Contents

13. Noise

13.1 Introduction

13.1.1 This chapter presents an assessment of the likely significant effects of the Proposed Development with respect to noise. The assessment is based on information obtained to date. It should be read in conjunction with the project description provided in **Chapter 4: Description of the Proposed Development**. This chapter also considers any potential impacts of construction of the grid connection in the area shown in **Figure 1.2** and **Figure 4.1**.

13.1.2 This chapter describes:

- the legislation, policy and technical guidance that has informed the assessment (**Section 13.2**);
- the consultation and engagement that has been undertaken and how comments from consultees relating to noise have been addressed (**Section 13.3**);
- the methods used for baseline data gathering (**Section 13.4**);
- the surveys undertaken, and a summary of the results (**Section 13.5**);
- the overall baseline conditions (**Section 13.6**);
- the data used to predict wind turbine noise levels (**Section 13.7**);
- embedded mitigation measures relevant to noise (**Section 13.8**);
- the scope of the assessment for noise (**Section 13.9**);
- the methods used for the assessment (**Section 13.10**);
- the assessment of noise effects (**Section 13.11**);
- the assessment of cumulative (inter-project) effects (**Section 13.12**);
- a summary of the significance conclusions (**Section 13.13**); and
- an outline of further work to be undertaken (**Section 13.14)**.

Limitations and assumptions

13.1.3 This Draft ES has been produced to fulfil the Applicant's consultation duties and enable consultees to develop an informed view of the likely significant effects of the Project.

13.1.4 The Proposed Development was subject to a previous application (ref. DNS/3273368) which was supported by an ES, including a noise assessment and a subsequent addendum addressing the removal of Turbine 5. Following submission of the ES addendum the application was withdrawn.

13.1.5 This chapter presents an assessment of the same scheme as appraised in the ES addendum for the previous application, also accounting for subsequent changes in cumulative development information.

13.1.1 To inform the assessment, a baseline noise survey was undertaken in parallel with a simultaneous meteorological survey under taken utilising a full height met mast, and in

accordance with Institute of Acoustics (IOA) guidance (see **Table 13.3** and **paragraph 13.5.1** for details).

13.2 Relevant legislation, planning policy and technical guidance

13.2.1 This section identifies the legislation, planning policy and technical guidance that has informed the assessment of effects with respect to noise. Further information on policies relevant to the Project is provided in **Chapter 5: Legislation and policy overview**.

Legislation

13.2.2 A summary of the relevant legislation is provided in **Table 13.1**.

Table 13.1 Legislation relevant to the noise assessment

Legislation	Legislative context
Environmental Protection Act 1990, Part III – as amended by the Noise and Statutory Nuisance Act 1993[1]	An Act to make provision for the improved control of pollution arising from certain industrial and other processes, including noise pollution.
Control of Pollution Act 1974[2]	An Act to make further provision with respect to waste disposal, water pollution, noise, atmospheric pollution, and public health; and for the purposes connected with the matters aforesaid.

Planning policy

13.2.3 A summary of the relevant national and local planning policy is provided in **Table 13.2**.

Table 13.2 Planning policy relevant to the noise assessment

Policy	Policy context
National planning policy	
Planning Policy Wales (PPW)	PPW[3] sets out the land use planning policies of the Welsh Government, supplemented by Technical Advice Notes (TANs). PPW sets out the importance of fully considering potential noise impacts from new energy infrastructure when making planning decisions. PPW refers to ETSU-R-97[4] for the assessment of noise from wind turbines.

[1] UK Government (1990), Environmental Protection Act 1990. (Online) Available at: https://www.legislation.gov.uk/ukpga/1990/43/contents (Accessed 30 August 2024).
[2] UK Government (1974). Control of Pollution Act 1974. (Online) Available at: https://www.legislation.gov.uk/ukpga/1974/40/contents (Accessed 30 August 2024).
[3] Welsh Government (2021). Planning Policy Wales. Edition 12. (Online) Available at: https://www.gov.wales/sites/default/files/publications/2024-07/planning-policy-wales-edition-12.pdf (Accessed 30 August 2024),
[4] The Working Group on Noise from Wind Turbines (1996). ETSU-R-97 The assessment and rating of noise from wind farms. (Online) Available at: https://regmedia.co.uk/2011/08/02/etsu_r_97.pdf (Accessed 30 August 2024).

Future Wales – The National Plan 2040[5]	Provides the national development framework up to 2040 and refers to the protection from noise through planning throughout, including renewables.
Welsh Assembly Government: Technical Advice Note (TAN) 11: Noise (1997)[6]	TAN 11 provides general advice on noise and refers to TAN 8[7] for guidance regarding noise from wind turbines and wind farms. TAN 8 has now been superseded by national development framework embedded within 'Future Wales'.
Local planning policy	
Torfaen County Borough Council Local Development Plan (to 2021) Adopted December 2013[8]	**Policy BW1 General Policy – Development Proposals** states*: "All development proposals will be considered favourably providing they comply with the following criteria where they are applicable:- **A Amenity and Design** … vi) The proposal does not have an unacceptable impact upon the amenities of the occupiers of adjoining or neighbouring properties; … **B Natural Environment**, i) The proposal does not result in unacceptable adverse effects in respect of land contamination, instability or subsidence; air, heat, noise or light pollution…"*
Blaenau Gwent County Borough Council Local Development Plan up to 2021 (Adopted November 2012)[9]	**Policy DM1** New Development states: *"Development proposals will be permitted provided: … There would be no unacceptable risk of harm to health and/or local amenity from unacceptably high levels of noise, vibration, odour or light pollution…"* **Policy DM4** Low and Zero Carbon Energy states: *"The Council will encourage major development proposals to incorporate schemes which generate energy from renewable and low/zero carbon technologies. These technologies include onshore wind… …These technologies will be permitted provided that: …They will not have an unacceptable adverse impact on local amenity by reason of noise emission…"*

Technical guidance

A summary of the technical guidance for noise is provided in **Table 13.3**.

Table 13.3 Technical guidance relevant to the noise assessment

Technical guidance document	Context

[5] Welsh Government (2021). Future Wales: The National Plan 2040. (online) Available at: https://gov.wales/sites/default/files/publications/2021-02/future-wales-the-national-plan-2040.pdf (Accessed 30 August 2024).
[6] Welsh Assembly Government (1997). Technical Advice Note 11: Noise. (Online) Available at: https://gov.wales/sites/default/files/publications/2018-09/tan11-noise.pdf (Accessed 30 August 2024).
[7] Welsh Assembly Government (2005). Technical Advice Note 8: Planning for Renewable Energy. (Online) Available at: https://gov.wales/sites/default/files/publications/2018-09/tan8-renewable-energy_0.pdf (Accessed 30 August 2024).
[8] Torfaen County Borough Council Local Development Plan (to 2021) Adopted December 2013, Written Statement (2013). (Online) Available at: https://www.torfaen.gov.uk/en/Related-Documents/Forward-Planning/Adopted-Torfaen-LDP-Writen-Statement.pdf (Accessed 30 August 2024)
[9] Blaenau Gwent County Borough Council (2012). Local Development Plan up to 2021. (Online) Available at: https://www.blaenau-gwent.gov.uk/en/resident/planning/local-development-plan/adopted-local-development-plan-2006-2021/adopted-ldp/ (Accessed 30 August 2024).

ETSU-R-97 The Assessment and Rating of Noise from Wind Farms, The Working Group on Noise from Wind Turbines (1996)[4]	Information and advice to developers and planners on the environmental assessment of noise from wind turbines. The guidance offers a framework for the measurement of wind farm noise and gives indicative noise levels thought to offer a reasonable degree of protection to wind farm neighbours.
A Good Practice Guide ('IOA GPG') to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise, Institute of Acoustics (2013)[10]	Presents current good practice in the application of ETSU-R-97[4] for all wind turbine developments above 50kW. The good practice guide gives information to assist consultants, developers and local planning authorities in using the correct technical and procedural methods for the assessment and determination of wind farm applications, reflecting the original principles within ETSU-R-97[4] and the results of research carried out and experience gained since its publication. Six Supplementary Guidance Notes (SGNs) present additional guidance on various topics: • SGN 1: Data collection[11] • SGN 2: Data processing & derivation of ETSU-R-97 background curves[12] • SGN 3: Sound power level data[13] • SGN 4: Wind shear[14] • SGN 5: Post completion measurements[15] • SGN 6: Noise propagation over water for on-shore wind turbines[16]
BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise, BSI (2014)[17]	Detailed guidance on assessing noise from construction sites. Approved code of practice for construction noise under the Control of Pollution Act 1974.

13.3 Consultation and engagement

Overview

13.3.1 The assessment has been informed by consultation responses and stakeholder engagement undertaken during the preparation and submission of the information which

[10] Institute of Acoustics (2013). A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise. (Online) Available at: https://www.ioa.org.uk/sites/default/files/IOA%20Good%20Practice%20Guide%20on%20Wind%20Turbine%20Noise%20-%20May%202013.pdf (Accessed 30 August 2024).
[11] Institute of Acoustics (2014). A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise. Supplementary guidance note 1: Data collection.
[12] Institute of Acoustics (2014). A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise. Supplementary guidance note 2: Data processing & derivation of ETSU-R-97 background curves.
[13] Institute of Acoustics (2014). A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise. Supplementary guidance note 3: Sound power level data.
[14] Institute of Acoustics (2014). A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise. Supplementary guidance note 4: Wind shear.
[15] Institute of Acoustics (2014). A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise. Supplementary guidance note 5: Post completion measurements.
[16] Institute of Acoustics (2014). A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise. Supplementary guidance note 6: SGN 6: Noise propagation over water for on-shore wind turbines.
[17] British Standards Institution (2014). British Standard BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites, Part 1: Noise. BSI, London.

accompanied the previous application. Those consultation responses have been included below where relevant following the removal of Turbine 5 and the minor alteration of the grid connection location for the resubmission that this ES supports. An overview of the approach to consultation is provided in **Section 2.4** of **Chapter 2: Approach to Environmental Impact Assessment**.

Scoping Direction

13.3.2 A Scoping Direction was issued by Planning and Environment Decisions Wales (PEDW), on behalf of the Welsh Ministers, on 6 August 2021. A summary of the relevant responses received in the Scoping Direction in relation to noise and confirmation of how these have been addressed within the assessment to date is presented in **Table 13.4**.

Table 13.4 Summary of EIA Scoping Direction responses for noise

Consultee	Consideration	How addressed in this ES
PEDW	The Inspectorate welcomes the assurance that mitigation for construction / construction traffic noise will be set out in the ES.	The mitigation of construction noise and construction traffic noise, where required, is provided in **Section 13.8.**

Technical engagement

13.3.3 Technical engagement with consultees in relation to noise is ongoing. A summary of the technical engagement undertaken to date is outlined in **Table 13.5**.

Table 13.5 Technical engagement on the noise assessment

Consultee	Consideration
Torfaen County Borough Council	Consultation with TCBC was undertaken based on the information contained in the documentation submitted as part of the withdrawn application, including the Draft ES, Final ES and ES Addendum. No further comments relating to noise were received at the time of preparing this ES. The LIR submitted during final submission raised questions as to the limits, further consultation will be undertaken to discuss this with the LPA.
Blaenau Gwent County Borough Council	Consultation with BGCBC was undertaken based on the information contained in the documentation submitted as part of the withdrawn application, including the Draft ES, Final ES and ES Addendum. No further comments relating to noise were received at the time of preparing this ES. The Environmental Health Officer advised that the submission was robust and raised no objections.

13.4 Data gathering methodology

Study area

Wind Farm development

13.4.1 The study area is based on a radius of 10 km from the Proposed Development.

13.4.2 Within the 10 km study area, other wind farm developments, including those that are consented but not built or at planning stage, have been considered as part of the assessment of cumulative effects. The proposed wind farm 'Mynydd Maen' has also been included. The planning application for this wind farm was submitted at the time of preparing this ES.

Grid Connection

13.4.3 The study area is based on the Noise Sensitive Receptors (NSRs) within, or in close proximity to, the proposed grid connection corridor.

Desk study

13.4.4 A desk study has been undertaken to assist in determining the baseline conditions. This has included:

- identification of cumulative windfarms and associated development details (e.g. planning status, scheme layouts, turbine dimensions / hub heights and candidate / installed wind turbine types etc;
- identification of noise-sensitive receptors including those with the greatest potential to be subject to an impact from the Proposed Development operating in isolation, or under the cumulative scenario;
- identification of possible local noise sources in the vicinity of the identified receptors (including local water courses etc.); and
- identification of information to inform the operational noise level predictions (e.g. topographic ground contour detail).

13.4.5 The desk study included consideration of data sources outlined in **Table 13.6**.

Table 13.6 Data sources used to inform the noise assessment

Organisation	Data source	Data
Google & Maxar Technologies	Google Earth Pro 7.3.4.8248[18] (software), Maxar Technologies (image source)	Aerial imagery
British Standards Institute	BS 5228-1:2009+A1:2014[17]	Noise data for construction noise and vibration predictions.
Enercon	Sound power levels of the Enercon E-53 Operational Mode 1 (Data sheet)[19] Sound emission according to IEC 61400-11[20]	Turbine noise data (Enercon E-53)

[18] Google (2021). Google Earth Pro, version 7.3.4.8248. (Online) Available at: https://www.google.com/earth/download/gep/agree.html?hl=en-GB (Accessed 30 August 2024).
[19] Enercon GmbH (2012). Sound power level of the Enercon E-53 Operational Mode 1 (Data sheet). Enercon GmbH, Aurich, Germany.
[20] Muller-BBM (2007). Enercon GmBH, Sound emission according to IEC 61400-11. Ebercon E-53 in 26409 Wittmun-Eggelingen in operational mode I. Test report No. M69 915/1. Muller-BBM, Germany.

Organisation	Data source	Data
Vestas	DMS 0067-4767 V05. V150-4.0/4.2 MW Third octave noise emission[21]	Turbine noise data (Vestas V150)
Stuart Burke Associates	Single wind turbine application – Roundshaw Farm[22]	Turbine noise data (Vestas V27)
Gamesa	MCG G128-4.5MW Noise Spectrum[23] G128 4.5MW Power curve and noise levels[24]	Turbine noise data (Gamesa G128)
Senvion	Octave & third octave band data [MM100/50Hz/60Hz][25]	Turbine noise data (Senvion MM100)
University of Groningen & University of Gothenburg	Project WINDFARMperception[26]	Turbine noise data (Vestas V66)
Nordex	Technical report. Octave sound power levels. Nordex N117/3000 – Standard Mode[27]	Turbine noise data (Nordex N117)

Cumulative Developments

13.4.6 The following cumulative developments have been identified within the Study Area:

- Abertillery Wind Farm (approx. 4 km to the north) – 6 turbine development, pre-application stage;
- Manmoel Wind Farm (approx. 8 km to the northwest) – 5 turbine development, planning application submitted;
- Blaentillery Wind Farm (approx. 6 km to the north) – 2 turbine development, consented and installed;
- Mynydd Carn y Cefn Wind Farm (approx. 4 km to the northwest) – 8 turbine development, consented;
- Coed y Gilfach Farm Wind Turbines (approx. 1 km to the north) – 2 turbine development, consented and installed;

[21] Vestas (2018). DMS 0067-4767 V05. V150-4.0/4.2 MW Third octave noise emission. Vestas, Denmark.
[22] Stuart Burke Associates (2014). Single wind turbine application – Roundshaw Farm. Environmental Statement: Volume III – Technical Assessment. SBA, 2014.
[23] Gamesa (2013). General characteristics manual. MCG G128-4.5MW Noise Spectrum. Gamesa.
[24] Gamesa (2012). General characteristics manual. G128 4.5MW Power curve and noise levels. Gamesa.
[25] Senvion (2014). Octave & third octave band data [MM100/50Hz/60Hz]. General information. Doc.-ID: GI-2.21-WT.PO.04-A-A-EN. Senvion, Hamburg, Germany.
[26] Frits van den Berg, et al (2008). Project WINDFARMperception. Visual and acoustic impact of wind turbine farms on residents. FP6-2005-Science-and-society-20, Specific Support Action, Project no. 044628. Final Report. University of Groningen & University of Gothenburg.
[27] Nordex (2015). Technical report. Octave sound power levels. Nordex N117/3000 – Standard Mode. Document no. F008_244_A04_EN. Nordex Energy GmbH, Germany.

- Mynydd Maen Wind Farm (approx. 3 km to the south) –13 turbine development, pre-application stage;
- Trecelyn Wind Farm (approx. 3 km to the south) – 4 turbine development, DNS application submitted;
- Oakdale Business Park Wind Turbines (approx. 4 km to the southwest) – 2 turbine development, consented and installed;
- Mynydd Bedwellte - (approx. 9 km to the northwest) – 8 turbine development, scoping stage;
- Pen y Fan Ganol Farm Wind Turbine (approx. 4 km to the west) – 1 turbine development consented and installed; and
- Pen-y-Fan Industrial Estate Wind Turbine (approx. 4 km to the west) – 1 turbine development, consented and installed.

13.4.7 In addition to the above, other small scale and single turbine developments such as Gelli-wen Farm and Bedlywn Farm have been identified between 5 and 10 km from the Proposed Development. Given their distance and small scale, these developments will give a negligible noise contribution at NSRs compared to the multi-turbine sites, and so have been scoped-out of further consideration.

Noise Sensitive Receptors

13.4.8 The Noise Sensitive Receptors (NSRs) in the vicinity of the Proposed Development that have the greatest potential to be subject to potential noise effects are listed below in **Table 13.7** and are shown in **Figure 13.1**. The selected NSRs have a good geographic spread across the local area.

Table 13.7 Noise sensitive receptors selected for assessment

Reference	Receptor Location	Approximate Easting, m	Approximate Northing, m
R1	Woodview Cottages, Cwmnantygroes, Six Bells, Abertillery, NP13 2PR	322722	203506
R2	Gilfach Wen Farm, Blaen-Y-cwm Road, Abertillery, NP13 2AZ	323042	202786
R3	Ty-Dafydd Farm, Six Bells, Abertillery, NP13 2AZ	322972	202495
R4	Blaencuffin Barn Farm, Blaen-Y-cwm Road, Abertillery, NP13 2AY	322880	201774
R5	Maescynew Farm, Hyde Place, Llanhilleth, Abertillery, NP13 2RU	322573	200977
R6	5 Incline Cottages, Llanhilleth, Abertillery, NP13 2JS	322895	200553
R7	Ty'r-Ysgybor-Ddu, Blaen-Y-cwm Road, Pantygasseg, Pontypool NP4 6UJ	323923	200771
R8	2 Ty Gwyn Cottages, Pantygasseg, Pontypool, NP4 6UJ	324172	200376

Reference	Receptor Location	Approximate Easting, m	Approximate Northing, m
R9	Ty Mari Hari Farm, Pantygasseg, Pontypool, NP4 6UA	324407	200127
R10	Cefn-y-Crib Farm, Blaen-Y-cwm Road, Pantygasseg, Pontypool, NP4 6UJ	324277	199857
R11	The Old School House, Pantygasseg, Pontypool, NP4 6UA	324433	199637
R12	2 - 9 Bush Terrace, Pantygasseg, Pontypool, NP4 6TY	325088	199767
R13	Mountain View House, Pantygasseg, Pontypool, NP4 6TY	325372	199885
R14	1 - 6 Ty-Bwmpyn Road, Pontypool, NP4 6UL	325621	200819
R15	Blaenant y Caws, PlasyCoed Rd, Pantygasseg, Ponytypool, NP4 6UN	324977	201238
R16	Cwmffrwdoer Farm, Cwmffrwdoer, Pontypool, NP4 6UB	325875	201256
R17	Yew Tree Cottage, Pentrepiod, Pontnewynydd, Pontypool, NP4 6TR	326035	201646
R18	Tal-ochor Farm, Pentrepiod, Pontnewynydd, Pontypool, NP4 6TR	325724	201892
R19	Pistyll Gwyn, Pentwyn, Abersychan, Pontypool, NP4 7TA	325803	202321
R20	British Road, Abersychan	325413	203423

13.5 Survey work

Baseline noise survey

13.5.1 A baseline noise survey was undertaken between Wednesday 22 February 2023 and Monday 22 March 2023 in accordance with ETSU-R-97[4] and the IOA GPG with meteorological data simultaneously acquired from a full height meteorological mast on the site (see meteorological data section below). The survey included four measurement locations M1 to M4.

13.5.2 The positions of the monitoring locations are shown in **Figure 13.1** and listed in **Table 13.8**.

Table 13.8 Noise monitoring locations

Monitoring location	Location	Approximate distance to nearest proposed turbine	Approximate Easting, m	Approximate Northing, m

M1	Blaencuffin Barn Farm	850 south west of Proposed Development turbine T3	322847	201771
M2	Maescynew Farm	820 m west of Proposed Development turbine T8	322580	200974
M3	Cefn-y-Crib Farm	1000 m south west of Proposed Development turbine T7	324314	199856
M4	Pistyll Gwyn	1200 m east of Proposed Development turbine T1	325808	202311
Met mast	Site of proposed development	220 m north west of Proposed Development turbine T7	324710	200900

13.5.3 The IoA GPG[10] advises that a survey duration of less than 2 weeks is unlikely to be sufficient to obtain a dataset covering the required range of wind speeds and directions (the latter if relevant). The survey was therefore allowed to monitor for a substantially longer period of approximately one month.. This was sufficient to ensure that a suitably wide range of wind conditions were captured during both quiet daytime and night-time periods (See paragraph 13.5.15).

13.5.4 The baseline sound level survey was undertaken using sound pressure level measurement equipment conforming to BS EN 61672-1:2013[28] Class 1 specification, listed in **Table 13.9**.

Table 13.9 Baseline sound level survey measurement equipment

Equipment Reference (Location)	Equipment Item	Make and Model	Serial Number
Kit 10 (M1)	Sound Level Meter	Rion NL-31	1141954
	Preamplifier	Rion NH-21	13599
	Microphone	Rion UC-52	319494
	Acoustic Calibrator (C2)	Rion NC-74	34251551
Kit 14 (M2)	Sound Level Meter	Rion NL-31	1283508
	Preamplifier	Rion NH-21	29265
	Microphone	Rion UC-52	315530

[28] British Standards Institution (2013). BS EN 61672-1:2013 Electroacoustics. Sound Level Meters. Specifications. BSI, London.

Equipment Reference (Location)	Equipment Item	Make and Model	Serial Number
	Acoustic Calibrator (C2)	Rion NC-74	34251551
Kit 11 (M3)	Sound Level Meter	Rion NL-31	583298
	Preamplifier	Rion NH-21	27528
	Microphone	Rion UC-52	314461
	Acoustic Calibrator (C2)	Rion NC-74	34251551
Kit 13 (M4)	Sound Level Meter	Rion NL-31	1283509
	Preamplifier	Rion NH-21	29266
	Microphone	Rion UC-52	315535
	Acoustic Calibrator (C2)	Rion NC-74	34251551

13.5.5 All sound level meters had been calibrated to traceable standards within the preceding 2 years and the calibrators within the preceding 12 months. Each measurement system was field-calibration-checked at the point of installation and at collection. No significant measurement drifts occurred.

13.5.6 Each of the measurement systems were fitted with WS-03 environmental windshields, which are of substantial dimensions (reticulated foam with approx. 200mm diameter).

13.5.7 Each measurement system was installed with the microphone mounted under free-field conditions, approximately 1.2m above ground level. The measurement location at each property was selected to be representative of the primary external living spaces, but also to minimise the influence of any local sources such as road traffic, water courses and wind through local trees/foliage etc.

13.5.8 The system time clocks were checked at the end of the survey, to ensure that none had exhibited a significant drift in accordance with the IoA GPG which states that "*A synchronisation drift of more than 1 minute over the duration of the survey should be reported and best avoided*". None of the measurement systems drifted to this degree.

13.5.9 Each measurement system was used to obtain noise level data in the $L_{A90,T}$ noise index (as well as other environmental monitoring indices), in continuous 10-minute intervals over the full measurement durations.

Meteorological Data

13.5.10 For the duration of the baseline noise survey, simultaneous 10-minute meteorological measurements were undertaken on the Site of the Proposed Development. The obtained measurement data included average wind speed and wind direction. Anemometers were installed on the mast at heights of 30 m, 50 m, 70 m and 90 m above ground. Publicly available rain data[29] was acquired from a site approximately 4.5 km east of the Proposed

[29] Natural Resources Wales. Trevethin Rain Gauge Data. (Online) Available at: https://rivers-and-seas.naturalresources.wales/station/1040. (Accessed 30 August 2024).

Development, which was used to identify and exclude measurement periods affected by precipitation.

Baseline Sound Survey Results

13.5.11 In order to determine how the measured background sound levels change with windspeed at each measurement location it is necessary to correlate the noise measurement data with the wind speed data measured on the Site.

13.5.12 The measured average wind speeds obtained at heights of 70 m and 90 m have been used to determine hub height (105 m) wind speed. This has then been adjusted to 10 m (standardised) height using the standard wind shear profile corresponding with standard ground roughness. The method used is accordance with the IoA GPG[10], applying the equations on Page 33 of that document. This standardisation process is necessary to allow a fair comparison of results against predicted wind turbine noise levels, which are undertaken based on wind turbine noise emissions also referenced to the same 10 m standardised height.

13.5.13 The standardised 10 m height average wind speed data and the measured $L_{A90,10min}$ noise level data for each measurement location were time synchronised. The synchronised datasets were filtered to remove any periods of significant rain, as well as any identified anomalous noise events not considered representative of the underlying background noise levels. Examples of anomalous noise events include, for example, the operation of a fixed or mobile plant item, or lawn mowing which falsely increased the measured background levels for a limited period. Such events were identified from a manual inspection of the noise measurement results, both in the measurement time histories and in the scatter graphs.

13.5.14 After filtering, the data has been split into the following sets as defined in ETSU-R-97[4]:

- quiet daytime hours - 18:00 to 23:00 on all days, as well as 13:00 to 18:00 on Saturdays and Sundays, and 07:00 to 13:00 on Sundays; and
- night-time hours - 23:00 and 07:00 on all days.

13.5.15 The datasets for each location are presented in **Graphs A13.1 to A13.8** of **Appendix 13A**. Separate graphs are presented for quiet daytime and night-time periods for each Measurement Location. Each graph depicts the data that has been retained in the analysis after exclusions for rain and anomalous events.

13.5.16 To define the relationship between wind speed and background noise level, each graph includes a 3rd-order polynomial line of best fit for the retained dataset.

13.5.17 The identified background noise levels (based on the polynomial lines of best fit) are presented in tabular form in **Table 13.10** (quiet daytime hours) and **Table 13.11** (night-time hours). In some cases, at higher wind speeds, there was insufficient measurement data for a reliable result. In those cases, sound level data for the next lowest wind speed has been used. This 'capped' approach is in accordance with the IoA GPG[10] and provides a more conservative result than if those data were available. The application of baseline datasets to receptor locations where these are considered representative are detailed in **Table 13.12**.

Table 13.10 Background sound levels dB $L_{A90,10min}$ – quiet daytime

Monitoring location	Wind speed at 10 m, ms^{-1}									
	3	4	5	6	7	8	9	10	11	12
M1	25.8	27.0	28.3	29.6	31.4	33.7	36.7	40.6	40.6*	40.6*
M2	29.2	30.0	30.0	29.7	29.9	31.1	34.1	39.4	39.4*	39.4*
M3	28.3	29.2	30.5	32.3	34.5	36.9	39.6	42.5	42.5*	42.5*
M4	27.7	28.6	29.6	30.7	32.2	34.0	36.4	39.6	39.6*	39.6*

* Preceding value used

Table 13.11 Background sound levels dB $L_{A90,10min}$ – night-time

Monitoring location	Wind speed at 10 m, ms^{-1}									
	3	4	5	6	7	8	9	10	11	12
M1	23.2	23.5	24.7	26.7	29.2	32.3	35.6	39.0	39.0*	39.0*
M2	24.0	23.8	24.3	25.4	27.0	29.0	31.4	34.0	34.0*	34.0*
M3	22.2	23.5	25.6	28.2	31.4	34.8	38.3	41.7	41.7*	41.7*
M4	24.2	25.4	27.0	28.7	30.6	32.6	34.6	36.4	36.4*	36.4*

* Preceding value used.

Table 13.12 Application of representative data to receptor locations

Monitoring location	Receptor locations where baseline dataset is considered representative, and has been applied in the assessment
M1	R1, R2, R3, R4
M2	R5, R6, R7
M3	R8, R9, R10, R11, R12, R13, R15
M4	R14, R16, R17, R18, R19, R20

13.6 Overall baseline

Current baseline

Wind Farm development and grid connection

13.6.1 The Proposed Development is located in a rural area southeast of Abertillery and Six Bells and east of Aberbeeg. In the vicinity of the nearest NSRs the local acoustic environment consists primarily of distant road noise from the A467 and A472, local vehicle movements, aircraft flying overhead, farming activities and naturogenic sounds of flora and fauna.

Future baseline

13.6.2 It is reasonable to assume that, over time, background noise levels in the vicinity of the Proposed Development would generally remain the same, with possible slight increases in road traffic noise in line with normal growth of flows of road traffic.

13.7 Turbine data

13.7.1 A range of turbine models would be appropriate for the Proposed Development. The final selection of turbine will follow a competitive tendering process and thus the actual model of turbine may differ from that which this assessment has been based. However, the final choice of turbine will be required to comply with the noise criterion levels which have been established for the development within this noise assessment.

13.7.2 The candidate turbine used in this assessment is a Vestas V150 Serrated Trailing Edge (STE) 4.2 MW turbine, with a hub height of 105 m and rotor diameter of 150 m. Broadband sound power level data for the candidate turbine used in the noise modelling is shown in **Table 13.13**, with octave band data in **Table 13.14**. The numbers listed in the tables are for Mode 0 operation, corrected to a standardised 10 m height (V_s) and including a +2 dB correction for uncertainty, in line with best practice. These data have been used in the noise level predictions for the Proposed Development.

Table 13.13 Broadband sound power data for candidate turbine

Turbine	Sound power level, dB L_{WA}, at wind speed at 10 m height, ms^{-1}									
	3	4	5	6	7	8	9	10	11	12
Vestas V150 STE[21]	93.9	97.7	102.6	106.4	106.9	106.9	106.9	106.9	106.9	106.9

Table 13.14 Octave band sound power data for candidate turbine

Turbine	Sound power level with wind speed of 10 ms^{-1} at 10 m height, dB L_{WA}, per Octave band centre frequency, Hz							
	63	125	250	500	1k	2k	4k	8k
Vestas V150 STE[21] @ V_s = 8 ms^{-1}	87.9	95.6	100.2	102.0	100.9	96.8	89.9	80.0

13.7.3 Data has also been collected for turbines to be considered within the cumulative assessment. **Table 13.15** presents the sites which are included in the cumulative assessment, along with the turbine type and sound power levels by wind speed for each. The listed turbine types are those as installed, those used in the latest noise assessment work for that development, or, where the development is in the early stage of development, are a reasonable selection based on the development parameters (e.g. maximum associated hub and tip height). Octave band sound power levels for each turbine type are presented in **Table 13.16**. The data presented in these tables are referenced to standardised 10 m height wind speed (Vs), having been corrected from a hub height wind speed reference where required, applying a ground roughness length (z) of 0.05. All data includes a +2 dB correction for uncertainty, in line with best practice.

Table 13.15 Broadband sound power data for cumulative turbines

Wind Farm Site	Turbine	Sound power levels, dB L_{WA}, per standardised wind speed ms^{-1} at 10 m height								
		4	5	6	7	8	9	10	11	12
Abertillery	Siemens Gamesa 6.6-155	100.4	105.2	107.0	107.0	107.0	107.0	107.0	107.0	107.0
Manmoel	Vestas V150 STE*	97.7	102.6	106.4	106.9	106.9	106.9	106.9	106.9	106.9
Blaentillery Farm	Enercon E53 800kW**	94.0	95.7	99.2	101.7	103.3	104.5	104.5	104.5	104.5
Carn y Cefn	Vestas V150 STE	97.7	102.6	106.4	106.9	106.9	106.9	106.9	106.9	106.9
Coed y Gilfach	Vestas V27 225kW	94.0	97.6	98.1	98.5	98.9	99.3	99.7	99.7	99.7
Mynydd Maen	Vestas V117 Serrated Trailing Edge (STE)	98.0	102.2	106.0	107.9	108.0	108.0	108.0	108.0	108.0
Oakdale Business Park	Senvion MM100 2MW	98.8	103.9	105.2	105.8	105.8	105.8	105.8	105.8	105.8

Wind Farm Site	Turbine	Sound power levels, dB L_{WA}, per standardised wind speed ms^{-1} at 10 m height								
		4	5	6	7	8	9	10	11	12
Pen y Fan Ganol Farm	Enercon E53 800kW**	94.0	94.0	95.7	99.2	101.7	103.3	104.5	104.5	104.5
Pen-y-Fan Industrial Estate	Vestas V66 1.5MW	104.6	104.6	104.6	104.6	105.6	105.6	105.6	105.6	105.6
Mynydd Bedwellte	Siemens Gamesa 6.6 170**	99.7	104.6	108.0	108.5	108.5	108.5	108.5	108.5	108.5
Trecelyn	Vestas V117 STE	97.8	102.0	105.7	107.8	108.0	108.0	108.0	108.0	108.0

* - The sound powers provided here are based on manufacturer's data. The sound power levels used in the assessment were corrected based on the draft planning condition noise limits[30]. If, based on the sound powers stated above, predicted noise levels at the receptors near to the proposed Manmoel Wind Farm were above the draft planning condition noise limits, then the sound powers were reduced to cap predicted noise levels from Manmoel Wind Farm to meet those draft noise limits. If predicted noise levels at the receptors near to the proposed Manmoel Wind Farm were below the draft noise limits, then the sound powers were increased by up to an additional 2 dB, whilst not exceeding the draft limits, to account for potential changes in turbine selection, assuming the scheme is consented.

** - Assumed turbine type

Table 13.16 Octave band sound power data for cumulative turbines

Turbine	Sound power level, dB L_{WA}, per octave band, Hz, at standardised wind speed of 8 ms^{-1} at 10 m							
	63	125	250	500	1k	2k	4k	8k
Siemens Gamesa 6.0-155	86.6	94.0	98.6	100.9	100.7	101.0	94.4	79.4

[30] PEDW (2024). Manmoel Draft Planning Conditions. (online) Available at: https://planningcasework.service.gov.wales/api/documents/download/A52267671?hash=8492573afae37b53bb4d74ca705eb41e6729bada00e951a95ebff314d7c91728 (Accessed 30 August 2024).

Turbine	Sound power level, dB L_{WA}, per octave band, Hz, at standardised wind speed of 8 ms^{-1} at 10 m							
	63	125	250	500	1k	2k	4k	8k
Vestas V150 STE	87.9	95.6	100.2	102.0	100.9	96.8	89.9	80.0
Enercon E53	85.3	92.1	94.3	96.3	98.6	96.6	88.3	77.7
Vestas V27	73.4	82.5	88.3	93.6	95.1	91.0	78.3	67.1
Gamesa G128	85.0	94.5	100.6	104.3	103.5	100.4	97.7	93.8
Senvion MM100	87.9	94.1	98.1	100.7	100.5	96.1	91.3	77.0
Vestas V66	88.2	95.6	100.2	102.0	100.9	97.0	90.2	80.6
Vestas V117 STE	88.3	95.5	100.3	102.6	102.4	99.7	94.5	86.8

13.8 Embedded measures

13.8.1 A range of environmental measures have been embedded into the Proposed Development as outlined in **Section 4.9**. **Table 13.17** outlines how these embedded measures will influence the noise assessment.

Table 13.17 Summary of the embedded environmental measures

Receptor	Potential changes and effects	Embedded measures	Compliance mechanism
Construction			
All	Construction noise and vibration effects from site works	All construction activities undertaken in accordance with good practice as set out in BS 5228-1:2009+A1:2014[17] and BS 5228-2:2009+A1:2014[31]	Construction Environmental Management Plan (CEMP)

[31] British Standards Institution (2014). British Standard BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites, Part 2: Vibration. BSI, London.

Receptor	Potential changes and effects	Embedded measures	Compliance mechanism
All	Construction noise and vibration effects from site works	All employees on the construction site will be advised of quieter methods of operating plant and tools. Noise control measures (silencers, mufflers, any noise barriers, etc.) are to be subject to regular inspection and maintenance.	CEMP
All	Construction noise and vibration effects from site works	Where practicable, for any particular activity, suitable plant, machinery and working practices will be adopted.	CEMP
All	Construction noise and vibration effects from site works	Construction plant capable of generating significant noise and vibration levels will be operated in a manner to minimise noise and vibration emissions.	CEMP
Operation			
All	Effects due to noise from operation of wind turbines	The design of the scheme has been subject to an iterative design which has sought to minimise and avoid adverse effects due to turbine noise. Where residual significant effects are identified, a scheme of mitigation will be implemented to reduce turbine noise levels sufficiently to avoid significant effects due to cumulative turbine noise.	Planning condition

13.9 Scope of the assessment

The Proposed Development

13.9.1 Wind farm noise assessment is part of an iterative design process, the aim of which is to achieve a design from which cumulative turbine noise emissions meet limits derived following the approach given in ETSU-R-97[4]. Consequently, the design of the scheme is such that relevant operational noise limits are met, with an appropriate scheme of mitigation, specifying reduced noise operating modes where necessary.

13.9.2 Due to the separation distances between the turbines and the nearest NSRs, construction noise will be limited, and hence only general good-practice noise control measures will be required for construction, with no specific additional mitigation.

13.9.3 Construction traffic will be limited in volume of flow and duration of programme, but an assessment has been undertaken based on the available construction traffic flow data indicating and baseline numbers of vehicles on the local highway network.

13.9.4 The EIA Regulations 2017 require that all ‘significant’ effects be identified. The majority of noise related guidance and standards (including ETSU-R-97[4]) are not directly related to the concepts of ‘significant’ and ‘not significant’ that underpin the EIA process. However, for the purposes of this assessment, the determination of effect significance is based upon compliance with the applicable noise limits; i.e., breach of the cumulative turbine noise limits indicates a ‘significant’ effect, whereas compliance with the cumulative turbine noise limits indicates a ‘not significant’ effect.

13.9.5 The agreed approach and scope for this chapter (in accordance with the noise and vibration chapter within the Scoping Report and subsequent Scoping Direction) is that construction noise and vibration (piling only, if required), operational noise, and construction traffic will be assessed.

13.9.6 On the basis of the information provided in **Chapter 4: Project Description Section 4.5: Construction Activities**, the only construction activity that may be required with the potential to generate significant levels of vibration is piling for the wind turbine foundations. It is noted that the nearest dwelling to any potential piling activities is R15, located approximately 250 m northeast of turbine 6, with the next nearest dwelling to any potential piling being R7 located approximately 575 m southeast of turbine 8. Due to the separation distances involved, it is considered that the potential for significant effects due to vibration during construction of the Proposed Development is negligible. Further assessment of construction vibration is therefore scoped-out.

13.9.7 It is assumed that decommissioning noise would be generally less than, or at most, similar to, that experienced during the construction period. It is therefore considered that noise impacts relating to the decommissioning of wind turbines would be no worse than those experienced during construction, provided similar restrictions on working hours and transport routes are applied. Noise from decommissioning has therefore been scoped out of further assessment.

Spatial scope

13.9.8 The spatial scope of the assessment of noise covers the area of the Proposed Development contained within the red line boundary, together with the Zones of Influence (ZoIs) that have formed the basis of the study area described in **Section 13.4**.

13.9.9 Receptors have been identified using the simplified assessment method outlined within ETSU-R-97[4]. The simplified assessment method can be adopted where noise at receptors from proposed and existing wind turbines does not exceed 35 dB $L_{A90,10min}$ at a standardised wind speed (V_s) of 10 ms^{-1}. Receptors that are predicted to experience wind turbine noise levels higher than 35 dB $L_{A90,10min}$ have been included in the assessment.

13.9.10 Initial noise modelling of the Proposed Development indicated that properties to the west, south and east would likely fall within the 35 dB $L_{A90,10min}$ contour and thus are considered further within this chapter.

Temporal scope

13.9.11 The temporal scope of the assessment of noise is consistent with the period over which the Project would be carried out and therefore covers the 30 years of operation.

Potential receptors

13.9.12 The principal noise receptors that have been identified as being potentially subject to effects are summarised in **Table 13.18**.

Table 13.18 Noise receptors subject to potential effects

Receptor	Reason for consideration
Residential receptors	Considered of high sensitivity in respect to noise.

Receptor	Reason for consideration
Ecological receptors	Have the potential to be affected by changes in the ambient noise level. These receptors are considered further in **Chapter 8: Biodiversity** and **Chapter 9: Ornithology.**

13.9.13 The residential receptors considered further in this assessment are detailed in **Table 13.7** and are shown in **Figure 13.1.**

Likely significant effects

13.9.14 The effects on sensitive receptors which have the potential to be significant, and are therefore being taken forward for detailed assessment, are summarised in **Table 13.19**.

Table 13.19 Summary of effects scoped in for further assessment

Activity	Likely significant effects
Piling noise	Noise disturbance to receptors in the area of potential piling activities
Construction traffic movements	Disturbance to receptors on the construction traffic route
Operational turbine noise	Noise disturbance from wind turbines

13.9.15 The potential impacts detailed in **Table 13.20** have been scoped out of the assessment because the potential effects are not considered likely to be significant.

Table 13.20 Summary of effects scoped out of the noise assessment

Activity	Justification
Blasting	Blasting would be very unlikely to be undertaken as part of the construction of the Proposed Development, however if any blasting is to occur it would be controlled via a blasting management plan as part of a planning condition requirement.
Construction vibration	The only activity likely to be required with the potential to generate significant construction vibration is impact piling for the turbine foundations. However, the distances to the nearest receptors are such (the closest receptor to a turbine is approximately 250 m away) that it is unlikely there would be any significant effects.
Construction activities other than piling	Noise emissions from construction activities other than piling (including vehicles on haul routes, but not on existing roads) are unlikely to be high enough, given the distance to the Proposed Development from NSRs, to warrant a noise assessment. Therefore, construction activities other than piling have been scoped out. However, planning conditions regarding standard times of work should apply.
Operational traffic	Operational traffic noise during the operation of the Proposed Development is scoped out as the amount of traffic associated during the operational phase would be minimal. See **Chapter 12: Traffic and Transport** for further details.

Activity	Justification
Decommissioning	The effects of decommissioning on any NSRs are likely to be similar in nature to, or of a lower magnitude than, those during the construction phase. As a result, noise from the decommissioning phase of the development has been scoped out.
Construction of the grid connection	Whilst there will be some construction noise associated with the grid connection at nearby residences, this will be temporary in nature. It is unlikely that the construction works associated with these connections will last for more than 10 days within any consecutive 15 or for a total number of days exceeding 40 in any 6 consecutive months, and therefore noise effects due to the construction at the grid connection has been scoped out from further assessment.

13.10 Assessment methodology

13.10.1 The generic project-wide approach to the assessment methodology is set out in **Chapter 2: Approach to Environmental Impact Assessment** and specifically in **Sections 2.5 to 2.8**. However, whilst this has informed the approach that has been used in this noise assessment, it is necessary to set out how this methodology has been applied, and adapted as appropriate, to address the specific needs of this noise assessment.

Construction activities

13.10.2 BS 5228-1:2009+A1:2014[17] includes guidelines relating to the acceptability of noise from construction sites. The appropriate noise limit for a project in an area such as the Proposed Development, i.e. rural areas with low ambient noise levels, are those defined as Category A as set out in Annex E of BS 5228-1:2009+A1:2014[17]. The Category A noise limit is 65 dB $L_{Aeq,T}$ during the daytime (from 07:00 to 19:00 hrs on weekdays and from 07:00 to 13:00 hrs on Saturdays).

13.10.3 The precise construction methodology for the Site would not be finalised until such a time as a contractor is commissioned to build the development. Therefore, the actual plant to be used is not yet known. For this project, a large rotary bored piling rig has been selected as the plant item with the potential to generate the greatest noise impacts, see **Table 13.21**, which presents noise emission data quoted from BS 5228-1:2009+A1:2014[18].

Table 13.21 Construction plant source data (piling only)

Plant	dB $L_{Aeq,T}$ at 10m	Number of plant	% on time	Typical sound power level dBA	Data source (BS 5228-1:2009+A1:2014[17] reference)
Large rotary bored piling rig	84	1	100	112	C.3.14

13.10.4 Estimates of piling noise are undertaken in accordance Annex F of BS 5228-1:2009+A1:2014[17] will be undertaken to assess potential significant effects.

Construction traffic

13.10.5 The assessment of increases in road traffic noise during the construction phase is undertaken based on the available traffic flow data with reference to BS 5228: 1:2009+A1:2014[17] and in the Design Manual for Roads and Bridges (DMRB)[32].

13.10.6 DMRB[32] states that, for the definition of the study area for construction traffic noise, road links *'with the potential for an increase in the baseline noise level of 1 dB(A) or more'* should be included. As a guide it takes an increase of 25% in traffic flows to have an increase in noise levels of 1 dB, though a higher proportion of HGVs would require less of an increase to give rise to an increase of 1 dB. The criteria for magnitude of impact due to short term increases of road noise provided in Table 3.54a of DMRB[32] indicates that any increase less than 1.0 dB is equivalent to an impact of negligible magnitude.

Operation noise assessment methodology

13.10.7 Planning Policy Wales (PPW) refers to ETSU-R-97[4] for guidance on the assessment of noise from wind farms.

13.10.8 Consequently, the assessment methodology adopted is that detailed in ETSU-R-97[4], supplemented by the IoA GPG[10] and SGNs[11,12,13,14,15,16]. The advice presented in the document was produced by The Working Group on Noise from Wind Turbines, a body comprising a number of interested parties including, amongst others, wind farm operators, environmental health officers, acoustic consultants and legal experts. The assessment approach was developed to address the shortcomings of other methods used to assess wind farm noise.

Noise limits

13.10.9 Acceptable limits for wind turbine operational noise are defined in ETSU-R-97[4] and apply to cumulative wind turbine noise. The key test for operational noise is therefore whether or not cumulative wind turbine noise levels at NSRs lie at or below the noise limits derived in accordance with ETSU-R-97[4]. However, an assessment of the Proposed Development on its own has also been included for information, but does not affect the conclusions on the significance of effect from the Proposed Development.

13.10.10 ETSU-R-97[4] presents a simplified assessment criterion of 35 dB L_{A90} at a wind speed (Vs) of 10 ms^{-1}, but also allows more detailed noise level limits to be determined, including account of the prevailing background sound. The more detailed limits are set at a lower fixed limit element or the background noise level +5 dB whichever is the higher.

13.10.11 Preliminary noise modelling indicated the potential for cumulative wind turbine noise levels to exceed the simplified assessment criterion at some NSRs. The more detailed approach to the determination of noise limits has therefore been adopted.

13.10.12 Limits have been determined for wind speeds ranging from the turbine cut-in speed up to 12 ms^{-1} (V_s), which is a point beyond which the turbines are at or above 95% power generation, i.e. beyond which no significant increases in noise emissions are expected. Wind speeds are referenced to a standardised 10 m height (V_s) on the wind farm site.

13.10.13 The daytime noise limit is derived from background noise data measured at the NSRs during 'quiet daytime' periods, as defined in ETSU-R-97[4]:

- Weekday evenings (from 18:00 to 23:00 hrs);

[32] Highways England, 2020. DMRB LA111 Noise and Vibration. Highways England.

- Saturday afternoons and evenings (from 13:00 to 23:00 hrs); and
- All Sunday daytime (from 07:00 to 23:00 hrs).

13.10.14 The noise measurements are plotted against the concurrent wind speed data measured at the application site and a 'best fit' correlation is established, as shown in **Graphs A13.1 to A13.8** of **Appendix 13A**

13.10.15 For the night-time, the lower fixed limit element is set at 43dB $L_{A90,10\ min}$. For the daytime, the lower fixed limit element is selected the range 35 to 40 dB $L_{A90,10min}$. Selection is made based upon a number of factors as outlined in Paragraph 22 of the ETSU-R-97[4] Guidance. These include:

- The number of dwellings in the neighbourhood of the wind farm;
- The effect of on the amount of electricity generated; and
- The duration and level of exposure.

13.10.16 The Scoping Report states that the cumulative assessment will be based on a limit with the daytime lower fixed element set at 40 dB $L_{A90,10min}$, based on the cumulative level of power provided by all the wind farms together, an approach advocated within ETSU-R-97[4]. Consideration of noise from the Proposed Development on its own is based upon a limit with a lower fixed element set at 35 dB $L_{A90,10min}$ for the daytime, to provide an indicative assessment of the potential impact from the Proposed Development alone.

13.10.17 For night-time period assessment will be based on a limit with the fixed element set at 43 dB $L_{A90,10min}$, as recommended in ETSU-R-97[4].

13.10.18 The only exception to the daytime and night-time limits outlined above is for properties with a financial involvement in the development where the fixed limit element can be increased to 45 dB $L_{A90,10min}$ (an increase in the background related element is also allowed, but has not been applied). The following receptors are considered as having a financial involvement in the Proposed Development; therefore the higher fixed limits have been adopted for these locations:

- Receptor 2 - Gilfach Wen Farm;
- Receptor 3 - Ty-Dafydd Farm;
- Receptor 4 - Blaencuffin Barn Farm;
- Receptor 7 – Ty'r-Ysgybor-Ddu;
- Receptor 8 - Ty Gwyn;
- Receptor 9 - Ty Mari Hari Farm; and
- Receptor 15 - Blaenant y Caws.

13.10.19 The ETSU-R-97[4] noise criteria assumes that the wind turbine noise contains no audible tones. Where tones are present, a correction is added to the measured or predicted noise level before comparison with the recommended limits. The level of correction will depend on how audible the tone is. A warranty would be sought from the manufacturers of the turbine selected for the Proposed Development such that the noise output would either not require a tonal correction (under the ETSU-R-97[4] guidance) or, where tonal corrections are required, the noise criteria would be met having made the appropriate correction to the source level for any tonal component.

13.10.20 The ETSU-R-97[4] Guidance states the $L_{A90,10min}$ descriptor should be used for both the background noise and wind farm noise when setting limits.

Applicable limits summary

13.10.21 The adopted noise limits are summarised as follows:

Proposed Development assessed in isolation

Non Financially Involved Receptors

Daytime: 35 dB $L_{A90,10min}$ or the Background noise level +5 dB whichever is the higher

Night-time: 43 dB $L_{A90,10min}$ or the Background noise level +5 dB whichever is the higher

Financially Involved Receptors

Daytime: 45 dB $L_{A90,10min}$ or the Background noise level +5 dB whichever is the higher

Night-time: 45 dB $L_{A90,10min}$ or the Background noise level +5 dB whichever is the higher

Cumulative turbine noise

Non Financially Involved Receptors

Daytime: 40 dB $L_{A90,10min}$ or the Background noise level +5 dB whichever is the higher

Night-time: 43 dB $L_{A90,10min}$ or the Background noise level +5 dB whichever is the higher

Financially Involved Receptors

Daytime: 45 dB $L_{A90,10min}$ or the Background noise level +5 dB whichever is the higher

Night-time: 45 dB $L_{A90,10min}$ or the Background noise level +5 dB whichever is the higher

Noise Modelling and Prediction

13.10.22 The Institute of Acoustics (IOA) published 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise'[10]. The use of the IOA GPG[10] in the assessment of wind turbine noise has been endorsed by Welsh Government. Carl Sargeant, Minister for Housing and Regeneration, Welsh Government, stated in a letter to the IOA on 22 May 2013:

"The assumptions listed in the section below are all confirmed within the IOA GPG as the correct approach to modelling wind turbine noise emissions."

13.10.23 In line with the IOA GPG[10], the model used in this assessment is based upon that found in ISO 9613-2 Acoustics – Attenuation of sound during propagation outdoors[33], but with application of the IOA GPG recommended adjustments for propagation across a valley and barrier screening cap, which are described below under the corresponding headings below.

13.10.24 The model takes account of:

- Geometric divergence (attenuation with distance);
- Air absorption;
- Barriers (including buildings or topography);
- Screening; and

[33] International Standards Organization (1996). *ISO 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*. ISO, Geneva.

- Ground absorption and reflection.

13.10.25 The ISO 9613-2[33] algorithm is recommended for use and has been identified to be the most robust prediction method, in the findings of a joint European Commission research project into wind farm noise propagation over large distances. According to this research, this model (like all others considered in the research) tends to over-estimate noise levels at nearby dwellings, rather than under-estimate them. The conclusion of the study was that the ISO 9613-2[33] algorithm tended to predict noise levels that would generally occur under downwind propagation conditions.

13.10.26 Another important outcome of the research demonstrated that under upwind propagation conditions between a given receiver and the wind farm, the wind farm noise level at that receiver will be as much as 10 to 15 dB lower than the level predicted using the ISO 9613-2[33] algorithm.

Propagation across a valley ('valley effect')

13.10.27 The IOA GPG[10] recommends that a correction is applied in circumstances where propagation is across a valley, i.e. a concave ground profile, or where the ground falls away significantly. Where this is the case, a penalty of +3 dB (or +1.5 dB if a ground absorption factor of 0 is being used) is applied to the overall predicted noise level at receptors.

Acoustic Screening Cap

13.10.28 The IOA GPG[10] also recommends that screening effects should be limited to no more than -2 dB, with that value only applied if the turbine is screened to the highest point on the turbine rotor (tip height), unless the screening is in close proximity to the receiver.

Model Parameters

13.10.29 For the purposes of the assessment, noise level predictions have been undertaken applying the following model parameters:

- A receiver height of 4.0 metres above local ground level, to represent the height of a typical bedroom window;
- Mixed ground (G = 0.5). This represents a ground cover that has equal amounts of fully reflective and fully absorptive character. For the purposes of this assessment, mixed ground represents a ground cover that is as equally absorptive of noise as it is reflective;
- Air absorption based on a temperature of 10°C and 70% relative humidity;
- $L_{A90,10min}$ is 2 dB less than $L_{Aeq,10min}$ for wind farm noise;
- Predicted turbine noise levels are inclusive of any 'valley effect' penalty where applicable; and
- The acoustic screening cap as detailed above has been applied where applicable.

13.10.30 Application of the above parameters is in compliance with the IOA GPG[10].

Significance evaluation methodology

13.10.31 The assessment of significant operational noise effects is based upon compliance with the ETSU-R-97[4] derived cumulative turbine noise limits, i.e. a breach of the cumulative turbine

noise limits indicates a 'significant' effect, whereas compliance with cumulative turbine noise limits indicates a 'not significant' effect. It is acknowledged that the ETSU-R-97 approach does not directly aim to determine significance in an EIA context, rather it represents a balance between the need for wind energy and the need to protect residential amenities. Since the purpose of identifying significant effect during EIA is to ensure they are taken into account in the 'planning balance', for the purposes of this assessment it is assumed that noise effects up to the ETSU-R-97 noise limits have already been taken into account and thus only noise levels exceeding the ETSU-R-97 limits are deemed to be 'significant' and require further consideration.

13.11 Assessment of noise effects

Construction of Proposed Development (piling only)

13.11.1 Predicted construction noise levels for potential piling activities are presented in **Table 13.22**.

Table 13.22 Predicted noise levels during construction phase (piling only)

Plant	No.	on time (%)	Sound Power, dBA L_W	Sound power corrected for no. & on time, dBA L_W
Large rotary bored piling rig	1	100	112	112
Total Sound power corrected for no. & on time, dBA L_W				112
Sound pressure level at 10 m, dB $L_{Aeq,t}$				84
Propagation distance r, m				250
Proportion of hard ground, %				0
Estimated activity sound level at receiver, dB $L_{Aeq,t}$				51

13.11.2 The results of the prediction in **Table 13.22** indicate that noise levels from piling activities would not exceed the significance threshold of 65 dB $L_{Aeq,t}$ at the nearest receptor. Therefore, the noise effects as a result of construction are considered to be **not significant**.

Construction traffic

13.11.3 Likely HGV routes are as follows:

- HGV Route 1 (north): Trefil Road – A465 – A467 – B4248 – Estate Road – B4246 – Unnamed Road / Farm Road – Site; and
- HGV Route 2 (south): Brook Street – A467 – A472 – A4043 – B4246 – Unnamed Road / Farm Road – Site.

13.11.4 It is assumed that construction vehicles would use one of the above routes. However, a combination of the above routes may be used for construction traffic subject to the location of material suppliers and aggregate from local quarries.

13.11.5 Estimates of future baseline flows in the year 2026, at the start of the construction programme, indicate that 12-hour flows of traffic on the major links listed above are as low as 6145 total with 75 HGVs on the B4246 – all other major links have significantly higher flows.

13.11.6 Based on the construction programme, construction traffic results in an approximate peak of 125 two-way HGV movements per 24 hours. This peak is predicted to occur during weeks 3 - 8 (15 June 2026 – 20 July 2026) of the total 20-month construction programme. Averaging the peak of 125 HGV movements over a 12 hour working day is equivalent to an approximate hourly flow of 11 HGVs per hour. For the rest of the construction programme, vehicle flows are much lower, with the next highest flow predicted in week 23 (2 November 2026) when an approximate hourly flow of 8 HGVs are predicted.

13.11.7 In consideration of the major road links with the lowest future baseline flow, the B4246, and assuming all 125 HGV movements occurred in a 12-hour period, the additional HGV movements would give rise to an increase in flow of 2.0%. As a guide it takes an increase of 25% in traffic flows to have an increase in noise levels of 1 dB. Though a higher proportion of HGVs would require less of an increase to have a corresponding increase of noise levels of 1 dB, the small percentage flow would still result in a negligible change in noise levels at residences on the B4246.

13.11.8 On the basis of the above, construction traffic noise will not give rise to any adverse impacts on road links with significant baseline flows of vehicles, and will therefore results in effects which are **not significant**.

13.11.9 On the less trafficked unnamed road/ Farm Road, a more significant increase in flow would be expected as a percentage compared to the baseline. However, no baseline flow data is available for Farm Road. Potential impacts due to construction traffic noise on Farm Road are considered below in terms of absolute sound levels.

13.11.10 Predictions of construction traffic noise, at the dwelling immediately north of the junction of Castle Wood and Farm Road, undertaken in accordance with the haul road method provided in BS 5228-1[17], are provided in **Table 13.23** and **Table 13.24**, below, for weeks 3 – 8 of the construction programme, when construction vehicle flows are anticipated to be highest, and week 23 when the 2nd highest flow of construction vehicles is predicted.

Table 13.23 Construction traffic noise – East end of Castle Wood (weeks 3 - 8)

Plant	No. per hour	Speed, km/h	Sound Power, dBA L_W	Sound power corrected for no., dBA L_W
C2.34 Lorry	11	45	108	119
			Total Sound power, dBA L_W	119
			Propagation distance to centre of haul road r, m	15
			Angle of view, ° (≤ 180°)	150
			Percentage of assessment period when vehicles are present, %	100
			Estimated sound level at receiver, dB $L_{Aeq,t}$	68

Table 13.24 Construction traffic noise – East end of Castle Wood (week 23)

Plant	No. per hour	Speed, km/h	Sound Power, dBA L_W	Sound power corrected for no., dBA L_W
C2.34 Lorry	8	45	108	117
			Total Sound power, dBA L_W	117
			Propagation distance to centre of haul road r, m	15
			Angle of view, ° (≤ 180°)	150
			Percentage of assessment period when vehicles are present, %	100
			Estimated sound level at receiver, dB $L_{Aeq,t}$	64

13.11.11 The results in **Table 13.23** indicate that, in weeks 3 - 8, at the closest receptor, the BS 5228-1[17] category A threshold of 65 dB $L_{Aeq,16h}$ may be exceeded by 3 dB due to sound from construction vehicles passing on Farm Road. There are a limited number of other dwellings potentially affected by sound from construction vehicles on Farm Road, however these are all at least double the distance from Farm Road and hence construction vehicle noise would be unlikely to exceed the BS 5228-1[17] category A threshold at those receptors. Based on the above there is potential for an adverse impact at the closest receptor. However, the haul road prediction method is considered to be a worst case estimate, and the predicted 3 dB exceedance of the BS 5228-1 category A threshold may therefore be an overestimate.

13.11.12 The results in **Table 13.24** indicate that, in week 23, at the closest receptor, the BS 5228-1[17] category A threshold of 65 dB $L_{Aeq,16h}$ would not be exceeded due to sound from construction vehicles passing on Farm Road.

13.11.13 Based on the above, the assessment has identified a potential adverse impact at a single dwelling during weeks 3 - 8 of the construction programme. The predicted absolute level of construction traffic noise is below the threshold that would trigger requirements for the provision of additional noise insulation as set out in Annex E4 of BS 5228-1[17] .

13.11.14 To determine the significance of an impact, BS 5228-1[17] states that the assessor should consider the number of receptors affected, and the duration and character of the impact. Given that only a single dwelling is predicted to experience an adverse impact, that the duration of the impact is limited and that the character of sound from construction vehicles is congruous with the setting of the receptor (i.e. immediately adjacent to a rural road where farm traffic and other heavy vehicles will sometimes pass), it is determined that the likely effects due to construction traffic noise to the receptor closest to Farm Road, and other receptors in the vicinity of Farm Road, are **not significant**.

13.11.15 Further details on construction traffic movements are provided in **Chapter 12: Traffic and Transport.**

Operation of Proposed Development in isolation

13.11.16 Operational noise levels have been predicted for the closest residential properties to the wind farm, as shown in **Figure 13.1** and listed in **Table 13.7**.

13.11.17 **Table 13.25** and **Table 13.26** present the following information for each wind speed for each of the properties for daytime and night-time respectively:

- the noise limits derived from the ETSU-R-97[4] Guidance and IOA GPG[10] as set out in **paragraph 13.10.21** above, based on the measured background noise levels as set out in **Section 13.5**;
- the predicted turbine noise levels (from the Proposed Development, based on worst-case downwind noise propagation to receptors, assuming all turbines are operating simultaneously); and
- the margin by which the predicted turbine noise levels meet the noise limits at each wind speed (negative values indicate the predicted noise levels are lower than the noise limits).

13.11.18 It should be noted, as outlined in **paragraph 13.10.9**, that the assessments presented in **Table 13.25** and **Table 13.26** are for information only. In accordance with ETSU-R-97[4] Guidance and IOA GPG[10] it is the cumulative assessment which determines the significance of wind turbine noise at each receptor.

13.11.19 The lowest range of daytime fixed noise level limits (i.e. 35 dBA) have been applied for the assessments in **Table 13.25** and **Table 13.26** to provide an indicative worst case assessment. However, the upper range of daytime fixed limits (i.e. 40 dBA) would be more appropriate for the majority of receptors which consist of isolated single dwellings, where the extent of any impacts would be limited to individual dwellings. The upper limit of 40 dBA is used in the cumulative assessment.

Table 13.25 Noise assessment – daytime

Noise parameter,	Standardised 10 m wind speed quoted by manufacturer (m/s)								
dB $L_{A90,10\,m}$	4	5	6	7	8	9	10	11	12
R1 - Woodview Cottages, Cwmnantygroes									
Background noise curve	27.0	28.3	29.6	31.4	33.7	36.7	40.6	40.6	40.6
ETSU-R-97 derived noise limit	35.0	35.0	35.0	36.4	38.7	41.7	45.6	45.6	45.6
Wind Farm turbine noise	22.5	27.5	31.2	31.7	31.7	31.7	31.7	31.7	31.7
Difference wrt noise limit	-12.5	-7.5	-3.8	-4.7	-7.0	-10.0	-13.9	-13.9	-13.9
R2 - Gilfach Wen Farm, Blaen-Y-cwm Road									
Background noise curve	27.0	28.3	29.6	31.4	33.7	36.7	40.6	40.6	40.6
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	45.0	45.6	45.6	45.6
Wind Farm turbine noise	30.5	35.5	39.2	39.7	39.7	39.7	39.7	39.7	39.7
Difference wrt noise limit	-14.5	-9.5	-5.8	-5.3	-5.3	-5.3	-5.9	-5.9	-5.9
R3 - Ty-Dafydd Farm, Six Bells									
Background noise curve	27.0	28.3	29.6	31.4	33.7	36.7	40.6	40.6	40.6
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	45.0	45.6	45.6	45.6
Wind Farm turbine noise	31.3	36.2	39.9	40.4	40.4	40.4	40.4	40.4	40.4
Difference wrt noise limit	-13.7	-8.8	-5.1	-4.6	-4.6	-4.6	-5.2	-5.2	-5.2

Noise parameter, dB $L_{A90,10\ m}$	Standardised 10 m wind speed quoted by manufacturer (m/s) 4	5	6	7	8	9	10	11	12
R4 - Blaencuffin Barn Farm, Blaen-Y-cwm Road									
Background noise curve	27.0	28.3	29.6	31.4	33.7	36.7	40.6	40.6	40.6
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	45.0	45.6	45.6	45.6
Wind Farm turbine noise	30.3	35.3	39.0	39.5	39.5	39.5	39.5	39.5	39.5
Difference wrt noise limit	-14.7	-9.7	-6.0	-5.5	-5.5	-5.5	-6.1	-6.1	-6.1
R5 - Maescynew Farm, Hyde Place									
Background noise curve	30.0	30.0	29.7	29.9	31.1	34.1	39.4	39.4	39.4
ETSU-R-97 derived noise limit	35.0	35.0	35.0	35.0	36.1	39.1	44.4	44.4	44.4
Wind Farm turbine noise	28.3	33.2	37.0	37.5	37.5	37.5	37.5	37.5	37.5
Difference wrt noise limit	-6.7	-1.8	+2.0	+2.5	+1.4	-1.6	-6.9	-6.9	-6.9
R6 - 5 Incline Cottages, Llanhilleth									
Background noise curve	30.0	30.0	29.7	29.9	31.1	34.1	39.4	39.4	39.4
ETSU-R-97 derived noise limit	35.0	35.0	35.0	35.0	36.1	39.1	44.4	44.4	44.4
Wind Farm turbine noise	29.5	34.5	38.2	38.7	38.7	38.7	38.7	38.7	38.7
Difference wrt noise limit	-5.5	-0.5	+3.2	+3.7	+2.6	-0.4	-5.7	-5.7	-5.7
R7 - Tir-Ysgubor-Ddu, Blaen-Y-cwm Road									
Background noise curve	30.0	30.0	29.7	29.9	31.1	34.1	39.4	39.4	39.4
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
Wind Farm turbine noise	31.8	36.7	40.4	40.9	40.9	40.9	40.9	40.9	40.9
Difference wrt noise limit	-13.2	-8.3	-4.6	-4.1	-4.1	-4.1	-4.1	-4.1	-4.1
R8 - 2 Ty Gwyn Cottages, Pantygasseg									
Background noise curve	29.2	30.5	32.3	34.5	36.9	39.6	42.5	42.5	42.5
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	45.0	47.5	47.5	47.5
Wind Farm turbine noise	30.2	35.1	38.9	39.4	39.4	39.4	39.4	39.4	39.4
Difference wrt noise limit	-14.8	-9.9	-6.1	-5.6	-5.6	-5.6	-8.1	-8.1	-8.1
R9 - Ty Mari Hari Farm, Pantygasseg									
Background noise curve	29.2	30.5	32.3	34.5	36.9	39.6	42.5	42.5	42.5
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	45.0	47.5	47.5	47.5
Wind Farm turbine noise	29.2	34.2	37.9	38.4	38.4	38.4	38.4	38.4	38.4
Difference wrt noise limit	-15.8	-10.8	-7.1	-6.6	-6.6	-6.6	-9.1	-9.1	-9.1
R10 - Cefn-y-Crib Farm, Blaen-Y-cwm Road									

Noise parameter,	Standardised 10 m wind speed quoted by manufacturer (m/s)								
dB $L_{A90,10\ m}$	4	5	6	7	8	9	10	11	12
Background noise curve	29.2	30.5	32.3	34.5	36.9	39.6	42.5	42.5	42.5
ETSU-R-97 derived noise limit	35.0	35.5	37.3	39.5	41.9	44.6	47.5	47.5	47.5
Wind Farm turbine noise	28.4	33.3	37.1	37.6	37.6	37.6	37.6	37.6	37.6
Difference wrt noise limit	-6.6	-2.2	-0.2	-1.9	-4.3	-7.0	-9.9	-9.9	-9.9
R11 - The Old School House, Pantygasseg									
Background noise curve	29.2	30.5	32.3	34.5	36.9	39.6	42.5	42.5	42.5
ETSU-R-97 derived noise limit	35.0	35.5	37.3	39.5	41.9	44.6	47.5	47.5	47.5
Wind Farm turbine noise	27.3	32.2	35.9	36.4	36.4	36.4	36.4	36.4	36.4
Difference wrt noise limit	-7.7	-3.3	-1.4	-3.1	-5.5	-8.2	-11.1	-11.1	-11.1
R12 - 2 - 9 Bush Terrace, Pantygasseg									
Background noise curve	29.2	30.5	32.3	34.5	36.9	39.6	42.5	42.5	42.5
ETSU-R-97 derived noise limit	35.0	35.5	37.3	39.5	41.9	44.6	47.5	47.5	47.5
Wind Farm turbine noise	25.9	30.9	34.6	35.1	35.1	35.1	35.1	35.1	35.1
Difference wrt noise limit	-9.1	-4.6	-2.7	-4.4	-6.8	-9.5	-12.4	-12.4	-12.4
R13 - Mountain View House, Pantygasseg									
Background noise curve	29.2	30.5	32.3	34.5	36.9	39.6	42.5	42.5	42.5
ETSU-R-97 derived noise limit	35.0	35.5	37.3	39.5	41.9	44.6	47.5	47.5	47.5
Wind Farm turbine noise	25.9	30.9	34.6	35.1	35.1	35.1	35.1	35.1	35.1
Difference wrt noise limit	-9.1	-4.6	-2.7	-4.4	-6.8	-9.5	-12.4	-12.4	-12.4
R14 - 1 - 6 Ty-Bwmpyn Road, Pontypool									
Background noise curve	28.6	29.6	30.7	32.2	34.0	36.4	39.6	39.6	39.6
ETSU-R-97 derived noise limit	35.0	35.0	35.7	37.2	39.0	41.4	44.6	44.6	44.6
Wind Farm turbine noise	27.9	32.9	36.6	37.1	37.1	37.1	37.1	37.1	37.1
Difference wrt noise limit	-7.1	-2.1	+0.9	-0.1	-1.9	-4.3	-7.5	-7.5	-7.5
R15 - Blaenant y Caws, PlasyCoed Rd									
Background noise curve	29.2	30.5	32.3	34.5	36.9	39.6	42.5	42.5	42.5
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	45.0	47.5	47.5	47.5
Wind Farm turbine noise	36.1	41.1	44.8	45.3	45.3	45.3	45.3	45.3	45.3
Difference wrt noise limit	-8.9	-3.9	-0.2	+0.3	+0.3	+0.3	-2.2	-2.2	-2.2
R16 - Cwmffrwdoer Farm, Cwmffrwdoer									
Background noise curve	28.6	29.6	30.7	32.2	34.0	36.4	39.6	39.6	39.6

Noise parameter,	Standardised 10 m wind speed quoted by manufacturer (m/s)								
dB $L_{A90,10\ m}$	4	5	6	7	8	9	10	11	12
ETSU-R-97 derived noise limit	35.0	35.0	35.7	37.2	39.0	41.4	44.6	44.6	44.6
Wind Farm turbine noise	24.7	29.6	33.4	33.9	33.9	33.9	33.9	33.9	33.9
Difference wrt noise limit	-10.3	-5.4	-2.3	-3.3	-5.1	-7.5	-10.7	-10.7	-10.7
R17 - Yew Tree Cottage, Pentrepiod									
Background noise curve	28.6	29.6	30.7	32.2	34.0	36.4	39.6	39.6	39.6
ETSU-R-97 derived noise limit	35.0	35.0	35.7	37.2	39.0	41.4	44.6	44.6	44.6
Wind Farm turbine noise	24.4	29.4	33.1	33.6	33.6	33.6	33.6	33.6	33.6
Difference wrt noise limit	-10.6	-5.6	-2.6	-3.6	-5.4	-7.8	-11.0	-11.0	-11.0
R18 - Tal-ochor Farm, Pentrepiod									
Background noise curve	28.6	29.6	30.7	32.2	34.0	36.4	39.6	39.6	39.6
ETSU-R-97 derived noise limit	35.0	35.0	35.7	37.2	39.0	41.4	44.6	44.6	44.6
Wind Farm turbine noise	26.1	31.1	34.8	35.3	35.3	35.3	35.3	35.3	35.3
Difference wrt noise limit	-8.9	-3.9	-0.9	-1.9	-3.7	-6.1	-9.3	-9.3	-9.3
R19 - Pistyll Gwyn, Pentwyn, Abersychan									
Background noise curve	28.6	29.6	30.7	32.2	34.0	36.4	39.6	39.6	39.6
ETSU-R-97 derived noise limit	35.0	35.0	35.7	37.2	39.0	41.4	44.6	44.6	44.6
Wind Farm turbine noise	25.4	30.3	34.1	34.6	34.6	34.6	34.6	34.6	34.6
Difference wrt noise limit	-9.6	-4.7	-1.6	-2.6	-4.4	-6.8	-10.0	-10.0	-10.0
R20 - British Road, Abersychan									
Background noise curve	28.6	29.6	30.7	32.2	34.0	36.4	39.6	39.6	39.6
ETSU-R-97 derived noise limit	35.0	35.0	35.7	37.2	39.0	41.4	44.6	44.6	44.6
Wind Farm turbine noise	22.8	27.8	31.5	32.0	32.0	32.0	32.0	32.0	32.0
Difference wrt noise limit	-12.2	-7.2	-4.2	-5.2	-7.0	-9.4	-12.6	-12.6	-12.6

Table 13.26 Noise assessment – night-time

Noise parameter,	Standardised 10 m wind speed quoted by manufacturer (m/s)								
dB $L_{A90,10\ m}$	4	5	6	7	8	9	10	11	12
R1 - Woodview Cottages, Cwmnantygroes									
Background noise curve	23.5	24.7	26.7	29.2	32.3	35.6	39.0	39.0	39.0
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.0	44.0	44.0	44.0
Wind Farm turbine noise	22.5	27.5	31.2	31.7	31.7	31.7	31.7	31.7	31.7

Noise parameter,	Standardised 10 m wind speed quoted by manufacturer (m/s)								
dB $L_{A90,10\ m}$	4	5	6	7	8	9	10	11	12
Difference wrt noise limit	-20.5	-15.5	-11.8	-11.3	-11.3	-11.3	-12.3	-12.3	-12.3
R2 - Gilfach Wen Farm, Blaen-Y-cwm Road									
Background noise curve	23.5	24.7	26.7	29.2	32.3	35.6	39.0	39.0	39.0
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
Wind Farm turbine noise	30.5	35.5	39.2	39.7	39.7	39.7	39.7	39.7	39.7
Difference wrt noise limit	-14.5	-9.5	-5.8	-5.3	-5.3	-5.3	-5.3	-5.3	-5.3
R3 - Ty-Dafydd Farm, Six Bells									
Background noise curve	23.5	24.7	26.7	29.2	32.3	35.6	39.0	39.0	39.0
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
Wind Farm turbine noise	31.3	36.2	39.9	40.4	40.4	40.4	40.4	40.4	40.4
Difference wrt noise limit	-13.7	-8.8	-5.1	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
R4 - Blaencuffin Barn Farm, Blaen-Y-cwm Road									
Background noise curve	23.5	24.7	26.7	29.2	32.3	35.6	39.0	39.0	39.0
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
Wind Farm turbine noise	30.3	35.3	39.0	39.5	39.5	39.5	39.5	39.5	39.5
Difference wrt noise limit	-14.7	-9.7	-6.0	-5.5	-5.5	-5.5	-5.5	-5.5	-5.5
R5 - Maescynew Farm, Hyde Place									
Background noise curve	23.8	24.3	25.4	27.0	29.0	31.4	34.0	34.0	34.0
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
Wind Farm turbine noise	28.3	33.2	37.0	37.5	37.5	37.5	37.5	37.5	37.5
Difference wrt noise limit	-14.7	-9.8	-6.0	-5.5	-5.5	-5.5	-5.5	-5.5	-5.5
R6 - 5 Incline Cottages, Llanhilleth									
Background noise curve	23.8	24.3	25.4	27.0	29.0	31.4	34.0	34.0	34.0
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
Wind Farm turbine noise	29.5	34.5	38.2	38.7	38.7	38.7	38.7	38.7	38.7
Difference wrt noise limit	-13.5	-8.5	-4.8	-4.3	-4.3	-4.3	-4.3	-4.3	-4.3
R7 - Tir-Ysgubor-Ddu, Blaen-Y-cwm Road									
Background noise curve	23.8	24.3	25.4	27.0	29.0	31.4	34.0	34.0	34.0
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
Wind Farm turbine noise	31.8	36.7	40.4	40.9	40.9	40.9	40.9	40.9	40.9
Difference wrt noise limit	-13.2	-8.3	-4.6	-4.1	-4.1	-4.1	-4.1	-4.1	-4.1

Noise parameter,	Standardised 10 m wind speed quoted by manufacturer (m/s)								
dB $L_{A90,10\ m}$	4	5	6	7	8	9	10	11	12
R8 - 2 Ty Gwyn Cottages, Pantygasseg									
Background noise curve	23.5	25.6	28.2	31.4	34.8	38.3	41.7	41.7	41.7
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	45.0	46.7	46.7	46.7
Wind Farm turbine noise	30.2	35.1	38.9	39.4	39.4	39.4	39.4	39.4	39.4
Difference wrt noise limit	-14.8	-9.9	-6.1	-5.6	-5.6	-5.6	-7.3	-7.3	-7.3
R9 - Ty Mari Hari Farm, Pantygasseg									
Background noise curve	23.5	25.6	28.2	31.4	34.8	38.3	41.7	41.7	41.7
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	45.0	46.7	46.7	46.7
Wind Farm turbine noise	29.2	34.2	37.9	38.4	38.4	38.4	38.4	38.4	38.4
Difference wrt noise limit	-15.8	-10.8	-7.1	-6.6	-6.6	-6.6	-8.3	-8.3	-8.3
R10 - Cefn-y-Crib Farm, Blaen-Y-cwm Road									
Background noise curve	23.5	25.6	28.2	31.4	34.8	38.3	41.7	41.7	41.7
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.3	46.7	46.7	46.7
Wind Farm turbine noise	28.4	33.3	37.1	37.6	37.6	37.6	37.6	37.6	37.6
Difference wrt noise limit	-14.6	-9.7	-5.9	-5.4	-5.4	-5.7	-9.1	-9.1	-9.1
R11 - The Old School House, Pantygasseg									
Background noise curve	23.5	25.6	28.2	31.4	34.8	38.3	41.7	41.7	41.7
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.3	46.7	46.7	46.7
Wind Farm turbine noise	27.3	32.2	35.9	36.4	36.4	36.4	36.4	36.4	36.4
Difference wrt noise limit	-15.7	-10.8	-7.1	-6.6	-6.6	-6.9	-10.3	-10.3	-10.3
R12 - 2 - 9 Bush Terrace, Pantygasseg									
Background noise curve	23.5	25.6	28.2	31.4	34.8	38.3	41.7	41.7	41.7
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.3	46.7	46.7	46.7
Wind Farm turbine noise	25.9	30.9	34.6	35.1	35.1	35.1	35.1	35.1	35.1
Difference wrt noise limit	-17.1	-12.1	-8.4	-7.9	-7.9	-8.2	-11.6	-11.6	-11.6
R13 - Mountain View House, Pantygasseg									
Background noise curve	23.5	25.6	28.2	31.4	34.8	38.3	41.7	41.7	41.7
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.3	46.7	46.7	46.7
Wind Farm turbine noise	25.9	30.9	34.6	35.1	35.1	35.1	35.1	35.1	35.1
Difference wrt noise limit	-17.1	-12.1	-8.4	-7.9	-7.9	-8.2	-11.6	-11.6	-11.6
R14 - 1 - 6 Ty-Bwmpyn Road, Pontypool									

Noise parameter,	Standardised 10 m wind speed quoted by manufacturer (m/s)								
dB $L_{A90,10\ m}$	4	5	6	7	8	9	10	11	12
Background noise curve	25.4	27.0	28.7	30.6	32.6	34.6	36.4	36.4	36.4
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
Wind Farm turbine noise	27.9	32.9	36.6	37.1	37.1	37.1	37.1	37.1	37.1
Difference wrt noise limit	-15.1	-10.1	-6.4	-5.9	-5.9	-5.9	-5.9	-5.9	-5.9
R15 - Blaenant y Caws, PlasyCoed Rd									
Background noise curve	23.5	25.6	28.2	31.4	34.8	38.3	41.7	41.7	41.7
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	45.0	46.7	46.7	46.7
Wind Farm turbine noise	36.1	41.1	44.8	45.3	45.3	45.3	45.3	45.3	45.3
Difference wrt noise limit	-8.9	-3.9	-0.2	+0.3	+0.3	+0.3	-1.4	-1.4	-1.4
R16 - Cwmffrwdoer Farm, Cwmffrwdoer									
Background noise curve	25.4	27.0	28.7	30.6	32.6	34.6	36.4	36.4	36.4
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
Wind Farm turbine noise	24.7	29.6	33.4	33.9	33.9	33.9	33.9	33.9	33.9
Difference wrt noise limit	-18.3	-13.4	-9.6	-9.1	-9.1	-9.1	-9.1	-9.1	-9.1
R17 - Yew Tree Cottage, Pentrepiod									
Background noise curve	25.4	27.0	28.7	30.6	32.6	34.6	36.4	36.4	36.4
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
Wind Farm turbine noise	24.4	29.4	33.1	33.6	33.6	33.6	33.6	33.6	33.6
Difference wrt noise limit	-18.6	-13.6	-9.9	-9.4	-9.4	-9.4	-9.4	-9.4	-9.4
R18 - Tal-ochor Farm, Pentrepiod									
Background noise curve	25.4	27.0	28.7	30.6	32.6	34.6	36.4	36.4	36.4
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
Wind Farm turbine noise	26.1	31.1	34.8	35.3	35.3	35.3	35.3	35.3	35.3
Difference wrt noise limit	-16.9	-11.9	-8.2	-7.7	-7.7	-7.7	-7.7	-7.7	-7.7
R19 - Pistyll Gwyn, Pentwyn, Abersychan									
Background noise curve	25.4	27.0	28.7	30.6	32.6	34.6	36.4	36.4	36.4
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
Wind Farm turbine noise	25.4	30.3	34.1	34.6	34.6	34.6	34.6	34.6	34.6
Difference wrt noise limit	-17.6	-12.7	-8.9	-8.4	-8.4	-8.4	-8.4	-8.4	-8.4
R20 - British Road, Abersychan									
Background noise curve	25.4	27.0	28.7	30.6	32.6	34.6	36.4	36.4	36.4

Noise parameter,	Standardised 10 m wind speed quoted by manufacturer (m/s)								
dB $L_{A90,10\ m}$	4	5	6	7	8	9	10	11	12
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
Wind Farm turbine noise	22.8	27.8	31.5	32.0	32.0	32.0	32.0	32.0	32.0
Difference wrt noise limit	-20.2	-15.2	-11.5	-11.0	-11.0	-11.0	-11.0	-11.0	-11.0

13.11.20 The results show that predicted turbine noise levels are below the lowest daytime noise limits at the majority of the receptors during the daytime, and at all but one receptor during the night-time.

13.11.21 During the daytime, without mitigation, predicted turbine noise levels are up to 3.7 dB above the daytime limits at R5 and R6 and up to 0.9 dB above the daytime limits at R14 and R15, but for a limited range of wind speeds. During the night-time, predicted turbine noise levels are up to 0.3 dB above the night-time noise limits at R15, but again for a limited range of wind speeds.

13.11.22 The exceedances outlined above do not confirm a significant effect but indicate the potential for significant effects where exceedances of the limits are greatest.

13.11.23 Potentially significant effects are assessed in **Section 13.12**.

Other operational noise issues

Infrasound and low frequency noise

Infra-sound

13.11.24 Infra-sound is defined as noise occurring at frequencies below that at which sound is normally audible, i.e. at less than 20 Hz, due to the significantly reduced sensitivity of the ear at such frequencies. In this frequency range, for sound to be perceptible, it has to be at very high amplitude, and it is generally considered that when such sounds are perceptible then they can cause considerable annoyance.

13.11.25 A study for the Department of Trade and Industry[34] (DTI) concluded that *'Infrasound noise emissions from WTGs are significantly below the recognised threshold of perception for acoustic energy within this frequency range. Even assuming that the most sensitive members of the population have a hearing threshold which is 12 dB lower than the median hearing threshold, measured infrasound levels are well below this criterion'*. It goes on to state that, based on information from the World Health Organisation, *'there is no reliable evidence that infrasound below the hearing threshold produces physiological or psychological effects'*. It can be concluded that *'infrasound associated with modern WTGs is not a source which may be injurious to the health of a wind farm neighbour'*.

13.11.26 Published on 10 February 2023, a review of noise guidance for onshore wind turbines sets out the results of a scoping review undertaken by WSP on behalf of the then UK Government Department for Business, Energy and Industrial Strategy (WSP BEIS

[34] Department of Trade and Industry (2006). W/45/00656/00/00 The Measurement of Low Frequency Noise at Three UK Windfarms. DTI.

Report[35]). It was commissioned as part of the Governments consideration to possible future updates of the ETSU-R-97[4] noise assessment guidance. The WSP BEIS Report is only an initial step towards any future updates and identifies key areas that warrant consideration for updating and provides recommendations for further evidence needed to support any future updates. Firm conclusions are drawn with respect of Infra-sound. It states:

> *"Overall, the findings from the existing evidence base indicate that infrasound from wind turbines at typical exposure levels has no direct adverse effects on physical or mental health, and reported symptoms of ill-health are more likely to be psychogenic in origin."*

13.11.27 It is concluded that this effect is not significant.

Low Frequency Noise

13.11.28 Noise from modern WTGs is essentially broadband in nature in that it contains similar amounts of noise energy in all frequency bands from low to high frequency. As distance from a WF site increases, the noise level decreases as a result of the spreading out of the sound energy but also due to air absorption which increases with increasing frequency. This means that although the energy across the whole frequency range is reduced, higher frequencies are reduced more than lower frequencies with the effect that as distance from the site increases, the ratio of low to high frequencies also increases. This effect may be observed with road traffic noise or natural sources such as the sea where higher frequency components are diminished relative to lower frequency components at long distances. At such distances, however, overall noise levels from WTGs are so low that this effect is negligible and not significant.

13.11.29 The WSP BEIS[35] notes the following:

> *"Reviews of the [potential] effects of exposure to low frequency sound from wind turbines currently suggest these are limited to annoyance, at typical exposure levels. It was found in a previous UK study of reported 'low frequency noise' issues associated with wind turbines, that disturbances reported were more likely to be due to audible AM [amplitude modulation] rather than low frequency sound . Moreover, the evidence currently suggests that, due to the inherent characteristics of wind turbine sound, suitable controls on A-weighted sound levels are expected to also provide sufficient control for the potential impact of low frequency noise."*

13.11.30 It is concluded that this effect is negligible.

Amplitude Modulation

13.11.31 The RenewableUK research programme on amplitude modulation (AM) concluded that high levels of AM can occasionally be heard at long distances from WTGs and proposed a planning condition to manage it[36]. That study was carried forward by the Institute of Acoustics' Amplitude Modulation Working Group, resulting in their 2016 report (IOA, 2016), which defined a "Reference Method" of quantifying AM noise. A subsequent

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[35] WSP UK Ltd. (2023). Department for Business, Energy & Industrial Strategy. A Review of Noise Guidance for Onshore Wind Turbines. (Online) Available at: https://www.wsp.com/-/media/insights/uk/images/2023/wind-turbine-noise-report/70081416-001-03-05-project-report-revision-05---public.pdf (Accessed 30 August 2024).

[36] RenewableUK (2013). Wind Turbine Amplitude Modulation: Research to Improve Understanding as to its Cause and Effects - Brief Summary. (Online) Available at: https://cdn.ymaws.com/www.renewableuk.com/resource/collection/4E7CC744-FEF2-473B-AF2B-135FF2AA3A43/ruk_brief_summary_v2_(1).pdf (Accessed 30 August 2024).

technical contribution in the IOA's Acoustics Bulletin[37] proposed a template planning condition, of which the AM element was based on that Reference Method.

13.11.32 The WSP BEIS Report, considered recent evidence and stakeholder views on AM and recommends that further, officially-recognised AM guidance should be developed with the aforementioned approach used as a starting point.

13.12 Assessment of cumulative (inter-project) effects

Cumulative wind turbine noise

13.12.1 A Cumulative Effects Assessment (CEA) assessing the potential for effects due to cumulative wind turbine noise has been undertaken for the Proposed Development which considers the combined impacts with other wind farm developments on the same NSRs (inter-project effects).

13.12.2 **Table 13.27** and **Table 13.28** present the predicted cumulative wind turbine noise levels at the receptors listed in **Table 13.7**, assessed against the ETSU-R-97[4] derived noise limits, the determination of which are set out in **Section 13.10**.

13.12.3 The modelling results assume all wind turbines are acting directly downwind of all receptors at the same time, showing an absolute worst-case scenario.

Table 13.27 Noise assessment – cumulative daytime

Noise parameter,	Standardised 10 m wind speed quoted by manufacturer (m/s)								
dB $L_{A90,10\,m}$	4	5	6	7	8	9	10	11	12
R1 - Woodview Cottages, Cwmnantygroes									
Background noise curve	27.0	28.3	29.6	31.4	33.7	36.7	40.6	40.6	40.6
ETSU-R-97 derived noise limit	40.0	40.0	40.0	40.0	40.0	41.7	45.6	45.6	45.6
Wind Farm turbine noise	31.3	34.2	37.0	37.5	37.6	37.8	37.7	37.7	37.7
Difference wrt noise limit	-8.7	-5.8	-3.0	-2.5	-2.4	-3.9	-7.9	-7.9	-7.9
R2 - Gilfach Wen Farm, Blaen-Y-cwm Road									
Background noise curve	27.0	28.3	29.6	31.4	33.7	36.7	40.6	40.6	40.6
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	45.0	45.6	45.6	45.6
Wind Farm turbine noise	34.2	37.6	40.8	41.3	41.4	41.4	41.5	41.5	41.5
Difference wrt noise limit	-10.8	-7.4	-4.2	-3.7	-3.6	-3.6	-4.1	-4.1	-4.1

[37] Hayes McKenzie Partnership (2006). The measurement of low frequency noise at three UK wind farms. Contract no. W/45/00656/00/00 URN no. 06/1412. Department of Trade & Industry. (Online) Available at: https://webarchive.nationalarchives.gov.uk/ukgwa/20090609003228/http:/www.berr.gov.uk/files/file31270.pdf (Accessed 30 August 2024)

Noise parameter, dB $L_{A90,10\ m}$	Standardised 10 m wind speed quoted by manufacturer (m/s) 4	5	6	7	8	9	10	11	12
R3 - Ty-Dafydd Farm, Six Bells									
Background noise curve	27.0	28.3	29.6	31.4	33.7	36.7	40.6	40.6	40.6
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	45.0	45.6	45.6	45.6
Wind Farm turbine noise	33.4	37.6	41.0	41.6	41.6	41.6	41.6	41.6	41.6
Difference wrt noise limit	-11.6	-7.4	-4.0	-3.4	-3.4	-3.4	-4.0	-4.0	-4.0
R4 - Blaencuffin Barn Farm, Blaen-Y-cwm Road									
Background noise curve	27.0	28.3	29.6	31.4	33.7	36.7	40.6	40.6	40.6
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	45.0	45.6	45.6	45.6
Wind Farm turbine noise	31.7	36.2	39.8	40.5	40.5	40.5	40.5	40.5	40.5
Difference wrt noise limit	-13.3	-8.8	-5.2	-4.5	-4.5	-4.5	-5.1	-5.1	-5.1
R5 - Maescynew Farm, Hyde Place									
Background noise curve	30.0	30.0	29.7	29.9	31.1	34.1	39.4	39.4	39.4
ETSU-R-97 derived noise limit	40.0	40.0	40.0	40.0	40.0	40.0	44.4	44.4	44.4
Wind Farm turbine noise	30.0	34.2	37.9	38.6	38.6	38.6	38.6	38.6	38.6
Difference wrt noise limit	-10.0	-5.8	-2.1	-1.4	-1.4	-1.4	-5.8	-5.8	-5.8
R6 - 5 Incline Cottages, Llanhilleth									
Background noise curve	30.0	30.0	29.7	29.9	31.1	34.1	39.4	39.4	39.4
ETSU-R-97 derived noise limit	40.0	40.0	40.0	40.0	40.0	40.0	44.4	44.4	44.4
Wind Farm turbine noise	31.0	35.5	39.1	39.8	39.9	39.9	39.9	39.9	39.9
Difference wrt noise limit	-9.0	-4.5	-0.9	-0.2	-0.1	-0.1	-4.5	-4.5	-4.5
R7 - Tir-Ysgubor-Ddu, Blaen-Y-cwm Road									
Background noise curve	30.0	30.0	29.7	29.9	31.1	34.1	39.4	39.4	39.4
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
Wind Farm turbine noise	32.7	37.4	41.1	41.8	41.9	41.9	41.9	41.9	41.9
Difference wrt noise limit	-12.3	-7.6	-3.9	-3.2	-3.1	-3.1	-3.1	-3.1	-3.1
R8 - 2 Ty Gwyn Cottages, Pantygasseg									
Background noise curve	29.2	30.5	32.3	34.5	36.9	39.6	42.5	42.5	42.5
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	45.0	47.5	47.5	47.5
Wind Farm turbine noise	32.0	36.6	40.3	41.3	41.3	41.3	41.3	41.3	41.3
Difference wrt noise limit	-13.0	-8.4	-4.7	-3.7	-3.7	-3.7	-6.2	-6.2	-6.2

Noise parameter,	Standardised 10 m wind speed quoted by manufacturer (m/s)								
dB $L_{A90,10\ m}$	4	5	6	7	8	9	10	11	12
R9 - Ty Mari Hari Farm, Pantygasseg									
Background noise curve	29.2	30.5	32.3	34.5	36.9	39.6	42.5	42.5	42.5
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	45.0	47.5	47.5	47.5
Wind Farm turbine noise	32.0	36.6	40.3	41.4	41.5	41.5	41.5	41.5	41.5
Difference wrt noise limit	-13.0	-8.4	-4.7	-3.6	-3.5	-3.5	-6.0	-6.0	-6.0
R10 - Cefn-y-Crib Farm, Blaen-Y-cwm Road									
Background noise curve	29.2	30.5	32.3	34.5	36.9	39.6	42.5	42.5	42.5
ETSU-R-97 derived noise limit	40.0	40.0	40.0	40.0	41.9	44.6	47.5	47.5	47.5
Wind Farm turbine noise	32.3	36.7	40.4	41.7	41.8	41.8	41.8	41.8	41.8
Difference wrt noise limit	-7.7	-3.3	+0.4	+1.7	-0.1	-2.8	-5.7	-5.7	-5.7
R11 - The Old School House, Pantygasseg									
Background noise curve	29.2	30.5	32.3	34.5	36.9	39.6	42.5	42.5	42.5
ETSU-R-97 derived noise limit	40.0	40.0	40.0	40.0	41.9	44.6	47.5	47.5	47.5
Wind Farm turbine noise	33.0	37.4	41.0	42.6	42.7	42.7	42.7	42.7	42.7
Difference wrt noise limit	-7.0	-2.6	+1.0	+2.6	+0.8	-1.9	-4.8	-4.8	-4.8
R12 - 2 - 9 Bush Terrace, Pantygasseg									
Background noise curve	29.2	30.5	32.3	34.5	36.9	39.6	42.5	42.5	42.5
ETSU-R-97 derived noise limit	40.0	40.0	40.0	40.0	41.9	44.6	47.5	47.5	47.5
Wind Farm turbine noise	33.4	37.7	41.3	43.0	43.1	43.1	43.1	43.1	43.1
Difference wrt noise limit	-6.6	-2.3	+1.3	+3.0	+1.2	-1.5	-4.4	-4.4	-4.4
R13 - Mountain View House, Pantygasseg									
Background noise curve	29.2	30.5	32.3	34.5	36.9	39.6	42.5	42.5	42.5
ETSU-R-97 derived noise limit	40.0	40.0	40.0	40.0	41.9	44.6	47.5	47.5	47.5
Wind Farm turbine noise	33.0	37.3	41.0	42.7	42.7	42.7	42.7	42.7	42.7
Difference wrt noise limit	-7.0	-2.7	+1.0	+2.7	+0.8	-1.9	-4.8	-4.8	-4.8
R14 - 1 - 6 Ty-Bwmpyn Road, Pontypool									
Background noise curve	28.6	29.6	30.7	32.2	34.0	36.4	39.6	39.6	39.6
ETSU-R-97 derived noise limit	40.0	40.0	40.0	40.0	40.0	41.4	44.6	44.6	44.6
Wind Farm turbine noise	29.7	34.4	38.1	39.0	39.1	39.1	39.1	39.1	39.1
Difference wrt noise limit	-10.3	-5.6	-1.9	-1.0	-0.9	-2.3	-5.5	-5.5	-5.5

Noise parameter,	Standardised 10 m wind speed quoted by manufacturer (m/s)								
dB $L_{A90,10\ m}$	4	5	6	7	8	9	10	11	12
R15 - Blaenant y Caws, PlasyCoed Rd									
Background noise curve	29.2	30.5	32.3	34.5	36.9	39.6	42.5	42.5	42.5
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	45.0	47.5	47.5	47.5
Wind Farm turbine noise	36.5	41.3	45.1	45.6	45.7	45.7	45.7	45.7	45.7
Difference wrt noise limit	-8.5	-3.7	+0.1	+0.6	+0.7	+0.7	-1.8	-1.8	-1.8
R16 - Cwmffrwdoer Farm, Cwmffrwdoer									
Background noise curve	28.6	29.6	30.7	32.2	34.0	36.4	39.6	39.6	39.6
ETSU-R-97 derived noise limit	40.0	40.0	40.0	40.0	40.0	41.4	44.6	44.6	44.6
Wind Farm turbine noise	27.1	31.7	35.3	36.4	36.4	36.4	36.4	36.4	36.4
Difference wrt noise limit	-12.9	-8.3	-4.7	-3.6	-3.6	-5.0	-8.2	-8.2	-8.2
R17 - Yew Tree Cottage, Pentrepiod									
Background noise curve	28.6	29.6	30.7	32.2	34.0	36.4	39.6	39.6	39.6
ETSU-R-97 derived noise limit	40.0	40.0	40.0	40.0	40.0	41.4	44.6	44.6	44.6
Wind Farm turbine noise	26.6	31.2	34.9	35.9	35.9	35.9	35.9	35.9	35.9
Difference wrt noise limit	-13.4	-8.8	-5.1	-4.1	-4.1	-5.5	-8.7	-8.7	-8.7
R18 - Tal-ochor Farm, Pentrepiod									
Background noise curve	28.6	29.6	30.7	32.2	34.0	36.4	39.6	39.6	39.6
ETSU-R-97 derived noise limit	40.0	40.0	40.0	40.0	40.0	41.4	44.6	44.6	44.6
Wind Farm turbine noise	27.4	32.1	35.7	36.5	36.5	36.5	36.5	36.5	36.5
Difference wrt noise limit	-12.6	-7.9	-4.3	-3.5	-3.5	-4.9	-8.1	-8.1	-8.1
R19 - Pistyll Gwyn, Pentwyn, Abersychan									
Background noise curve	28.6	29.6	30.7	32.2	34.0	36.4	39.6	39.6	39.6
ETSU-R-97 derived noise limit	40.0	40.0	40.0	40.0	40.0	41.4	44.6	44.6	44.6
Wind Farm turbine noise	27.0	31.6	35.2	36.0	36.1	36.1	36.1	36.1	36.1
Difference wrt noise limit	-13.0	-8.4	-4.8	-4.0	-3.9	-5.3	-8.5	-8.5	-8.5
R20 - British Road, Abersychan									
Background noise curve	28.6	29.6	30.7	32.2	34.0	36.4	39.6	39.6	39.6
ETSU-R-97 derived noise limit	40.0	40.0	40.0	40.0	40.0	41.4	44.6	44.6	44.6
Wind Farm turbine noise	25.6	30.0	33.2	33.8	33.9	33.9	33.9	33.9	33.9
Difference wrt noise limit	-14.4	-10.0	-6.8	-6.2	-6.1	-7.5	-10.7	-10.7	-10.7

Table 13.28 Noise assessment – cumulative night-time

Noise parameter,	Standardised 10 m wind speed quoted by manufacturer (m/s)								
dB $L_{A90,10\ m}$	4	5	6	7	8	9	10	11	12
R1 - Woodview Cottages, Cwmnantygroes									
Background noise curve	23.5	24.7	26.7	29.2	32.3	35.6	39.0	39.0	39.0
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.0	44.0	44.0	44.0
Wind Farm turbine noise	31.3	34.2	37.0	37.5	37.5	37.8	37.7	37.7	37.7
Difference wrt noise limit	-11.7	-8.8	-6.0	-5.5	-5.5	-5.2	-6.3	-6.3	-6.3
R2 - Gilfach Wen Farm, Blaen-Y-cwm Road									
Background noise curve	23.5	24.7	26.7	29.2	32.3	35.6	39.0	39.0	39.0
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
Wind Farm turbine noise	34.2	37.7	40.8	41.4	41.4	41.4	41.5	41.5	41.5
Difference wrt noise limit	-10.8	-7.3	-4.2	-3.6	-3.6	-3.6	-3.5	-3.5	-3.5
R3 - Ty-Dafydd Farm, Six Bells									
Background noise curve	23.5	24.7	26.7	29.2	32.3	35.6	39.0	39.0	39.0
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
Wind Farm turbine noise	33.4	37.6	41.0	41.6	41.6	41.6	41.6	41.6	41.6
Difference wrt noise limit	-11.6	-7.4	-4.0	-3.4	-3.4	-3.4	-3.4	-3.4	-3.4
R4 - Blaencuffin Barn Farm, Blaen-Y-cwm Road									
Background noise curve	23.5	24.7	26.7	29.2	32.3	35.6	39.0	39.0	39.0
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
Wind Farm turbine noise	31.7	36.2	39.8	40.5	40.5	40.5	40.5	40.5	40.5
Difference wrt noise limit	-13.3	-8.8	-5.2	-4.5	-4.5	-4.5	-4.5	-4.5	-4.5
R5 - Maescynew Farm, Hyde Place									
Background noise curve	23.8	24.3	25.4	27.0	29.0	31.4	34.0	34.0	34.0
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
Wind Farm turbine noise	30.0	34.2	37.9	38.6	38.6	38.6	38.6	38.6	38.6
Difference wrt noise limit	-13.0	-8.8	-5.1	-4.4	-4.4	-4.4	-4.4	-4.4	-4.4
R6 - 5 Incline Cottages, Llanhilleth									
Background noise curve	23.8	24.3	25.4	27.0	29.0	31.4	34.0	34.0	34.0
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
Wind Farm turbine noise	31.0	35.5	39.1	39.8	39.9	39.9	39.9	39.9	39.9
Difference wrt noise limit	-12.0	-7.5	-3.9	-3.2	-3.1	-3.1	-3.1	-3.1	-3.1

Noise parameter,	Standardised 10 m wind speed quoted by manufacturer (m/s)								
dB $L_{A90,10\ m}$	4	5	6	7	8	9	10	11	12
R7 - Tir-Ysgubor-Ddu, Blaen-Y-cwm Road									
Background noise curve	23.8	24.3	25.4	27.0	29.0	31.4	34.0	34.0	34.0
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
Wind Farm turbine noise	32.7	37.4	41.1	41.8	41.9	41.9	41.9	41.9	41.9
Difference wrt noise limit	-12.3	-7.6	-3.9	-3.2	-3.1	-3.1	-3.1	-3.1	-3.1
R8 - 2 Ty Gwyn Cottages, Pantygasseg									
Background noise curve	23.5	25.6	28.2	31.4	34.8	38.3	41.7	41.7	41.7
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	45.0	46.7	46.7	46.7
Wind Farm turbine noise	32.0	36.6	40.3	41.3	41.3	41.3	41.3	41.3	41.3
Difference wrt noise limit	-13.0	-8.4	-4.7	-3.7	-3.7	-3.7	-5.4	-5.4	-5.4
R9 - Ty Mari Hari Farm, Pantygasseg									
Background noise curve	23.5	25.6	28.2	31.4	34.8	38.3	41.7	41.7	41.7
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	45.0	46.7	46.7	46.7
Wind Farm turbine noise	32.0	36.6	40.3	41.4	41.5	41.5	41.5	41.5	41.5
Difference wrt noise limit	-13.0	-8.4	-4.7	-3.6	-3.5	-3.5	-5.2	-5.2	-5.2
R10 - Cefn-y-Crib Farm, Blaen-Y-cwm Road									
Background noise curve	23.5	25.6	28.2	31.4	34.8	38.3	41.7	41.7	41.7
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.3	46.7	46.7	46.7
Wind Farm turbine noise	32.3	36.7	40.4	41.7	41.8	41.8	41.8	41.8	41.8
Difference wrt noise limit	-10.7	-6.3	-2.6	-1.3	-1.2	-1.5	-4.9	-4.9	-4.9
R11 - The Old School House, Pantygasseg									
Background noise curve	23.5	25.6	28.2	31.4	34.8	38.3	41.7	41.7	41.7
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.3	46.7	46.7	46.7
Wind Farm turbine noise	33.0	37.4	41.0	42.6	42.7	42.7	42.7	42.7	42.7
Difference wrt noise limit	-10.0	-5.6	-2.0	-0.4	-0.3	-0.6	-4.0	-4.0	-4.0
R12 - 2 - 9 Bush Terrace, Pantygasseg									
Background noise curve	23.5	25.6	28.2	31.4	34.8	38.3	41.7	41.7	41.7
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.3	46.7	46.7	46.7
Wind Farm turbine noise	33.4	37.7	41.3	43.0	43.1	43.1	43.1	43.1	43.1
Difference wrt noise limit	-9.6	-5.3	-1.7	0.0	+0.1	-0.2	-3.6	-3.6	-3.6

Noise parameter,	Standardised 10 m wind speed quoted by manufacturer (m/s)								
dB $L_{A90,10\ m}$	4	5	6	7	8	9	10	11	12
R13 - Mountain View House, Pantygasseg									
Background noise curve	23.5	25.6	28.2	31.4	34.8	38.3	41.7	41.7	41.7
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.3	46.7	46.7	46.7
Wind Farm turbine noise	33.0	37.3	41.0	42.7	42.7	42.7	42.7	42.7	42.7
Difference wrt noise limit	-10.0	-5.7	-2.0	-0.3	-0.3	-0.6	-4.0	-4.0	-4.0
R14 - 1 - 6 Ty-Bwmpyn Road, Pontypool									
Background noise curve	25.4	27.0	28.7	30.6	32.6	34.6	36.4	36.4	36.4
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
Wind Farm turbine noise	29.7	34.4	38.1	39.0	39.1	39.1	39.1	39.1	39.1
Difference wrt noise limit	-13.3	-8.6	-4.9	-4.0	-3.9	-3.9	-3.9	-3.9	-3.9
R15 - Blaenant y Caws, PlasyCoed Rd									
Background noise curve	23.5	25.6	28.2	31.4	34.8	38.3	41.7	41.7	41.7
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	45.0	46.7	46.7	46.7
Wind Farm turbine noise	36.5	41.3	45.1	45.6	45.7	45.7	45.7	45.7	45.7
Difference wrt noise limit	-8.5	-3.7	+0.1	+0.6	+0.7	+0.7	-1.0	-1.0	-1.0
R16 - Cwmffrwdoer Farm, Cwmffrwdoer									
Background noise curve	25.4	27.0	28.7	30.6	32.6	34.6	36.4	36.4	36.4
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
Wind Farm turbine noise	27.1	31.7	35.3	36.4	36.4	36.4	36.4	36.4	36.4
Difference wrt noise limit	-15.9	-11.3	-7.7	-6.6	-6.6	-6.6	-6.6	-6.6	-6.6
R17 - Yew Tree Cottage, Pentrepiod									
Background noise curve	25.4	27.0	28.7	30.6	32.6	34.6	36.4	36.4	36.4
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
Wind Farm turbine noise	26.6	31.2	34.9	35.9	35.9	35.9	35.9	35.9	35.9
Difference wrt noise limit	-16.4	-11.8	-8.1	-7.1	-7.1	-7.1	-7.1	-7.1	-7.1
R18 - Tal-ochor Farm, Pentrepiod									
Background noise curve	25.4	27.0	28.7	30.6	32.6	34.6	36.4	36.4	36.4
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
Wind Farm turbine noise	27.4	32.1	35.7	36.5	36.5	36.5	36.5	36.5	36.5
Difference wrt noise limit	-15.6	-10.9	-7.3	-6.5	-6.5	-6.5	-6.5	-6.5	-6.5

Noise parameter,	Standardised 10 m wind speed quoted by manufacturer (m/s)								
dB $L_{A90,10\ m}$	4	5	6	7	8	9	10	11	12
R19 - Pistyll Gwyn, Pentwyn, Abersychan									
Background noise curve	25.4	27.0	28.7	30.6	32.6	34.6	36.4	36.4	36.4
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
Wind Farm turbine noise	27.0	31.6	35.2	36.0	36.1	36.1	36.1	36.1	36.1
Difference wrt noise limit	-16.0	-11.4	-7.8	-7.0	-6.9	-6.9	-6.9	-6.9	-6.9
R20 - British Road, Abersychan									
Background noise curve	25.4	27.0	28.7	30.6	32.6	34.6	36.4	36.4	36.4
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
Wind Farm turbine noise	25.6	30.0	33.2	33.8	33.9	33.9	33.9	33.9	33.9
Difference wrt noise limit	-17.4	-13.0	-9.8	-9.2	-9.1	-9.1	-9.1	-9.1	-9.1

13.12.4 The results of the cumulative noise assessment show that without mitigation, compliance is achieved at the majority of the receptors during the daytime period, resulting in a **not significant** effect. Exceedances of the daytime limits of up to 3.0 dB are indicated at receptors R10 to R13 and R15 resulting in a potential **significant** effect, but only for a limited range of wind speeds. During the night-time, without mitigation, compliance is predicted at the majority of receptors, resulting in a **not significant** effect. Exceedances of the night-time limits of up to 0.7 dB are indicated at receptors R12 and R15 resulting in a potential **significant** effect, but only for a limits range of wind speeds.

13.12.5 The predicted noise levels reported in **Table 13.27** and **Table 13.28** assume a worst case of downwind propagation from all wind turbines. It should be noted that directivity effects due to wind direction will have a significant influence (reduction) at R10 to R13, which are due south of the Proposed Development and north of the proposed Mynydd Maen wind farm, and at R15 which is south east of the Proposed Development and north of the proposed Mynydd Maen wind farm. Those receptors are where the highest daytime exceedances are predicted, without mitigation. The cumulative noise at R10 to R13, where the greatest exceedances are predicted, is predicted to be dominated by sound from the proposed Mynydd Maen turbines 1 and 3 to 7, and to a lesser extent, the Proposed Development T7 (on the basis of the assumed downwind propagation from all turbines).

13.12.6 As receptors R10 to R13 and R15 are located between the Proposed Development and the proposed Mynydd Maen wind farm, they cannot be downwind of both wind farms at any given time. These receptors would either be upwind of one of the wind farms and downwind of the other, the wind direction would be grazing for these receptors and both proposed wind farms, or somewhere in between.

13.12.7 The noise level contribution from turbines subject to upwind conditions will be significantly reduced from those modelled, which will reduce the cumulative noise at these receptors. During grazing wind conditions, cumulative noise levels from turbines at angles perpendicular to the wind direction would also be reduced, to a lesser degree than in upwind conditions, but to turbines at both developments simultaneously, and so would still provide a significant attenuation reducing cumulative turbine noise and reducing the extent of the potential exceedances indicated in the assessment.

13.12.8 Further assessment of potential noise mitigation measures has been explored on the basis of the identified worst case downwind predictions under the heading **'Implementation of environmental measures'**, below.

Implementation of environmental measures

13.12.9 Whilst the candidate turbine may change, the residential amenity of surrounding areas would be protected by an appropriately worded planning condition based on ETSU-R-97[4] limit compliance, as outlined in **Section 13.10**. Compliance with these limits can be proven with measurements taken at residential receptor locations once the wind farm is operational.

13.12.10 As discussed above at **paragraphs 13.12.5 to 13.12.7**, it is considered that the limited number of exceedances identified before mitigation are likely to be an overestimate, as the wind turbine noise predictions do not take directivity effects into account.

13.12.11 However, further assessment of potential noise mitigation measures has been explored on the basis of the identified worst case downwind predictions. Other mitigation measures (beyond account of directional affects) that are available to the developers/ operators include:

- Careful selection of the final turbine type selected for installation (e.g. selecting a turbine type with lower noise emission data than the candidate turbine type that has been assessed).
- Use of a turbine noise management scheme i.e. application of noise reduced turbine operational modes to specific turbines at specific periods and under specific direction conditions.
- A combination of the above measures.

13.12.12 With regards to the use of noise reduced operational modes, at wind speeds of 7 ms^{-1} where the greatest potential exceedance is identified, the candidate turbines for the Proposed Development, Mynydd Maen wind farm and Trecelyn wind farm (the Vestas 150 STE or the Vestas V117 STE) can both be operated in a range of noise reduced modes. Incremental noise reduced modes are available for both of these turbine models, offering noise reductions of up to 5 dB. These reductions are greater than the maximum 3.0 dB noise level reduction required to ensure limit compliance. Therefore, application of appropriate noise management schemes at the Mynydd Maen Wind Farm, Trecelyn Wind Farm and the Proposed Development can fully mitigate the cumulative noise levels, controlling them to below the ETSU-R-97[4] derived cumulative noise limits.

13.12.13 A further initial investigation into the attenuations required to ensure compliance with the ETSU-R-97[4] derived noise limits has been undertaken, by focussing greater levels of attenuation to the turbines making the greatest contribution at the receptors where exceedances were predicted. The turbine sound level attenuations provided in **Table 13.29** would reduce turbine noise levels such that the limits are not exceeded at any of the receptors considered in the assessment, without taking directivity into account.

Table 13.29 Summary of turbine attenuations to meet cumulative turbine noise limits (without directivity)

Scenario	Day 6 ms-1	Night 6 ms-1	Day 7 ms-1	Night 7 ms-1	Day 8 ms-1	Night 8 ms-1	Day 9 ms-1	Night 9 ms-1
Max exceedance, dB	1.3	0.1	3.0	0.6	1.2	0.7	0.7	0.7
Max attenuation achieved, dB	1.3	0.4	3.0	0.8	1.2	0.9	0.9	0.9
Attenuations per turbine, dB								
M. Llanhilleth T6		-0.5		-1.5	-1	-1.5	-1.5	-1.5
M. Llanhilleth T7	-2.5		-4.5		-0.5			
M. Maen T1	-2		-4		-1.5			
M. Maen T2			-2.5					
M. Maen T3	-3.5		-4.5		-3.5	-0.5		
M. Maen T4			-2.5					
M. Maen T5	-0.5		-3		-0.5			
M. Maen T6	-3		-5		-3			
M. Maen T7			-3.5					
Trecelyn T1			-2					

13.12.14 The results of the mitigation investigation in **Table 13.29** indicate that contributions from the proposed Mynydd Maen Wind Farm tend to dominate the greatest exceedances, and therefore turbines associated with the proposed Mynydd Maen Wind Farm require the most significant attenuations to achieve compliance with the ETSU-R-97[4] derived noise limits. The results of the mitigation investigation indicate that turbine noise reductions would also be required for some of the turbines associated with the Proposed Development and Trecelyn Wind Farm. The mitigation investigation indicates that, by incorporation of an appropriate mitigation strategy, the ETSU-R-97[4] derived noise limits would not be exceeded cumulatively.

13.12.15 The mitigation investigation has demonstrated that, with attenuations to specific turbines, compliance with the ETSU-R-97[4] derived noise limits can be achieved. As outlined in **paragraph 13.12.12**, there are noise reduced operating modes available for the turbines considered in the assessment which can achieve the necessary attenuations. On this basis, through the implementation of appropriate mitigation measures to ensure that cumulative wind turbine noise levels will not exceed the ETSU-R-97 derived noise limits, resulting effects due to cumulative turbine noise will be **not significant**.

Significance conclusions

13.12.16 The results of the assessment of operational noise indicates that without mitigation, the ETSU-R-97[4] derived noise limits are likely to be exceeded, over limited wind speed ranges, at R10 to R13 and R15 during the daytime and at receptors R12 and R15 during the night-time, resulting in potential significant effects.

13.12.17 In the majority of cases where exceedances are identified, turbines associated with the proposed Mynydd Maen wind farm are dominant. It is noted that, at this stage, the turbine type for Mynydd Maen wind farm is not confirmed. It is also noted, as outlined in **paragraphs 13.12.5 to 13.12.7**, that directivity effects may have a significant influence in terms of reducing cumulative noise levels where the greatest exceedances are indicated.

13.12.18 It is considered that, in further analysis of cumulative noise levels, cumulative noise levels can be controlled appropriately to avoid exceedances of the ETSU-R-97[4] derived noise limits and hence avoid significant noise effects. The scheme of mitigation may include, for example, the application of reduced noise operating modes during specific wind speed and direction conditions, or selecting an alternative quieter turbine for installation.

13.12.19 An example is presented in **Table 13.29**, above, which demonstrates how operational management schemes can be used to reduce cumulative operational noise levels to below the applicable noise level limits and ensure operational compliance with the applicable ETSU-R-97[4] noise level limits

13.12.20 Based on the above, it is considered that the identified exceedances will be reduced when accounting for directivity and site-specific wind shear, and can be fully mitigated through the application of a turbine noise management schemes, sufficient that there would be no cumulative exceedance of the ETSU-R-97[4] derived noise limits. On this basis, the effect of operational noise on residences would be **not significant**.

13.12.21 A summary of the results of the assessment is provided in **Table 13.30**.

Cumulative effects with other developments

13.12.22 A review of the other developments listed in **Chapter 2: Approach to Environmental Impact Assessment** identified two other non-wind farm developments considered to have the potential to give rise to significant cumulative effects: Tirpentwys Quarry and The British – TCBC Masterplan. No other non-wind farm developments were considered likely to result in significant cumulative effects. A CEA has been carried out for Tirpentwys Quarry and The British – TCBC Masterplan, below.

Tirpentwys Quarry

13.12.23 In addition to the cumulative wind farm schemes assessed above, the proposed Tirpentwys Quarry, which is currently at the scoping stage, is identified as a scheme that could result in cumulative noise and vibration effects. It is noted that the scoping opinion[38] for the quarry was issued 1st February 2023 and, since that time, a planning application for the scheme has not been submitted. The information supplied[39] to inform the scoping opinion with regard to potential noise impact was issued in April 2022 to support the promotion/allocation of the site as a candidate mineral extraction site as part of a review of

[38] Torfaen County Borough Council (2023). Scoping Opinion. Application no. 22/P/0762/SCOPE.
[39] SLR Consulting Limited (2022). Tir Pentwys, Noise Impact & Tranquillity Assessment. SLR Ref No. 403.00542.00007.

the Torfaen Council Local Development Plan[40]. As such, there is only limited information available on the potential noise emissions associated with the proposed quarry. Therefore, assessment of potential cumulative impacts due to quarrying activities, presented below, is limited to the information available, as presented in the report 'Tir Pentwys, Noise Impact & Tranquillity Assessment'[39], which only considered the potential impact of road traffic movements associated with the operation of the proposed quarry.

13.12.24 It is noted that, in terms of potential cumulative effects during the construction phase of the Proposed Development, that the assessment of the Proposed Development presented in the 2023 ES indicates that predicted construction noise levels are significantly below the threshold for a significant effect at the closest receptors to the Proposed Development. As such, it is considered there is no potential for significant cumulative effects during the construction phase of the Proposed Development, and that the likely cumulative noise effects during the construction phase of the Proposed Development are **not significant**.

13.12.25 In consideration of potential cumulative effects due to road traffic noise from the construction traffic for the Proposed Development and operational quarry traffic, it is noted that the vehicular access route to the proposed quarry is from the north and does not pass the dwellings in close proximity to Farm Road considered in the 2023 ES. Where the quarry haul road does pass in closer proximity to dwellings, it is considered that there is little potential for cumulative effects from quarry road traffic noise and operational wind turbine noise, because wind turbines produce a continuous sound which will be significantly lower than that of passing vehicles. Assuming the same quarry haul road route is retained in future proposals for the quarry, and there is no rerouting of quarry traffic along Farm Road, then there is no potential for significant cumulative noise effects with the addition of road traffic for the quarry. On this basis the likely cumulative noise effects due to road traffic noise are **not significant**.

13.12.26 With regard to potential cumulative noise effects arising from quarry extraction operations (i.e. activity at the quarry and not traffic), it is noted that there is no data available on likely noise levels from quarry activities at the nearest receptors to facilitate a quantitative assessment. Additionally, noise from wind turbines and from quarry operations are very different in character and subject to different assessment methodologies and criteria. Notwithstanding this, it is considered that, as long both the quarry and the Proposed Development apply appropriate mitigation measures to avoid significant adverse noise impacts individually and in accordance with their respective methodologies and criteria, then significant cumulative noise impacts would be unlikely. Based on the above, it is considered that the likely cumulative noise effects during the operation phase of the Proposed Development are **not significant**.

The British – TCBC Masterplan

13.12.27 Site remediation and improvements to the drainage system are proposed at The British – a former industrial site west of Talywain, Abersychan. The information provided in the EIA Screening Report[41] regarding potential noise and vibration impacts due to the scheme state that *'The A4043, approximately 1km east of the proposed scheme, is designated a noise priority action area. There is potential for construction noise to increase the noise and disturbance within this area and the adjacent properties to the proposed scheme.',* but

[40] Torfaen County Borough Council (2013). Local Development Plan (to 2021). Adopted December 2013. Written Stratement. Available at: https://www.torfaen.gov.uk/en/Related-Documents/Forward-Planning/Adopted-Torfaen-LDP-Writen-Statement.pdf (Accessed 30 August 2024).
[41] WSP (2024). The British. Environmental Impact Assessment (EIA) Screening Report. Doc ref. GC4075-WSP-74-XX-RP-L-0015. Available at https://planningonline.torfaen.gov.uk/online-applications/files/79319AD501B2695EB4BCCF99308BB92F/pdf/24_P_0537_SCREEN-ENVIRONMENTAL_IMPACT_ASSESSMENT__EIA__SCREENING_REPORT-262785.pdf (Accessed 30 August 2024).

no quantitative data or assessment is presented. The work at The British will be subject to further assessment when detailed proposals for the scheme are available, including assessment of any potentially significant cumulative effects.

13.12.28 In consideration of potential cumulative effects, it is considered that cumulative effects during either construction activities (i.e. not construction traffic) or operational activities associated with the Proposed Development are unlikely. This is on the basis that the predicted noise level due to piling provided in the 2023 ES was 51 dBA at a distance of 250 m, and the predicted cumulative turbine noise level at the receptor nearest The British (R20, British Road, Abersychan) reported above is 35.5 dBA. The predicted piling noise level is likely to be around 20 dB below the threshold of significance at the nearest receptor which may also be affected by works at The British. The predicted cumulative turbine noise levels are low in absolute terms and unlikely to contribute to any cumulative noise effects. Therefore, it is considered that cumulative effects due to construction activities (i.e. not construction traffic) and operational noise are **not significant**.

13.12.29 There is potential that a cumulative effect could arise at the few dwellings, in the vicinity of the eastern extent of Castle Wood Road, due to construction traffic associated with the Proposed Development and construction traffic associated with The British site on Farm Road. The potential for such a cumulative effect is dependent on the final vehicular access route that is selected to The British site, the volumes of traffic to The British site and the extent of any overlaps in the construction programmes. There is currently no information available indicating the likely construction programme, intensity of works, or likely number of vehicle movements required, for the proposed works at The British.

13.12.30 The assessment of the Proposed Development presented here notes that construction traffic associated with the Proposed Development is only predicted to marginally exceed the BS 5228-1[42] significance threshold, and predicted construction traffic noise levels are considered likely to be an overestimate. It is also noted that the peak of construction traffic is anticipated to last for one month, with the prior month experiencing a similar volume of construction traffic and all other months in the construction programme anticipated to have much lower numbers of construction vehicles.

13.12.31 As such, any cumulative impacts to which construction traffic associated with the Proposed Development would significantly contribute would be limited to a duration of one to two months and would only occur if the design and programme for The British works included access via Farm Road with significant volumes of construction traffic at the same time as the peak in construction traffic associated with the Proposed Development. This is considered unlikely.

13.12.32 Based on the above it is considered that, whilst there is potential for cumulative effects due to construction traffic noise, these would be very limited in terms of the number of receptors affected and the duration. Considering the localised extent of any cumulative effects, the duration, and notwithstanding the uncertainty regarding the proposals for The British works, it is considered that the likely cumulative noise effects due to construction traffic associated with the Proposed Development and construction traffic to The British site are **not significant**.

13.12.33 A summary of the results of the above assessment is provided in **Table 13.30**.

[42] British Standards Institution, 2014. British Standard BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites, Part 1: Noise. BSI, London.

13.13 Significance Conclusions

13.13.1 A summary of the results of the assessments are provided below in **Table 13.30**.

Table 13.30 Summary of significance of effects

Receptor and summary of predicted effects	Sensitivity/ importance/ value of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
Construction vibration: All NSRs	High	Negligible	Not Significant	The likelihood of vibration from potential piling activities giving rise to significant effects is considered to be negligible due to the separation distances involved (the nearest receptor is approximately 250 m from potential piling activities).
Construction noise daytime: All NSRs	High	Negligible	Not Significant	BS 5228-1:2009+A1:2014 limits are not exceeded during the daytime period due to piling noise.
Construction traffic	High	Negligible	Not significant	The majority of the proposed construction routes feature significant existing baseline flows where the increase in flow associated with the additional construction traffic would not cause a material increase in road traffic noise. On the less trafficked portion of the construction routes traffic noise may give rise to an adverse impact in weeks 3 - 5 of the construction programme at a single dwelling. The adverse impacts at the single dwelling are considered to result in effects which are not significant.
Operational daytime: **All NSRs**	High	High	Not Significant	Without mitigation, compliance with the ETSU-R-97 noise limits is predicted at the majority of receptors. However, exceedances of the ETSU-R-97 noise limits are indicated during the daytime period at receptors R10, R11, R12, R13, & R15. It has been demonstrated how noise mitigation measures are available, sufficient to ensure that cumulative turbine noise can be controlled to be compliant with the applicable limits determined in accordance with ETSU-R-97. An example of such a scheme, with the specific turbine noise attenuations required, is provided in **Section 13.12**, under the heading '**Implementation of environmental measures**'. With such a scheme of mitigation, residual noise effects at all NSRs will be **not significant**.

Receptor and summary of predicted effects	Sensitivity/ importance/ value of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
Operational night-time: **All NSRs**	High	High	Not Significant	Without mitigation, compliance with the ETSU-R-97 noise limits is predicted at the majority of receptors. However, exceedances of the ETSU-R-97 noise limits are indicated during the daytime period at receptors R12 and R15. It has been demonstrated how noise mitigation measures are available, sufficient to ensure that cumulative turbine noise can be controlled to be compliant with the applicable limits determined in accordance with ETSU-R-97. An example of such a scheme, with the specific turbine noise attenuations required, is provided in **Section 13.12**, under the heading '**Implementation of environmental measures**'. With such a scheme of mitigation, residual noise effects at all NSRs will be **not significant**.
Cumulative effects with other developments: All NSRs	High	Negligible	Not Significant	CEA indicates that cumulative effects would be **not significant**.

1. The sensitivity/importance/value of a receptor is defined using the criteria set out in **Section 13.7** and is defined as low, medium, or high.
2. The magnitude of change on a receptor resulting from activities relating to the development is defined using the criteria set out in **Section 13.8** and is defined as negligible or high.
3. The significance of the environmental effects is based on the combination of the sensitivity/importance/value of a receptor and the magnitude of change and is expressed as major (significant), moderate (potentially significant) or minor/negligible (not significant), subject to the evaluation methodology outlined in **Section 13.8**. The significance is based on the residual effects post mitigation assumed to be included into the design.

13.14 Further work

13.14.1 Prior to preparing the assessment to be presented in the Final ES, consultation with TCBC and BGCBC will be undertaken based on the contents of this Draft ES.

Appendix 13A – Background noise level curves

Graphs are presented below showing the background noise level data used in the assessment presented in this ES.

Figure A13.1 Location M1: daytime trendlines from measurement data

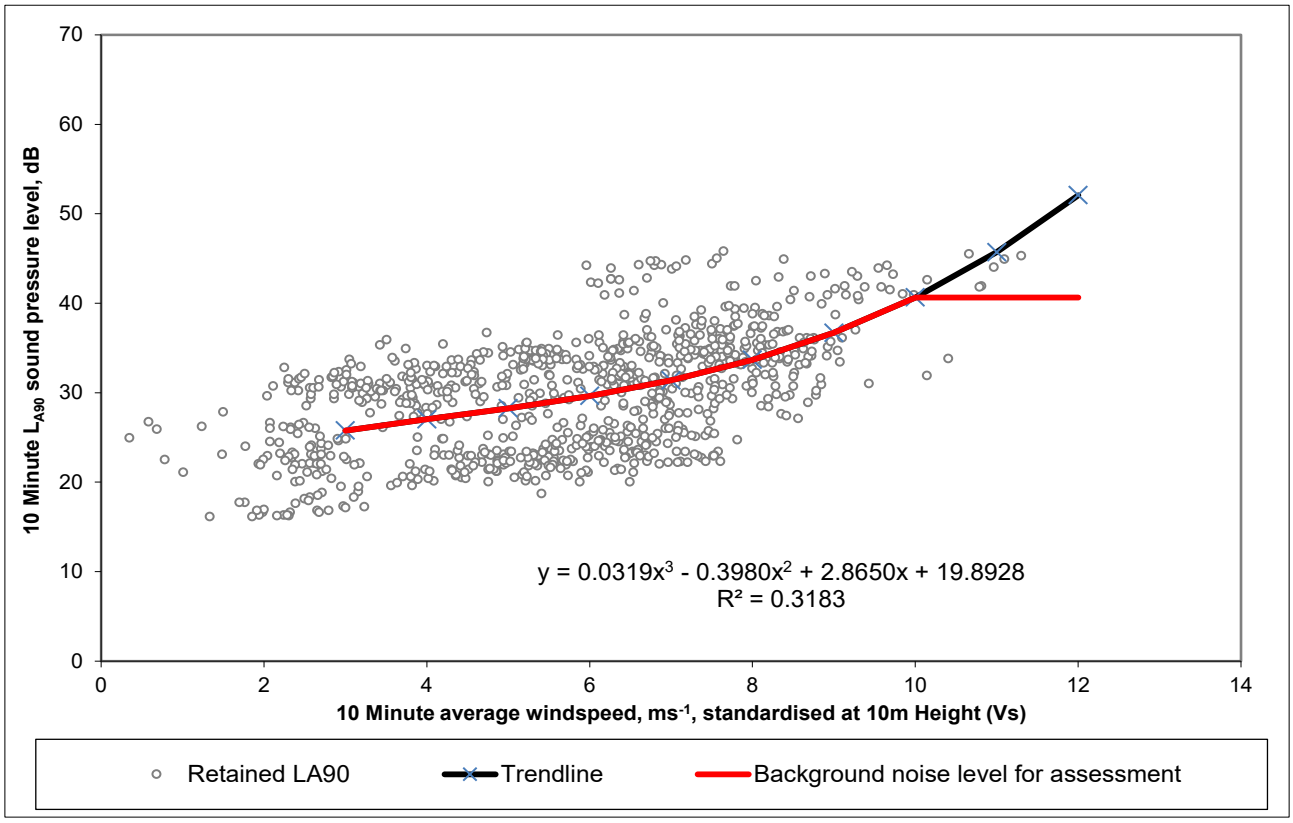

Figure A13.2 Location M1: night-time trendlines from measurement data

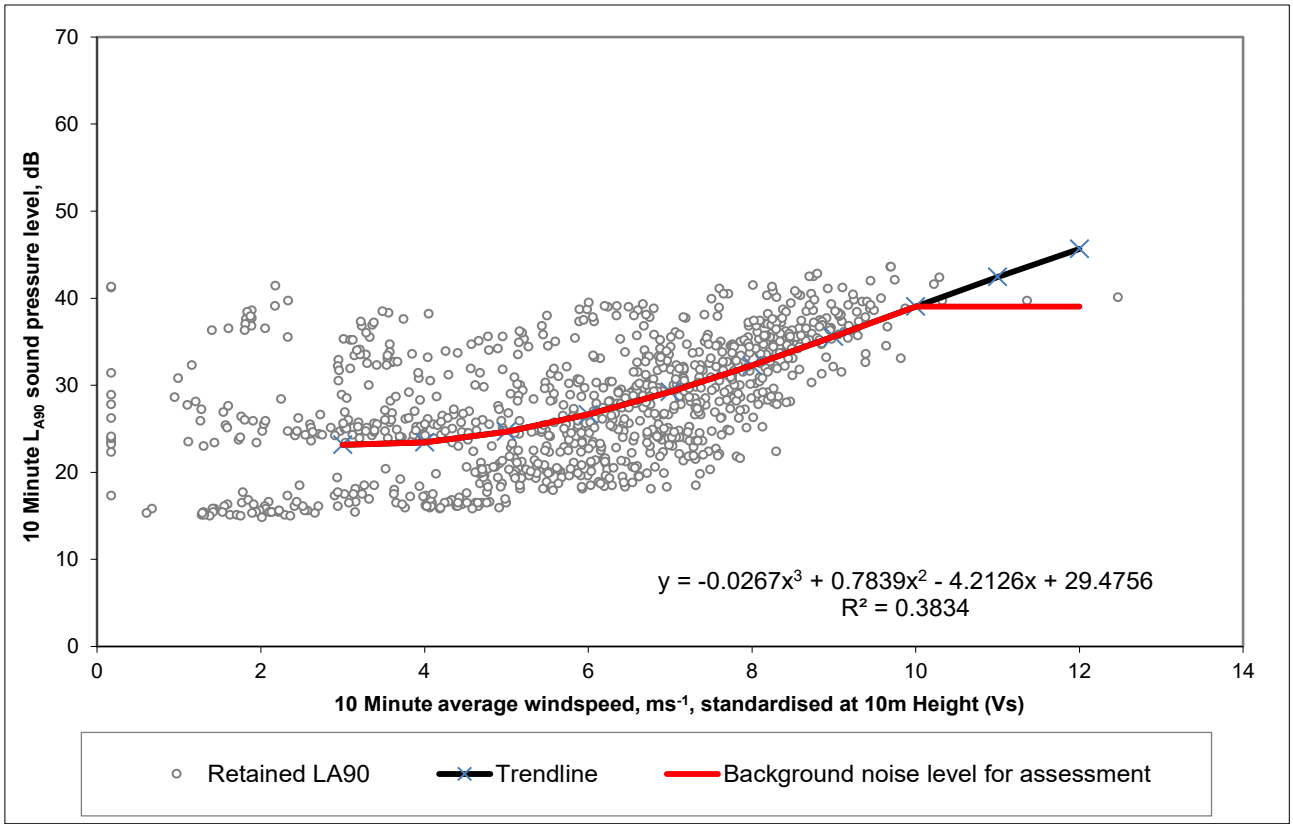

Figure A13.3 Location M2: daytime trendlines from measurement data

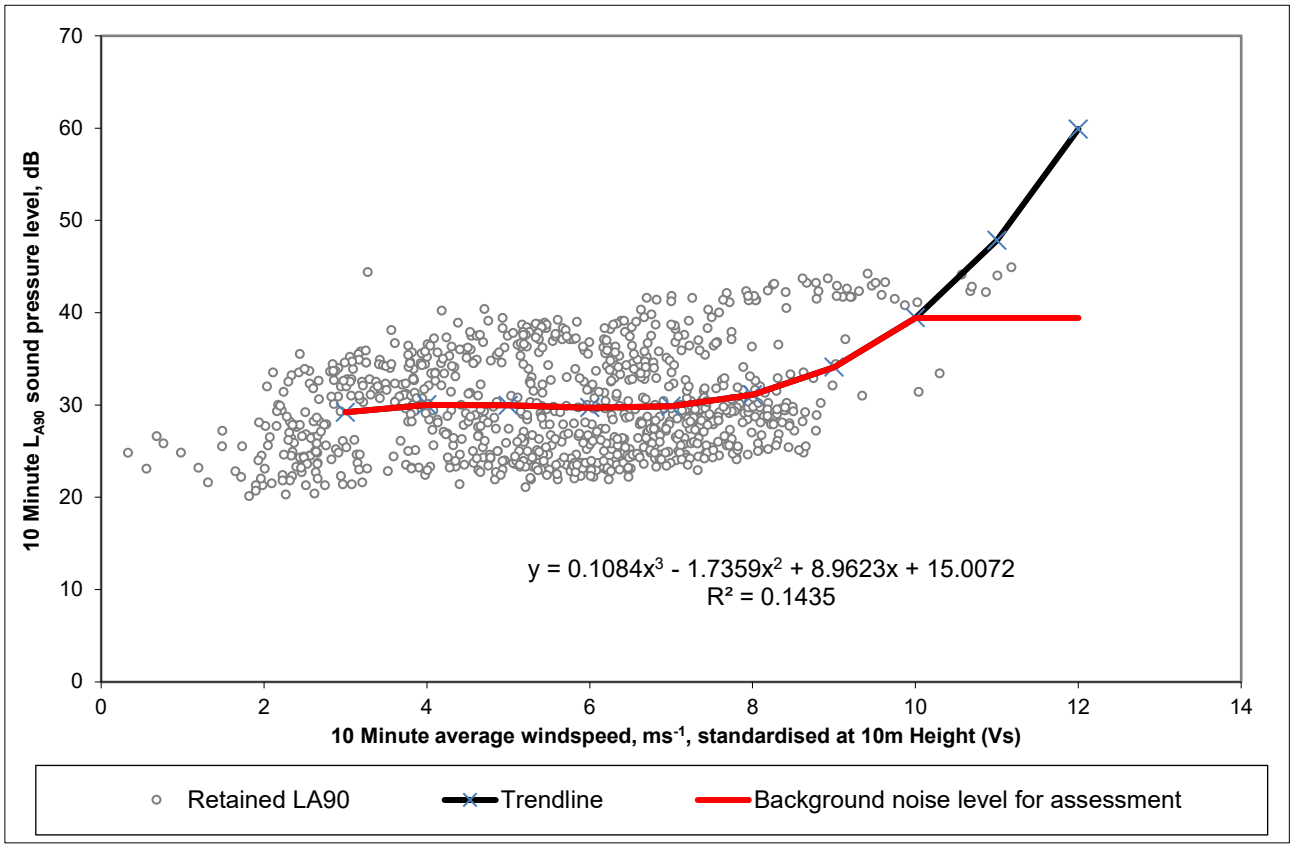

Figure A13.4 Location M2: night-time trendlines from measurement data

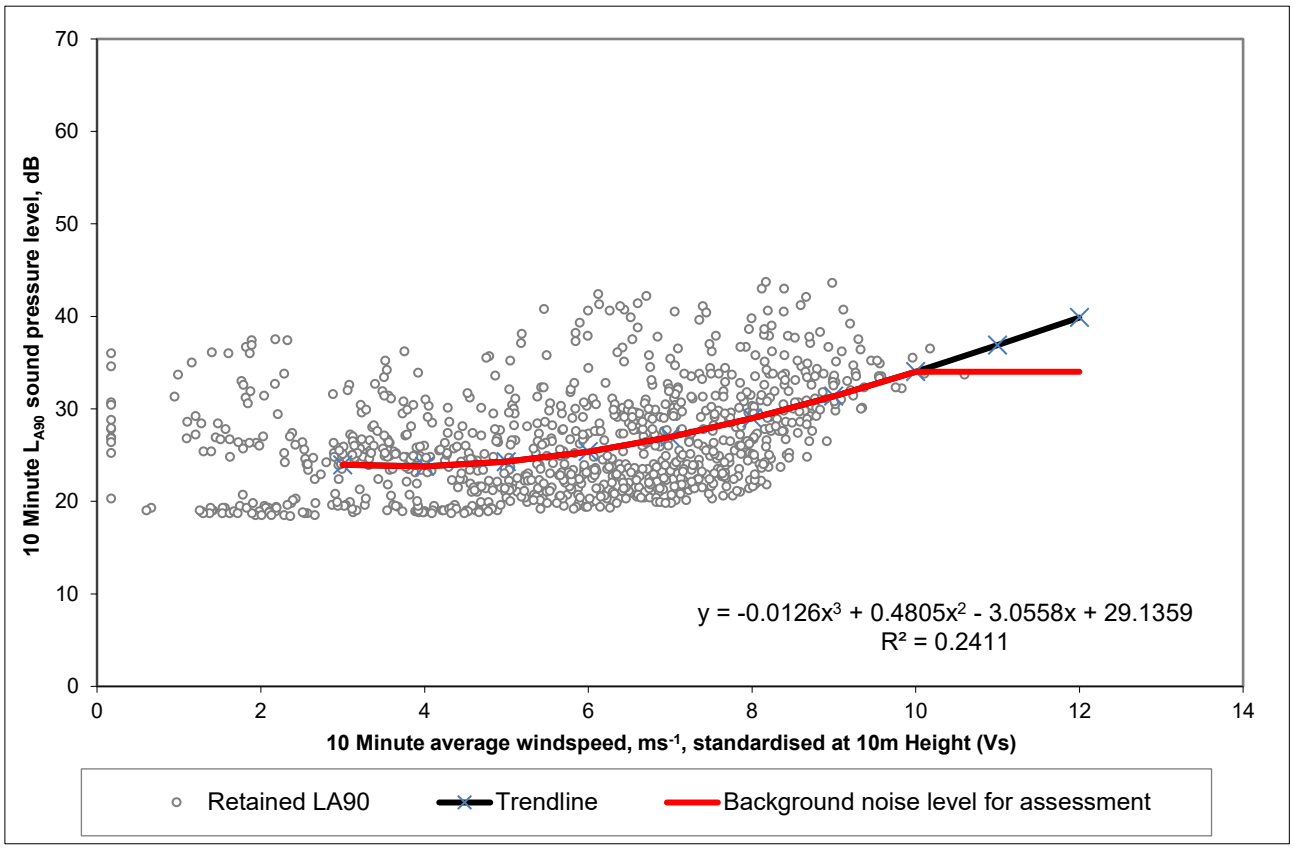

Figure A13.5 Location M3: daytime trendlines from measurement data

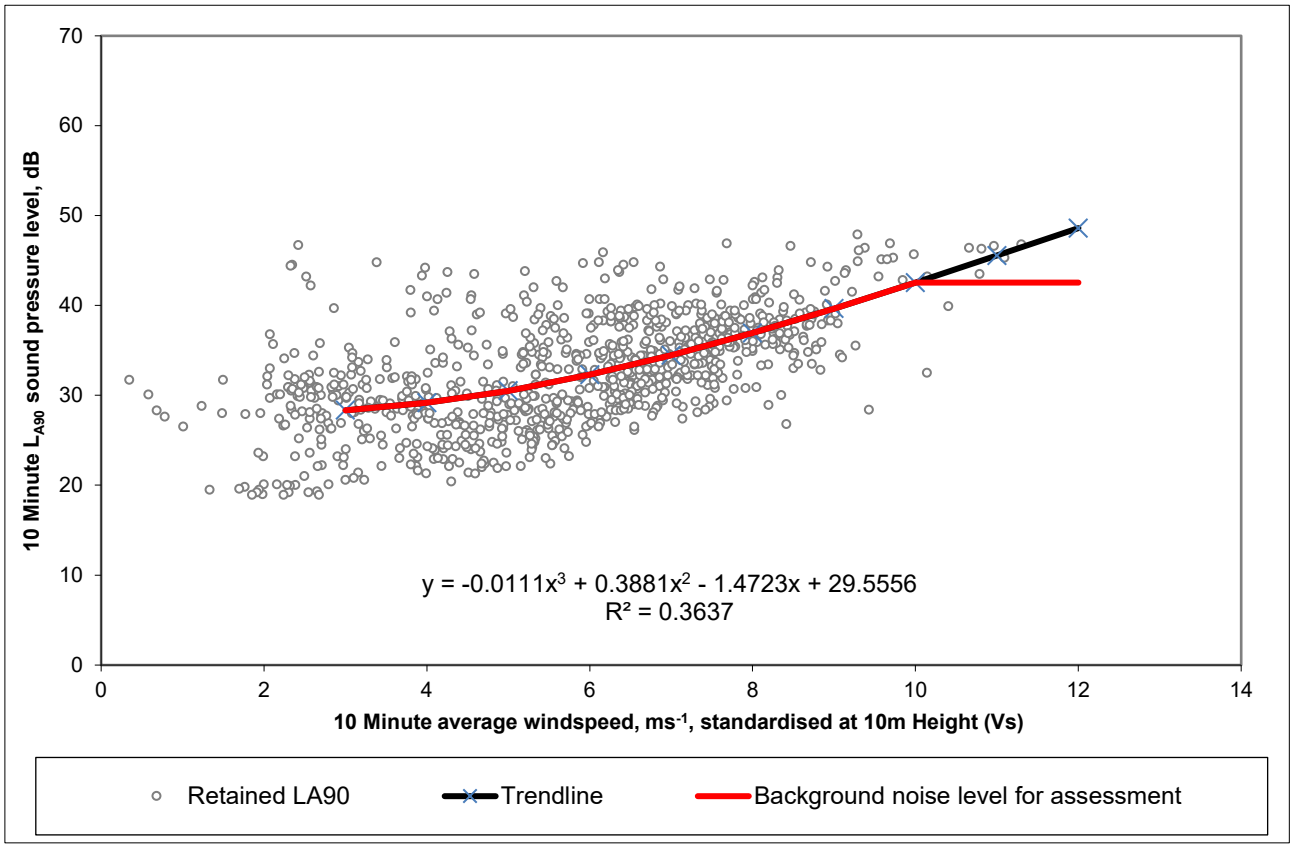

Figure A13.6 Location M3: night-time trendlines from measurement data

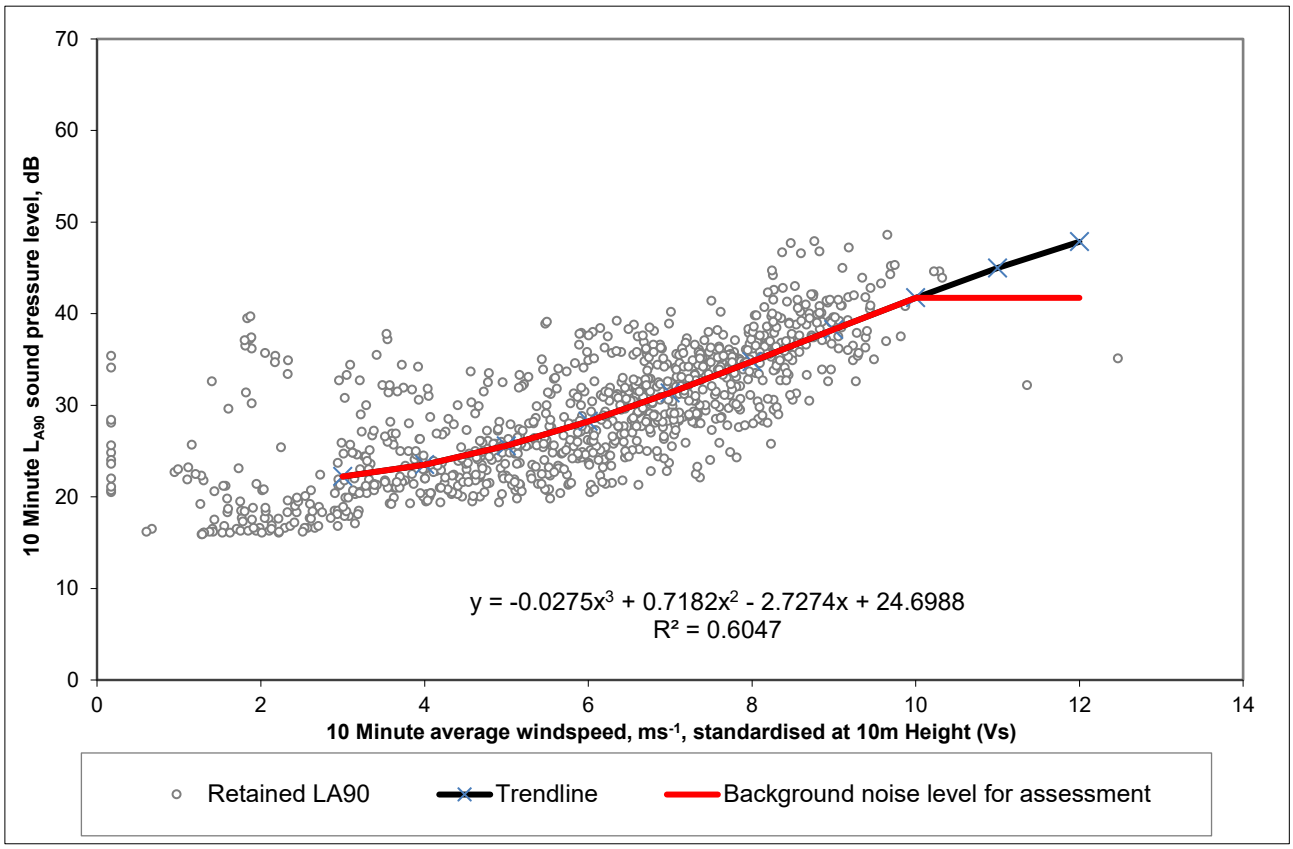

Figure A13.7 Location M4: daytime trendlines from measurement data

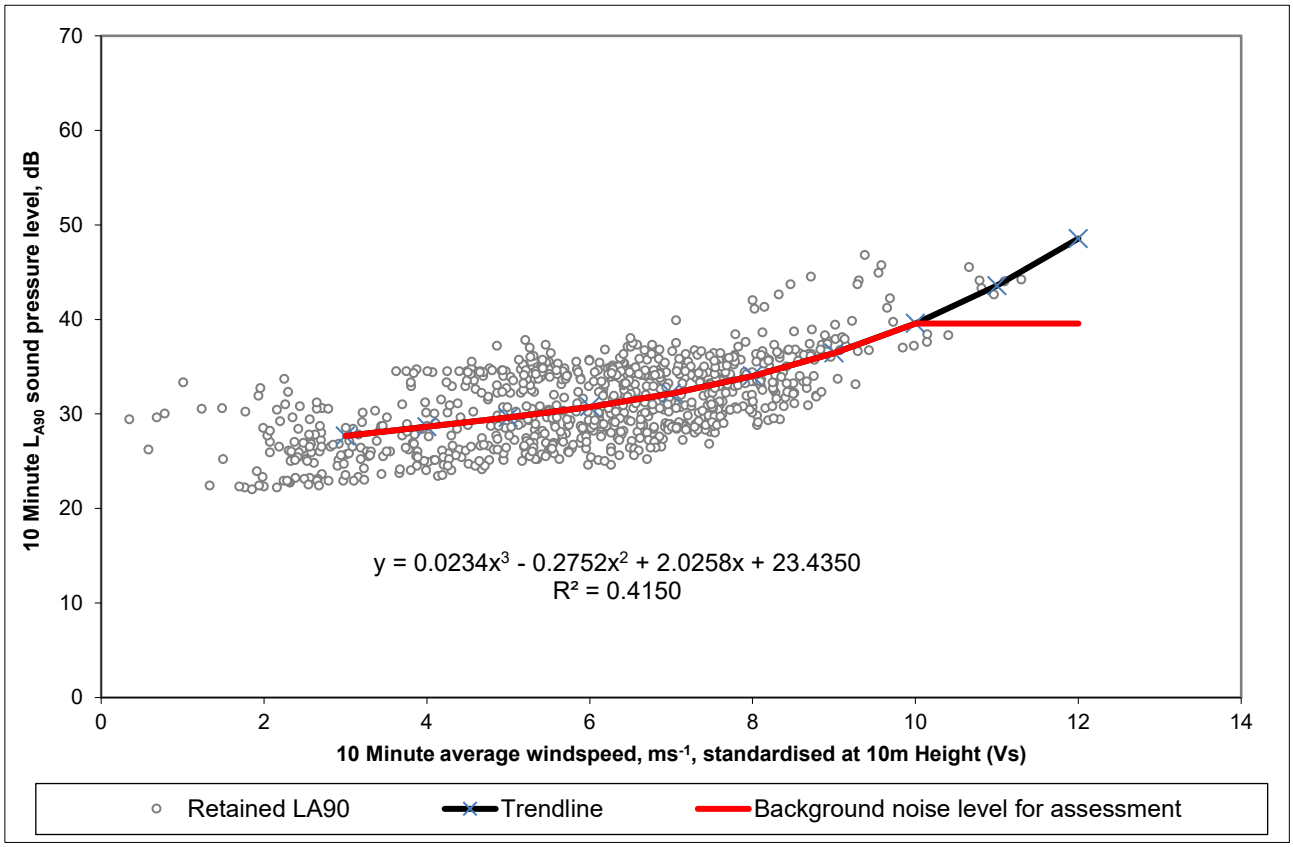

Figure A13.8 Location M4: night-time trendlines from measurement data