Noise Impact Assessment

Lower Berse Farm, Wrexham

Reference: 50-311-R1-6

Date: August 2023

NOISE IMPACT ASSESSMENT

Lower Berse Farm,
Wrexham

Prepared for:

Redrow Homes Limited

Report Ref: 50-311-R1-6
Date Issued: 9th August 2023

E3P

Taylor Road
Trafford Park
Urmston
Manchester
M41 7JQ

+ 44 (0) 161 707 9612
https://e3p.co.uk

Registered in England
CRN: 807255262

QUALITY ASSURANCE

PROJECT NUMBER	50-311		
VERSION	Version 1	Version 4	Version 6
REMARKS	Draft for Comment	Final	Final
DATE	17th November 2022	5th June 2023	9th August 2023
PREPARED BY	L Faulkner	L Faulkner	L Faulkner
QUALIFICATIONS	BSc (Hons) MIEnvSci MIOA	BSc (Hons) MIEnvSci MIOA	BSc (Hons) MIEnvSci MIOA
POSITION	Associate Director	Associate Director	Associate Director
CHECKED BY	S Boughton	S Boughton	S Boughton
QUALIFICATIONS	BEng (Hons), AMIOA	BEng (Hons), MIOA	BEng (Hons), MIOA
POSITION	Consultant	Consultant	Consultant
AUTHORISED BY	L Faulkner	L Faulkner	L Faulkner
QUALIFICATIONS	BSc (Hons) MIEnvSci MIOA	BSc (Hons) MIEnvSci MIOA	BSc (Hons) MIEnvSci MIOA
POSITION	Associate Director	Associate Director	Associate Director

EXECUTIVE SUMMARY

BACKGROUND

Site Address	Ruthin Road, Wrexham, LL11 3BX
National Grid Reference	E 331504 N 349940
Proposed Development	Residential development for up to 1520 dwellings, plus associated roads, open space, community facilities, a site for a primary school and a wastewater treatment plant (if necessary).
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 in order to provide a robust assessment.

ASSESSMENT

Surveys Completed	Unattended road traffic sound measurements have been undertaken for Ruthin Road and the A483 during a typical weekday period in accordance with Calculation of Road Traffic Noise. Attended road traffic sound measurements have been undertaken for Bersham Road during a typical weekday period in accordance with CRTN. A full weekday and weekend background and ambient sound measurement has been conducted to quantify baseline levels of noise at receptors closest to the potential wastewater treatment plant.
Assessments	A 3D noise model has been constructed to assess road traffic sound across the site and incident upon facades. An initial site risk assessment has been conducted and advice provided based on the guidance given in ProPG and BS 8233:2014+A1:2019. Plant noise emission limits have been set for the wastewater treatment plant.
Mitigation Requirements	The assessment has provided advice on good acoustic design and provided recommendations on likely mitigation measures. Furthermore, plant noise emission limits have been set for the proposed wastewater treatment plant.

CONCLUSIONS

With good acoustic design measures incorporated into the design and potentially 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.

As such, there are no noise related reasons why planning permission should not be granted from the proposed development as long as the recommendations of this report are followed and included within the design stage.

TABLE OF CONTENTS

EXECUTIVE SUMMARY 2
Background 2
Assessment 2
Conclusions 2

1. INTRODUCTION 5
1.1. Background 5
1.2. Proposed Development 5
1.3. Limitations 5

2. ASSESSMENT METHODOLOGY 6
2.1. Planning Policy Wales (2021) 6
2.1.1. Air Quality and Soundscape 6
2.2. Noise and Soundscape Action Plan 2018-2023 7
2.3. Planning Guidance (wales), Technical Advice Noise (Wales) 11, Noise (1997) 7
2.4. Professional Practice Guidance on Planning & Noise (2017) 9
2.4.1. Element 1 – Demonstrating a "Good Acoustic Design Process" 10
2.4.2. Element 2 – Observing Internal "Noise Level Guidelines" 10
2.4.3. Element 3 – Undertaking an "External Amenity Area Noise Assessment" 11
2.4.4. Element 4 – Consideration of "Other Relevant Issues" 12
2.5. British Standard BS 8233:2014+A1:2019 – Guidance on Sound Insulation and Noise Reduction for Buildings 12
2.5.1. Noise Criteria Limits 12
2.5.2. Ventilation Requirements 13
2.6. World Health Organisation (WHO) – Guidelines for Community Noise 13
2.7. Institute of Acoustics and Association of Noise Consultants (2020) Acoustics Ventilation and Overheating: Residential Design Guide 14

3. SURVEY RESULTS 16
3.1. Road Traffic Sound Measurement – Ruthin Road 16
3.2. Road Traffic Sound Measurement – A483 17
3.3. Road Traffic Sound Measurement – Bersham Road 18
3.4. Unattended Background and Ambient Sound Survey 19

4. INITIAL NOISE RISK ASSESSMENT 21

5. FULL ASSESSMENT 23
5.1. Good Acoustic Design Process 23
5.2. Internal Noise Level Assessment 23
5.3. External Amenity Area Noise Level Assessment 25
5.4. Other Relevant Issues 25
5.5. Wastewater Treatment Plant 25
5.6. Proposed School Site 26

6. MITIGATION STRATEGY AND ACOUSTIC DESIGN STATEMENT 27
6.1. Site Layout and Design 27
6.2. Internal Habitable Rooms – Glazing and Ventilation Requirements 27
6.3. Acoustic Design Statement 28

7. CONCLUSION AND RECOMMENDATIONS 29

APPENDIX I GLOSSARY OF ACOUSTIC TERMINOLOGY 30

APPENDIX II MEASURED SOUND PRESSURE LEVELS 33

APPENDIX III FIGURES 38

1. INTRODUCTION

1.1. BACKGROUND

E3P were commissioned by Redrow Homes to undertake a Noise Impact Assessment for a proposed Residential development for up to 1520 dwellings, plus associated roads, open space, community facilities, a site for a primary school and a wastewater treatment plant (if necessary) at Lower Berse Farm, Ruthin Road, in Wrexham, 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

The client intends to construct up to 1,520 residential dwellings with associated roads, open space, community facilities, primary school and a wastewater treatment plant, if necessary. The key source of sound impacting upon the Site is road traffic associated with Ruthin Road, Bersham Road and the A483. There is potential for new noise sources, such as the wastewater treatment plant, impacting upon proposed and existing receptors.

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

- Masterplan Framework Option 1 (D9730.001F) dated received 7th August 2023.

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 (2021)

2.1.1. AIR QUALITY AND SOUNDSCAPE

Clean air and an appropriate soundscape contribute to a positive experience of place as well as being necessary for public health, amenity and well-being. They are indicators of local environmental quality and integral qualities of place which should be protected through preventative or proactive action through the planning system. Conversely, air, noise and light pollution can have negative effects on people, biodiversity and the resilience of ecosystems and should be reduced as far as possible.

Certain sounds, such as those created by trees, birds or water features, can contribute to a sense of tranquillity whilst others can be reassuring as a consequence of their association with the normality of everyday activities. Problematic forms of sound are generally experienced as noise pollution and can affect amenity and be prejudicial to health or a nuisance. Noise action plans drawn up by public bodies aim to prevent and reduce noise levels where necessary and preserve soundscape quality where it is good. Noise levels used to identify priority areas contained in noise action plans are usually set quite high in order to focus resources on the most polluted areas and noise must meet a number of tests before it qualifies as a statutory nuisance. Lower levels of noise, however, can still be annoying or disruptive and impact on amenity and as such should be protected through the planning process wherever necessary. The planning system must protect amenity and it is not acceptable to rely on statutory nuisance under the Environmental Protection Act 1990 to do so.

The health imperative of good air quality and appropriate soundscapes in contributing to the overall character and quality of places and the health and well-being of people and wildlife should be fully recognised. It will not be appropriate to locate sensitive uses, such as hospitals, schools, care homes and housing adjacent to busy roads or other transport routes, where there are no connectivity benefits to be gained and where health and amenity impacts associated with increased exposure of people to pollution will be unacceptable. Whilst some uses may be appropriate with the aid of good design air quality and soundscape considerations can be overriding factors, especially for sensitive uses, if they cannot be adequately mitigated and impacts minimised.

Where sensitive developments need to be located close to existing transportation infrastructure for sustainable movement and access they should be designed, as far as practicable, to limit harmful substances and noise levels within and around those developments both now and in the future. This may include employing the principles of good acoustic design and the inclusion of active travel or travel management measures as part of development proposals. Such development, however, should preferably be located away from existing sources of significant noise, which may include aircraft noise or roads, particularly new roads or those with programmed route improvements.

Regard should be paid to current air quality and noise levels and the quality of the existing soundscape and account taken of any relevant local air quality action plan, noise action plan and/ or local or regional air quality strategy as part of development strategies and proposals in development plans and before determining planning applications.

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, 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. PROFESSIONAL PRACTICE GUIDANCE ON PLANNING & NOISE (2017)

The Professional Practice Guidance (ProPG) on Planning and Noise has been produced to provide practitioners with guidance on a recommended approach to the management of noise. The guidance encourages better acoustic design for new residential development and aims to protect people from the harmful effects of noise. It aims to complement government planning and noise policy and guidance. In particular, it strives to:

- Advocate full consideration of the acoustic environment from the earliest possible stage of the development control process.
- Encourage the process of good acoustic design in and around new residential developments.
- Outline what should be taken into account in deciding planning applications for new noise-sensitive developments.
- Improve understanding of how to determine the extent of potential noise impact and effect; and
- Assist the delivery of sustainable development.

This ProPG advocates a systematic, proportionate, risk-based, two-stage, approach. The approach encourages early consideration of noise issues, facilitates straightforward accelerated decision-making for lower-risk sites, and assists proper consideration of noise issues where the acoustic environment is challenging.

The two sequential stages of the overall approach are:

- **Stage 1** – An initial noise risk assessment of the proposed development site. It is important that the assessment of noise risk at a proposed residential development site is not the basis for the eventual recommendation to the decision maker. The recommended approach is intended to give an early indication of the likely initial suitability of the site for new residential development from a noise perspective and the extent of the acoustic issues that would be faced.

- **Stage 2** – A systematic consideration of four key elements. These elements are presented in the following four subsections.

2.4.1. ELEMENT 1 – DEMONSTRATING A "GOOD ACOUSTIC DESIGN PROCESS"

It is imperative that acoustic design is considered at an early stage of the development control process. A good acoustic design process takes a multifaceted and integrated approach to achieve optimal acoustic conditions, both internally and externally. Good acoustic design should avoid "unreasonable" acoustic conditions and prevent "unacceptable" acoustic conditions.

2.4.2. ELEMENT 2 – OBSERVING INTERNAL "NOISE LEVEL GUIDELINES"

TABLE 2.2 PROPG INTERNAL NOISE LEVEL GUIDELINES (ADDITIONS TO BS 8233:2014 SHOWN IN BOLD)

ACTIVITY	LOCATION	DAYTIME HOURS (07:00–23:00)	NIGHT-TIME HOURS (23:00–07:00)
Resting	Living Room	35 dB $L_{Aeq,16\ hr}$	–
Dining	Dining Room/Area	40 dB $L_{Aeq,16\ hr}$	–
Sleeping (Daytime Resting)	Bedrooms	35 dB $L_{Aeq,16\ hr}$	30 dB $L_{Aeq,8\ hr}$ 45 dB $L_{Amax,fast}$ [4]

Notes

1) Table 2.2 provides recommended internal L_{Aeq} target levels for overall noise in the design of a building. These are the sum total of structure-borne and airborne noise sources. Ground-borne noise is assessed separately and is not included as part of these targets, as human response to ground-borne noise varies with many factors such as level, character, timing, occupant expectation and sensitivity.

2) The internal L_{Aeq} target levels shown in Table 2.2 are based on the existing guidelines issued by the WHO and assume normal diurnal fluctuations in external noise. In cases where local conditions do not follow a typical diurnal pattern, for example on a road serving a port with high levels of traffic at certain times of the night, an appropriate alternative period, e.g. 1 hour, may be used, but the level should be selected to ensure consistency with the internal L_{Aeq} target levels recommended in the table.

3) These internal L_{Aeq} target levels are based on annual average data and do not have to be achieved in all circumstances. For example, it is normal to exclude occasional events, such as fireworks night or New Year's Eve.

4) Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of Sound Exposure Level (SEL) or $L_{Amax,F,}$ depending on the character and number of events per night. Sporadic noise events could require separate values. In most circumstances, in noise-sensitive rooms at night (e.g. bedrooms), good acoustic design can be used so that individual noise events do not normally exceed 45 dB $L_{Amax,F}$ more than ten times a night. However, where it is not reasonably practicable to achieve this guideline, then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability and regularity of noise events.

5) Designing the site layout and the dwellings so that the internal target levels can be achieved with open windows in as many properties as possible demonstrates good acoustic design. Where it is not possible to meet internal target levels with windows open, internal noise levels can be assessed with windows closed; however, any façade openings used to provide whole-dwelling ventilation (e.g. trickle ventilators) should be assessed in the "open" position and, in this scenario, the internal L_{Aeq} target levels should not normally be exceeded, subject to the further advice in 7).
6) Attention is drawn to the requirements of the building regulations.
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.

2.4.3. ELEMENT 3 – UNDERTAKING AN "EXTERNAL AMENITY AREA NOISE ASSESSMENT"

Advice in BS 8233:2014 provides the following:

> *If external amenity spaces are an intrinsic part of the overall design, the acoustic environment of those spaces should be considered so that they can be enjoyed as intended. The acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50–55 dB $L_{Aeq,16hr}$. These guideline values may not be achievable in all circumstances where development might be desirable. In such a situation, development should be designed to achieve the lowest practicable noise levels in these external amenity spaces.*

Where, despite following a good acoustic design process, significant adverse noise impacts remain on any private external amenity space, then that impact may be partially offset if the residents are provided, through the design of the development or the planning process, with access to:

- A relatively quiet façade or a relatively quiet externally ventilated space as part of their dwelling; and/or
- A relatively quiet alternative or additional external amenity space for sole use by a household; and/or
- A relatively quiet, protected, nearby, external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings; and/or
- A relatively quiet, protected, publicly accessible, external amenity space that is nearby.

2.4.4. ELEMENT 4 – CONSIDERATION OF "OTHER RELEVANT ISSUES"

Some further considerations to make in the second stage of the ProPG overall approach are:

- Compliance with relevant national and local policy.
- Magnitude and extent of compliance with ProPG.
- Likely occupants of the development.
- Acoustic design versus unintended adverse consequences; and
- Acoustic design versus wider planning objectives.

SUBSEQUENT RECOMMENDATIONS

Following the above stages, including the initial site risk assessment and full assessment, a recommendation to the decision maker is determined as follows:

- Grant without noise conditions; or
- Grant with noise conditions; or
- Avoid (significant adverse effects); or
- Prevent (unacceptable adverse effects).

2.5. BRITISH STANDARD BS 8233:2014+A1:2019 – GUIDANCE ON SOUND INSULATION AND NOISE REDUCTION FOR BUILDINGS

2.5.1. 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 undergoing a change of 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.*

2.5.2. 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.*

2.6. WORLD HEALTH ORGANISATION (WHO) – 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"*.

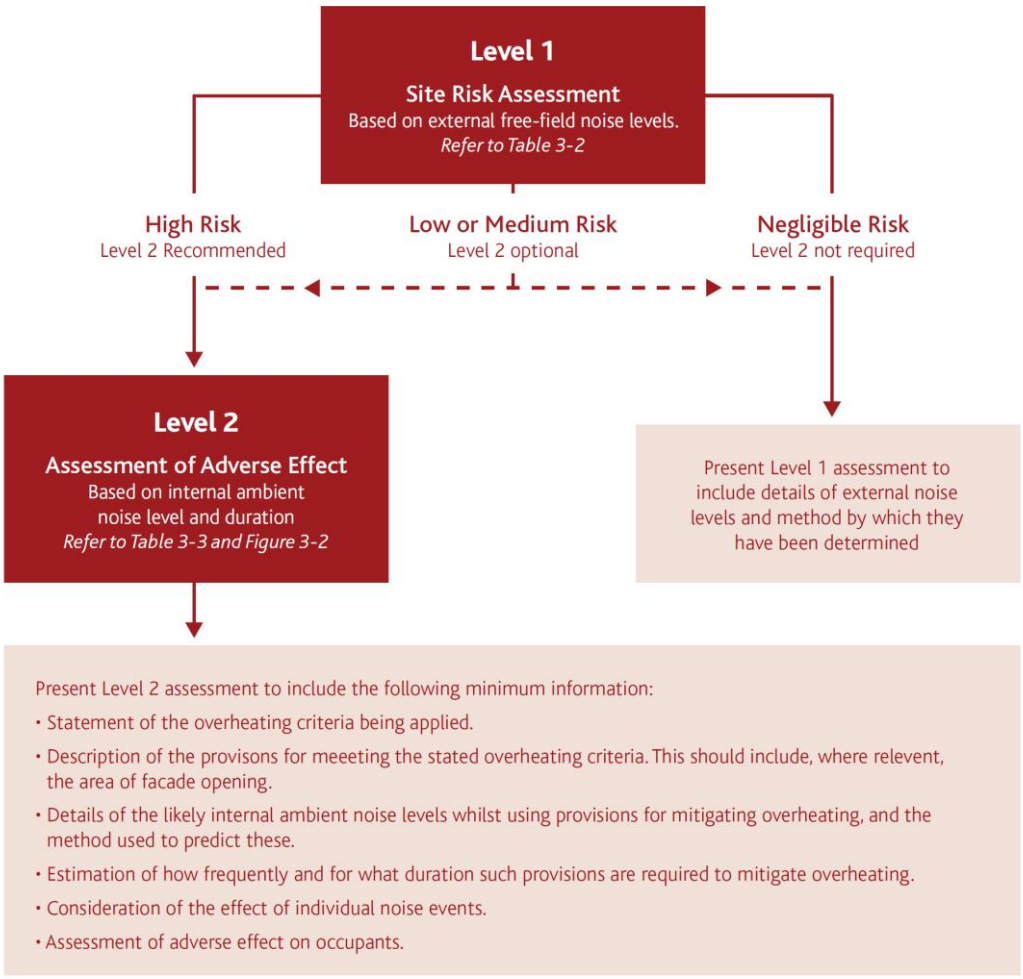
A report was submitted to the WHO in 1995 for consideration as a revision to the 1980 document and revised community guidelines were issued in 2000. In the 2000 guidelines, it is considered that the sleep disturbance criteria should be taken as an internal noise level of 30 dB $L_{Aeq,8\,hr}$ or an external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

2.7. 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

3.1. ROAD TRAFFIC SOUND MEASUREMENT – RUTHIN ROAD

E3P have undertaken a road traffic sound survey over a 24-hour period in accordance with the procedures stated in Calculation of Road Traffic Noise (CRTN) during a typical weekday period. The survey was undertaken during the following period:

- 12:00 Monday 8th November to 12:00 Tuesday 9th November 2021.

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

- Noise Measurement Position 1 (NMP1): Located on the northern boundary of the site approximately 14 m from the roadside edge. The microphone was located at a height of 1.5 m above ground level and in free-field conditions. Sound sources consisted of road traffic sound along Ruthin Road.

Table 3.1 details the measured sound pressure levels.

TABLE 3.1 MEASURED ROAD TRAFFIC SOUND LEVELS – RUTHIN ROAD

MEASUREMENT START TIME	MEASURED SOUND PRESSURE LEVELS (dB)			
	$L_{Aeq,T}$	10th Highest $L_{Amax,fast}$	$L_{A90,T}$	$L_{A10,T}$
12:00	61.9		49.7	64.6
13:00	61.9		49.5	65.6
14:00	61.9		51.2	65.5
15:00	62.4		52.2	65.7
16:00	61.7		53.8	65.3
17:00	60.6	-	51.3	64.3
18:00	61.0		52.5	64.6
19:00	60.3		50.0	64.4
20:00	58.5		47.4	62.8
21:00	57.5		44.2	61.8
22:00	55.1		39.1	59.0
23:00	55.4		40.4	54.2
00:00	51.4		39.2	51.1
01:00	49.0		32.2	48.6
02:00	47.3	72.1	29.1	45.7
03:00	48.2		30.9	44.4
04:00	51.2		33.7	50.1
05:00	57.4		45.9	62.2

MEASUREMENT START TIME	MEASURED SOUND PRESSURE LEVELS (dB)			
	$L_{Aeq,T}$	10th Highest $L_{Amax,fast}$	$L_{A90,T}$	$L_{A10,T}$
06:00	59.6		49.3	64.6
07:00	62.7		53.3	66.3
08:00	62.6		54.6	65.5
09:00	61.6	-	51.3	65.2
10:00	61.1		51.1	64.4
11:00	60.9		51.4	64.4
Derived Daytime Noise Level, $L_{Aeq,16hr}$				**61.1**
Derived Night-time Noise Level, $L_{Aeq,8hr}$				**54.6**

3.2. ROAD TRAFFIC SOUND MEASUREMENT – A483

E3P have undertaken a road traffic sound survey over a 24-hour period in accordance with the procedures stated in Calculation of Road Traffic Noise (CRTN) during a typical weekday period. The survey was undertaken during the following period:

- 12:00 Monday 8th November to 12:00 Tuesday 9th November 2021.

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

- Noise Measurement Position 2 (NMP2): Located on the western boundary of the site approximately 9 m from the roadside edge. The microphone was located at a height of 1.5 m above ground level and in free-field conditions. Sound sources consisted of road traffic sound along the A483.

Table 3.2 details the measured sound pressure levels.

TABLE 3.2 MEASURED ROAD TRAFFIC SOUND LEVELS – A483

MEASUREMENT START TIME	MEASURED SOUND PRESSURE LEVELS (dB)			
	$L_{Aeq,T}$	10th Highest $L_{Amax,fast}$	$L_{A90,T}$	$L_{A10,T}$
12:00	66.1		61.7	68.5
13:00	66.1		61.7	68.4
14:00	66.1		61.7	68.5
15:00	66.5	-	62.0	68.9
16:00	67.5		63.8	69.6
17:00	68.6		65.4	70.6
18:00	67.5		64.2	69.4
19:00	67.3		63.1	69.4

MEASUREMENT START TIME	MEASURED SOUND PRESSURE LEVELS (dB)			
	$L_{Aeq,T}$	10th Highest $L_{Amax,fast}$	$L_{A90,T}$	$L_{A10,T}$
20:00	65.2		59.5	68.0
21:00	64.1		55.8	67.3
22:00	61.3		51.3	65.2
23:00	60.3	76.3	46.3	64.4
00:00	58.4		43.8	62.8
01:00	56.7		40.5	61.2
02:00	54.7		33.3	59.2
03:00	53.6		30.8	56.9
04:00	54.2		33.3	57.9
05:00	57.0		40.2	61.7
06:00	62.7		53.8	66.3
07:00	66.0	-	60.9	68.7
08:00	67.9		64.4	69.9
09:00	67.7		64.0	69.9
10:00	66.8		62.9	68.9
11:00	66.3		62.5	68.6
Derived Daytime Noise Level, $L_{Aeq,16hr}$				**66.6**
Derived Night-time Noise Level, $L_{Aeq,8hr}$				**58.3**

3.3. ROAD TRAFFIC SOUND MEASUREMENT – BERSHAM ROAD

E3P have undertaken a road traffic sound survey in accordance with the shortened measurement procedure given in Calculation of Road Traffic Noise (CRTN) during a typical weekday period. The survey was undertaken during the following period:

- 11:30-13:30 Monday 8th November 2021.

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

- Noise Measurement Position 3 (NMP3): Located on the southern boundary of the site approximately 4 m from the roadside edge. The microphone was located at a height of 1.5 m above ground level and in free-field conditions. Sound sources consisted of road traffic along Bersham Road

Table 3.3 details the measured sound pressure levels.

TABLE 3.3 MEASURED ROAD TRAFFIC SOUND LEVELS – BERSHAM ROAD

MEASUREMENT START TIME	MEASURED SOUND PRESSURE LEVELS (dB)			
	$L_{Aeq,T}$	10th Highest $L_{Amax,fast}$	$L_{A90,T}$	$L_{A10,T}$
11:30	69.1	79.5	38.4	60.5
12:30	59.8		38.7	60.8
13:30	58.8		37.6	58.6
Derived Daytime Noise Level, $L_{Aeq,16hr}$				**57.0**
Derived Night-time Noise Level, $L_{Aeq,8hr}$				**49.3**

3.4. UNATTENDED BACKGROUND AND AMBIENT SOUND SURVEY

E3P have undertaken an unattended background and ambient sound survey in a position considered representative of the closest receptors to the proposed wastewater treatment plant.

The survey was carried out over the following time periods:

- 15:00 Thursday 13th October to 12:00 Tuesday 18th October 2022.

The following noise measurement position was chosen for the Background Sound Survey:

- Noise Measurement Position 4 (NMP4): Located in the south eastern area of the Site, equidistant from Bersham Road as the closest existing plots to the proposed wastewater treatment plant. The microphone of the sound level meter was set at a height of 1.2 m above ground level and in free-field conditions. Sound sources consisted of road traffic on the local road network.

Table 3.4 details the measured background sound levels. The daytime levels correspond to the $L_{A90,1hr}$ and the night-time levels to the $L_{A90,15mins}$.

TABLE 3.4 MEASURED BACKGROUND SOUND PRESSURE LEVELS

DATE	TIME PERIOD	RANGE OF MEASURED BACKGROUND SOUND LEVELS, $L_{A90,T}$ (dB)	MODAL MEASURED BACKGROUND SOUND LEVEL, $L_{A90,T}$ (dB)
Thursday 13th October 2022	Daytime	37.4-46.4	43
	Night-time	28.5-45.6	35
Friday 14th October 2022	Daytime	39.3-48.7	43
	Night-time	30.5-44.5	**33**
Saturday 15th October 2022	Daytime	43.1-51.3	47
	Night-time	38.3-46.1	42
Sunday 16th October 2022	Daytime	33.9-46.0	**41**
	Night-time	28.8-48.7	35
	Daytime	34.6-54.0	50

DATE	TIME PERIOD	RANGE OF MEASURED BACKGROUND SOUND LEVELS, $L_{A90,T}$ (dB)	MODAL MEASURED BACKGROUND SOUND LEVEL, $L_{A90,T}$ (dB)
Monday 17th October 2022	Night-time	26.8-49.6	34

The levels highlighted above are the lowest measured modal levels to be used to inform a worst case assessment.

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

The equipment outlined in Table 3.5 was used for the noise survey.

TABLE 3.5 NOISE MEASUREMENT EQUIPMENT AND CALIBRATION DATES

MEASUREMENT POSITION	EQUIPMENT DESCRIPTION	MANUFACTURER & TYPE NUMBER	SERIAL NUMBER	CALIBRATION DUE DATE AT TIME OF SURVEY
NMP1	Sound Level Meter	01dB Fusion	12039	30/06/2023
	Pre-amplifier	01dB Pre22	1805124	
	Microphone	GRAS 40CE	330832	
	Calibrator	01dB Cal31	87281	03/02/2023
NMP2	Sound Level Meter	Cirrus CR:171B	G301925	27/11/2022
	Pre-amplifier	Cirrus MV:200F	10730F	
	Microphone	Cirrus MK:224	213437D	
	Calibrator	Cirrus CR:515	93700	27/11/2021
NMP3	Sound Level Meter	Norsonic Nor145	14529152	18/06/2023
	Pre-amplifier	Norsonic Nor1209	22293	
	Microphone	Norsonic Nor1227	332220	
	Calibrator	Norsonic Nor1255	125525208	08/06/2023

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

4. INITIAL NOISE RISK ASSESSMENT

The noise risk assessment should provide an indication of the likely risk of adverse effects from noise where no subsequent mitigation is to be included as part of the development proposal. It should indicate whether the proposed site is considered to pose a negligible, low, medium or high risk from a noise perspective. The risk assessment should not include the impact of any new or additional mitigation measures that may subsequently be included in development proposals for the site and proposed as part of a subsequent planning application.

Accordingly, a site noise risk assessment has been undertaken for road traffic noise.

For the purposes of this assessment, E3P have used noise modelling software, CadnaA 2023 MR2, to determine the impact of noise from the surrounding roads.

The following inputs have been included in the model:

- Masterplan Framework Option 1
- Existing Site elevations in the form of 2m contours from a Digital Terrain Model (DTM) which contains public sector information licensed under the Open Government License v3.0.
- Existing buildings that provide shielding from any of the noise sources have been included in the model.
- Ground absorption is set at 0.5.
- 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* have been incorporated into CadnaA software.

Figures 2 and 3 in Appendix III represent the noise levels across the site during the daytime and night-time periods, respectively.

Figure 2 determines that noise levels range between 46 dB and up to 69 dB within the red line boundaries. This results in the majority of the site being **"Negligible Risk"** with areas closest to the roads ranging between **"Low Risk"** and **"Medium Risk"** for areas close to the A483 during daytime periods.

For night-time periods, Figure 3 determines that noise levels range between 41 dB and up to 65 dB within the red line boundaries. This results in the site being between **"Negligible Risk"** for the majority of the areas and **"High Risk"** for areas that border the A483.

The pre-planning application advice is as follows:

NEGLIGIBLE RISK

> *These noise levels indicate that the development site is likely to be acceptable from a noise perspective, and the application need not normally be delayed on noise grounds.*

Accordingly, with regards the majority of the Site, particularly parcels B, C, K, L and M there should be no adverse impact in regard to noise and mitigation measures are not likely to be required.

LOW RISK

> *At low noise levels, the site is likely to be acceptable from a noise perspective provided that a good acoustic design process is followed and is demonstrated in an acoustic design statement (ADS) which confirms how the adverse impacts of noise will be mitigated and minimised in the finished development.*

For these areas, areas centrally and towards the roads, specifically parcels A and E, careful consideration of site layout may be required to minimise the requirements of mitigation. This applies primarily to the areas closest to the roads within these areas. However, mitigation measures may be suitable in controlling noise where appropriate site design is not possible due to other factors.

MEDIUM RISK

> *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.*

Areas along the boundaries with the roads of **"Medium Risk"** and an acoustic design statement (ADS) will be required to ensure that everything possible has been done to design the layout with acoustics in mind. Additionally, mitigation measures such as acoustic barriers, mechanical ventilation and/or higher-specification glazing may still be required following this process.

HIGH RISK

> *High noise levels indicate that there is an increased risk that development may be refused on noise grounds. This risk may be reduced by following a good acoustic design process that is demonstrated in a detailed ADS. Applicants are strongly advised to seek expert advice.*

Some areas, at night, along the A483 are subject to high risk. But this is based on the assumption for the potential for dwelling facades on the boundary. Given this applied to internal bedroom areas, consideration will be given to glazing and ventilation requirements if Good Acoustic Design is not possible.

5. FULL ASSESSMENT

The assessment outlined in Section 4 has been used for the basis of the full assessment in relation to transportation sound.

5.1. GOOD ACOUSTIC DESIGN PROCESS

Good acoustic design should avoid "unreasonable" acoustic conditions and prevent "unacceptable" acoustic conditions. Good acoustic design is not just compliance with recommended internal and external noise exposure standards. Good acoustic design 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 some developable areas to fall within "Medium Risk" along the boundary with the roads, 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 roads 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. This is essential in parcels D, F, G, I, H, J and N.
- Gaps between dwellings along the above boundaries should be kept to a minimum to avoid noise creep into the gardens behind.
- Wherever possible, windows for habitable rooms should face away from the noise sources, especially given the potential for high risk areas at night in parcel N, 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.

5.2. INTERNAL NOISE LEVEL ASSESSMENT

Due to the outline nature of the application for the residential aspect, detailed assessments are not possible. Accordingly, it is assumed that habitable rooms are located along the road.

With regards internal noise levels, BS 8233:2014 suggests that a glazing unit with configuration 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 "+$C_{t,r}$" correction, has a sound insulation performance value of approximately 25 dB and so this value has been used to calculate internal noise levels. The AVO Guide suggests that a partially open window provides approximately 13 dB attenuation.

In order to assess the potential for higher specification glazing, the worst-case day and night-time noise levels in each parcel are considered:

- Parcel A – 52 dB day and 46 dB night – standard glazing sufficient.
- Parcel B and C – 49 dB day and 45 dB night – standard glazing sufficient.
- Parcel D – 61 dB day and 55 dB night – **higher specification needed for plots closest to the road.**
- Parcel E – 52 dB day and 46 dB night – standard glazing sufficient.
- Parcel F – 63 dB day and 58 dB night **– higher specification needed for plots closest to the road.**
- Parcel G – 57 dB day and 52 dB night – standard glazing sufficient.
- Parcel H – 62 dB day and 57 dB night – **higher specification needed for plots closest to the road.**
- Parcel I – 63 dB day and 57 dB night – **higher specification needed for plots closest to the road.**
- Parcel J –59 dB day and 54 dB night – standard glazing sufficient.
- Parcel K - 55 dB day and 50 dB night – standard glazing sufficient.
- Parcel L – 47 dB day and 41 dB night – standard glazing sufficient.
- Parcel M – 57 dB day and 50 dB night – standard glazing sufficient.
- Parcel N – 68 dB day and 63 dB night – **higher specification needed for plots closest to the road.**
- Wastewater Treatment Plant Parcel (should it be used for residential use) - 55 dB day and 47 dB night – standard glazing sufficient.

As such, higher specification glazing may be required for living rooms and bedrooms located close to the roads in the highlighted parcels, providing, at most 33 dB $R_w + C_{t,r}$. Furthermore, with a partially open window, the internal levels would be exceeded in most parcels, accordingly, a whole dwelling ventilation system will be required, for ventilation and potentially for mitigating overheating, for any living rooms and bedrooms closest to the roads.

With regards whole dwelling ventilation, it has been assumed that the standard systems in accordance with Approved Document F would be installed and that open windows would be used for purge ventilation and to mitigate overheating. Mitigation of overheating would need to be addressed at the detailed design stage and would dictate the type of system to be installed.

With regards the maximum instantaneous noise levels at night, the 10th highest maximum noise level for Ruthing Road was 72 dB, for the A483 was 76 dB and for Bersham Road was 80 dB. These levels are taken as representative of the closest proposed facades. With windows closed, internal maximum noise levels would be exceeded along Bersham Road only. This exceedance would be 4 dB and so glazing performance of at least 35 dB R_w may be required for bedrooms immediately along Bersham Road

5.3. EXTERNAL AMENITY AREA NOISE LEVEL ASSESSMENT

Figure 2 in Appendix III shows that noise levels range from 46 dB up to 69 dB within the proposed developable areas during the daytime periods. Accordingly, areas along the road/s may experience an exceedance of the 50–55 dB criteria given in BS 8233:2014 and ProPG. There is provision for the 55 dB criteria to be exceeded, 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 in accordance with ProPG, which should achieve levels below the 55 dB criteria for the worst-affected areas. The remainder of the site is subject to levels below 55 dB.

Where good acoustic design is not possible and is justified, particularly in parcel N, mitigation measures in the form of acoustic barriers will be required in order to achieve, at least, the lowest practicable levels. 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.

Acoustic barriers can provide up to 18.4 dB attenuation but, given that garden fences will be used, the actual attenuation is likely to range between 5 dB and 10 dB. Accordingly, the highest permissible height of barriers would be required in certain parcels, in order to achieve levels of up to 58 dB which is not likely to be acceptable. As such, good acoustic design is paramount along the A483 as 55 dB will not be achieved if gardens back on to the road.

5.4. OTHER RELEVANT ISSUES

The ProPG 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.

5.5. WASTEWATER TREATMENT PLANT

At this stage, information in relation to the wastewater treatment works is limited. As such, E3P have looked to set plant noise emission limits for the proposed plant so as not to cause adverse impact at the closest existing or proposed receptors.

Accordingly, the rating level, as calculated using BS 4142:2014+A1:2019, should not exceed the background sound level at the closest receptor, day or night. The lowest modal background sound levels are noted to be 41 dB during the day and 33 dB during the night.

It is recommended that a detailed Noise Assessment of the wastewater treatment plant is undertaken when a fixed layout and noise level data is available for the proposed plant. This should be conducted by a competent person and in accordance with BS 4142:2014+A1:2019 and accounting for any potential acoustic feature corrections, in this case any potential tonality.

Additionally, the wastewater treatment plant is in close proximity to the school. However, the school receptors would not be subject to a BS 4142 assessment and, as such, an additional limit is required for the school.

In order to ensure the most sensitive room criterion is achieved at the school, 30 dB, it is reasonable to set a limit of 43 dB from the wastewater treatment plant so that this criterion can be achieved with windows open.

In addition to the above, E3P are in receipt of a Letter of Support in relation to the Wastewater strategy from Severn Trent Connect. Within this document, typical noise levels from an existing plant in Petersfield are provided via an appended Noise Assessment undertaken by Accon UK. Within this document, an attenuated specific noise level of 39 dB at 20 m is provided. Assuming a receptor would not be within 50 m of the centre of the WWTW, a noise level of no more than 31 dB is expected. This falls comfortably below the required limits.

5.6. PROPOSED SCHOOL SITE

At this stage, no detail is provided beyond the highlighted parcel for the school. As such, a basic assessment considering outdoor teaching areas and façade noise levels has been conducted.

The highest daytime noise level noted at this parcel is 48 dB. This level falls comfortably below a level of 50 dB which would be considered acceptable for outdoor teaching areas or playing fields.

Assuming standard thermal double glazing, an internal noise level of up to 23 dB is expected. This falls well below the most stringent internal criterion (Ensemble room, recording studio or teaching space intended specifically for students with special hearing and communication needs) at 30 dB.

Accordingly, no good acoustic design measures are necessary at the school and acceptable noise levels can be achieved without the need for any mitigation, except for potential ventilation.

However, it is important to note the school's proximity to the wastewater treatment plant and noise limits have been set above.

6. MITIGATION STRATEGY AND ACOUSTIC DESIGN STATEMENT

6.1. SITE LAYOUT AND DESIGN

With regards to the A483 and parcels along this road, the following design features are recommended:

- 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 road should be kept to a minimum to avoids noise creep into the gardens behind.
- 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.

With regards to Ruthin Road and parcels along this road, the following design features are recommended:

- Plots bounding the road should, ideally, be orientated such that the garden areas are protected by the building envelope. However, acoustic barriers are likely to be sufficient.
- Gaps between dwellings along the boundaries with the road should be kept to a minimum to avoids noise creep into the gardens behind.
- 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.

With regards to Bersham Road and parcels along this road, no particular measures are required to be incorporated into the design given the negligible impact.

6.2. INTERNAL HABITABLE ROOMS – GLAZING AND VENTILATION REQUIREMENTS

Section 5 has indicated that habitable rooms located on the boundary with the A483 and/or Ruthin Road may require higher specification glazing of up to 33 dB $R_W + C_{t,r}$. The remainder of the site can achieve acceptable internal noise levels with standard thermal double glazing.

It was determined that, with a partially open window, the internal noise levels for habitable rooms closest to the roads will exceed the internal target criteria when habitable rooms cannot be orientated away from the source.

However, it is assumed that a whole dwelling ventilation system, in accordance with ADF, will be installed which will satisfy any requirements here. However, this may not be sufficient following an overheating assessment at the detailed design stage.

Ideally, any inlet for fresh air should be located away from the noise source to ensure that the freshest air available is brought into the habitable rooms.

6.3. ACOUSTIC DESIGN STATEMENT

The majority of the Site is of **"Negligible to Low Risk"** and there should be no adverse impact in regards to noise and mitigation measures are not likely to be required.

With regards to **"Low Risk"**, areas, this applies to the areas that experience noise levels of between 50 dB and 60 dB. For these areas, careful consideration of site layout may be required to minimise the requirements of mitigation. However, mitigation measures are likely to be suitable in controlling noise where appropriate site design is not possible due to other factors.

Any plots located along the boundaries with Ruthin Road and close to the A483 will experience noise levels of **"Medium Risk",** with potential for high-risk areas at night in parcel N, and good acoustic design is required to ensure that everything possible has been done to design the layout with acoustics in mind. Additionally, mitigation measures such as acoustic barriers, whole dwelling ventilation and/or higher-specification glazing may still be required following this process.

In external areas, the assessment determined that noise levels range from 46 dB up to 69 dB within the developable areas during the daytime periods. Accordingly, areas along the road will experience an exceedance of the 50–55 dB criteria given in BS 8233:2014 and ProPG. Accordingly, it is recommended that good acoustic design is followed, which should achieve levels below the 55 dB criteria for the worst-affected areas. Most of the site is subject to levels below 55 dB.

The assessment has indicated that most habitable rooms will experience acceptable internal noise levels with standard thermal double glazing that provides at least 25 dB $R_W + C_{t,r}$. Higher specification glazing may be required for habitable rooms close to the roads. With a partially open window, the internal noise levels for the habitable rooms facing and along the road will exceed the internal target criteria when habitable rooms cannot be orientated away from the source.

Due to certain areas of the site being of **"Medium Risk"**, good acoustic design and/or mitigation measures will be required. As such, the adverse impacts of noise will be mitigated and minimised as follows:

- Good acoustic design, with gardens behind dwellings facing the road.
- Habitable rooms facing away from the noise source or implementation of whole dwelling ventilation systems.

7. CONCLUSION AND RECOMMENDATIONS

E3P were commissioned by Redrow Homes to undertake a Noise Constraints Assessment for a proposed residential led development on land off Ruthin Road in Wrexham.

Road traffic sound measurements have been undertaken for Ruthin Road, the A483 and Bersham Road. Additionally, a full weekday and weekend background and ambient sound survey has been conducted in a position representative of receptors closest to the proposed wastewater treatment plant.

With regards to road traffic sound, this is assessed in accordance with the criterion, for day and night, given in BS 8233:2014 along with advice given in ProPG. The model has predicted noise levels in gardens and incident upon proposed facades. Furthermore, an initial noise risk assessment has been undertaken which determined most of the site was subject to negligible risk with only areas close to the roads being of low to high risk.

The assessment has recommended good acoustic design is implemented along Ruthin Road and the A483 so that rear garden areas are protected by the building envelope to negate the need for unduly high barriers or, alternatively, other uses located here to act as buffers. Where habitable rooms cannot be orientated away from the sound source, higher specification glazing and a whole dwelling ventilation system is likely to be required for dwellings close to the roads, depending on the final layout.

With good acoustic design measures followed and mitigation measures in place, this assessment has shown that no adverse impact is predicted day or night at the receptors.

Plant noise emission limits have been set for the proposed wastewater treatment plant in the absence of detail.

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.

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
MEASURED SOUND PRESSURE LEVELS

TABLE A1 MEASURED SOUND PRESSURE LEVELS – NMP4

MEASUREMENT START TIME	MEASURED SOUND PRESSURE LEVELS (dB)	
	$L_{Aeq,T}$	$L_{A90,T}$
13/10/2022 15:00	46.2	42.3
13/10/2022 16:00	47.6	43.8
13/10/2022 17:00	49.0	46.4
13/10/2022 18:00	48.4	45.5
13/10/2022 19:00	47.0	42.9
13/10/2022 20:00	44.7	41.1
13/10/2022 21:00	44.4	40.9
13/10/2022 22:00	41.9	37.4
13/10/2022 23:00	39.3	35.2
14/10/2022 00:00	35.5	31.1
14/10/2022 01:00	36.1	29.9
14/10/2022 02:00	38.2	31.2
14/10/2022 03:00	40.0	34.2
14/10/2022 04:00	39.3	34.1
14/10/2022 05:00	42.8	38.1
14/10/2022 06:00	47.4	41.1
14/10/2022 07:00	49.0	43.7
14/10/2022 08:00	55.6	44.7
14/10/2022 09:00	52.0	42.3
14/10/2022 10:00	46.0	39.3
14/10/2022 11:00	48.8	41.1
14/10/2022 12:00	50.4	45.4
14/10/2022 13:00	49.7	47.4
14/10/2022 14:00	51.0	48.7
14/10/2022 15:00	50.5	48.2
14/10/2022 16:00	48.8	45.0
14/10/2022 17:00	46.4	41.7
14/10/2022 18:00	42.7	40.0
14/10/2022 19:00	43.1	40.3
14/10/2022 20:00	44.1	40.9
14/10/2022 21:00	45.5	42.1
14/10/2022 22:00	42.6	39.8



MEASUREMENT START TIME	MEASURED SOUND PRESSURE LEVELS (dB)	
	$L_{Aeq,T}$	$L_{A90,T}$
14/10/2022 23:00	41.8	37.1
15/10/2022 00:00	41.2	35.5
15/10/2022 01:00	39.5	33.8
15/10/2022 02:00	36.9	32.5
15/10/2022 03:00	36.3	31.3
15/10/2022 04:00	37.3	31.9
15/10/2022 05:00	40.4	36.3
15/10/2022 06:00	43.2	39.8
15/10/2022 07:00	52.1	45.8
15/10/2022 08:00	49.7	46.6
15/10/2022 09:00	52.3	49.5
15/10/2022 10:00	50.0	47.6
15/10/2022 11:00	51.2	48.7
15/10/2022 12:00	54.8	48.6
15/10/2022 13:00	51.8	47.4
15/10/2022 14:00	58.5	51.3
15/10/2022 15:00	52.1	50.1
15/10/2022 16:00	50.8	48.6
15/10/2022 17:00	49.6	47.0
15/10/2022 18:00	54.7	48.5
15/10/2022 19:00	58.9	46.6
15/10/2022 20:00	47.1	44.4
15/10/2022 21:00	45.8	43.1
15/10/2022 22:00	51.7	44.3
15/10/2022 23:00	51.1	41.3
16/10/2022 00:00	45.8	40.0
16/10/2022 01:00	51.5	40.7
16/10/2022 02:00	49.4	41.8
16/10/2022 03:00	46.8	40.5
16/10/2022 04:00	45.7	39.0
16/10/2022 05:00	47.4	42.3
16/10/2022 06:00	49.3	44.5
16/10/2022 07:00	48.7	46.0

MEASUREMENT START TIME	MEASURED SOUND PRESSURE LEVELS (dB)	
	$L_{Aeq,T}$	$L_{A90,T}$
16/10/2022 08:00	46.4	40.4
16/10/2022 09:00	44.0	39.6
16/10/2022 10:00	43.8	40.6
16/10/2022 11:00	44.3	39.8
16/10/2022 12:00	45.8	39.4
16/10/2022 13:00	44.8	42.1
16/10/2022 14:00	46.3	41.8
16/10/2022 15:00	43.8	41.0
16/10/2022 16:00	42.0	38.1
16/10/2022 17:00	43.3	40.1
16/10/2022 18:00	43.2	41.6
16/10/2022 19:00	43.5	41.6
16/10/2022 20:00	41.2	38.6
16/10/2022 21:00	40.3	36.2
16/10/2022 22:00	37.7	33.9
16/10/2022 23:00	36.8	33.6
17/10/2022 00:00	35.4	30.4
17/10/2022 01:00	38.4	30.6
17/10/2022 02:00	43.4	31.9
17/10/2022 03:00	38.0	32.2
17/10/2022 04:00	39.9	35.5
17/10/2022 05:00	46.6	41.8
17/10/2022 06:00	49.8	46.9
17/10/2022 07:00	50.7	48.9
17/10/2022 08:00	52.3	49.8
17/10/2022 09:00	52.4	48.9
17/10/2022 10:00	57.2	50.3
17/10/2022 11:00	59.4	50.3
17/10/2022 12:00	63.4	54.0
17/10/2022 13:00	59.8	50.7
17/10/2022 14:00	55.1	49.8
17/10/2022 15:00	56.7	51.2
17/10/2022 16:00	53.9	49.2



MEASUREMENT START TIME	MEASURED SOUND PRESSURE LEVELS (dB)	
	$L_{Aeq,T}$	$L_{A90,T}$
17/10/2022 17:00	49.8	47.6
17/10/2022 18:00	49.6	47.0
17/10/2022 19:00	48.6	45.9
17/10/2022 20:00	45.1	39.5
17/10/2022 21:00	47.0	39.8
17/10/2022 22:00	40.1	34.6
17/10/2022 23:00	38.4	32.7
18/10/2022 00:00	33.6	29.1
18/10/2022 01:00	34.7	28.3
18/10/2022 02:00	39.7	32.9
18/10/2022 03:00	39.9	34.8
18/10/2022 04:00	44.0	37.1
18/10/2022 05:00	46.7	42.9
18/10/2022 06:00	49.8	45.9
18/10/2022 07:00	53.5	51.0
18/10/2022 08:00	52.6	49.8
18/10/2022 09:00	52.8	47.3
18/10/2022 10:00	45.5	39.5
18/10/2022 11:00	54.9	39.8

APPENDIX III
FIGURES

Figure 1 - Noise Measurement Positions



1 Residential development up to 1430 dwellings
2 Two site access points onto the A525 Ruthin Road
3 Two site access points onto Bersham Road
4 Main access roads suitable for buses with active travel walking and cycling routes, tree avenue planting and landscape verges with swales
5 Site for a primary school up to 2FE located close to the existing high school
6 Provision of a wastewater treatment plant (if necessary) at the lowest part of the site or, if the treatment plant is not required then additional
7 Local centre reflecting historic courtyard layout with Lower Berse Farmhouse and associated buildings of heritage value retained and
8 Development blocks to front onto existing and proposed roads and open space to create active frontages
9 Development overlooking Ruthin Road and set back to create a green frontage to the road
10 Development to sensitively integrate with Bersham Conservation Area and create a rural character along Bersham Road and Berse
11 Variations in density and building heights to be used to create different character areas with lower density development to the south
the Conservation Area and rural character
12 Development set back from the existing dwelling Bryn-moel at the site centre
13 East-west green corridor and active travel route along the PRoW Bridleway with buffers to development and central open space
14 Northeast southwest green link and active travel route along PRoW connecting Bersham to Wrexham and providing a wildlife corridor
15 Retention of the existing watercourse as a wildlife corridor and feature providing a green link through the northern part of the site
16 Retention of existing landscape features including strong landscape
17 Drainage attenuation basins integrated at low parts of the site and along primary roads as swales

Project:
Lower Berse Farm, Wrexham

Project-No:
50-311

Client:
Redrow Homes Ltd

N

e3p

Project Engineer: Lee Faulkner
Date: 09/08/2023

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



Project:
Lower Berse Farm
Wrexham

Project-No:
50-311

Client:
Redrow Homes Ltd

Daytime Noise Level, LAeq 16hr (dB)

- ... <= 55
- 55 < ... <= 62
- 62 < ... <= 70
- 70 < ... <= 70
- 70 < ...

Noise Map Objects

- Road
- Building
- Receiver
- Calculation Area

e3p

Project Engineer: Lee Faulkner
Date: 09/08/2023

Figure 3 - Nihgt-time Grid Noise Map - Calculation at 4.5 m above ground level



Project:
Lower Berse Farm
Wrexham

Project-No:
50-311

Client:
Redrow Homes Ltd

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

- ... <= 55
- 55 < ... <= 62
- 62 < ... <= 70
- 70 < ... <= 70
- 70 < ...

Noise Map Objects

- Road
- Building
- Receiver
- Calculation Area

e3p

Project Engineer: Lee Faulkner
Date: 09/08/2023