Noise Assessment Addendum to Chapter 11 (Noise and Vibration) of Jubilee Park Environmental Statement

Contents

A1 Introduction

In 2012 noise and vibration from the then proposed Jubilee Park development was assessed in Chapter 11 (Noise and Vibration) of the Environmental Statement (ES) submitted alongside the original application for outline planning permission to deliver the Jubilee Park development. The original outline planning permission envisaged a local centre to be delivered on the application site. This has been delivered at a location offsite and Walters Land (Rogerstone) Ltd is proposing to redevelop the site for up to 50 homes. This Addendum Noise Assessment reviews the conclusions of the original assessment in the light of the proposed changes. The original Chapter 11 (Noise and Vibration), and the original Appendix 11 (Noise Survey Results and Glossary of Acoustic Terminology) have been included in Appendix A for reference.

The original noise assessment examined construction noise, operational traffic noise and operational building services noise at four receptor locations around the then proposed site, shown in Figure 1. It concluded that there would be no significant effects from any of the noise sources assessed. This Noise Assessment Addendum will review the original assessment of each noise source and demonstrate that the original conclusions are still valid.

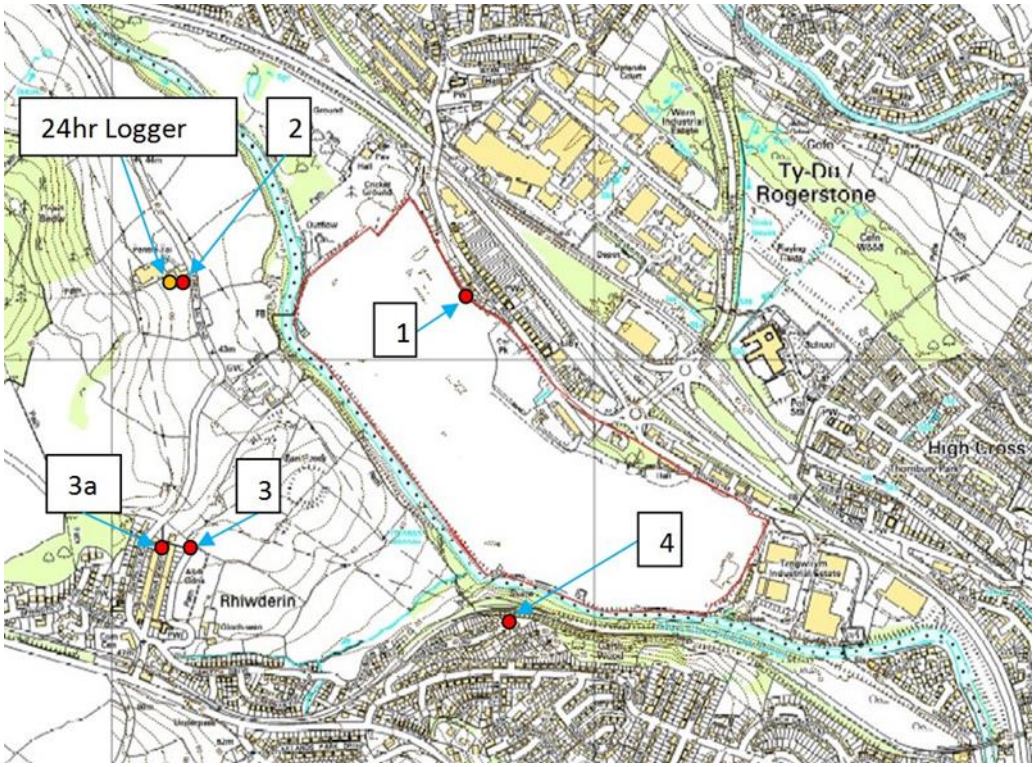

Figure 1 Original proposed site and four locations that were assessed in the 2012 ES.

The plots in question within the development area are shown in Figure 2.

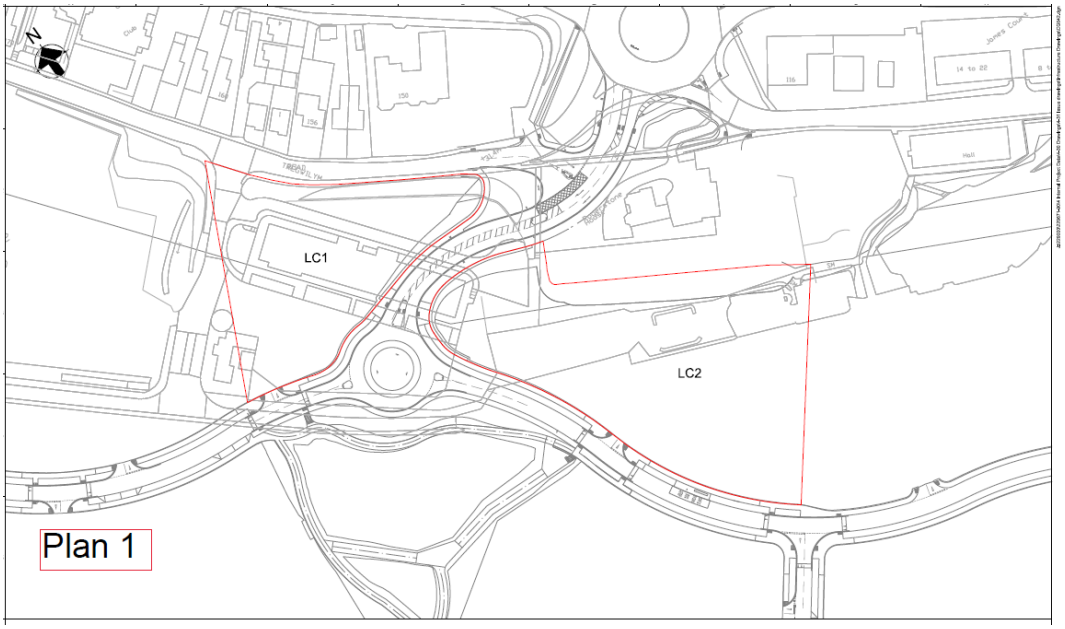

Figure 2 Plots with proposed change of use to residential (for context with Figure 1 this is close to the junction accessing the site from the A467)

A2 Scoping

The Environmental Health Officer for Newport City Council NCC has been consulted to agree an appropriate scope for this latest assessment. The conclusions of the consultation were confirmed in an email dated 9 March 2021 from Arup to NCC, and replicated below:

- "The revised proposed scheme includes the provision of an additional 38 residential units in the area of the development previously indicated for commercial use (supermarket, and pub) in the original application. I should note that the original assessment assumed 1200 dwellings, whereas only 938 have in fact been built, with an additional 38 planned as mentioned above.

- As the proposed relatively minor changes introduce additional housing, which would be less noise-generating than the commercial uses, it is considered that the original submission could be updated by means of a suitable addendum examining if there would be any change to the original assessment conclusions.

- It was agreed in our conversation that there would be no need for a further baseline sound level survey, as the original information is considered to remain valid. In addition, we concurred that the original survey data are likely to be more representative than that currently experienced in the area due to Covid-19 restrictions.

- The updated assessment, as previously, would be based on illustrative construction methods and associated noise emissions assumed for the original assessment of the other housing on the site. Where appropriate, the assessment will be partially qualitative.

- The review of construction and operation of the plots with the proposed change of use would be of effects on external receptors. As before, it would not consider the suitability of the noise climate of the site within the redline boundary for residential use".

Note: following these discussions, the proposal was revised to allow for a maximum of 50 residential units.

A3 Methodology

This assessment will apply the same methodology as originally used; this is explained in detail in the original ES, which can be found in Appendix A.

A4 Policy and guidance

A4.1 National Policy and guidance

Since the original ES submission, two policies have been superseded with the following documents:

- WELSH GOVERNMENT (2021) Planning Policy Wales Edition 11 - February 2021 and
- National Assembly for Wales (1997), Planning Guidance (Wales), Technical Advice Note (Wales) 11, NOISE, National Assembly for Wales

Planning Policy Wales Edition 11 February 2021[1] (PPW) sets out the land use planning policies of the Welsh Government. PPW aims to ensure that the planning system contributes towards the delivery of sustainable development and improve the social, economic, environmental and cultural well-being of Wales. The PPW is supplemented by the Technical Advice Note (TANs) as before.

With regards to noise, the PPW aims to promote healthier places by reducing exposure of local communities to noise pollution (paragraph 3.20 of the PPW under section 3 Strategic and Spatial choices). It also notes that planning authorities must consider current and future sources of noise as part of developing their strategies for locating new development. The pattern of proposed development should be informed by the sensitivity and compatibility of uses in relation to the sources of noise and the importance of ensuring appropriate soundscapes.

A4.2 Local Policy

It is understood that Newport City Council's standard planning conditions remain unchanged from those referenced within the original ES, see Appendix A.

[1] The Welsh Government. Planning Policy Wales Edition 11 Feb 2021. Accessed via: https://gov.wales/sites/default/files/publications/2021-02/planning-policy-wales-edition-11_0.pdf

A5 Potential impacts

A5.1 Construction phase

A5.1.1 Original assessment

Construction noise levels were predicted on the basis of typical residential construction plant from similar projects and the development of other phases at Jubilee Park, and assuming construction would take place in three phases. With reference to FigureFigure 1, at location 1, construction noise was predicted to slightly exceed the threshold for potential significant effect during phase 1, and be slightly below the threshold in phases 2 and 3. However the predictions were based on the worst-case scenario of construction plant operating at the site boundary nearest to the receptor. In reality, construction plant would only be operating at this proximity for a short period, so would cause a short-term disturbance only. Therefore, it was not assessed to cause a significant adverse impact. At locations 2-4 predicted noise levels were significantly below the threshold for a potential significant effect throughout all construction phases.

With regards to vibration, the original assessment stated that “the nature of the ground works and distances to the receptors is such that vibration from construction is not expected cause any disruption”. This remains the case for this addendum.

A5.1.2 Changes

The proposal is for the development of Plots LC1 and LC2 for housing rather than as a local centre as envisaged in the original outline permission. As such, the original construction plant assumptions are still valid and would be no worse in terms of noise impact than originally assessed assuming the construction of potential commercial buildings on the affected plots. Clearly, the construction programme is likely to be much shorter across the application site compared to the original construction programme for the whole residential development of 938 units. Therefore, the current proposal for these plots is likely to have no more impact than originally assessed, and the original conclusion of no significant effect is still valid.

Further to this, it is understood that some earlier construction works at other locations in the development may have produced relative high noise levels due the breaking-out of extensive and heavily reinforced concrete foundations, basements, slabs etc. It should be noted that such remediation/reclamation works are not required for the 50 units.

A5.2 Operation traffic noise

A5.2.1 Original assessment

The original assessment predicted the increase in traffic noise associated with any road links whose traffic flows were predicted to increase by more than 25%. This covered four road links: A1-2, A1-3, A2-1 and C4. The increase in traffic noise was predicted to be less than 3dB (the threshold for potential significant effect) for

links A1-2, A2-1 and C4. For link A1-3 the traffic noise was predicted to increase by more than 3dB, but this was not considered significant as the link did not border any existing residential property or sensitive uses. Overall, the effect of traffic noise increase was assessed and considered not significant.

A5.2.2 Changes

Arup Traffic Consultants have predicted that the overall daily traffic flows in the current proposal for a residential development will be approximately 30% less than those predicted if a commercial development was constructed. This will result in a lesser increase in traffic noise level than originally predicted, so the original assessment of no significant effect is still valid.

A5.3 Operational building services noise

A5.3.1 Original assessment

The original assessment commented that “for a residential development there would not be any building services plant noise other than small domestic heating and ventilation extracts”, but that potential building services noise would be assessed due to the possibility of plant noise from a school and retail area on the development. Rating noise targets for external building services noise were set, with reference to BS4142, at the four receptor locations marked inFigure 1, and it was stated that these targets would be met by design of any building services equipment. Consequently, noise from operational building services was assessed as not significant.

A5.3.2 Changes

As the site is proposed to be developed for housing rather than for commercial uses, there will be less building services equipment than originally planned. Therefore, the original conclusion of no significant effect is still valid.

A6 Mitigation measures

A6.1 Construction phase

The Best Practicable Means advice in the original assessment is still applicable. No additional mitigation measures are required.

A6.2 Operational traffic noise

No additional mitigation measures are required.

A6.3 Operational building services noise

As stated in the original assessment, any potential building services noise would be controlled to the noise targets set out in that document. No additional mitigation measures are required.

A7 Residual effects

A7.1 Construction phase

With the Best Practicable Means measures from the original assessment in place, the residual effects of construction phase noise will not be significant.

A7.2 Operational traffic noise

No traffic noise mitigation has been proposed; residual effects are not significant.

A7.3 Operational building services noise

If building services equipment is designed to the previously mentioned targets, residual effects will be not significant (although there are no new commercial uses proposed with this change of use to these plots).

A8 Conclusion

The original noise assessment has been reviewed with regards to the proposed change of use for two plots from commercial to residential use. The proposed changes will result in similar or lesser construction, traffic and building services noise impacts; this is summarised in Table 1. Therefore, there are no changes to the result of the original noise assessment.

Table 1 Summary of changes in assessment

Potential effect	Original assessment	Changes	Updated assessment
Construction noise	Not significant	Similar construction plant, shorter construction programme	Not significant
Operational traffic noise	Not significant	Approximate 30% reduction in predicted traffic flows	Not significant
Operational building services noise	Not significant	Commercial building services plant replaced by small domestic heating and ventilation extracts	Not significant

Appendix A

Original Chapter 11 (Noise and Vibration) and Appendix 11 (Noise Survey Results and Glossary of Acoustic Terminology)

11. Noise and Vibration

Introduction

11.1 This Chapter of the ES assesses the likely significant effects of the Development with respect to Noise and Vibration. It also describes the methods used to assess the effects; the baseline conditions currently existing at the site and surrounding area; the mitigation measures required to prevent, reduce or offset any significant negative effects; and the likely residual effects after these measures have been adopted.

11.2 Appendix 11.1 describes the details and results of the noise measurement survey and Appendix 11.2 contains a glossary of terminology used within this chapter.

Review of Proposed Development

11.3 The 40 hectare development site has the potential to affect noise sensitive receptors around its boundary during construction and operation. The residential build is likely to occur in approximately four phases starting from the north of the site. A primary school and a small, local shop also form part of the development masterplan.

11.4 Based on the proposal plans, the following potential noise changes have been identified:

- construction of the proposed development;
- road traffic noise from within the development and from any changes in traffic flow or composition on existing surrounding roads;
- plant machinery noise associated with the school and retail buildings.

11.5 The eastern boundary of the proposed development is approximately 100m from the A467 dual carriageway which heavily influences the noise climate at existing residential areas to the west of the A467. Between the A467 and the eastern site boundary of the site there are residential properties on Tregwilym Road. The rear gardens of the properties on the west side of Tregwilym Road are separated from the boundary by a narrow track.

11.6 To the west of the site the closest residential properties are located to the southwest in the Laurel Road area. Further to the west are residences in the Rhiwderin area approximately 500m from the western boundary.

Scoping and Consultation

11.7 Consultation with the local authority was carried out on behalf of the Applicant throughout June 2012. A number of telephone and email discussions have taken place with the Senior Environmental Health Officer at Newport City Council. This has helped to identify the sensitive receptors near to the site, agree locations for long and short term noise monitoring, and to determine the appropriate assessment methodologies.

11.8 It has been agreed that the noise and vibration assessment would not include the site clearance / preparation ground works.

11.9 The agreed monitoring locations represent the following receptors (refer to Figure 11. 1):

- Location 1: residential properties along Tregwilym Road
- Location 2: Pentre Tai farm and guesthouse along Pentre Tai Road
- Location 3: residential properties at the end of Tredegar Street
- Location 4: residential properties along Grovenor Road

11.10 Measurements of noise levels and assessment of noise impact have been made for these receptor locations as set out in more detail in this Chapter.

Planning Policy

1.10 This section provides a brief overview of development plan policy as relevant to noise and vibration.

National Planning Policy

11.11 Planning Policy Wales Edition 4[1] - February 2011 describes the planning development policies of the Welsh Assembly Government. Chapter 13 of the policy 'Minimising and Managing Environmental Risks and Pollution' sets out the policy objectives with regard to noise from new development; this is summarised in paragraph 13.14.2 of the document:

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

The document refers to Technical Advice Note (Wales) 11[2], which provides guidance on the assessment and control of environmental noise relating to existing and planned development.

Local Planning Policy

11.12 Newport City Council has been consulted and their local planning policy in the form of Newport City Council's standard planning conditions in relation to noise are detailed below.

11.13 *Construction Hours – Non-Piling (EH20) No development, (including land raising and demolition if required) shall be carried out other than between the hours of 08.00 and 18.00 Monday to Friday and between the hours of 08.00 and 13.00 on Saturdays, unless otherwise first agreed in writing by the Local Planning Authority.*

11.14 *Construction Hours – Piling (EH21) No construction work involving piling shall be carried out on the site other than between the hours of 08.00 and 17.00 Mondays to Fridays and no construction work involving piling shall be carried out on Saturdays, Sundays or Bank Holidays, unless otherwise first agreed in writing by the Local Planning Authority.*

[1] WELSH ASSEMBLY GOVERNMENT (2011) *Planning Policy Wales Edition 4 - February 2011 - Chapter 13 Minimising and Managing Environmental Risks and Pollution*
[2] NATIONAL ASSEMBLY FOR WALES (1997), *Planning Guidance(Wales),Technical Advice Note (Wales) 11, NOISE,* National Assembly for Wales

11.15 *Plant Noise – 5dB(A) Above Background (EH24) The rating level of the noise emitted from plant located at the site shall not exceed the existing background noise level at any time by more than 5dB(A) at any residential property when measured and corrected in accordance with BS 4142: 1997[3].*

Assessment Methodology and Information Sources

General Approach

11.16 For construction and traffic noise effects, prescribed prediction methodologies have been described below to predict the likely noise exposures based on construction activities and forecast traffic data. For fixed plant associated with buildings, it is possible to establish target noise criteria or operational constraints to ensure that they do not have an adverse impact on surrounding receptors.

Construction Noise

11.17 BS 5228-1: 1997[4] provides a method for predicting and assessing construction noise levels based on details of construction activities. The predictive method is based upon the sound power level (Lw) of each item of plant to be used and the application of corrections for:

- distance between the source and receptor location;
- the percentage operating time of the plant; and,
- any attenuation due to screening between source and receptor.

11.18 The source noise levels used for this assessment are taken from the BS 5228 sound power noise level database. The predicted noise level is compared against the existing ambient noise level to determine the likelihood of significant effects.

Road Traffic Noise

11.19 For traffic noise effects, prescribed prediction methodologies have been used to predict the likely noise changes based on forecast vehicle movements. The noise exposure arising from new or altered roads associated with the proposed

[3] BRITISH STANDARDS INSTITUTION (1997), BS 4142 *Method for rating industrial noise affecting mixed residential and industrial areas,* British Standards Institution
[4] BRITISH STANDARDS INSTITUTION (2009), BS 5228 *Code of Practice for Noise and Vibration Control on Open Construction Sites,* British Standards Institution

development, as well as resulting changes in traffic flow on existing roads, can be calculated using the Calculation of Road Traffic Noise[5] (CRTN) method, to derive the absolute noise levels at noise sensitive locations.

11.20 However, for the purposes of this assessment it was not necessary to calculate absolute noise levels. Instead, the relative changes in road traffic noise levels directly resulting from the proposed development have been considered to assess the likely impacts these would have on the surrounding areas. The variations in traffic speeds and composition were sufficiently small as to be insignificant to the traffic analysis. Therefore, it was only necessary to analyse the change in traffic flow. The relevant parts of the CRTN methodology were used to determine the likely change in noise levels.

11.21 Changes in noise levels have been estimated at noise sensitive locations surrounding the proposed development concentrating primarily on residential locations closest to the site where the largest traffic changes would be expected. The traffic data used for the calculations has been taken from the traffic assessment for the proposed development.

Buildings Services Noise

11.22 For plant machinery associated with buildings it is difficult to predict noise levels given the uncertainty as to the exact locations of the sources or the intensity of operation. However, it is possible to establish target noise criteria or operational constraints to ensure these sources do not have an adverse impact on the noise climate at nearby sensitive receivers. This would normally be assessed using the local authority criteria described in paragraph 11.15 which specifically relate to the level of the introduced noise relative to the existing noise level.

Assessment Criteria: Construction Noise Impact

11.23 BS5228 provides a number of methods for the assessment of significant effects from construction noise. The 'ABC' method of assessment is proposed to establish the threshold of potential significant effect at residential receptors.

11.24 Under this approach, the adverse impact threshold is determined at a dwelling using the existing ambient noise level, rounded to the nearest 5dB. This is then used to determine the assessment category: A, B or C, which then defines the adverse noise

[5] DEPARTMENT OF TRANSPORT WELSH OFFICE (1988), *Calculation of Road Traffic Noise,* HMSO

impact threshold, as described in Table 11. 1. The predicted construction noise level is then compared to the appropriate noise impact threshold level.

11.25 If the L_{Aeq} construction noise level exceeds the appropriate noise impact threshold level, then an adverse impact with the potential to cause a significant effect is identified.

Table 11. 1: Threshold of Significant Effect at Dwellings According to ABC Method in BS 5228-1:2009

Assessment category and threshold value period	Threshold value, dB		
	Category A	Category B	Category C
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75
- Category A: threshold value to use when ambient noise levels (rounded to the nearest 5dB) are less than these values Category B: threshold value to use when ambient noise levels (rounded to the nearest 5dB) are the same as Category A values Category C: threshold value to use when ambient noise levels (rounded to the nearest 5dB) are higher than Category A values.			

11.26 For example, for a site exposed to an existing ambient noise level of 68dB(A), this would be rounded to 70dB(A). 70dB(A) is higher than the Category A value of 65dB(A), therefore the Category C value of 75dB(A) applies as a threshold for potential significant effect.

11.27 For residential receptors, the overall significance of the effect is assessed using professional judgement by considering not only the BS5228 criteria but also other factors, as discussed later in Paragraph 11.37.

Assessment Criteria: Road Traffic Noise Impact

11.28 There is no established UK guidance that clearly defines criteria for the assessment of significant effects arising from road traffic noise. The response of people to noise is

subjective, and sensitivity to changes in traffic noise varies across the population. Given the variability of response and the potential for non-acoustic factors to influence perceptions of noise, any assessment of significance can only represent the general community response to traffic noise.

11.29 Chapter 3 of DMRB HD 213/11 Revision 1[6] notes that "A change of 1 dB(A) in the short-term (e.g. when a project is opened) is the smallest that is considered perceptible. In the long-term, a 3 dB(A) change is considered perceptible, and such an increase should be mitigated if possible."

11.30 DMRB provides categories for assessing road noise impact magnitude. On the basis of the available guidance, Arup has developed significance criteria for changes in road traffic noise at sensitive receptors. The impact criteria and potential significance thresholds are given below in Table 11. 2.

Table 11. 2: Summary Table of Noise Impact Evaluation Criteria for Changes in Traffic Noise

Change in noise level	Impact category	Initial indicator of significance
>+10	Major adverse	Potential for significant increase
≥+5 to <+10	Moderate adverse	
≥+3 to <+5	Minor adverse	
0 to <+3	Negligible	Unlikely to be significant
>-3 to 0	Negligible	
≤-3 to >-5	Minor beneficial	Potential for significant decrease
≤-5 to >-10	Moderate beneficial	
≤-10	Major beneficial	

11.31 Where a noise change of +3dB is identified, the effect may be potentially significant, and an assessment of the receptors affected by the change is made.

11.32 For residential receptors, the overall significance of the effect is assessed using professional judgement by considering not only the DMRB noise impact criteria but also other factors, as discussed later in Paragraph 11.37.

[6] THE HIGHWAYS AGENCY, TRANSPORT SCOTLAND, WELSH ASSEMBLY, DRD (2011), *Design Manual for Roads and Bridges Volume 11, Section 3, Part 7,HD 213/11 – Revision 1, TSO*

Assessment Criteria: Building Services Plant Noise

11.33 For plant machinery associated with buildings it is difficult to predict noise levels given the uncertainty as to the exact locations of the sources or the intensity of operation. However, it is possible to establish target noise criteria or operational constraints to ensure these sources do not have an adverse impact on the noise climate at nearby sensitive receptors.

11.34 BS 4142 describes a method for determining the likelihood of complaints arising from noise from factories, industrial premises, fixed installations and sources of an industrial nature in commercial premises. To prevent the proposed development having an unacceptable impact on the surrounding area, appropriate plant machinery noise targets would be specified based on the existing noise climate. Although the title of the Standard implies a limited application to just industrial situations, the assessment methods it recommends are often used to assess noise from building services plant from commercial premises. Fixed plant of this nature is included within the scope of the Standard.

11.35 The standard considers noise levels outside a building and compares the L_{Aeq} rating level from the industrial noise source of interest (including any adjustment for acoustic features) against L_{A90} background noise level.

11.36 Newport City Council's plant noise criteria has been adopted (repeated below for clarity).

Plant Noise – 5dBA Above Background (EH24) The rating level of the noise emitted from plant located at the site shall not exceed the existing background noise level at any time by more than 5dB(A) at any residential property when measured and corrected in accordance with BS 4142: 1997.

Determining significance of effects

11.37 All of the identified sources of noise and vibration have been evaluated to determine if there would be adverse impacts or the potential to cause significant effects according to the criteria described above.

11.38 The overall assessment of significance for the surrounding residential receptors would be evaluated using the above criteria as well as professional judgement based on the following factors.

Additional consideration is given to:

- the number of receptors subject to the impacts
- the proportion of the community subject to the impact
- the existing absolute noise levels (particularly very noisy and quiet / tranquil areas).
- duration of exposure

Assumptions and Limitations

11.39 The predicted level of noise from construction depends on the particular items of plant used. At this stage in the programme, a fully detailed schedule of construction equipment is not available. Therefore, a typical schedule has been developed based on an illustrative construction methodology for a residential development from experience of similar projects (as described in Paragraph 11.48).

Baseline Conditions

Baseline Survey Methodology

11.40 An attended noise survey was undertaken to establish the baseline noise levels at the nearest noise sensitive receptors to the proposed development. Figure 11. 1. Noise Survey Measurement Locations shows the measurement locations selected to be representative of these noise sensitive receptors and Table 11. 3 to Table 11. 5 present a summary of the results. Full noise survey details and results can be found in Appendix A11.1.

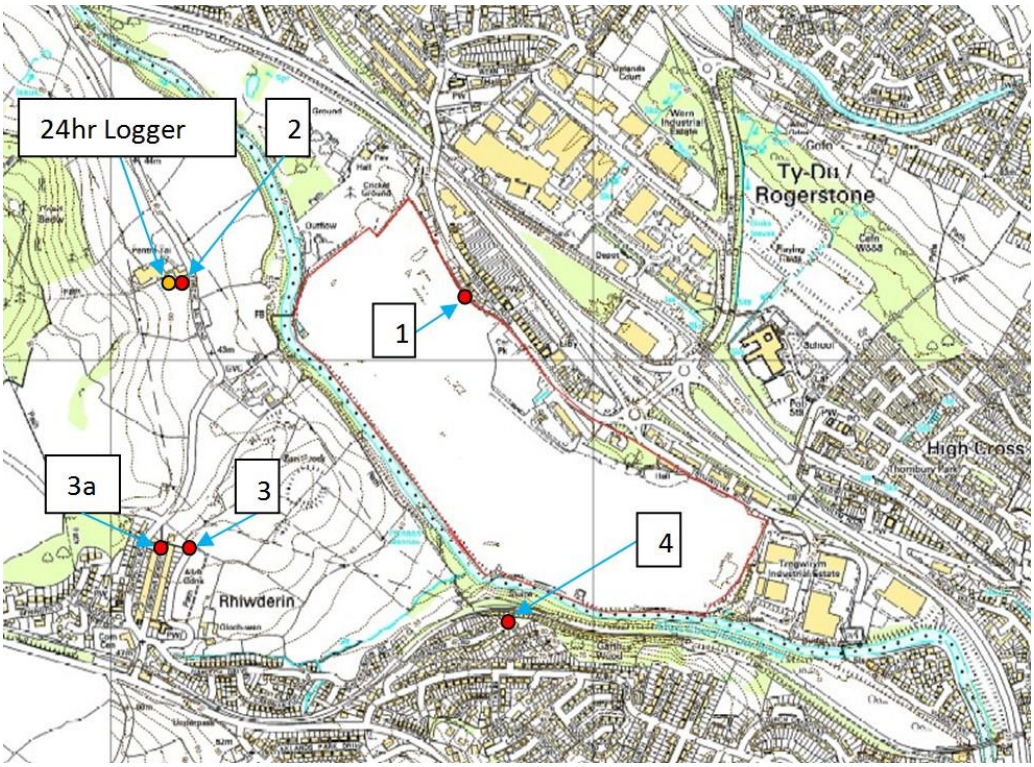

Figure 11. 1. Noise Survey Measurement Locations

11.41 The survey locations were as follows:

Location 1 - north of the development site, representative of the residences that front on to Tregwilym road, this position was to the rear of May cottages on the rear access lane to garages.

Location 2 – northwest of the development site, representative of residence that fronts on to Pentre Tai Road and overlooks the site. A noise logger was also installed at this position to measure over a 24hr period.

Location 3 & 3A – southwest of the development site, representative of residences that front and back on to Tredgart Street (west) and Tredgart Street (east) and overlook the site.

Location 4 – south of the development site, representative of the residences at Grovenor Road that overlook the site.

11.42 Attended noise surveys were conducted by Arup as follows:

- Daytime (interpeak) between 12:58 and 17:32 on 10 July 2012

- Late evening between 20:23 and 23:07 on 10 July 2012.
- Quietest night between 00:00 and 04:05 on 11 July 2012.
- Unattended noise surveys at location 2 were conducted between 14:30 on 10 July 2012 to 14:30 11 July 2012.

11.43 The sound level meter was set to record noise levels over 10-minute periods during all three periods the interpeak (day time), late evening time and quietest night time. For each noise measurement, the noise climate, wind speed and direction, and the measured noise levels, were all noted on survey sheets. The meter was set to automatically store the L_{Aeq}, L_{A10}, L_{A90} and $L_{Amax,F}$ indices. Measurements were made with a fast (0.125s) time constant.

11.44 The measurements were made with the measurement microphone mounted using a tripod approximately 1.2m – 1.5m above ground level under acoustically free field conditions (ie at least 3.5m from any acoustically reflecting surface other than the ground).

Summary noise survey results

11.45 Measured noise levels are summarised in Table 11. 3 – Table 11. 5. Noise levels were measured over 10 minute durations for daytime, evening and night-time measurements respectively.

11.46 Ambient noise level indicators L_{Aeq} and L_{A10} and background noise level indicator L_{A90} were all dominated by local and distant road traffic noise during the day. During the evening and night background noise levels were controlled by distant traffic noise and the flowing river at location 4, while ambient (average) noise levels were also influenced by local traffic noise.

11.47 Figure A11.2 in Appendix A11.1 shows the typical diurnal variation in noise level over 24 hour period as confirmed by the sampled results at the other locations over the day, evening and night-time periods.

Table 11. 3: Summary of Measured Daytime Noise Levels (13:00 – 16:30)

Location	Sound pressure level, dB	
	L_{A90}	L_{Aeq}
1	43 - 45	46 - 48

2	42 - 46	49 – 58
3	-	-
3A*	42 - 46	48 – 50
4	45 - 48	51 – 53

*****Location 3A was used as an alternative to location 3 being judged to have an equivalent noise climate to receptors in this area closest to the site. It was used only during the daytime as location 3 was affected by temporary construction works.

Table 11. 4: Summary of Measured Evening Noise Levels (20:00 – 23:00)

Location	Sound pressure level, dB	
	L_{A90}	L_{Aeq}
1	35 - 37	39 – 44
2	34 - 38	38 - 46
3	33 - 35	37 – 38
3A	-	-
4	41 - 42	42 - 45

Table 11. 5: Summary of Measured Night-time Noise Levels (00:00 – 04:00)

Location	Sound pressure level, dB	
	L_{A90}	L_{Aeq}
1	33 - 35	38 – 46
2	27* - 31	35 – 35
3	27 - 30	35 – 38
3A	-	-
4	39	40

*Measured with logger at location 2

Potential Impacts

Construction Phase

11.48 The details of the construction methodology for the residential development have not been established at this stage. Therefore, the construction plant assumptions have been based on knowledge of typical residential construction plant based on experience from similar projects. This is intended to provide an indication of the variation in levels of noise associated with the different stages of work. Table 11. 6 shows the assumed stages of construction and illustrative plant used for the purpose of the construction noise assessment.

Table 11. 6: Stages of Construction of the Residential Development and Plant Assumptions

Phase Number	Stage	Typical plant used during residential construction
1	Foundations	wheel washer concrete mixer excavator
2	House building construction	forklift truck delivery lorry/van lorry mounted crane
3	Landscaping works	tipper truck (10t) fork lift truck tracked excavator delivery lorry/van dumper (6t)

11.49 Table 11. 7 shows the calculation results for the four representative noise receptors identified as part of the scoping/consultation exercise. The calculated noise levels assume the construction work is concentrated in the phase area closest to the receptor in question. A 'worst case' scenario has been assumed where the construction noise sources are at the boundary edge of the phase zone closest to the sensitive receptor. For most of the works the construction noise levels can be assumed to be lower than those presented.

11.50 It is assumed that there will be partial screening of the construction works by either hoarding at the site boundary of a surface mass 7kg/m^2 or enclosures used to shield noisy static plant equipment or construction processes

Table 11. 7: Stages of Residential Construction and Predicted Noise Levels

(Worst case - short period of works closest to receptors)

Location	Baseline			Construction noise assessment		
	Ambient noise level $L_{Aeq, 15\ min}$	ABC method category (BS 5228)	ABC threshold	Construction stage	Construction noise level $dBL_{Aeq,daytime}$	Level above threshold dB
1	47dB	A	65dB	1	70	+5
				2	59	-6
				3	58	-7
2	52dB	A	65dB	1	50	-15
				2	45	-20
				3	44	-21
3A*	49dB	A	65dB	1	45	-20
				2	40	-25
				3	39	-26
4	52dB	A	65dB	1	53	-12
				2	47	-18
				3	46	-19

*Location 3A (equivalent to location 3) used for daytime measurements

11.51 The threshold for potential significance for construction noise (based on the BS 5228 ABC categories) is exceeded only for one work stage at one receptor. This exceedance at location 1 during the foundations construction stage would only occur if these works were taking place closest to the boundary, and hence only for a short duration. The item of plant causing the dominant contribution to this noise level would be the wheel washer. Given the short duration of the foundation works this close to the receptor, this would be rated as **not significant**, although the need to control this noise source will be examined in the mitigation section of this chapter.

11.52 The nature of the ground works and distances to the receptors is such that vibration from construction is not expected cause any disruption.

Operational Phase: Road Traffic Noise

11.53 Current and forecast traffic flows for the scheme have been produced by Arup Traffic Consultants. Table 11. 8 shows the percentage change in traffic flow in column 3, and column 4 shows the calculated traffic noise increase associated with particular road links. Only links with forecast increases of greater than 25% (equivalent to traffic noise increases of 1dB(A)) have been included in this analysis. Changes less than this would not be assessed according to the DMRB methodology.

Table 11. 8: Road Links with Traffic Flow Increases >25% (ie >1dB(A)) Associated with the Development (2026)

Link	Location/description	Estimated Percentage increase in traffic flow between with and without development scenarios, 2026 (AAWT 18 hr)	Estimated increase in traffic noise contribution from road link $dBL_{A10,18hr}$
A1-2	Link west directly from A467 junction to Tregwilym Rd	64	2.1
A1-3	North access road to development (from A467 junction)	332	5.2
A2-1	Tregwilym Rd southeast of A467 junction (south side of A467)	86	2.7
C4	A467 northeast slip road	50	1.8

11.54 The link road west from the A467 junction (A1-2) is forecast to have traffic increases which would increase traffic noise by just over 2dB(A), but this link is not bordered by residential properties. The north access road to the development itself (A1-3) would be subject to an increase of noise of greater than 3dB(A), again, this link is not bordered by existing residential property. The southern access road to the development is not in a residential area. The predicted traffic noise increase of 2.7dB(A) on Tregwilym Road south east of the A467 junction (A2-1) would not affect residential properties as the road is bordered only by commercial uses. The northeast sliproad of the A467 junction (C4) would be subject to forecast increases of

1.8dB(A). This link is not close to any residential properties and would not contribute to noise from the A467 mainline already experienced by residents north of the A467.

11.55 The effect of traffic noise increases on the local road network associated with the development is therefore assessed as **not significant**.

Operational Phase: Building Services Plant Noise

11.56 Through detailed design it is possible to ensure that building services noise levels do not give rise to significant adverse noise impacts at surrounding residential properties. It should be noted that for a residential development there would not be any building services plant noise other than small domestic heating and ventilation extracts. However, the locations of the school and retail area are not fixed as part of the masterplan and there is the possibility of buildings plant noise from these premises, hence the need to assess these effects.

11.57 Calculations of target noise levels for plant noise emissions at the facades of the nearest noise sensitive receptors are detailed in Table 11. 9 below. This assumes a target criterion of the rating level ($L_{Ar,Tr}$)[7] being 5dB above the measured background noise level as part of this study. The target criterion conforms to Newport City Council's plant noise criteria policy EH24.

Table 11. 9 Target Rating Noise Levels $L_{Ar,Tr}$ at Receptor Locations

Location	Daytime limit (0700-1900)	Evening limit (1900-2300)	Night-time limit (2300-0700)
1	48	40	38
2	47	39	35*
3	47	38	35*
4	50	46	44

*BS 4142 describes its assessment method as being valid unless the background and rating noise levels are very low (ie 30dBL_{A90} and 35dBL_{Aeq} respectively). Hence the rating level has been set no lower than 35dBL_{Aeq}.

11.58 It should be noted that plant is often operated at a reduced level overnight. This may assist in achieving the plant noise limits set above. The noise impact of operational

[7] As defined by BS 4142:1997

plant and equipment is therefore assessed as **not significant** during normal operating conditions provided the above conditions are achieved.

Significance summary

The assessed construction and operational noise effects are summarised below.

Table 11. 10: Significance Assessment - Construction

Receptor	Importance / Sensitivity	Impact	Magnitude / Nature	Significance
1	High	Exceeds ABC* impact threshold for short period (foundation works)	Potentially short-term adverse impact	Not significant
2	High	Below ABC threshold	No adverse impact	Not significant
3	High	Below ABC threshold	No adverse impact	Not significant
4	High	Below ABC threshold	No adverse impact	Not significant

***BS 5228:1997**

Table 11. 11: Significance Assessment - Operation

Receptor	Importance / Sensitivity	Impact	Magnitude / Nature	Significance
1	High	Traffic – negligible Building services - negligible	No adverse impact	Not significant
2	High	Traffic – negligible Building services – negligible	No adverse impact	Not significant
3	High	Traffic – negligible Building services – negligible	No adverse impact	Not significant
4	High	Traffic – negligible Building services - negligible	No adverse impact	Not significant

Mitigation Measures

Construction

11.59 Construction noise from the phased residential construction has been assessed as not significant. However, it was noted that when the works are close to location 1, as these properties border the site, there is the potential for noise level to exceed the BS 5228:1997 ABC criterion if only for a short period. In this case it would be necessary to review the use of the noisiest plant (such as vehicle wheel washers for example) to consider location and screening to minimise noise emission to sensitive receptors.

11.60 As part of Best Practicable Means the site contractors would be required to operate to a Code of Construction Practice to control noise. This is a good practice guide which includes measures which should be adopted to minimise the likelihood of significant disturbance to neighbouring properties. Newport City Council's policies EH20 and EH 21 on construction hours and piling should also be observed (although piling works are not anticipated for this type of development).

11.61 Particular consideration needs to be given to the careful selection of plant, construction methods and programming to minimise the noise impact at closest sensitive receivers, as summarised below:

- Only plant conforming to SI 2001/1701 (UK implementation of EC directive 2000/14/EC on noise emission) should be used if placed on the market or put into service since January 2002.
- Plant placed on the market or put into service prior to that date should conform to SI 1985/1968 (as amended) or to SI 1988/361 (as amended) as appropriate to the type of plant.
- Equipment should be sited as far from sensitive receptors or as close to any acoustic screen located between the activity and the receptor as reasonably practicable.
- Specific measures should also be employed. These may include, where reasonably practicable:

1. Provision of lined and sealed acoustic covers for equipment which will be in place while equipment is running;
2. Regular maintenance of all equipment;
3. Operation of equipment in the mode of operation that minimises noise;
4. Shutting down equipment when not in use;

5. Avoiding waiting or queuing on the public highway with engines running;
6. Selection of piling methods which minimise noise and vibration;
7. Handling all materials in a manner which minimises noise;
8. The use, by preference, of non-audible warning systems and where audible warnings are necessary for reversing, vehicles operations will be planned to minimise reversing;
9. Fitting of silencers to all plant, machinery and vehicles;

Operation – Building Services

11.62 Buildings service plant would be controlled to the appropriate limits defined in Table 11. 9 Target Rating Noise Levels $L_{Ar,Tr}$ at Receptor Locations according to Newport City Council's plant noise criteria policy EH24.

Operation – Traffic Noise

11.63 As traffic noise impacts would be negligible, no mitigation is appropriate.

Residual Effects

Construction – Noise

11.64 With the above Best Practicable Means measures in place the residual effects of worst case construction noise predictions, would be not significant.

Operation

11.65 Buildings service plant would be designed to meet Newport City Council's plant noise criteria, residual effects would therefore be **not significant**.

Operation – Traffic Noise

11.66 No traffic noise mitigation has been proposed, residual effects are **not significant**.

Summary & Table of Significance

11.67 The proposed development will result in phased construction across the 40 Hectare site. The construction of residential estates is less intensive than larger types of building and does not involve major ground works, for basements and foundations. Hence the excavation and concreting works, although widespread, will not be concentrated in any area for long durations. Although construction noise would potentially cause some short-term disturbance at location 1 (Tregwilym Rd) when the ground works are very close to the boundary, the noise levels are generally predicted to be well below the threshold of noise significance. Best Practicable Means will be

applied to minimise construction noise. At more distant surrounding receptors construction noise would be less noticeable.

11.68 Traffic flows are forecast to increase as result of the development. Although there are predicted to be increases in traffic noise on certain links on the surrounding road network, these links are less than the threshold of significant traffic noise change and would occur on links that are not bordered by residential areas.

11.69 Building services noise is not expected to be prevalent on a residential estate although there could be some small-scale heating and ventilation plant associated with the proposed school building and retail buildings. Any such building plant will be controlled by design to prevent any adverse noise effects.

Table 11. 12 summarises the noise effects, any appropriate mitigation measures, and the predicted residual effects.

Table 11. 12: Summary Table of Significance

Potential Effect	Nature of Effect (Permanent / Temporary, and Direct / Indirect)	Significance (Major / Moderate/ Minor / Negligible, and Beneficial / Adverse)	Geographic Scale of Impact (Local / Borough / County / Regional / National / International)	Mitigation Measures	Residual effects (Major / Moderate/ Minor / Negligible, and Beneficial / Adverse)
Construction					
Construction noise	Temporary/direct	Negligible	Local	Best Practicable Means controls to minimise noise emission	Negligible
Operation					
Traffic noise	Permanent / indirect	Negligible	Local	Not applicable	Negligible
Building services plant	Permanent / direct	Negligible	Local	Controlled by design to NCC criteria (Policy EH24)	Negligible
Cumulative Effects					
	Permanent /	Negligible	Local	Not	Negligible

Traffic noise	indirect			applicable	

NOTE

Figures / drawings etc (eg. **Figure 7.1**, Figure 7.2 etc) which are referred to in the text but not incorporated should be collated at the end of each chapter.

This also applies to Appendices (e.g. **Appendix 7.1**, 7.2 etc).

Larger documents should be referred to as Technical Appendices (e.g. **Technical Appendix 7.1**, Technical Appendix 7.2 etc) which will be contained within Volume 2 of the ES.

Appendix A11

A11.1 Noise Survey Results

Attended Survey Periods

11.1.1 Attended noise surveys were carried out at the locations shown in Figure A11.1. The survey was conducted by Ray Houghton of Arup at the following times:

- Daytime (interpeak) between 12:58 and 17:32 on 10 July 2012
- Late evening between 20:23 and 23:07 on 10 July 2012
- Quietest night-time between 00:00 and 04:05 on 11 July 2012.

Attended Survey Methodology

11.1.2 The sound level meter was set to record noise levels over 10-minute periods during all three periods the interpeak (day time), late evening time and quietest night time. For each noise measurement, the noise climate, wind speed and direction, and the measured noise levels, were all recorded and noted. The meter was set to automatically store the L_{Aeq}, L_{A10}, L_{A90} and $L_{Amax,F}$ indices. Measurements were made with a fast (0.125s) time constant.

11.1.3 The measurements were made with the measurement microphone mounted using a tripod approximately 1.2m – 1.5m above ground level under acoustically free field conditions (ie at least 3.5m from any acoustically reflecting surface other than the ground).

11.1.4 The measurement locations were chosen to provide a representative indication of the typical ambient noise levels across the area proposed for the development.

11.1.5 The weather conditions during the survey were dry and variable with wind speeds less than 5ms-1 generally from the northeast.

Attended Measurement Equipment

Measurements were carried out using equipment as detailed in
11.1.6 **Table A11. 1**. The sound level meter and microphone are Type 1, conforming to BS EN 61672-1: 2003. The calibration of the sound level meter, pre-amplifier and

microphone chains were checked before and after use, to confirm that there was no significant drift in meter response at the calibrator frequency and level. All Arup's sound level meters are regularly calibrated and this calibration is traceable to international standards.

Table A11. 1 Measurement Instrumentation

Attended measurements (Kit A)	Manufacturer	Type Number	Serial Number
Type 1 sound pressure calibrator	Rion	NC74	35173564
Precision grade sound level meter	Norsonic	140	SN1403429
½" diameter pre-polarised condenser microphone	Norsonic	1225	98521

Attended Measurements

Error! Reference source not found. to **Table A11. 5** give, respectively, the day, evening and night measured results of the attended noise survey, with data provided in chronological order. Measurements locations are as shown in

11.1.7 **Figure A11. 1**.

Unattended Survey Periods

11.1.8 An unattended noise survey was carried out at the location shown in Figure A11.1. The logging device was set to run over the following period:

- Between 14:30 on 10 July 2012 to 14:30 11 July 2012.

Unattended Survey Methodology

11.1.9 The sound level meter was set to record noise levels over 10-minute periods for 24 hours to cover all three periods the Interpeak (day time), late evening time and Quietest night time. The noise climate, wind speed and direction, and the measured noise levels, were all noted on survey sheets at the beginning and the end of the time period. The meter was set to automatically store the L_{Aeq}, L_{A10}, L_{A90} and $L_{Amax,F}$ indices. Measurements were made with a fast (0.125s) time constant.

11.1.10 The measurements were made with the measurement microphone mounted using a tripod approximately 1.2m – 1.5m above ground level under acoustically free field conditions (ie at least 3.5m from any acoustically reflecting surface other than the ground).

11.1.11 The measurement locations were chosen to provide a representative indication of the typical ambient noise levels across the area proposed for mixed use development.

11.1.12 The weather conditions during the survey were dry and variable with wind speeds less than 5ms-1 generally from the northeast.

Unattended Measurement Equipment

11.1.13 Measurements were carried out using equipment as detailed in **Error! Reference source not found.**. The sound level meter and microphone are Type 1, conforming to BS EN 61672-1: 2003. The calibration of the sound level meter, pre-amplifier and microphone chains were checked before and after use, to confirm that there was no significant drift in meter response at the calibrator frequency and level. All Arup's sound level meters are regularly calibrated and this calibration is traceable to international standards.

Table A11. 2 Measurement Instrumentation

Unattended measurements (Kit B)	Manufacturer	Type Number	Serial Number
Type 1 sound pressure calibrator	Rion	NC-74	SN 35015247
Precision grade noise logging sound level meter	Rion	NL52	SN 00120481
½" diameter pre-polarised condenser microphone	Rion	4188	SN 03153/ NH-10480

Unattended Measurements

11.1.14 **Table A11. 7** gives the results of the 24 hour unattended noise survey. The results of the L_{Aeq} and L_{A90} measurements are shown a s a time history in Figure A11.2.

11.1.15 At the logging position, measurements were made over consecutive 10 minute periods between 014:30hrs on 10th February and 14:29hrs on 11th July 20012.

Figure A11. 1 Attended and Unattended (Logger) Measurement Positions

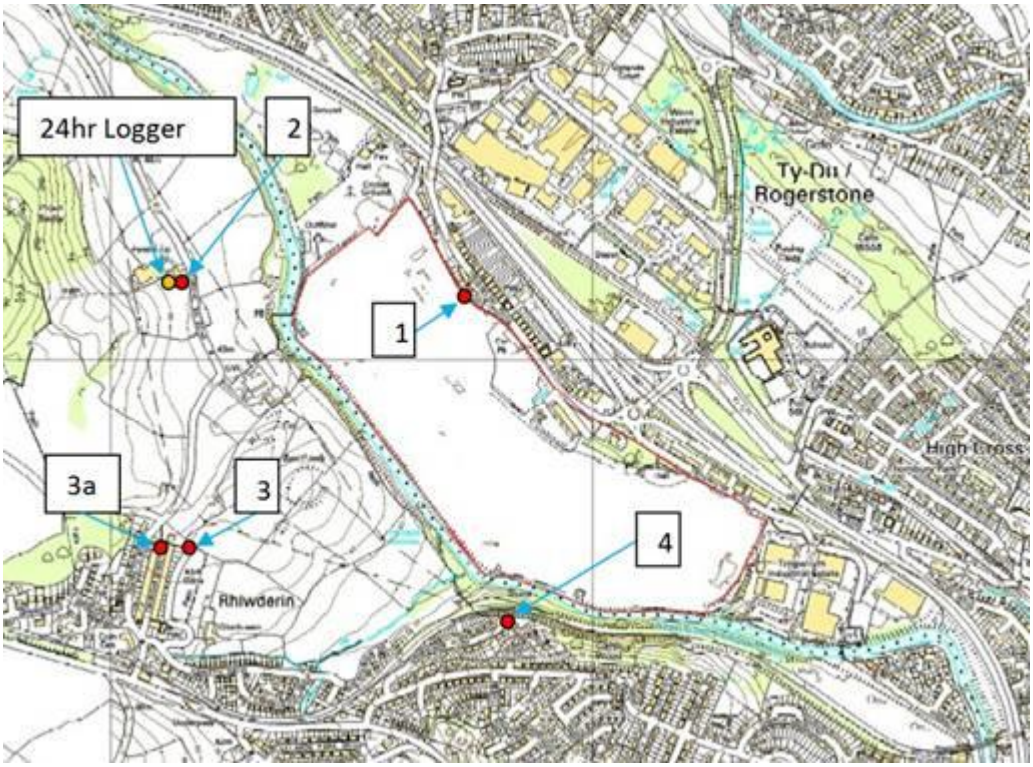

Table A11. 3 Location 1 Baseline Noise Level

Date	Time		Wind		Noise Level, dB (A)					Comments
	Start	Finish	Speed (ms-1)	Direction	L_{min}	L_{90}	L_{10}	L_{max}	L_{eq}	
10.07.12	12:58	01:08	0	-	41.1	42.9	49.1	67.1	46.5	Road can be heard from north west. Cars on Tregwilym Rd can be heard
	14:51	15:01	0	-	40.7	42.5	48.4	63.9	46.0	Birds singing, some background noise from A467
	16:21	16:31	0	-	41.4	44.6	50.4	56.9	48.0	
	21:31	21:41	0	-	34.7	37.3	48.0	58.4	44.2	
	22:57	23:07	0	-	32.9	34.9	42.6	55.1	39.4	
	00:00	00:10	0	-	32.8	35.1	41.6	58.2	39.3	
	01:24	01:34	0	-	32.3	34.0	39.2	57.1	37.2	River can be heard from this location
	02:47	02:57	0	-	32.1	33.3	39.5	62.0	37.4	

Table A11. 4 Location 2 Baseline Noise Level

Date	Time		Wind		Noise Level, dB (A)					Comments
	Start	Finish	Speed (ms-1)	Direction	L_{min}	L_{90}	L_{10}	L_{max}	L_{eq}	
10.07.12	14:15	14:25	0.6	N/E	39.6	42.4	49.3	70.9	50.1	Logging in at 02:30 at location 2
	15:55	16:05	-	-	40.5	43.8	53.5	84.2	57.5	
	17:22	17:32	0.7	N/E	43.9	46.2	50	70.7	48.8	
	20:23	20:33	0.3	N/E	34.7	37.7	45.7	67.7	45.6	Bird song
	21:56	22:06	0.5	N	30.0	34.0	38.7	63.6	37.9	
	01:00	01:10	-	-	27.7	29.7	37.5	58.0	35.1	
	02:23	02:33	-	-	26.8	28.8	36.1	61.7	34.9	
	03:55	04:05	-	-	29.1	30.6	30.6	51.9	35.2	

Table A11. 5 Location 3A Baseline Noise Level

Date	Time		Wind		Noise Level, dB (A)					Comments
	Start	Finish	Speed (ms-1)	Direction	Lmin	L90	L10	Lmax	Leq	
10.07.12	13:55	14:05	0.7	N/E	39.2	41.9	50.0	73.0	47.8	
	15:33	15:43	-	-	41.0	42.9	52.1	68.8	49.6	
	17:04	17:14	0.7	N/E	43.2	46.0	51.1	64.5	48.9	

Location 3A was used as an alternative to location 3 being judged to have an equivalent noise climate to receptors in this area closest to the site. It was used only during the daytime as location was affected by temporary construction works.

Table A11. 6 Location 3 Baseline Noise Level

Date	Time		Wind		Noise Level, dB (A)					Comments
	Start	Finish	Speed (ms-1)	Direction	L_{min}	L_{90}	L_{10}	L_{max}	L_{eq}	
10.07.12	20:47	20:57	0.1	N/W	32.7	34.7	40.0	59.2	38.3	Road noise to the north east A467 & A468
	22:14	22:24	0.7	N/E	29.7	32.9	39.4	59.7	37.1	
	00:42	00:52	-	-	24.4	28.4	38.5	50.4	35.0	
	02:05	02:15	-	-	24.7	27.4	38.2	57.0	34.9	
	03:33	03:34	-	-	25.0	30.0	39.3	65.4	37.9	

Table A11. 7 Location 4 Baseline Noise Level

Date	Time		Wind		Noise Level, dB (A)					Comments
	Start	Finish	Speed (ms-1)	Direction	L_{min}	L_{90}	L_{10}	L_{max}	L_{eq}	
10.07.12	20:47	20:57	0.1	N/W	32.7	34.7	40.0	59.2	38.3	Road noise to the north east A467 & A468
	22:14	22:24	0.7	N/E	29.7	32.9	39.4	59.7	37.1	
	00:42	00:52	-	-	24.4	28.4	38.5	50.4	35.0	
	02:05	02:15	-	-	24.7	27.4	38.2	57.0	34.9	
	00:24	00:34	0.1	N/E	37.7	38.6	40.8	52.8	39.8	
	01:47	01:57	-	-	38.1	38.9	41.5	55.3	40.3	River dominating

	03:12	03:22	-	-	37.7	38.6	40.8	53.8	39.7	

Figure A11. 2 Location 2 – 24hr Noise Logger Results

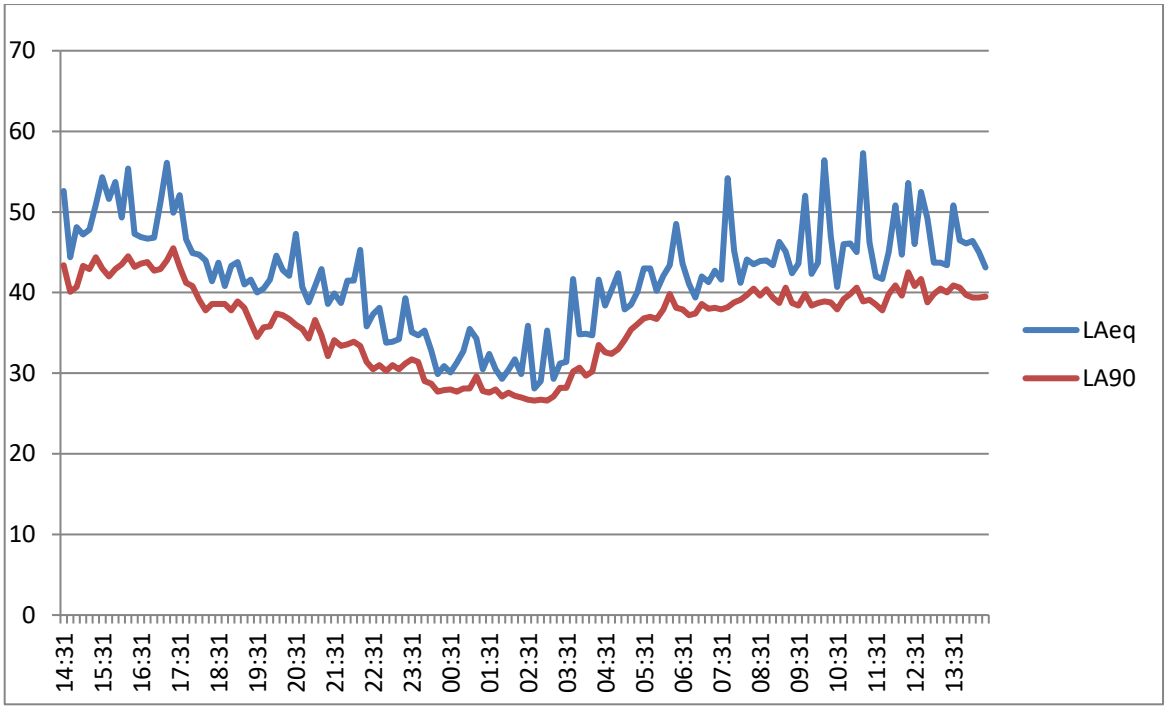

Table A11. 8 24hr Logger at Location 2 Baseline Noise Level for L_{Aeq} and L_{A90}

Location 2 (24hr)	Noise Level, dB re. 20µPa (10 min)	
	L_{A90}	L_{Aeq}
14:31	43.4	52.6
14:41	40.1	44.4
14:51	40.7	48.1
15:01	43.3	47.2
15:11	42.9	47.8
15:21	44.4	50.9
15:31	43	54.3
15:41	42	51.6
15:51	42.9	53.7
16:01	43.5	49.3
16:11	44.5	55.4
16:21	43.2	47.3
16:31	43.6	46.9
16:41	43.8	46.7
16:51	42.7	46.8
17:01	42.9	51.2
17:11	44	56.1
17:21	45.5	49.9
17:31	43.2	52.1
17:41	41.2	46.6
17:51	40.8	44.9
18:01	39.1	44.7
18:11	37.8	44
18:21	38.6	41.4
18:31	38.6	43.7

Location 2 (24hr)	Noise Level, dB re. 20µPa (10 min)	
	L_{A90}	L_{Aeq}
18:41	38.6	40.8
18:51	37.8	43.3
19:01	38.9	43.8
19:11	38.1	41
19:21	36.3	41.6
19:31	34.5	40
19:41	35.7	40.5
19:51	35.8	41.6
20:01	37.4	44.6
20:11	37.2	42.8
20:21	36.7	42.1
20:31	36	47.3
20:41	35.5	40.7
20:51	34.3	38.8
21:01	36.6	40.8
21:11	34.7	42.9
21:21	32.1	38.6
21:31	34.1	39.9
21:41	33.4	38.7
21:51	33.6	41.5
22:01	33.9	41.5
22:11	33.4	45.3
22:21	31.4	35.8
22:31	30.5	37.3
22:41	31	38.1
22:51	30.3	33.8
23:01	31	33.9
23:11	30.5	34.2
23:21	31.2	39.3
23:31	31.7	35.1
23:41	31.4	34.7
23:51	29	35.3
00:01	28.7	32.8
00:31	28	30.1
00:41	27.7	31.3
00:51	28.1	32.7
01:01	28.1	35.5
01:11	29.6	34.3
01:21	27.8	30.5
01:31	27.6	32.4
01:41	28	30.5
01:51	27.1	29.3
02:01	27.6	30.4
02:11	27.2	31.7
02:21	27	29.9
02:31	26.7	35.9
02:41	26.6	28.1
02:51	26.7	29
03:01	26.6	35.3
03:11	27.1	29.3
03:21	28.2	31.2

Location 2 (24hr)	Noise Level, dB re. 20µPa (10 min)	
	L_{A90}	L_{Aeq}
03:31	28.2	31.4
03:41	30.2	41.7
03:51	30.7	34.8
04:01	29.7	34.9
04:11	30.2	34.7
04:21	33.5	41.6
04:31	32.6	38.4
04:41	32.4	40.3
04:51	33	42.4
05:01	34.1	37.9
05:11	35.4	38.5
05:21	36.1	40.1
05:31	36.8	43
05:41	37	43
05:51	36.7	40.2
06:01	37.9	42.1
06:11	39.8	43.4
06:21	38.1	48.5
06:31	37.9	43.6
06:41	37.2	41.1
06:51	37.4	39.4
07:01	38.6	42
07:11	38	41.3
07:21	38.1	42.7
07:31	37.9	41.6
07:41	38.2	54.2
07:51	38.8	45.2
08:01	39.1	41.2
08:11	39.7	44.1
08:21	40.5	43.5
08:31	39.6	43.9
08:41	40.4	44
08:51	39.4	43.4
09:01	38.7	46.3
09:11	40.6	45.1
09:21	38.7	42.4
09:31	38.4	43.6
09:41	39.8	52
09:51	38.4	42.3
10:01	38.7	43.7
10:11	38.9	56.4
10:21	38.8	47
10:31	37.9	40.7
10:41	39.2	46
10:51	39.8	46.1
11:01	40.6	45
11:11	38.9	57.3
11:21	39.1	46.2
11:31	38.5	42
11:41	37.8	41.7
11:51	39.8	45

Location 2 (24hr)	Noise Level, dB re. 20µPa (10 min)	
	L_{A90}	L_{Aeq}
12:01	40.9	50.8
12:11	39.6	44.7
12:21	42.5	53.6
12:31	40.8	46
12:41	41.7	52.5
12:51	38.8	49.2
13:01	39.8	43.7
13:11	40.5	43.7
13:21	40	43.4
13:31	40.9	50.8
13:41	40.6	46.5
13:51	39.7	46.1
14:01	39.4	46.4
14:11	39.4	45
14:21	39.5	43.1

A11.2 Glossary of Acoustic Terminology

A11.2 Decibel

The ratio of sound pressures, which we can hear, is a ratio of 106 (one million: one). For convenience, therefore, a logarithmic measurement scale is used. The resulting parameter is called the 'sound pressure level' (Lp) and the associated measurement unit is the decibel (dB). As the decibel is a logarithmic ratio, the laws of logarithmic addition and subtraction apply.

A11.3 Equivalent Continuous Sound Level

Another index for assessment for overall noise exposure is the equivalent continuous sound level, Leq. This is a notional steady level which would, over a given period of time, deliver the same sound energy as the actual time-varying sound over the same period. Hence fluctuating levels can be described in terms of a single figure level.

A11.4 Statistical Noise Levels

For levels of noise that vary widely with time, for example road traffic noise, it is necessary to employ an index which allows for this variation. The L10, the level exceeded for ten per cent of the time period under consideration, has been adopted in this country for the assessment of road traffic noise. The L90, the level exceeded for ninety per cent of the time, has been adopted to represent the background noise level. The L1, the level exceeded for one per cent of the time, is representative of the maximum levels recorded during the sample period. A weighted statistical noise levels are denoted L_{A10}, dB L_{A90} etc. The reference time period (T), is normally included, eg $dBL_{A10, 5min}$ or $dBL_{A90, 8hr}$.

A11.5 Maximum Noise Level

This is generally expressed as the maximum A-weighted noise level (LAmax) and represents the maximum instantaneous noise level that occurred with the monitoring period. Certain assessment criteria recommend maximum noise levels to avoid disturbance as well as limits for longer-term averaged noise exposures.

A11.6 Frequency

The rate of repetition of a sound wave. The subjective equivalent in music is pitch. The unit of frequency is the Hertz (Hz), which is identical to cycles per second. A thousand hertz is often denoted kHz, eg 2kHz = 2000Hz. Human hearing ranges approximately from 20Hz to 20kHz. For design purposes, the octave bands between 63Hz to 8kHz are generally used. The most commonly used frequency bands are octave bands, in which the mid frequency of each band is twice that of the band below it. For more detailed analysis, each octave band may be split into three one-third octave bands or in some cases, narrow frequency bands.

A11.7 Sound Pressure Level

The sound power emitted by a source results in pressure fluctuations in the air, which are heard as sound.

The sound pressure level (Lp) is 10 times the logarithm of the ratio of the measured sound pressure (detected by a microphone) to the reference level of 2 x 10-5Pa (the threshold of hearing).

Thus Lp (dB) = 10 log (P1/Pref)2 where Pref, the lowest pressure detectable by the ear, is 0.00002 pascals (ie 2x10-5 Pa).

The threshold of hearing is 0dB, while the threshold of pain is approximately 120dB. Normal speech is approximately 60dB(A) or more and a change of 3dB is only just detectable. A change of 10dB is subjectively twice, or half, as loud.

Vibration

Vibration may be expressed in terms of displacement, velocity and acceleration. Velocity and acceleration are most commonly used when assessing structureborne noise or human comfort issues respectively. Vibration amplitude may be quantified as a peak value, or as a root mean squared (rms) value.

Vibration amplitude can be expressed as an engineering unit value eg 1 mms-1 or as a ratio on a logarithmic scale in decibels:

vibration velocity level, dB = 20 log (V/Vref).

(where the preferred reference level, Vref, for vibration velocity = 10-9 ms-1.)

The decibel approach has advantages for manipulation and comparison of data.

A11.8 Typical Noise Levels

Some typical noise levels are given below:

Noise Level dB(A)	Example
130	Threshold of pain
120	Jet aircraft take-off at 100m
110	Chain saw at 1m
100	Inside disco
90	Heavy lorries at 5m
80	Kerbside of busy street
70	Loud radio (in typical domestic room)
60	Office or restaurant
50	Domestic fan heater at 1m
40	Living room
30	Theatre
20	Remote countryside on still night
10	Sound insulated test chamber
0	Threshold of hearing