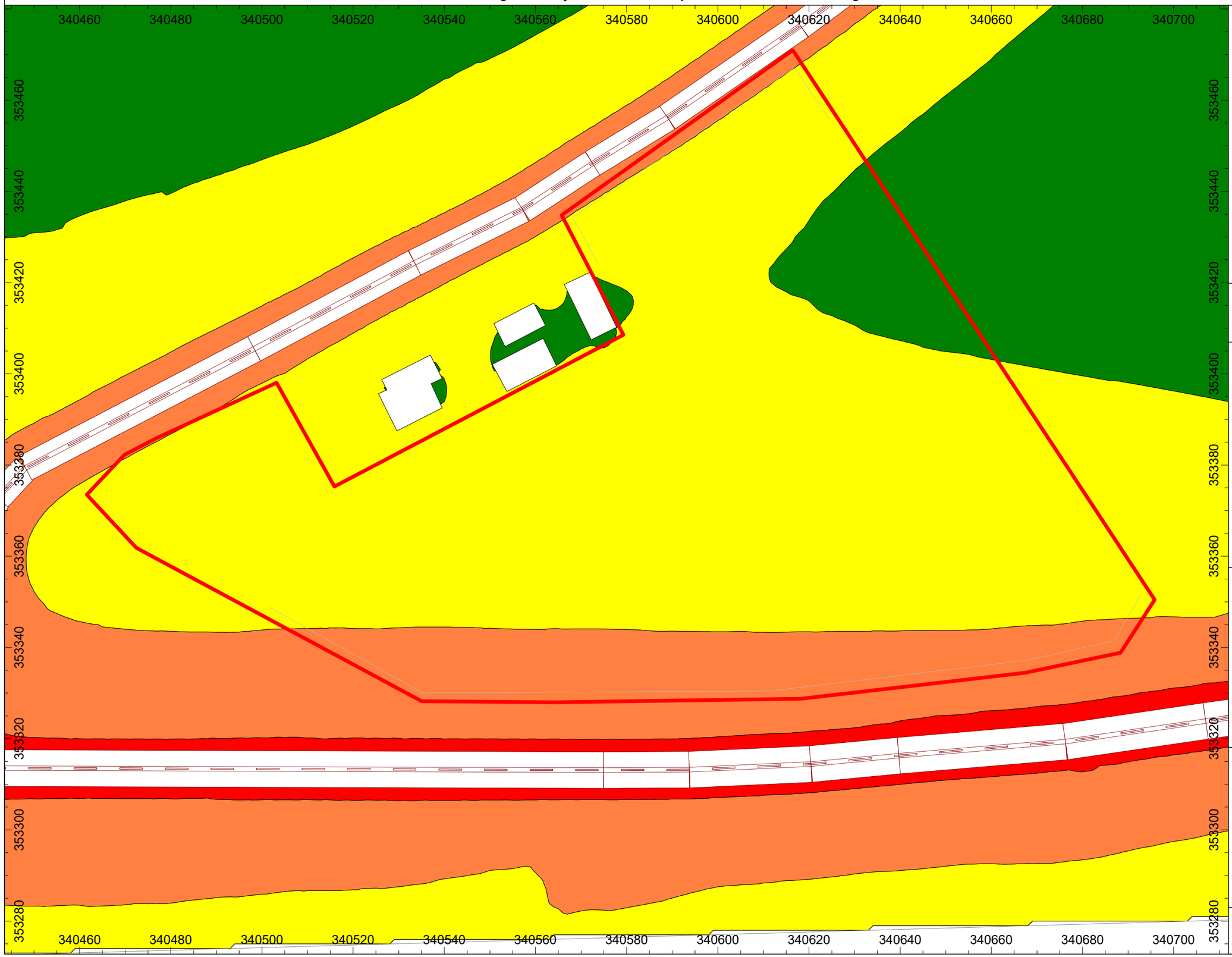
Client:
Pridding Farming Partnership

N

e3p

Project Engineer: L Faulkner
Date: 28/01/2021

Figure 2 - Daytime Grid Noise Map - Calculation at 1.5m above ground level



Project:
Wrexham Road, Holt

Project-No:
50-256

Client:
Pridding Farming Partnership

Daytime Noise Level, LAeq,16hr (dB)

- ... <= 55
- 55 < ... <= 63
- 63 < ... <= 72
- 72 < ... <= 100
- 100 < ...

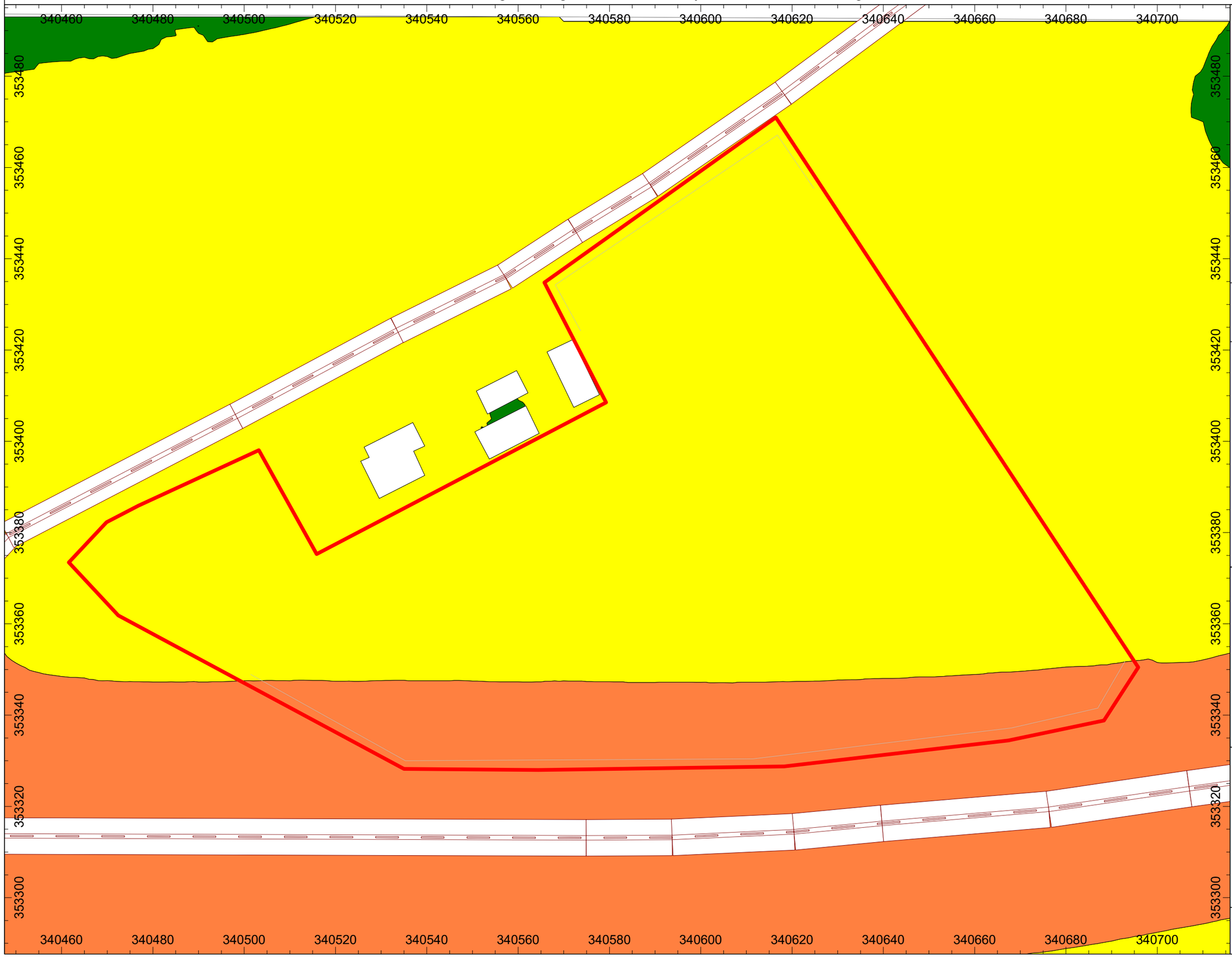
Noise Map Objects

- Road
- Building
- Barrier
- Contour Line
- Calculation Area

e3p

Project Engineer: L Faulkner
Date: 28/01/2021

Figure 3 - Night-time Grid Noise Map - Calculation at 4m above ground level



Project:
Wrexham Road, Holt

Project-No:
50-256

Client:
Pridding Farming Partnership

Night-time Noise Level, LAeq,8hr (dB)

- ... <= 45
- 45 < ... <= 57
- 57 < ... <= 66
- 66 < ... <= 100
- 100 < ...

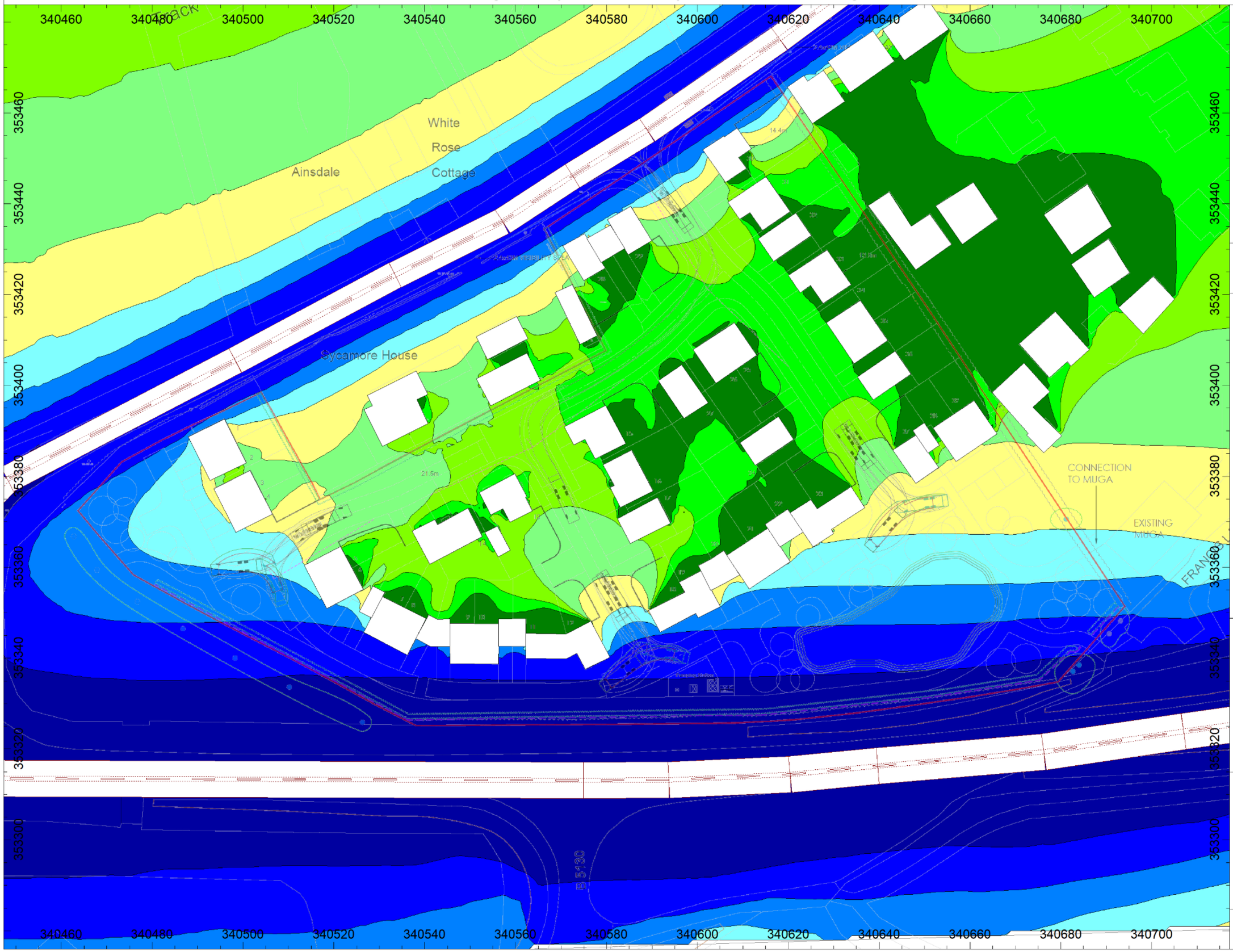
Noise Map Objects

- Road
- Building
- Barrier
- Contour Line
- Calculation Area

e3p

Project Engineer: L Faulkner
Date: 28/01/2021

Figure 4 - Daytime Grid Noise Map - Calculation at 1.5m above ground level



Project:
Wrexham Road, Holt

Project-No:
50-256

Client:
Pridding Farming Partnership

Daytime Noise Level, LAeq,16hr (dB)

- ... <= 48
- 48 < ... <= 50
- 50 < ... <= 52
- 52 < ... <= 56
- 56 < ... <= 58
- 58 < ... <= 60
- 60 < ... <= 62
- 62 < ... <= 65
- 65 < ...

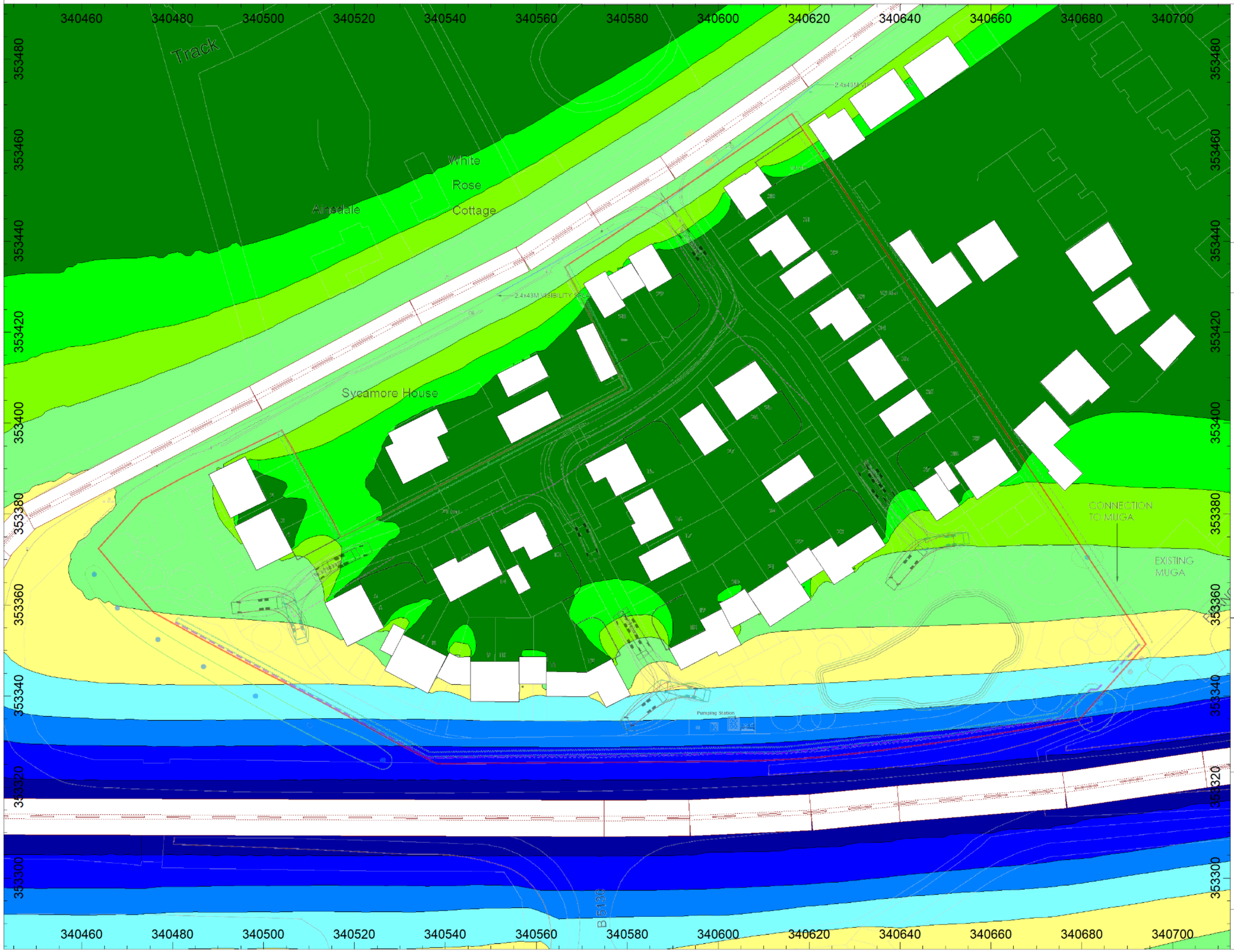
Noise Map Objects

- Road
- Building
- Barrier
- Contour Line
- Calculation Area

e3p

Project Engineer: L Faulkner
Date: 10/12/2021

Figure 5 - Night-time Grid Noise Map - Calculation at 4m above ground level



Project:
Wrexham Road, Holt

Project-No:
50-256

Client:
Pridding Farming Partnership

Night-time Noise Level, LAeq,8hr (dB)

- ... <= 48
- 48 < ... <= 50
- 50 < ... <= 52
- 52 < ... <= 56
- 56 < ... <= 58
- 58 < ... <= 60
- 60 < ... <= 62
- 62 < ... <= 65
- 65 < ...

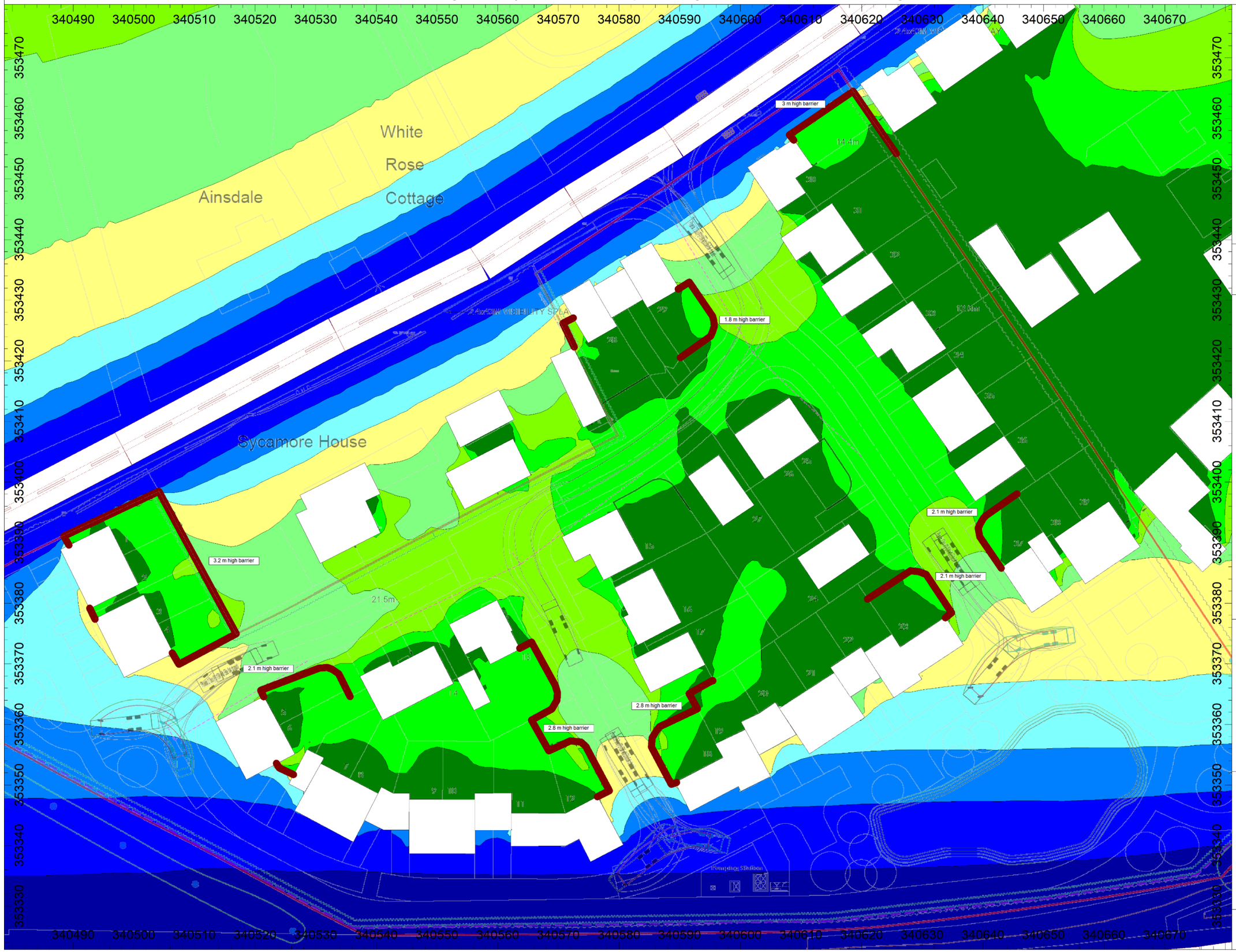
Noise Map Objects

- Road
- Building
- Barrier
- Contour Line
- Calculation Area

e3p

Project Engineer: L Faulkner
Date: 10/12/2021

Figure 6 - Daytime Grid Noise Map with Mitigation - Calculation at 1.5m above ground level



Project:
Wrexham Road, Holt

Project-No:
50-256

Client:
Pridding Farming Partnership

Daytime Noise Level, LAeq,16hr (dB)

- ... <= 48
- 48 < ... <= 50
- 50 < ... <= 52
- 52 < ... <= 56
- 56 < ... <= 58
- 58 < ... <= 60
- 60 < ... <= 62
- 62 < ... <= 65
- 65 < ...

Noise Map Objects

- Road
- Building
- Barrier
- Contour Line
- Calculation Area

e3p

Project Engineer: L Faulkner
Date: 09/06/2022