Miller Goodall
Environmental Services

NOISE ASSESSMENT

on behalf of

PWA ASSOCIATES LTD

for the site at

LAND AT CLITHEROE ROAD, BARROW

REPORT DATE: **6TH MAY 2014**

REPORT NUMBER: **100869V2**

Miller Goodall Environmental Services Ltd
214 Turton Road
Bradshaw
Bolton
Lancashire
BL2 3EE

Tel: 01204 596166

www.millergoodall.co.uk

Company registration number 5201673

Summary

A noise assessment was undertaken to predict the potential impact of existing noise levels on a proposed development of 7 detached properties on land at Clitheroe Road, Barrow. This was requested by the Local Authority to support a planning application for the development.

Measurements were made at the location of the nearest proposed residential dwellings to identify the pre-development ambient noise levels. This data was subsequently used to predict the potential impact of noise from existing sources on the proposed residential dwellings.

Mitigation measures were recommended and with the implementation of these recommendations, it is considered that a suitable and commensurate level of protection against noise will be provided to the occupants of the proposed accommodation.

Prepared By	Joanne Miller MIOA	Reviewed By	Simon Faircloth MIOA
Signed		Signed	
Date	6th May 2014	Date	6th May 2014

Record of changes

Version	Date	Change	Initials
1	6/05/14	Initial issue	JLM
2	22/07/2014	Revisions to plan	JLM

Contents

1 Introduction

1.1 Miller Goodall Environmental Services Ltd (MGES) has, on behalf of PWA Associates Ltd of Ribble Saw Mill, Paley Road, Preston PR1 8LT, undertaken a noise assessment to support a planning application for a residential development on behalf of Reilly Developments Ltd. The development is to consist of 13 new properties on land to the east of Clitheroe Road, Barrow. Our understanding is that Ribble Valley Borough Council (RVBC) has requested a noise assessment and is particularly concerned in relation to noise from a small industrial site to the south east of the proposed development.

2 Site Description

2.1 The site is located to the east of Clitheroe Road, Barrow on land which is currently a vacant field. To the far east of the site is Ashlea, a large residential development. To the south east is a small industrial site, Whalley Industrial Park. The park contains a number of small scale light industrial and retail premises including; maintenance garages, furniture manufacturing and a bike shop. The western boundary of the site borders Clitheroe Road, with residential properties on the opposite side. The centre of Barrow village is approximately 250 m to the north. The A59 main road lies approximately 450 m to the south of the site.

2.2 The total area of the site is 0.49 hectares and a previous outline permission was granted in May 2013 (ref 03/2012/0617).

3 Proposed Development

3.1 The proposal is to develop a greenfield site of approximately 0.49 hectares for residential use involving the erection of 10 detached dwellings houses and 3 bungalows. Outline planning permission was granted in May 2013 for the development of seven dwellings on the major part of the site (application ref: 03/2012/0617). A noise assessment was submitted for the former application from Sound Advice, dated 7th November 2012.

3.2 Road access to the development site is off Clitheroe Road. A layout plan has been provided to the Local Authority and is shown in Appendix 1.

3.3 This assessment seeks to address the noise impact from both Clitheroe Road and the Whalley Industrial Park and where necessary identify any mitigation requirements for the site to control noise to acceptable levels.

4 Local Authority Requirements

4.1 The Local Authority as part of the pre-application response has stated:

We have concern with regards to the proximity of plots 1-13 to the existing Industrial Park. Upon speaking to the head of Environmental Health Services he advised that whilst there may not be a requirement to do a completely new noise assessment (considering the details of the report linked to the previous appn. on the site Appn. 03/2012/0617) it would need to be revised and updated to take into account these properties. He advises that some information is supplied at application stage which confirms the use of existing units at the Industrial Park in order to clarify potential noise disturbance. You would also need to demonstrate that measures have been taken to mitigate noise such as acoustic fencing, buffering in the form of landscaping and glazing etc. Properties should meet NEC Cat A external noise criteria or suitable acoustic measures be provided and incorporated to both the buildings and site perimeter to ensure residential properties achieve NEC Cat A noise criteria.

4.2 Noise Exposure Catagories (NEC's) were incorportated within Planning Policy Guidance 24: Planninig and Noise (PPG24):1994 and was the principle guidance document used by Local Authorities when considering noise issues in relation to residential planning applications. As part of the PPG24 assessment procedure, the prevailing ambient noise levels affecting a proposed development site are measured and the Noise Exposure Category (NEC) determined, based upon the nature of the dominant noise source affecting the site. Sites falling within NEC A for road traffic are below $L_{Aeq(18hour)}$ 55 dB between 07:00 and 23:00 and below $L_{Aeq(18hour)}$ 45 dB between 23:00 and 07:00 hours. This guidance has since been repealed by the introduction of the Noise Policy Statement for Engand (NPSE) and the National Planning Policy Framework as discussed below.

5 Policy Context

5.1 Noise Policy Statement for England

5.1.1 The Noise Policy Statement for England (NPSE[1]), published in March 2010, sets out the long-term vision of Government noise policy. The Noise Policy aims, as presented in this document, are:

"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- avoid significant adverse effects on health and quality of life;
- mitigate and minimise adverse effects on health and quality of life; and
- where possible, contribute to the improvement of health and quality of life."

5.1.2 The NPSE makes reference to the concepts of NOEL (No Observed Effect Level) and LOAEL (Lowest Observed Adverse Effect Level) as used in toxicology but applied to noise impacts. It also introduces the concept of SOAEL (Significant Observed Adverse Effect Level) which is described as the level above which significant adverse effects on health and the quality of life occur.

5.1.3 The first aim of the NPSE is to avoid significant adverse effects, taking into account the guiding principles of sustainable development (as referenced in Section 1.8 of the Statement). The second

[1] Noise Policy Statement for England, Defra, March 2010

aim seeks to provide guidance on the situation that exists when the potential noise impact falls between the LOAEL and the SOAEL, in which case:

"…all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development".

5.1.4 Importantly, the NPSE goes on to state:

"This does not mean that such adverse effects cannot occur".

5.1.5 The Statement does not provide a noise-based measure to define SOAEL, acknowledging that the SOAEL is likely to vary depending on the noise source, the receptor and the time in question. NPSE advises that:

"Not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available"

5.1.6 It is therefore likely that other guidance will need to be referenced when applying objective standards for the assessment of noise, particularly in reference to the SOAEL, whilst also taking into account the specific circumstances of a proposed development.

5.2 National Planning Policy Framework

5.2.1 The National Planning Policy Framework (NPPF[2]) was published in March 2012. One of the documents that the NPPF replaces is Planning Policy Guidance Note 24 (PPG 24) "Planning and Noise"[3].

5.2.2 Paragraph 109 of the NPPF states that the planning system should contribute to and enhance the natural and local environment by, (amongst others) "preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, water or noise pollution or land stability".

5.2.3 The NPPF goes on to state in Paragraph 123 "planning policies and decisions should aim to:

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

[2] National Planning Policy Framework, DCLG, March 2012
[3] Planning Policy Guidance 24: Planning and Noise, DCLG, September 1994

5.2.4 The NPPF document does not refer to any other documents regarding noise other than NPSE.

5.3 Planning Practice Guidance – Noise

5.3.1 As of March 2014, a Planning Practice Guidance[4] for noise was issued which provides additional guidance and elaboration on the NPPF. It advises that when plan-making and decision-taking, the Local Planning Authority should consider the acoustic environment in relation to:

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

5.3.2 In line with the Explanatory Note of the NPSE, the PPG goes on to reference the LOAEL and SOAEL in relation to noise impact. It also provides examples of outcomes that could be expected for a given perception level of noise, plus actions that may be required to bring about a desired outcome. However, in line with the NPSE, no objective noise levels are provided for LOAEL or SOAEL although the PPG acknowledges that:

"…the subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any particular situation".

5.3.3 Examples of these factors include:

- The source and absolute noise level of the source along with the time of day that it occurs;
- Where the noise is non-continuous, the number of noise events and pattern of occurrence;
- The frequency content and acoustic characteristics of the noise;
- The effect of noise on wildlife;
- The acoustic environment of external amenity areas provided as an intrinsic part of the overall design;
- The impact of noise from certain commercial developments such as night clubs and pubs where activities are often at their peak during the evening and night.

5.3.4 The PPG also provides general advice on the typical options available for mitigating noise. It goes on to suggest that Local Plans may include noise standards applicable to proposed developments within the Local Authority's administrative boundary, although it states that:

"Care should be taken, however, to avoid these being implemented as fixed thresholds as specific circumstances may justify some variation being allowed".

[4] Planning Practice Guidance – Noise, http://planningguidance.planningportal.gov.uk/blog/guidance/noise/, 06 March 2014

6 Acoustic Standards and Guidance

6.1 BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings

6.1.1 BS 8233:1999[5] was superseded by BS 8233:2014[6], with the former code of practice replaced by a guidance document. The updated Standard provides recommended guideline values for internal noise levels within dwellings which are similar in scope to guideline values contained within the World Health Organisation (WHO) document, Guidelines for Community Noise (1999)[7]. These guideline noise levels are shown in Table 1, below.

Table 1: BS 8233: 2014 guideline indoor ambient noise levels for dwellings

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

6.1.2 BS 8233:2014 no longer provides recommendations in relation to maximum noise levels in residential bedrooms at night from individual noise events such as vehicle pass-bys or aircraft movements. Instead, it advises that:

> *"regular individual noise events…can cause sleep disturbance. A guideline value may be set in terms of SEL[8] or $L_{Amax,F}$ depending on the character and number of events per night. Sporadic noise events could require separate values".*

6.1.3 BS 8233:2014 adopts guideline external noise values provided in WHO for external amenity areas such as gardens and patios. The Standard states that it is "desirable" that the external noise does not exceed 50 dB $L_{Aeq,T}$ with an upper guideline value of 55 dB $L_{Aeq,T}$ whilst recognising that development in higher noise areas such as urban areas or those close to the transport network may require a compromise between elevated noise levels and other factors that determine if development in such areas is warranted. In such circumstances, the development should be designed to achieve the lowest practicable noise levels in external amenity areas.

[5] BS 8233:1999 Sound Insulation and Noise Reduction for Buildings – Code of Practice
[6] BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings
[7] World Health Organisation Guidelines for Community Noise, 1999
[8] Sound exposure level or L_{AE}

6.2 World Health Organisation (WHO) Guidelines for Community Noise 1999

6.2.1 The WHO Guidelines 1999 recommends that to avoid sleep disturbance, indoor night-time guideline noise values of 30 dB L_{Aeq} for continuous noise and 45 dB L_{AFmax} for individual noise events should be applicable. It is to be noted that the WHO Night Noise Guidelines for Europe 2009[9] makes reference to research that indicates sleep disturbance from noise events at indoor levels as low as 42 dB L_{AFmax}.

6.2.2 The WHO document recommends that steady, continuous noise levels should not exceed 55 dB L_{Aeq} on balconies, terraces and outdoor living areas. It goes on to state that to protect the majority of individuals from moderate annoyance, external noise levels should not exceed 50 dB L_{Aeq}.

6.3 BS 4142: 1997 'Rating industrial noise affecting mixed residential and industrial areas'

6.3.1 BS 4142: 1997[10] provides guidance on the assessment of the likelihood of complaints relating to noise from industrial sources.

6.3.2 The standard presents a method of rating noise levels by comparing the noise level of the new source (the Rating Level) with that of the existing background noise level at the nearest noise sensitive receiver in the absence of the source (the Background Noise Level).

6.3.3 The Specific Noise Level - the noise level produced by the source in question at the assessment location - is determined and a +5 dB correction applied for any unusual acoustic features such as discreet tones, whines, hisses or impulsive character. The corrected Specific Noise Level is referred to as the Rating Level.

6.3.4 The Background Noise Level is arithmetically subtracted from the Rating Level to provide the BS 4142 Rating. A Rating of +10 dB or more indicates that complaints about noise are likely. A Rating of +5 dB is said to be of marginal significance. If the Rating Level is more than 10 dB below the measured Background Noise Level it is a positive indication that complaints are unlikely.

6.4 Possible LOAEL and SOAEL Noise Standards

6.4.1 It is acknowledged that the NPSE and the Planning Practice Guidance both advise caution when attempting to set objective standards in relation to LOAEL and SOAEL that may be applicable to a new development.

6.4.2 That said, the guideline values for noise within the WHO documents are set at the level of the lowest adverse health effect (the critical health effect) and as such, the values could form the basis of the LOAEL as referenced in the NPSE and PPG. Targeting the WHO guidelines levels as the LOAEL should, therefore, provide a robust basis for assessment. No levels are provided within the WHO guidance that may be directly applicable to the SOAEL and any such threshold levels will, as

[9] WHO Night Noise Guidelines for Europe 2009
[10] BS 4142:1997 Method for rating industrial noise affecting mixed residential and industrial areas

indicated in the above guidance, vary depending on the specific circumstances of the development and the noise climate in which it is located.

6.4.3 With reference to noise from industrial sources assessed using BS 4142: 1997, it is considered that a Rating Level equivalent to at least –10 dB above the existing background noise level would equate to No Observed Effect Level (NOEL). Since a Rating Level equivalent to +10 dB above the existing background noise level provides a subjective response equivalent to "complaints likely", this could equate to the SOAEL. The LOAEL would therefore fall somewhere between these two extremes and it is proposed that a Rating Level of –5 dB above the existing background noise level would be appropriate in this regard.

7 Noise Survey

7.1 Measurements of Existing Noise Sources

7.1.1 Noise measurements were undertaken at a location consistent with the proposed development in accordance with BS 7445-1: 2003[11] by Simon Faircloth of Miller Goodall Environmental Services Ltd. The calibration of the sound level meter was checked before and after measurements with negligible deviation (<0.1 dB). Details of the equipment used are shown in Table 2, below.

[11] BS 7445-1: 2003 Description and measurement of environmental noise - Part 1: Guide to quantities and procedures

Table 2: Noise monitoring equipment

Equipment Description	Type Number	Manufacturer	Serial No.	Date Calibrated	Calibration Certification Number
Class 1 Integrating Real Time 1/3 Octave Sound Analyzer	Type 2260	Brüel & Kjær	2467009	03/09/13	U14377
Microphone	Type 4189	Brüel & Kjær	2508884	03/09/13	U14377
Calibrator	Type 4231	Brüel & Kjær	2478249	03/09/13	U14375

Specific, background and ambient noise monitoring was undertaken at the times specified in Figure 1.

Table 3, below. Measurement locations are shown in Figure 1.

Table 3: Dates, times and weather conditions during noise measurements

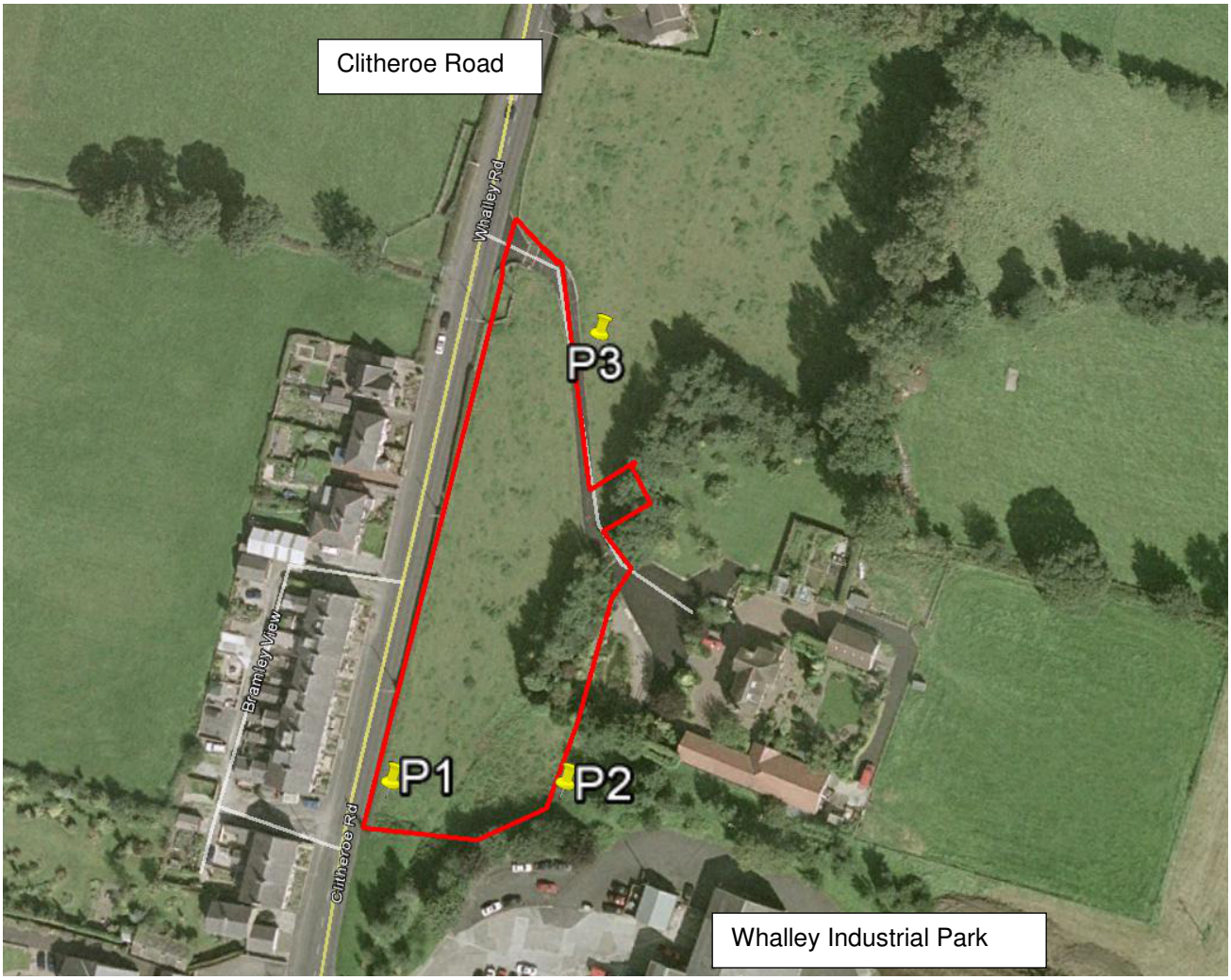
Measurement Locations	Date	Time	Weather conditions
P1, P2 and P3	23/04/2014	06:03 – 09:45	Dry, bright, 10^0C, still no wind to start, from 07:00 light easterly breeze 1 – 2 m/s.

7.1.2 Measurements were taken at times considered to be representative of the periods during which the proposed residential accommodation would be subject to the highest levels of ambient noise from road traffic and to include noise from the Whalley Industrial Park. Measurements were made under free-field conditions at a height of 1.5 m above the ground.

7.1.3 The measurement locations are detailed below and indicated on Figure 1.

- P1 - approximately 7 m from the near roadside edge
- P2 - at the closest location to Whalley Industrial Park, approximately 3 m higher than ground level on the mound at the far south eastern border of the site, equivalent to Plot 7 rear garden.
- P3 – located approximately 30 m from Clitheroe Road at the equivalent location of Plot 1 of the proposed development.

Figure 1: Measurement locations



7.1.4 The noise sources within the vicinity of the measurement locations are summarised in Table 4, below:

Table 4: Description of noise sources affecting the site

Measurement Locations	Noise Sources
P1	Noise from Clitheroe Road, including cars, occasional buses and LGV and 1 delivery vehicle to the Eagle at Barrow restaurant. Birdsong. Some light activity on the Industrial Park from 07:00 hours.
P2	Noise from Clitheroe Road as above. Some noise from a vehicle carwash on the Industrial Park garage units for a few minutes.
P3	Noise from Clitheroe Road, as for P1.

7.2 Monitoring Results

7.2.1 A summary of the broadband measurement data is provided in Table 5. All data are free field sound pressure levels in dB re 20 μPa.

Table 5: Summary of noise measurements

Measurement Location	Start Time	Elapsed Time (hr:min:sec)	$L_{Aeq,T}$ (dB)	Overall L_{AFmax} (dB)	99th% $L_{AFmax,1sec}$ (dB)	$L_{AF10,T}$ (dB)	$L_{AF90,T}$ (dB)
P1	06:02:59	0:30:00	56.9	79.1	73.0	58.2	45.6
P1	06:34:14	0:30:00	59.5	77.5	73.0	63.7	47.1
P1	08:12:09	0:30:00	63.2	78.9	72.5	67.0	52.2
P1	08:42:28	0:30:00	62.5	75.1	71.3	66.5	53.1
P2	07:06:54	0:30:00	54.2	69.2	66.7	57.4	46.6
P2	09:14:35	0:30:00	53.5	68.0	63.4	55.9	49.0
P3	07:39:32	0:30:00	52.8	66.5	63.2	54.8	48.9

7.2.2 Each measurement period consisted of sequential 1 second samples which therefore allowed the variation in noise level over time to be assessed. This data was subsequently used to determine a 'typical' L_{AFmax} noise level and octave band spectrum based on the 99th percentile of individual 1 second measurements. This data was subsequently utilised within the assessment.

7.2.3 The full 1 second noise levels have not been presented in this report but are kept on file for future reference, however a time history of the 1 second L_{AFmax} samples measured at P1 is provided in Figure 2.

7.2.4 Octave band frequency data was also obtained and this was utilised within the noise ingress calculations. This source data is provided in Table 6, below.

Figure 2: $L_{AFmax,1sec}$ time history at location P1 (night-time)

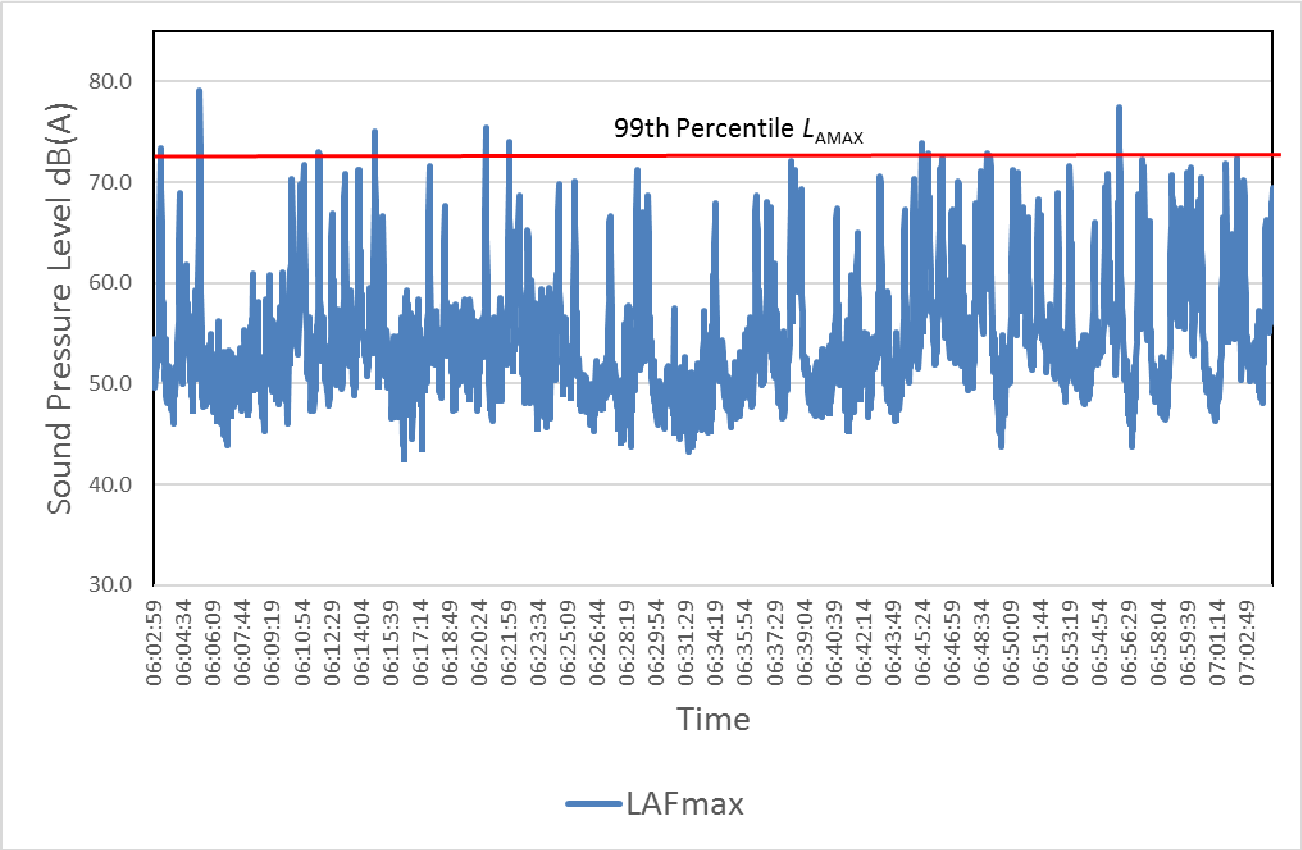


Table 6: Octave band free-field external noise level spectra

Measurement Positions	Sound Pressure Level, dB in Octave Band Centre Frequency, Hz								dB L_{Aeq}
	63	125	250	500	1k	2k	4k	8k	
P1 – Night-time	67	59	53	51	55	54	48	39	60
P1 – Day-time	71	64	59	57	59	57	50	41	63
P2- Day-time	61	53	44	45	49	45	49	44	54
P3 – Day-time	62	55	44	45	49	44	46	40	53
									L_{MAX}
P1 – Night-time	81	74	69	66	68	68	61	56	73
P2- Night-time	71	63	56	53	57	54	64	64	68

8 Impact of Existing Noise Sources on the Development

8.1 Predicted Internal Noise Levels Assessed to BS 8233 Criteria

8.1.1 It is proposed that noise from the development is controlled to 30 dB L_{Aeq} in bedrooms at night and 35 dB L_{Aeq} in habitable rooms during the day. This is in line with the recommended levels advised in

BS 8233 The proposed upper limit for individual noise events such as vehicle pass-bys is an indoor level of 45 dB $L_{AFmax.}$ These proposed limits could equate to the LOAEL as discussed in section 6.4.

8.1.2 The generally accepted rule of thumb is that a window left open for ventilation provides 10 - 15 dB attenuation from external noise sources with the WHO Guidelines for Community Noise suggesting 15 dB. The DEFRA report NANR116: Open/Closed Window Research[12] suggests the figure to be between 12 and 18 dB for road and rail traffic. Where external noise levels are more than around 15 dB higher than the internal noise targets, openable windows should not be relied upon as the sole means of ventilation and some form of acoustically attenuated ventilation may be required. This equates to an external noise level of 45 dB L_{Aeq} or higher during the night.

8.1.3 In order to assess the potential glazing and ventilation requirements for dwellings, noise ingress calculations were undertaken based on the methodology in BS EN 12354-3[13]. The following assumptions were made regarding the internal rooms:

- Assessed within first floor bedrooms with an internal volume of 30 m^3
- 'Normal' internal surface finishes e.g. carpeted with curtains etc
- Glazed area of 1.5 m^2 per room.

8.1.4 The areas of the proposed site where internal noise may exceed the standards are bedrooms on elevations closest to, and facing, Clitheroe Road. Worst case daytime and night-time periods have been assessed for bedrooms as the standards are more onerous than for daytime periods.

8.1.5 Noise ingress calculations are provided in Appendix 2 with a summary of the results below in Table 7, below:

[12] NANR116: 'Open/closed window research' Sound Insulation through ventilated open windows, Defra April 2007

[13] BS EN 12354-3:2000 Building acoustics. Estimation of acoustic performance in buildings from the performance of elements - Airborne sound insulation against outdoor sound

Table 7: Predicted internal noise levels

Description	External Noise Levels		Predicted Internal Noise Levels		BS 8233 Criteria		Exceedance of Criteria		Proposed Glazing and Ventilation
	dB $L_{Aeq,1hr}$	99th% $L_{AFmax,1sec}$	dB $L_{Aeq,1hr}$	dB L_{AFmax}	dB $L_{Aeq,T}$	dB L_{AFmax}	dB $L_{Aeq,T}$	dB L_{AFmax}	
Plots 1 – 7 Bedrooms and Living rooms facing on Clitheroe Road	60	73	30	44	30	45	0	-1	10/12/6.4 thermal double glazing; acoustic trickle vents
Plots 1 – 7 Bedrooms and Living rooms facing away from Clitheroe Road	53	61	30	36	30	45	0	-9	4/12/4 thermal double glazing; acoustic trickle vents

8.1.6 It is to be appreciated that the night-time levels were measured between 06:00 and 07:00 when noise from Clitheroe Road was dominant and increasing as the morning rush hour approached. When averaged over a typical 8 hr period, night-time noise levels would be expected to be lower.

8.1.7 It can be seen from Table 7 that rooms on the noisiest elevations are predicted to satisfy the internal noise level requirements with glazing with a weighted sound reduction index of 35 dB $R_w + C_{tr}$; this could be achieved using double glazing with a 10/12/6.4 configuration. Background ventilation could be provided by trickle ventilators with a minimum weighted element normalised level difference of 38 dB $D_{ne,w} + C_{tr.}$

8.1.8 For dwellings with habitable rooms facing away from Clitheroe Road or where shielding from other buildings is provided, a lower specification of glazing with a weighted sound reduction index of 27 dB $R_w + C_{tr}$; this could be achieved using double glazing with a 4/12/4 configuration be feasible. Background ventilation could be provided by trickle ventilators with a minimum element normalised sound level difference of 29 dB $D_{ne,w} + C_{tr.}$

8.2 External Noise Levels

8.2.1 The measured daytime noise levels across the open site are currently around 63 dB L_{Aeq} at the front elevation of Clitheroe Road, this level however drops to 53 – 54 dB L_{Aeq} towards the rear of the site in the area of the proposed gardens to the rear of plots 1 – 7. This level would also be expected to be lower than measured due to the shielding provided by the houses and garages to be constructed as part of the development As such, the rear garden noise levels for all plots would achieve the Local Authority's daytime noise criteria in external amenity spaces of below 55 dB L_{Aeq}. We would suggest that this level of noise would also relate to Lowest Observed Adverse Effect Level (LOAEL).

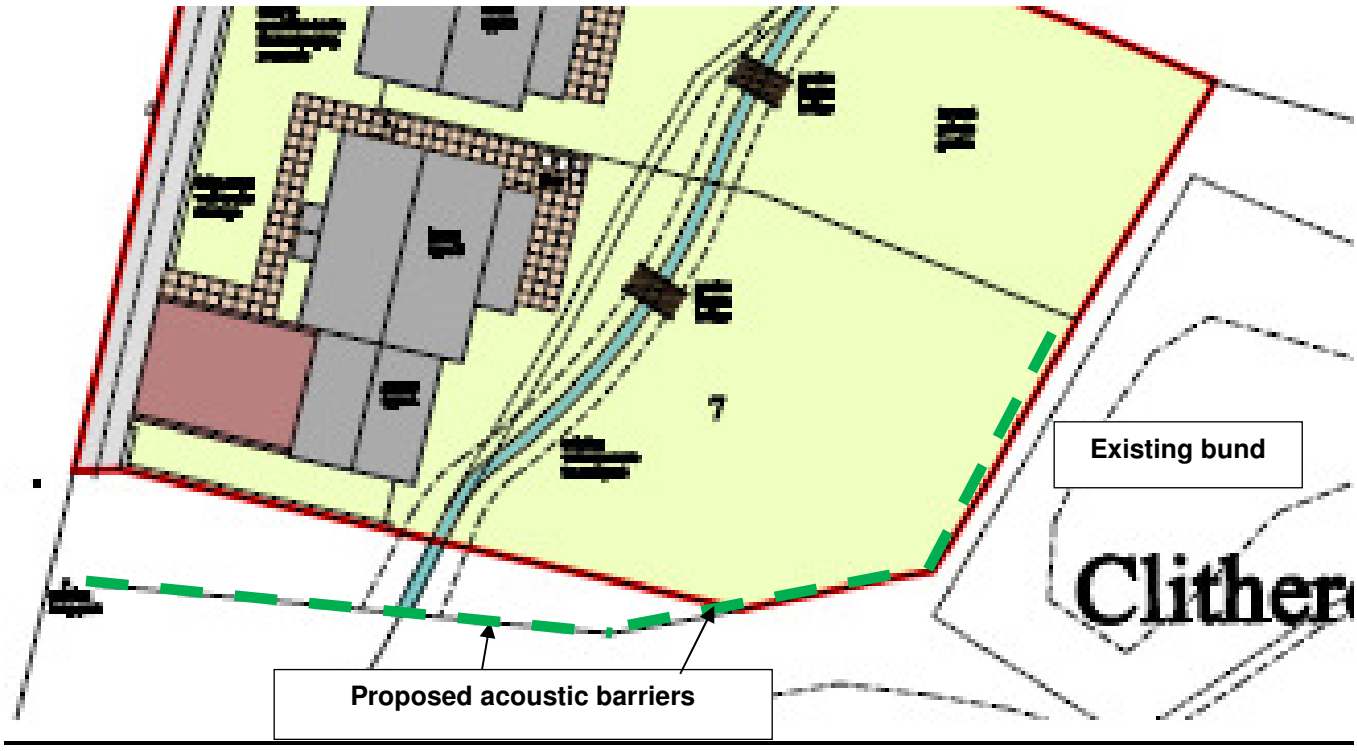
8.3 Industrial Noise Assessment

8.3.1 During the noise measurements it was not possible to measure the specific noise of the industrial site, since the road traffic noise from Clitheroe Road was the dominant noise source and industrial noise was not distinguishable. It was therefore not possible to undertake a full BS 4142 assessment. This was also true of the measurements undertaken by Sound Advice in November 2012, which states on page 2:

'The measurements were taken in the early afternoon of Friday November 2nd 2012 …The most noticeable noise was from the regular traffic on the Clitheroe Road combined with distant traffic noise from the Whalley bypass road running on the embankment to the south. There was no significant noises of any kind from the industrial area'.

8.3.2 To the rear of plots 6 and 7 there is a bund which extends approximately 3 m high, providing a good degree of acoustic screening for the rear gardens of plots 6 and 7. We would however recommend, to protect future residents from potential noise disturbance from the Whalley Park Industrial estate, a noise barrier be erected at the boundary of plot 7 to join with the existing bund, as shown in Figure 3. The barrier is to be constructed from continuous, imperforate material the specification is provided in Section 9.3.

Figure 3: Location of Acoustic Barrier to Plots 7.



9 Mitigation Measures

9.1 Building Envelope - Glazing and Ventilation

9.1.1 Table 8 below provides suggested glazing and ventilation specifications to be utilised within the development.

Table 8: Suggested glazing and ventilation specifications

Elevation	Minimum Required dB R_w+ C_{tr} of Glazing	Suggested Glazing Specification	Recommended Ventilation Solution
Plots 1 – 7 Bedrooms and Living rooms facing Clitheroe Road	35	10/12/6.4 lam double glazed unit	Acoustic trickle vents with min. rating of 38 dB $D_{ne,w}$
Plots 1 – 7 Bedrooms and Living rooms facing away from Clitheroe Road	27	4/12/4 double glazed	Acoustic trickle vents with min. rating of 29 dB $D_{ne,w}$

9.1.2 Standard thermal double glazing would be recommended for all other windows not detailed above.

9.2 Acoustic Barrier

9.2.1 As discussed in Section 8.3 and 8.4, it is recommended that a noise barrier is erected at the locations shown in Figure 3. This is to protect future occupiers from noise from Clitheroe Road and potential future noise from Whalley Industrial Park.

9.2.2 The barrier is to be constructed from continuous, imperforate material with a minimum mass of 12 kg/m^2 and is to extend from the ground to a minimum height of 2.0 m above the level of the site at its western boundary. Close-boarded or overlapped timber panelling would be suitable in this regard; hit-and-miss fencing would not. Alternatively, a proprietary acoustic fence with a minimum weighted sound reduction index of 25 dB R_w would be appropriate.

10 Conclusions

10.1 A noise assessment has been undertaken at the site of a proposed development of land at Clitheroe Road, Barrow to support a planning application. Measurements have been taken to determine the ambient noise levels affecting the proposed dwellings at the site. The measured data has been used to predict the impact of existing noise sources on future users of the accommodation. A recommended glazing and ventilation specification has been provided to enable the recommended internal noise limits to be achieved within the properties. Recommendations for acoustic barriers have also been made.

10.2 With the implementation of these recommendations, it is considered that a suitable and commensurate level of protection against noise will be provided to the occupants of the proposed accommodation. We therefore so no reasons why permission need be refused on the basis of noise.

Glossary of Terms

Decibel (dB) The unit used to quantify sound pressure levels; it is derived from the logarithm of the ratio between the value of a quantity and a reference value. It is used to describe the level of many different quantities. For sound pressure level the reference quantity is 20 µPa, the threshold of normal hearing is in the region of 0 dB, and 140 dB is the threshold of pain. A change of 1 dB is usually only perceptible under controlled conditions.

dB L_A Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB L_A broadly agree with an individual's assessment of loudness. A change of 3 dB L_A is the minimum perceptible under normal conditions, and a change of 10 dB L_A corresponds roughly to halving or doubling the loudness of a sound. The background noise level in a living room may be about 30 dB L_A; normal conversation about 60 dB L_A at 1 meter; heavy road traffic about 80 dB L_A at 10 meters; the level near a pneumatic drill about 100 dB L_A.

$L_{A90,T}$ The A weighted noise level exceeded for 90% of the specified measurement period (*T*). In BS 4142: 1997 it is used to define background noise level.

$L_{Aeq,T}$ The equivalent continuous sound level. The sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period (*T*). $L_{Aeq,T}$ is used to describe many types of noise and can be measured directly with an integrating sound level meter.

L_{Amax} The highest A weighted noise level recorded during the time period. It is usually used to describe the highest noise level that occurred during the event.

$L_{A10(18\ hour)}$ Often referred to as the UK road traffic noise index, this is the arithmetic average of the values of L_{A10} hourly for each of the 18 one hour periods between 06:00 and 00:00.

NOEL No observed effect level: the level of noise exposure below which no effect at all on health or quality of life can be detected.

LOAEL Lowest observed adverse effect level: the level of noise exposure above which adverse effects on health or quality of life can be detected.

SOAEL Significant observed adverse effect level: the level of noise exposure above which significant adverse effects on health or quality of life can be detected.

R_w *S*ingle number rating used to describe the sound insulation of building elements and is defined in BSEN ISO 140-3: 1995. It is derived by measurement under laboratory conditions and does not take into account the effects of flanking transmissions.

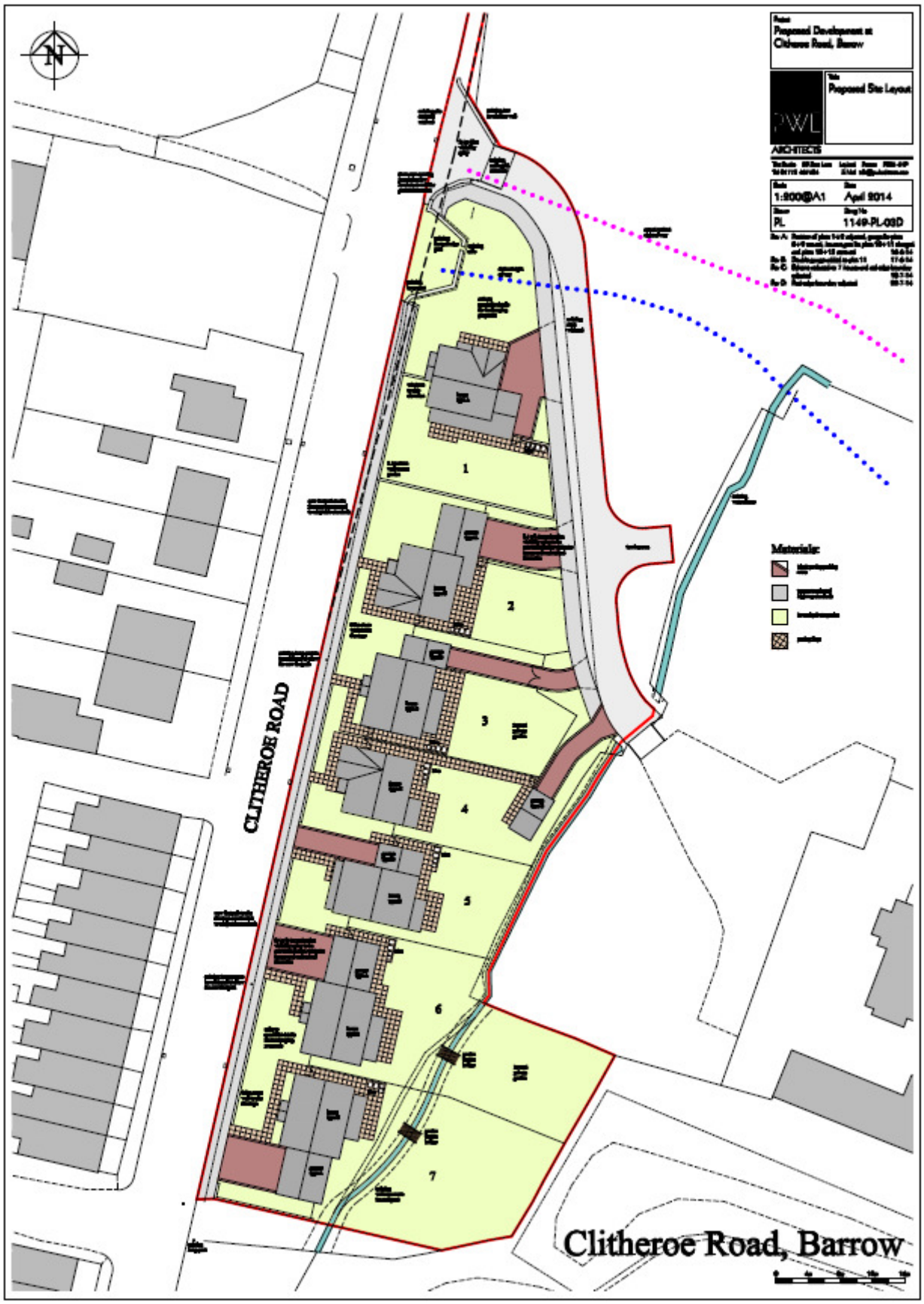
$D_{nT,w}$ The weighted standardized level difference is a single figure rating used to describe the sound insulation of a construction separating two rooms, for example a wall or floor, and is

defined in BSEN ISO 140-4: 1998. It is derived by measurement of an in-situ construction and therefore takes into account the effects of flanking transmissions, workmanship etc.

$D_{ne,w}$ The weighted element-normalized level difference is a single figure rating used to describe the sound insulation of small elements within a larger construction and is defined in BSEN ISO 140-10: 1991. It is most often used to rate the sound insulation performance of ventilator units e.g. trickle vents.

C_{tr} A spectrum adaptation term used to characterise the sound insulation rating with respect to urban traffic.

Appendix 1: Proposed Site Layout



Appendix 2a – Noise Ingress Calculations – P1 Bedroom

Miller Goodall Environmental Services: Noise Ingress Calculation

Project:	869								**Calcs By:**		JLM			
Description:	Clitheroe Road, Barrow P1								**Date:**		2.5.14			

Calculation is based on methodology within BS 8233:1999 & BSEN ISO 12354-3. The following equation is utilised:

$L_{internal} = L_{external} - \Sigma R + 10 \log S/A + 3$

where A = 0.16V/T

This can be broken down further to:

$L_{eq,2} = L_{eq,ff}+10\text{xlog}\ ((A_0/Sx10^{(-D_{n,e}/10)})+(S_{wi}/Sx10^{(-R_{wi}/10)})+(S_{ew}/Sx10^{(-R_{ew}/10)})+(S_{rr}/Sx10^{(-R_{rr}/10)}))+10\text{xlog}\ (S/A)+3$

The above terms are described below.

Description	**Term**	**Value**	
Total facade area (m2)	S_f	7.5	Room assessed: Bedroom, 3.0 m wide x 4.0 m deep x 2.5 m high
Window area (m2)	S_{wi}	1.5	
External wall area (Sf - Swi)	S_{ew}	6	
Area of ceiling (m2)	S_{rr}	12	
Total area of elements (Sf + Srr)	S	19.5	
Volume of receiving room (m3)	V	30	
Reference absorption area (m2)	A_0	10	
Number of ventilators in facade:		2	

	Octave band centre frequency, Hz												
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**	**Rw**	**Ctr**	**Rw+ Ctr**	**Notes**
External Leq, freefield (dB Leq,ff)	67.0	59.0	53.2	51.3	55.4	54.0	47.6	38.7	60	-	-	-	Freefield night-time level
External Lmax, freefield (dB Lmax,ff)	81.2	73.8	69.0	65.8	67.7	67.6	61.0	55.5	73	-	-	-	99th% Freefield night-time level
Dne of each ventilator	*27*	31	33	42	43	39	44	*44*		41	-3	38	Renson AK38 acoustic trickle vent
Total Dne of all ventilators	24	28	30	39	40	36	41	41		38	-3	35	
SRI of window (Rwi)	*21*	27	29	36	41	42	52	*52*		39	-4	35	10/12/6.4
SRI of external wall (Rew)	*35*	37	42	52	60	63	68	*68*		54	-6	48	Double leaf 112 mm brickwork, 50 mm cavity, rigid wall tie
SRI of roof and ceiling (Rrr)	*21*	27	37	43	48	52	*52*	*52*		46	-7	39	Tiled/slate roof, 25 mm plasterboard ceiling, 100 mm min
Rev time of receiving room (T) - secs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5					Habitable room ref Part E
All ventilators [eqn. B]	0	0	0	0	0	0	0	0					A0/S x 10^(-Dne/10)
Glazing [eqn. C]	0	0	0	0	0	0	0	0					Swi/S x 10^(-Rwi/10)
External wall [eqn. D]	0	0	0	0	0	0	0	0					Sew/S x 10^(-Rew/10)
Ceiling [eqn. E]	0	0	0	0	0	0	0	0					Srr/S x 10^(-Rrr/10)
All ventilators [10 x log "B"]	-26.7	-30.7	-32.6	-41.6	-43.1	-38.6	-44.1	-43.9					
Glazing [10 x log "C"]	-32.1	-38.1	-40.1	-47.1	-52.1	-53.1	-63.1	-63.1					
External wall [10 x log "D"]	-40.1	-42.1	-47.1	-57.1	-65.1	-68.1	-73.1	-73.1					
Ceiling [10 x log "E"]	-23.1	-29.1	-39.1	-45.1	-50.1	-54.1	-54.1	-54.1					
All elements combined [eqn. F]	-21.1	-26.4	-31.0	-39.2	-41.9	-38.3	-43.6	-43.4					Log sum of equations B,C,D,E
Equiv. absorption area of rec. room (m	10	10	10	10	10	10	10	10					
10 x log(S/A) [eqn. G]	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1					

	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**		**Target**	**Exc.**	
Internal Leq,2	52	39	28	18	20	22	10	1	30		30	0	Equations (A+F+G) +3 dB
Internal Lmax,2	66	53	44	33	32	35	23	18	44		45	-1	Equations (A+F+G) +3 dB

Appendix 2b – Noise Ingress Calculations – P1 Living Room

Miller Goodall Environmental Services: Noise Ingress Calculation

Project:	869								**Calcs By:**	JLM			
Description:	Clitheroe Road, Barrow P1 Living								**Date:**	2.5.14			

Calculation is based on methodology within BS 8233:1999 & BSEN ISO 12354-3. The following equation is utilised:

$L_{internal} = L_{external} - \Sigma R + 10 \log S/A + 3$

where A = 0.16V/T

This can be broken down further to:

$L_{eq,2} = L_{eq,ff}+10\text{xlog}\ ((A_0/Sx10^{(-D_{n,e}/10)})+(S_{wi}/Sx10^{(-R_{wi}/10)})+(S_{ew}/Sx10^{(-R_{ew}/10)})+(S_{rr}/Sx10^{(-R_{rr}/10)}))+10\text{xlog}\ (S/A)+3$

The above terms are described below.

Description	**Term**	**Value**	
Total facade area (m2)	S_f	7.5	Room assessed: Bedroom, 3.0 m wide x 4.0 m deep x 2.5 m high
Window area (m2)	S_{wi}	1.5	
External wall area (Sf - Swi)	S_{ew}	6	
Area of ceiling (m2)	S_{rr}	0	
Total area of elements (Sf + Srr)	S	7.5	
Volume of receiving room (m3)	V	30	
Reference absorption area (m2)	A_0	10	
Number of ventilators in facade:		2	

	Octave band centre frequency, Hz												
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**	**Rw**	**Ctr**	**Rw+ Ctr**	**Notes**
External Leq, freefield (dB Leq,ff)	70.7	63.7	58.9	57.0	59.2	57.1	50.5	41.2	63	-	-	-	Freefield day-time level
External Lmax, freefield (dB Lmax,ff)										-	-	-	98th% Freefield night-time level
Dne of each ventilator	*27*	31	33	42	43	39	44	*44*		41	-3	38	Renson AK38 acoustic trickle vent
Total Dne of all ventilators	24	28	30	39	40	36	41	41		38	-3	35	
SRI of window (Rwi)	*21*	27	29	36	41	42	52	*52*		39	-4	35	10/12/6.4
SRI of external wall (Rew)	*35*	37	42	52	60	63	68	*68*		54	-6	48	Double leaf 112 mm brickwork, 50 mm cavity, rigid wall tie
SRI of roof and ceiling (Rrr)	*21*	27	37	43	48	52	*52*	*52*		46	-7	39	Tiled/slate roof, 25 mm plasterboard ceiling, 100 mm min
Rev time of receiving room (T) - secs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5					Habitable room ref Part E
All ventilators [eqn. B]	0.01	0	0	0	0	0	0	0					A0/S x 10^(-Dne/10)
Glazing [eqn. C]	0	0	0	0	0	0	0	0					Swi/S x 10^(-Rwi/10)
External wall [eqn. D]	0	0	0	0	0	0	0	0					Sew/S x 10^(-Rew/10)
Ceiling [eqn. E]	0	0	0	0	0	0	0	0					Srr/S x 10^(-Rrr/10)
All ventilators [10 x log "B"]	-22.5	-26.5	-28.4	-37.4	-38.9	-34.4	-39.9	-39.7					
Glazing [10 x log "C"]	-28.0	-34.0	-36.0	-43.0	-48.0	-49.0	-59.0	-59.0					
External wall [10 x log "D"]	-36.0	-38.0	-43.0	-53.0	-61.0	-64.0	-69.0	-69.0					
Ceiling [10 x log "E"]	####	####	####	####	####	####	####	####					
All elements combined [eqn. F]	-21.3	-25.6	-27.6	-36.3	-38.4	-34.3	-39.9	-39.7					Log sum of equations B,C,D,E
Equiv. absorption area of rec. room (m²	10	10	10	10	10	10	10	10					
10 x log(S/A) [eqn. G]	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1					

	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**	**Target**	**Exc.**	
Internal Leq,2	51	40	33	23	23	25	12	3	32	35	-3	Equations (A+F+G) +3 dB
Internal Lmax,2	-19	-24	-26	-34	-36	-32	-38	-38	-27	45	-72	Equations (A+F+G) +3 dB

Appendix 2c – Noise Ingress Calculations – P2 Bedroom

Miller Goodall Environmental Services: Noise Ingress Calculation

Project:	869								**Calcs By:**		JLM			
Description:	Clitheroe Road, Barrow P2 bedroom								**Date:**		2.5.14			

Calculation is based on methodology within BS 8233:1999 & BSEN ISO 12354-3. The following equation is utilised:

$L_{internal} = L_{external} - \Sigma R + 10 \log S/A + 3$

where A = 0.16V/T

This can be broken down further to:

$L_{eq,2} = L_{eq,ff}+10\text{xlog}\ ((A_0/Sx10^{(-D_{n,e}/10)})+(S_{wi}/Sx10^{(-R_{wi}/10)})+(S_{ew}/Sx10^{(-R_{ew}/10)})+(S_{rr}/Sx10^{(-R_{rr}/10)}))+10\text{xlog}\ (S/A)+3$

The above terms are described below.

Description	**Term**	**Value**	
Total facade area (m2)	S_f	7.5	Room assessed: Bedroom, 3.0 m wide x 4.0 m deep x 2.5 m high
Window area (m2)	S_{wi}	1.5	
External wall area (Sf - Swi)	S_{ew}	6	
Area of ceiling (m2)	S_{rr}	12	
Total area of elements (Sf + Srr)	S	19.5	
Volume of receiving room (m3)	V	30	
Reference absorption area (m2)	A_0	10	
Number of ventilators in facade:		2	

	Octave band centre frequency, Hz												
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**	**Rw**	**Ctr**	**Rw+ Ctr**	**Notes**
External Leq, freefield (dB Leq,ff)	60.5	52.7	43.9	44.5	48.9	45.3	48.9	43.9	54	-	-	-	Freefield night-time level
External Lmax, freefield (dB Lmax,ff)	71.3	63.4	55.8	53.0	57.4	54.1	63.8	63.6	68	-	-	-	99th% Freefield night-time level
Dne of each ventilator	*29*	33	32	29	28	30	34	*40*		30	-1	29	Greenwood 8000HDW, open (report ref. ATV40)
Total Dne of all ventilators	26	30	29	26	25	27	31	37		26	0	26	
SRI of window (Rwi)	*18*	24	20	25	35	38	35	*35*		31	-4	27	4/12/4
SRI of external wall (Rew)	*35*	37	42	52	60	63	68	*68*		54	-6	48	Double leaf 112 mm brickwork, 50 mm cavity, rigid wall tie
SRI of roof and ceiling (Rrr)	*21*	27	37	43	48	52	*52*	*52*		46	-7	39	Tiled/slate roof, 25 mm plasterboard ceiling, 100 mm min
Rev time of receiving room (T) - secs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5					Habitable room ref Part E
All ventilators [eqn. B]	0	0	0	0	0	0	0	0					A0/S x 10^(-Dne/10)
Glazing [eqn. C]	0	0	0	0	0	0	0	0					Swi/S x 10^(-Rwi/10)
External wall [eqn. D]	0	0	0	0	0	0	0	0					Sew/S x 10^(-Rew/10)
Ceiling [eqn. E]	0	0	0	0	0	0	0	0					Srr/S x 10^(-Rrr/10)
All ventilators [10 x log "B"]	-28.9	-32.9	-31.9	-28.9	-27.9	-29.9	-33.9	-39.9					
Glazing [10 x log "C"]	-29.1	-35.1	-31.1	-36.1	-46.1	-49.1	-46.1	-46.1					
External wall [10 x log "D"]	-40.1	-42.1	-47.1	-57.1	-65.1	-68.1	-73.1	-73.1					
Ceiling [10 x log "E"]	-23.1	-29.1	-39.1	-45.1	-50.1	-54.1	-54.1	-54.1					
All elements combined [eqn. F]	-21.3	-26.8	-28.1	-28.0	-27.8	-29.8	-33.6	-38.8					Log sum of equations B,C,D,E
Equiv. absorption area of rec. room (m	10	10	10	10	10	10	10	10					
10 x log(S/A) [eqn. G]	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1					

	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**		**Target**	**Exc.**	
Internal Leq,2	45	32	22	23	27	22	21	11	31		30	1	Equations (A+F+G) +3 dB
Internal Lmax,2	56	43	34	31	36	30	36	31	41		45	-4	Equations (A+F+G) +3 dB