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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**);
 - Consultation and engagement that has been undertaken and how comments from consultees relating to noise have been addressed (**Section 13.3**);
 - The methods to be used for baseline data gathering (**Section 13.4**);
 - Overall baseline (**Section 13.5**);
 - Embedded measures relevant to noise (**Section 13.6**);
 - The scope of the assessment for noise (**Section 13.7**);
 - The methods used for the assessment (**Section 13.8**);
 - The assessment of noise effects (**Section 13.9**);
 - Assessment of cumulative (inter-project) effects (**Section 13.10**);
 - A summary of the significance conclusions (**Section 13.11**); and
 - An outline of further work to be undertaken for the Environmental Statement (ES) (**Section 13.12**).

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 An initial baseline noise survey for the Draft ES has been undertaken using a 10-metre meteorological mast. It is proposed that this will be updated using a full height met mast in accordance with Institute of Acoustics (IOA) guidance (see **Table 13.3** for details), with results being submitted at Final ES submission. However, at this stage, the survey data gathered in conjunction with the 10 metre wind speeds provides a suitable understanding of the baseline noise environment and is likely to result in a conservative assessment using the IOA correction factor (see **paragraph 13.9.7**).

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 1993¹	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 1974²	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	
National Policy Statements	NPS EN-1 ³ advises that applicants include a noise assessment to consider both construction and operation effects where appropriate. EN-3 ⁴ at 2.7.56 states that the applicant's assessment of noise from the operation of the wind turbines should use ETSU-R-97 ⁵ , taking account of the latest industry

¹ UK Government (1990), Environmental Protection Act 1990. (Online) Available at: <https://www.legislation.gov.uk/ukpga/1990/43/contents> (Accessed 5 October 2022).

² UK Government (1974). Control of Pollution Act 1974. (Online) Available at: <https://www.legislation.gov.uk/ukpga/1974/40/contents> (Accessed 5 October 2022).

³ Department of Energy & Climate Change (2011). Overarching National Policy Statement for Energy (EN-1). (Online) Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf (Accessed 5 October 2022).

⁴ Department of Energy & Climate Change (2011). National Policy Statement for Renewable Energy Infrastructure (EN-3). (Online) Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/37048/1940-nps-renewable-energy-en3.pdf (Accessed 5 October 2022).

⁵ 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 5 October 2022).

Policy	Policy context
	good practice. ETSU-R-97 ⁵ is also referred to alongside associated good practice guides (see Table 1.3) in Planning Policy Wales ⁶ .
Future Wales – The National Plan 2040⁷	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)⁸	TAN 11 provides general advice on noise and refers to TAN 8 ⁹ 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 2013¹⁰	Policy BW1 General Policy – Development Proposals states: “ <i>All development proposals will be considered favourably providing they comply with the following criteria where they are applicable:-</i> A Amenity and Design ... vi) <i>The proposal does not have an unacceptable impact upon the amenities of the occupiers of adjoining or neighbouring properties; ...</i> B Natural Environment , i) <i>The proposal does not result in unacceptable adverse effects in respect of land contamination, instability or subsidence; air, heat, noise or light pollution...</i> ”
Blaenau Gwent County Borough Council Local Development Plan up to 2021 (Adopted November 2012)¹¹	<p>Policy DM1 New Development states: “<i>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...</i>”</p> <p>Policy DM4 Low and Zero Carbon Energy states: “<i>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...</i>”</p>

Technical guidance

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

⁶ Welsh Government, Planning Policy Wales. Edition 11: February 2021. (Online) Available at: https://gov.wales/sites/default/files/publications/2021-02/planning-policy-wales-edition-11_0.pdf (Accessed 5 October 2022).

⁷ Welsh Assembly Government (2021). Future Wales. The National Plan 2020. (Online) Available at: <https://gov.wales/sites/default/files/publications/2021-02/future-wales-the-national-plan-2040.pdf> (Accessed on 5 October 2022).

⁸ 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 5 October 2022).

⁹ 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 5 October 2022).

¹⁰ 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-Written-Statement.pdf> (Accessed 28 October 2022)

¹¹ 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-ldp-allocations/adopted-local-development-plan-2006-2021/> (Accessed 5 October 2022).

Table 13.3 Technical guidance relevant to the noise assessment

Technical guidance document	Context
ETSU-R-97 The Assessment and Rating of Noise from Wind Farms, The Working Group on Noise from Wind Turbines (1996)⁵	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)¹²	<p>Presents current good practice in the application of ETSU-R-97⁵ 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-97⁵ and the results of research carried out and experience gained since its publication.</p> <p>Six Supplementary Guidance Notes (SGNs) present additional guidance on various topics:</p> <ul style="list-style-type: none"> • SGN 1: Data collection¹³; • SGN 2: Data processing & derivation of ETSU-R-97 background curves¹⁴; • SGN 3: Sound power level data¹⁵; • SGN 4: Wind shear¹⁶; • SGN 5: Post completion measurements¹⁷; and • SGN 6: Noise propagation over water for on-shore wind turbines¹⁸.
BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise, BSI (2014)¹⁹	Detailed guidance on assessing noise from construction sites. Approved code of practice for construction noise under the Control of Pollution Act 1974.

¹² 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 5 October 2022).

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 1: Data collection.

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 2: Data processing & derivation of ETSU-R-97 background curves.

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 3: Sound power level data.

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 4: Wind shear.

¹⁷ 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.

¹⁸ 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.

¹⁹ 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.

13.3 Consultation and engagement

Overview

- 13.3.1 The assessment has been informed by consultation responses and stakeholder engagement. 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 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 Draft ES
PEDW	The Inspectorate welcomes the assurance that mitigation for construction / construction traffic noise will be set out in the ES.	A preliminary assessment of construction noise and construction traffic noise is provided in Section 13.9 .

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	It is proposed that consultation with TCBC will be undertaken based on the information contained in this Draft ES.
Blaenau Gwent County Borough Council	It is proposed that consultation with BGCBC will be undertaken based on the information contained in this Draft ES.

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.

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 summary of the source of data, together with the nature of that data is 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 ²⁰ (software), Maxar Technologies (image source)	Aerial imagery
British Standards Institute	BS 5228-1:2009+A1:2014 ¹⁹	Noise data for construction noise and vibration predictions.
Enercon	Sound power level of the Enercon E-53 Operational Mode 1 (Data sheet) ²¹ Sound emission according to IEC 61400-11 ²²	Turbine noise data (Enercon E-53)
Vestas	DMS 0067-4767 V05. V150-4.0/4.2 MW Third octave noise emission ²³	Turbine noise data (Vestas V150)
Stuart Burke Associates	Single wind turbine application – Roundshaw Farm ²⁴	Turbine noise data (Vestas V27)
Gamesa	MCG G128-4.5MW Noise Spectrum ²⁵ G128 4.5MW Power curve and noise levels ²⁶	Turbine noise data (Vergnet GEV MPR 250kW)
Senvion	Octave & third octave band data [MM100/50Hz/60Hz] ²⁷	Turbine noise data (Senvion MM100)

²⁰ 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 05 October 2022).

²¹ Enercon GmbH (2012). Sound power level of the Enercon E-53 Operational Mode 1 (Data sheet). Enercon GmbH, Aurich, Germany.

²² 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.

²³ Vestas (2018). DMS 0067-4767 V05. V150-4.0/4.2 MW Third octave noise emission. Vestas, Denmark.

²⁴ Stuart Burke Associates (2014). Single wind turbine application – Roundshaw Farm. Environmental Statement: Volume III – Technical Assessment. SBA, 2014.

²⁵ Gamesa (2013). General characteristics manual. MCG G128-4.5MW Noise Spectrum. Gamesa.

²⁶ Gamesa (2012). General characteristics manual. G128 4.5MW Power curve and noise levels. Gamesa.

²⁷ 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.

Organisation	Data source	Data
University of Groningen & University of Gothenburg	Project WINDFARMperception ²⁸	Turbine noise data (Vestas V66)
Nordex	Technical report. Octave sound power levels. Nordex N117/3000 – Standard Mode ²⁹	Turbine noise data (Nordex N117)

Survey work

Wind Farm development

- 13.4.5 A baseline sound level survey was carried out between Wednesday 3 August 2022 and Wednesday 24 August 2022 alongside a 10 m meteorological mast. It is acknowledged that this is not the preferred method for wind speed data acquisition in the IOA GPG¹². For the Final ES, a repeat survey is proposed following the installation of a permanent (full height) met mast.
- 13.4.6 The positions of the monitoring locations are shown in **Figure 13.1** and listed in **Table 13.7**.

Table 13.7 Noise monitoring locations

Monitoring location	Location	Approximate distance to nearest proposed turbine, m	Easting	Northing
M1	Blaencuffin Barn Farm	850	322847	201771
M2	Maescynew Farm	820	322580	200974
M3	Cefn-y-Crib Farm	1000	324314	199856
10 m Met Mast	-	-	324660	200840

²⁸ 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.

²⁹ Nordex (2015). Technical report. Octave sound power levels. Nordex N117/3000 – Standard Mode. Document no. F008_244_A04_EN. Nordex Energy GmbH, Germany.

- 13.4.7 Based on the survey results, the background levels identified from the measured levels at each location using a polynomial curve as per ETSU-R-97⁵ requirements are presented in **Table 13.8** and **Table 13.9**.

Table 13.8 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
M2	26.9	27.3	28.2	29.3	33.7*	35.9*	38.4*	38.4*	38.4*	38.4*
M3	27.5	27.1	27.6	29.2	32.5	35.9*	39.4*	39.4*	39.4*	39.4*
M4	26.3	27.3	29.4	32.6	37.0	38.6*	41.0*	41.0*	41.0*	41.0*

* Inadequate no. of daytime data points at these wind speeds, night-time data used as representative.

Table 13.9 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
M2	26.9	28.4	29.9	31.7	33.7	35.9	38.4	38.4*	38.4*	38.4*
M3	27.1	28.0	29.2	30.8	33.0	35.9	39.4	39.4*	39.4*	39.4*
M4	25.2	27.6	30.3	33.1	35.9	38.6	41.0	41.0*	41.0*	41.0*

* Preceding value used.

Turbine data

- 13.4.8 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 and which will be confirmed in the Final ES.
- 13.4.9 The candidate turbine used in this assessment is a Vestas V150 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 13.10**, with octave band data in **Table 13.11**. The numbers listed in the tables are for Mode 0 of operation, corrected to a standardised 10 m height and include 2 dB uncertainty, in line with best practice.

Table 13.10 Broadband sound power data, dB L_{WA} for candidate turbine used in the assessment

Turbine	Wind speed at 10 m, ms ⁻¹									
	3	4	5	6	7	8	9	10	11	12
Vestas V150	97.0	101.7	106.3	109.5	110.0	110.0	110.0	110.0	110.0	110.0

Table 13.11 Octave band sound power data dB L_{WA} for candidate turbine used in the assessment at 8 ms⁻¹ wind speed at 10 m

Turbine	Sound power level, dB L _{WA} , per Octave band centre frequency, Hz							
	63	125	250	500	1k	2k	4k	8k
Vestas V136 STE	88.1	95.5	100.7	103.7	104.5	103.2	99.7	94.0

13.4.10 Data has also been collected for turbines to be considered within the cumulative assessment. Whilst the study area is 10 km from the Proposed Development, there are a number of single turbines between 5 to 10 km. Given the distances, and the relatively negligible contribution from the single turbines as compared to the multi-turbine sites, both within the 5 km buffer and the 10 km buffer, the single turbine sites between 5 to 10 km have not been included in the cumulative assessment.

13.4.11 **Table 13.12** presents the sites which are included in the cumulative assessment, along with the turbine type and sound power levels by wind speed. Octave sound power levels for each turbine type are presented in **Table 13.13**. Where details are not available about the turbine type, a reasonable worst-case turbine has been assumed. The numbers listed in the tables are corrected to a standardised 10m height and include corrections for uncertainty, in line with best practice.

Table 13.12 Broadband sound power data for turbines used in cumulative assessment

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/ Manmoel Wind Farm	Envelope	103.5	107.4	110.9	112.0	112.3	112.4	112.4	112.4	112.4
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*	101.7	106.3	109.5	110.0	110.0	110.0	110.0	110.0	110.0
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	Gamesa G128*	100.6	105.3	108.9	109.5	109.2	108.9	108.6	108.6	108.6
Oakdale Business Park	Senvion MM100 2MW	98.8	103.9	105.2	105.8	105.8	105.8	105.8	105.8	105.8
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
Trecelyn	Nordex N117*	99.0	103.5	105.5	106.5	107.0	107.0	107.0	107.0	107.0

* - assumed turbine type

Table 13.13 Octave band sound power data for turbines used in cumulative assessment

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
Envelope	97.4	102.2	104.1	104.1	105.7	105.3	102.6	99.5
Enercon E53	85.3	92.1	94.3	96.3	98.6	96.6	88.3	77.7
Vestas V150	88.1	95.5	100.7	103.7	104.5	103.2	99.7	94.0
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
Nordex N117	85.5	92.5	97.3	98.9	101.8	100.7	98.3	88.2

13.5 Overall baseline

Current baseline

Wind Farm development and grid connection

- 13.5.1 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

- 13.5.2 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.

13.6 Embedded measures

- 13.6.1 A range of environmental measures have been embedded into the Proposed Development as outlined in **Section 4.9**. **Table 13.14** outlines how these embedded measures will influence the noise assessment.

Table 13.14 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 BS5228-1:2009+A1:2014 ¹⁹ .	Construction Environmental Management Plan (CEMP)
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 emissions.	CEMP

13.7 Scope of the assessment

The Proposed Development

- 13.7.1 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-97⁵. Consequently, the design of the scheme is such that relevant operational noise limits are met, and no additional environmental mitigation measures are necessary. By way of separation between receptors and turbines resulting from this process, construction noise is also limited, thus only general good-practice noise control measures are required, and no specific mitigation is necessary.
- 13.7.2 The EIA Regulations 2017 require that all 'significant' effects be identified. The majority of noise related guidance and standards (including ETSU-R-97⁵) 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.
- 13.7.3 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.

- 13.7.4 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 and operation of the Proposed Development is negligible. Therefore, based on the above, quantitative assessment of construction vibration has not been carried out, and potential vibration effects have been assessed qualitatively.
- 13.7.5 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

- 13.7.6 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**.
- 13.7.7 The assessment study area has been defined using the screening approach outlined within ETSU-R-97⁵. The screening approach can be adopted where noise at receptors from proposed existing wind turbines does not exceed 35 dB $L_{A90,10min}$ in wind speeds up to 10 ms^{-1} at or a 10-metre height. Receptors that are predicted to experience wind turbine noise levels higher than 35 dB $L_{A90,10min}$ have been considered to fall within the assessment study area.
- 13.7.8 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

- 13.7.9 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

- 13.7.10 The principal noise receptors that have been identified as being potentially subject to effects are summarised in **Table 13.15**.

Table 13.15 Noise receptors subject to potential effects

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

13.7.11 The residential receptors considered further in this assessment are detailed in **Table 13.16**.

Table 13.16 Potential residential receptors

Reference	Receptor Location	Easting	Northing	Representative monitoring location
R1	Woodview Cottages, Cwmnantygroes, Six Bells, Abertillery, NP13 2PR	322722	203506	M1
R2	Gilfach Wen Farm, Blaen-Y-cwm Road, Abertillery, NP13 2AZ	323042	202786	M1
R3	Ty-Dafydd Farm, Six Bells, Abertillery, NP13 2AZ	322972	202495	M1
R4	Blaencuffin Barn Farm, Blaen-Y-cwm Road, Abertillery, NP13 2AY	322880	201774	M1
R5	Maescynew Farm, Hyde Place, Llanhilleth, Abertillery, NP13 2RU	322573	200977	M2
R6	5 Incline Cottages, Llanhilleth, Abertillery, NP13 2JS	322895	200553	M2
R7	Tir-Ysgubor-Ddu, Blaen-Y-cwm Road, Pantygasseg, Pontypool NP4 6UJ	323923	200771	M2
R8	2 Ty Gwyn Cottages, Pantygasseg, Pontypool, NP4 6UJ	324172	200376	M3
R9	Ty Mari Hari Farm, Pantygasseg, Pontypool, NP4 6UA	324407	200127	M3
R10	Cefn-y-Crib Farm, Blaen-Y-cwm Road, Pantygasseg, Pontypool, NP4 6UJ	324277	199857	M3
R11	The Old School House, Pantygasseg, Pontypool, NP4 6UA	324433	199637	M3
R12	2 - 9 Bush Terrace, Pantygasseg, Pontypool, NP4 6TY	325088	199767	M3
R13	Mountain View House, Pantygasseg, Pontypool, NP4 6TY	325372	199885	M3
R14	1 - 6 Ty-Bwmpyn Road, Pontypool, NP4 6UL	325621	200819	M3
R15	Blaenant y Caws, PlasyCoed Rd, Pantygasseg, Pontypool, NP4 6UN	324977	201238	M2
R16	Cwmffrwdroer Farm, Cwmffrwdroer, Pontypool, NP4 6UB	325875	201256	M2
R17	Yew Tree Cottage, Pentrepiod, Pontnewynydd, Pontypool, NP4 6TR	326035	201646	M2
R18	Tal-ochor Farm, Pentrepiod, Pontnewynydd, Pontypool, NP4 6TR	325724	201892	M2
R19	Pistyll Gwyn, Pentwyn, Abersychan, Pontypool, NP4 7TA	325803	202321	M2
R20	British Road, Abersychan	325413	203423	M1

Likely significant effects

- 13.7.12 The effects on noise receptors which have the potential to be significant and are being taken forward for detailed assessment are summarised in **Table 13.17**.

Table 13.17 Summary of effects scoped in for further assessment

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

- 13.7.13 In addition to the above, noise and vibration effects from the construction and operation of the grid connection are considered qualitatively, as described in **Chapter 4: Project Description**.
- 13.7.14 The receptors/effects detailed in **Table 13.18** have been scoped out from being subject to further assessment because the potential effects are not considered likely to be significant.

Table 13.18 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 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 of the Proposed Development to NSRs, to warrant a noise assessment. 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.
Decommissioning	The effects of decommissioning on any NSRs are likely to be similar in nature but of a lower magnitude than those during the construction phase. As a result, it is not proposed to assess the decommissioning phase of the development in addition to that of the construction phase.
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.

13.8 Assessment methodology

- 13.8.1 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.

Proposed Development construction assessment methodology

- 13.8.2 Noise emissions from construction activities other than piling are unlikely to be high enough to result in significant effects given the distance of the Proposed Development to NSRs. Therefore, only noise effects due to piling will be considered.
- 13.8.3 BS 5228-1:2009+A1:2014¹⁹ 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 would be 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).
- 13.8.4 The precise construction methodology for the Site will not be finalised until such a time as a contractor is commissioned to build the development and as such the actual plant to be used is not yet known. The plant list provided in **Table 13.19** is based upon experience of other wind farm construction projects. The noise emission data quoted is taken from BS 5228-1:2009+A1:2014¹⁹.

Table 13.19 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
Large rotary bored piling rig	83	1	100	111	BS 5228-1:2009+A1:2014 ¹⁹ Table C.3 Reference 14

- 13.8.5 Estimates of piling noise are undertaken in accordance with Annex F of BS 5228-1:2009+A1:2014¹⁹.

Proposed Development operation assessment methodology

- 13.8.6 Planning Policy Wales (PPW) refers to ETSU-R-97⁵ for guidance on the assessment of noise from wind farms.
- 13.8.7 Consequently, the assessment methodology adopted is that found in ETSU-R-97⁵. 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

- 13.8.8 Acceptable limits for wind turbine operational noise are defined in ETSU-R-97⁵. The test for operational noise is therefore whether or not the cumulative wind turbine noise levels at noise sensitive properties lie at or below the noise limits derived in accordance with

ETSU-R-97⁵. The key assessment is the cumulative assessment as ETSU-R-97⁵ requires all wind farm noise to be assessed against a baseline free of wind farm noise. However, an assessment of the Proposed Development on its own has also been included for information, but does not affect the significance of effect from the Proposed Development.

- 13.8.9 Preliminary modelling for the Proposed Development indicated that operational noise was likely to exceed this threshold at a number of surrounding properties. The ETSU-R-97⁵ Guidance therefore recommends that wind farm noise limits should be set relative to existing background noise levels, subject to a fixed minimum limit, and that these limits should reflect the variation in background noise with wind speed. The wind speeds that should be considered range from the cut-in speed up to 12 ms⁻¹, the point at which turbines are usually at or above 95% of their rated power and thus no significant increases in noise emissions are expected. Wind speeds are referenced to a 10-metre measurement height (V10) on the wind farm site.
- 13.8.10 The daytime noise limit is derived from background noise data measured at residential properties during the 'quiet daytime', as defined in ETSU-R-97⁵, which comprises:
- Weekday evenings (from 18:00 to 23:00 hrs);
 - Saturday afternoons and evenings (from 13:00 to 23:00 hrs); and
 - All Sunday daytime (from 07:00 to 23:00 hrs).
- 13.8.11 The noise measurements are plotted against the concurrent wind speed data measured at the application site and a 'best fit' correlation is established.
- 13.8.12 In low noise environments (i.e. where background noise levels are less than 30 to 35 dBA, the ETSU-R-97⁵ Guidance recommends that wind farm noise for quiet daytime periods should be limited to a lower fixed level within the range 35 to 40 dB L_{A90,10min} or 5 dB above the prevailing background, whichever is the greater. The choice of which lower fixed level to use within the range is based upon a number of factors as outlined in Paragraph 22 of the ETSU-R-97⁵ Guidance. These include:
- The number of dwellings in the neighbourhood of the wind farm;
 - The effect of noise limits on the amount of electricity generated; and
 - The duration and level of exposure.
- 13.8.13 The Scoping Report states that the cumulative assessment will be based on a daytime lower fixed noise limit of 40 dB L_{A90,10min}, based on the level of power provided by all the wind farms together, an approach advocated within ETSU-R-97⁵. Consideration of noise from the Proposed Development on its own is based upon a 35 dB L_{A90,10min} for the daytime, to provide an indicative worst-case assessment.
- 13.8.14 The night-time noise limit is derived from the background noise data measured during the night-time period (23:00 to 07:00 hrs) every day. As with the daytime data, this is plotted against the concurrent wind speed data and a 'best fit' correlation established. For night-time periods, the ETSU-R-97⁵ recommended limits are 43 dB L_{A90,10min} or 5 dB above prevailing background, whichever is the greater.
- 13.8.15 The only exception to the daytime and night-time limits outlined above is for properties with a financial involvement in the development where ETSU-R-97⁵ limits can be increased to 45 dB L_{A90,10min} (or 5 dB above the prevailing background, whichever is greater). Receptor 2 - Gilfach Wen Farm, Receptor 3 - Ty-Dafydd Farm, Receptor 9 Ty Mari Hari Farm and Receptor 15 - Blaenant y Caws are considered as having a financial benefit from the Proposed Development, therefore the higher noise limits have been adopted for these locations.

- 13.8.16 The ETSU-R-97⁵ 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 will be sought from the manufacturers of the turbine selected for the Proposed Development such that the noise output will either not require a tonal correction (under the ETSU-R-97⁵ Guidance) or, where tonal corrections are required, the noise criteria will be met having made the appropriate correction for any tonal component.
- 13.8.17 The ETSU-R-97⁵ Guidance states the $L_{A90,10min}$ descriptor should be used for both the background noise and wind farm noise when setting limits.

Research background

- 13.8.18 The Institute of Acoustics (IOA) published ‘A Good Practice Guide to the Application of ETSU-R-97⁵ for the Assessment and Rating of Wind Turbine Noise’¹¹. The use of the IOA GPG¹² 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.”*
- 13.8.19 In line with the IOA GPG¹², the model used in this assessment is based upon that found in ISO 9613-2 Acoustics – Attenuation of sound during propagation outdoors³⁰. The model takes account of:
- Geometric divergence (attenuation with distance);
 - Air absorption;
 - Barriers (including buildings or topography);
 - Screening (including vegetation); and
 - Ground absorption and reflection.
- 13.8.20 The ISO 9613-2³⁰ algorithm has been chosen as being the most robust prediction method, based on 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 9613-2³⁰ algorithm tended to predict noise levels that would generally occur under downwind propagation conditions.
- 13.8.21 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 9613-2³⁰ algorithm.

Operational noise modelling

- 13.8.22 For the purposes of the present assessment, noise level predictions have been based upon the following assumed model parameters:

³⁰ International Standards Organization (1996). *ISO 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*. ISO, Geneva.

- 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; and
- Predicted turbine noise levels are inclusive of any ‘valley effect’ penalty (discussed below).

Valley effect

- 13.8.23 The IOA GPG¹² recommends that a noise correction is applied in circumstances where the intervening terrain height between a proposed wind development and sensitive receptors drops away significantly. Where a ‘valley effect’ is shown to occur, 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.

Significance evaluation methodology

- 13.8.24 The assessment of significant operational noise effects is based upon compliance with the ETSU-R-97⁵ 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-97⁵ 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-97⁵ noise limits have already been taken into account and thus only noise levels exceeding the ETSU-R-97⁵ noise limits are deemed to be ‘significant’ and require further consideration.

13.9 Preliminary assessment of noise effects

Construction of Proposed Development (piling only)

Vibration

- 13.9.1 As outlined in **paragraph 13.7.4**, due to the separation distances involved (the nearest receptor to any potential piling activities is approximately 250 m away), it is considered that the potential for significant effects due to vibration arising from construction and operation is negligible. The vibration effects as a result of construction and operation are therefore considered to be **not significant**.
- 13.9.2 Notwithstanding the above, should piling be required, vibration emissions would be subject to detailed assessment and vibration emissions controlled, as appropriate, via the CEMP.

Noise

- 13.9.3 Predictions of the noise levels from piling have been undertaken to find the distance at which 65 dB $L_{Aeq,T}$ would no longer be experienced, as summarised in **Table 13.20**.

Table 13.20 Predicted noise levels during construction phase (piling only)

Plant item	dB $L_{Aeq,T}$ @ 10m	Distance at which resultant $L_{Aeq,T}$ is below 65 dB, m
Large rotary bored piling rig	83	110

- 13.9.4 As no NSRs fall within 110 m of the construction area where piling could take place, it is considered highly unlikely that an exceedance of 65 dB $L_{Aeq,T}$ would be experienced at the NSRs due to piling. Therefore, the noise effects as a result of construction are considered to be **not significant**.

Construction traffic

- 13.9.5 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.
- 13.9.6 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.
- 13.9.7 Estimates of future baseline flows indicate that 12-hour flows of traffic on the major links listed above are as low as 5504 total with 32 HGVs on the B4246 – all other major links have significantly higher flows.
- 13.9.8 Based on the construction program, construction traffic results in an approximate peak of 76 HGV movements per 24 hours two-way. This peak is predicted to occur during month 2 (April 2025) of the total 22-month construction programme.
- 13.9.9 In consideration of the road with the lowest future baseline flow, the B4246, and assuming all 76 HGV movements occurred in a 12-hour period, the additional HGV movements would give rise to an increase in flow of 1.4%. As a guide it takes an increase of 25% in traffic flows to have an increase in noise levels of 1 dB. Whilst the increase in HGV numbers 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.
- 13.9.10 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, it is considered most unlikely that absolute traffic noise levels give rise to any adverse impacts
- 13.9.11 Further details on construction traffic movements are provided in **Chapter 12: Traffic and Transport**.

Consideration of grid connection noise

- 13.9.12 Whilst the exact installation method of the grid connection is not known, the construction noise from installing underground cabling would not be significant. This conclusion can be reached based on the construction noise being temporary with any works in close proximity to residences being less than one month and the threshold for construction noise impacts where noise levels exceed 65 dBA.
- 13.9.13 Once the detailed design for the grid connection is known, further analysis may be undertaken to check the assumption within the Final ES.

Operation of Proposed Development

- 13.9.14 Noise levels have been predicted for the closest residential properties to the wind farm, as shown in **Figure 13.1** and listed in **Table 13.16**. As per the IOA GPG¹², to account for the use of 10 m wind speeds, the turbine noise results at residential receptors have been shifted to the left along the wind speeds (e.g. the prediction results for 10 ms⁻¹ are compared against the baseline and criteria for 7 ms⁻¹). This is to account for the potentially much higher wind shear gradient on the Site than would normally be specified with turbine noise corrections at 10 m height. This correction is already embedded in the results tables below.
- 13.9.15 **Table 13.21** and **Table 13.22** 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-97⁵ Guidance and IOA GPG¹² based on background noise levels measured;
 - The predicted turbine noise levels (as corrected) from the Proposed Development, based on worst-case downwind noise propagation and inclusive of any 'valley effect' penalty at receptors and assuming turbines are operating simultaneously; and
 - The margin by which the predicted turbine noise, inclusive of any 'valley effect' penalty, meets the noise limits at each wind speed using the worst-case downwind noise predictions (negative values indicate the predicted noise levels are lower than the noise limits).
- 13.9.16 It should be noted, as outlined in **paragraph 13.8.8**, that the assessments presented in **Table 13.21** and **Table 13.22** are for information only. In accordance with ETSU-R-97⁵ Guidance and IOA GPG¹² it is the cumulative assessment which determines the significance of wind turbine noise at each receptor. The lowest range of daytime fixed noise level limits (i.e. 35 dBA) have been applied for the assessments in **Table 13.21** and **Table 13.22** 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 13.21 Noise assessment – daytime

Noise parameter,	Standardised 10 m wind speed, ms ⁻¹								
	4	5	6	7	8	9	10	11	12
dB L_{A90,10 m}									
R1 - Woodview Cottages, Cwmnantygroes									
Background noise curve	27.3	28.2	29.3	33.7	35.9	38.4	38.4	38.4	38.4
ETSU-R-97 derived noise limit	35.0	35.0	35.0	38.7	40.9	43.4	43.4	43.4	43.4

Noise parameter, dB L _{A90,10 m}	Standardised 10 m wind speed, ms ⁻¹								
	4	5	6	7	8	9	10	11	12
Wind Farm turbine noise	33.6	33.6	33.6	33.6	33.6	33.6	33.6	33.6	33.6
Difference wrt noise limit	-1.4	-1.4	-1.4	-5.1	-7.3	-9.8	-9.8	-9.8	-9.8
R2 - Gilfach Wen Farm, Blaen-Y-cwm Road									
Background noise curve	27.3	28.2	29.3	33.7	35.9	38.4	38.4	38.4	38.4
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	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9
Difference wrt noise limit	-3.1	-3.1	-3.1	-3.1	-3.1	-3.1	-3.1	-3.1	-3.1
R3 - Ty-Dafydd Farm, Six Bells									
Background noise curve	27.3	28.2	29.3	33.7	35.9	38.4	38.4	38.4	38.4
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	42.6	42.6	42.6	42.6	42.6	42.6	42.6	42.6	42.6
Difference wrt noise limit	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4
R4 - Blaencuffin Barn Farm, Blaen-Y-cwm Road									
Background noise curve	27.3	28.2	29.3	33.7	35.9	38.4	38.4	38.4	38.4
ETSU-R-97 derived noise limit	35.0	35.0	35.0	38.7	40.9	43.4	43.4	43.4	43.4
Wind Farm turbine noise	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6
Difference wrt noise limit	+6.6	+6.6	+6.6	+2.9	+0.7	-1.8	-1.8	-1.8	-1.8
R5 - Maescynew Farm, Hyde Place									
Background noise curve	27.1	27.6	29.2	32.5	35.9	39.4	39.4	39.4	39.4
ETSU-R-97 derived noise limit	35.0	35.0	35.0	37.5	40.9	44.4	44.4	44.4	44.4
Wind Farm turbine noise	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5
Difference wrt noise limit	+4.5	+4.5	+4.5	+2.0	-1.4	-4.9	-4.9	-4.9	-4.9
R6 - 5 Incline Cottages, Llanhilleth									
Background noise curve	27.1	27.6	29.2	32.5	35.9	39.4	39.4	39.4	39.4
ETSU-R-97 derived noise limit	35.0	35.0	35.0	37.5	40.9	44.4	44.4	44.4	44.4
Wind Farm turbine noise	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9
Difference wrt noise limit	+5.9	+5.9	+5.9	+3.4	+0.0	-3.5	-3.5	-3.5	-3.5
R7 - Tir-Ysgubor-Ddu, Blaen-Y-cwm Road									
Background noise curve	27.1	27.6	29.2	32.5	35.9	39.4	39.4	39.4	39.4
ETSU-R-97 derived noise limit	35.0	35.0	35.0	37.5	40.9	44.4	44.4	44.4	44.4
Wind Farm turbine noise	43.2	43.2	43.2	43.2	43.2	43.2	43.2	43.2	43.2
Difference wrt noise limit	+8.2	+8.2	+8.2	+5.7	+2.3	-1.2	-1.2	-1.2	-1.2
R8 - 2 Ty Gwyn Cottages, Pantygasseg									
Background noise curve	27.3	29.4	32.6	37.0	38.6	41.0	41.0	41.0	41.0
ETSU-R-97 derived noise limit	35.0	35.0	37.6	42.0	43.6	46.0	46.0	46.0	46.0
Wind Farm turbine noise	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6
Difference wrt noise limit	+6.6	+6.6	+4.0	-0.4	-2.0	-4.4	-4.4	-4.4	-4.4
R9 - Ty Mari Hari Farm, Pantygasseg									
Background noise curve	27.3	29.4	32.6	37.0	38.6	41.0	41.0	41.0	41.0

Noise parameter, dB L _{A90,10m}	Standardised 10 m wind speed, ms ⁻¹								
	4	5	6	7	8	9	10	11	12
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	46.0	46.0	46.0	46.0
Wind Farm turbine noise	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6
Difference wrt noise limit	-4.4	-4.4	-4.4	-4.4	-4.4	-5.4	-5.4	-5.4	-5.4
R10 - Cefn-y-Crib Farm, Blaen-Y-cwm Road									
Background noise curve	27.3	29.4	32.6	37.0	38.6	41.0	41.0	41.0	41.0
ETSU-R-97 derived noise limit	35.0	35.0	37.6	42.0	43.6	46.0	46.0	46.0	46.0
Wind Farm turbine noise	39.6	39.6	39.6	39.6	39.6	39.6	39.6	39.6	39.6
Difference wrt noise limit	+4.6	+4.6	+2.0	-2.4	-4.0	-6.4	-6.4	-6.4	-6.4
R11 - The Old School House, Pantygasseg									
Background noise curve	27.3	29.4	32.6	37.0	38.6	41.0	41.0	41.0	41.0
ETSU-R-97 derived noise limit	35.0	35.0	37.6	42.0	43.6	46.0	46.0	46.0	46.0
Wind Farm turbine noise	38.4	38.4	38.4	38.4	38.4	38.4	38.4	38.4	38.4
Difference wrt noise limit	+3.4	+3.4	+0.8	-3.6	-5.2	-7.6	-7.6	-7.6	-7.6
R12 - 2 - 9 Bush Terrace, Pantygasseg									
Background noise curve	27.3	29.4	32.6	37.0	38.6	41.0	41.0	41.0	41.0
ETSU-R-97 derived noise limit	35.0	35.0	37.6	42.0	43.6	46.0	46.0	46.0	46.0
Wind Farm turbine noise	37.2	37.2	37.2	37.2	37.2	37.2	37.2	37.2	37.2
Difference wrt noise limit	+2.2	+2.2	-0.4	-4.8	-6.4	-8.8	-8.8	-8.8	-8.8
R13 - Mountain View House, Pantygasseg									
Background noise curve	27.3	29.4	32.6	37.0	38.6	41.0	41.0	41.0	41.0
ETSU-R-97 derived noise limit	35.0	35.0	37.6	42.0	43.6	46.0	46.0	46.0	46.0
Wind Farm turbine noise	37.2	37.2	37.2	37.2	37.2	37.2	37.2	37.2	37.2
Difference wrt noise limit	+2.2	+2.2	-0.4	-4.8	-6.4	-8.8	-8.8	-8.8	-8.8
R14 - 1 - 6 Ty-Bwmpyn Road, Pontypool									
Background noise curve	27.3	29.4	32.6	37.0	38.6	41.0	41.0	41.0	41.0
ETSU-R-97 derived noise limit	35.0	35.0	37.6	42.0	43.6	46.0	46.0	46.0	46.0
Wind Farm turbine noise	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5
Difference wrt noise limit	+4.5	+4.5	+1.9	-2.5	-4.1	-6.5	-6.5	-6.5	-6.5
R15 - Blaenant y Caws, PlasyCoed Rd									
Background noise curve	27.1	27.6	29.2	32.5	35.9	39.4	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	48.4	48.4	48.4	48.4	48.4	48.4	48.4	48.4	48.4
Difference wrt noise limit	+3.4	+3.4	+3.4	+3.4	+3.4	+3.4	+3.4	+3.4	+3.4
R16 - Cwmffrwdroer Farm, Cwmffrwdroer									
Background noise curve	27.1	27.6	29.2	32.5	35.9	39.4	39.4	39.4	39.4
ETSU-R-97 derived noise limit	35.0	35.0	35.0	37.5	40.9	44.4	44.4	44.4	44.4
Wind Farm turbine noise	36.7	36.7	36.7	36.7	36.7	36.7	36.7	36.7	36.7
Difference wrt noise limit	+1.7	+1.7	+1.7	-0.8	-4.2	-7.7	-7.7	-7.7	-7.7
R17 - Yew Tree Cottage, Pentrepiod									

Noise parameter, dB L _{A90,10 m}	Standardised 10 m wind speed, ms ⁻¹								
	4	5	6	7	8	9	10	11	12
Background noise curve	27.1	27.6	29.2	32.5	35.9	39.4	39.4	39.4	39.4
ETSU-R-97 derived noise limit	35.0	35.0	35.0	37.5	40.9	44.4	44.4	44.4	44.4
Wind Farm turbine noise	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9
Difference wrt noise limit	+1.9	+1.9	+1.9	-0.6	-4.0	-7.5	-7.5	-7.5	-7.5
R18 - Tal-ochor Farm, Pentrepiod									
Background noise curve	27.1	27.6	29.2	32.5	35.9	39.4	39.4	39.4	39.4
ETSU-R-97 derived noise limit	35.0	35.0	35.0	37.5	40.9	44.4	44.4	44.4	44.4
Wind Farm turbine noise	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2
Difference wrt noise limit	+4.2	+4.2	+4.2	+1.7	-1.7	-5.2	-5.2	-5.2	-5.2
R19 - Pistyll Gwyn, Pentwyn, Abersychan									
Background noise curve	27.1	27.6	29.2	32.5	35.9	39.4	39.4	39.4	39.4
ETSU-R-97 derived noise limit	35.0	35.0	35.0	37.5	40.9	44.4	44.4	44.4	44.4
Wind Farm turbine noise	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2
Difference wrt noise limit	+4.2	+4.2	+4.2	+1.7	-1.7	-5.2	-5.2	-5.2	-5.2
R20 - British Road, Abersychan									
Background noise curve	27.3	28.2	29.3	33.7	35.9	38.4	38.4	38.4	38.4
ETSU-R-97 derived noise limit	35.0	35.0	35.0	38.7	40.9	43.4	43.4	43.4	43.4
Wind Farm turbine noise	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4
Difference wrt noise limit	-0.6	-0.6	-0.6	-4.3	-6.5	-9.0	-9.0	-9.0	-9.0

Table 13.22 Noise assessment – night-time

Noise parameter, dB L _{A90,10 m}	Standardised 10 m wind speed, ms ⁻¹								
	4	5	6	7	8	9	10	11	12
R1 - Woodview Cottages, Cwmnantygroes									
Background noise curve	28.4	29.9	31.7	33.7	35.9	38.4	38.4	38.4	38.4
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.4	43.4	43.4	43.4
Wind Farm turbine noise	33.6	33.6	33.6	33.6	33.6	33.6	33.6	33.6	33.6
Difference wrt noise limit	-9.4	-9.4	-9.4	-9.4	-9.4	-9.8	-9.8	-9.8	-9.8
R2 - Gilfach Wen Farm, Blaen-Y-cwm Road									
Background noise curve	28.4	29.9	31.7	33.7	35.9	38.4	38.4	38.4	38.4
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	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9
Difference wrt noise limit	-3.1	-3.1	-3.1	-3.1	-3.1	-3.1	-3.1	-3.1	-3.1
R3 - Ty-Dafydd Farm, Six Bells									
Background noise curve	28.4	29.9	31.7	33.7	35.9	38.4	38.4	38.4	38.4
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	42.6	42.6	42.6	42.6	42.6	42.6	42.6	42.6	42.6
Difference wrt noise limit	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4
R4 - Blaencuffin Barn Farm, Blaen-Y-cwm Road									

Noise parameter, dB L _{A90,10 m}	Standardised 10 m wind speed, ms ⁻¹								
	4	5	6	7	8	9	10	11	12
Background noise curve	28.4	29.9	31.7	33.7	35.9	38.4	38.4	38.4	38.4
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.4	43.4	43.4	43.4
Wind Farm turbine noise	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6
Difference wrt noise limit	-1.4	-1.4	-1.4	-1.4	-1.4	-1.8	-1.8	-1.8	-1.8
R5 - Maescynew Farm, Hyde Place									
Background noise curve	28.0	29.2	30.8	33.0	35.9	39.4	39.4	39.4	39.4
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	44.4	44.4	44.4	44.4
Wind Farm turbine noise	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5
Difference wrt noise limit	-3.5	-3.5	-3.5	-3.5	-3.5	-4.9	-4.9	-4.9	-4.9
R6 - 5 Incline Cottages, Llanhilleth									
Background noise curve	28.0	29.2	30.8	33.0	35.9	39.4	39.4	39.4	39.4
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	44.4	44.4	44.4	44.4
Wind Farm turbine noise	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9
Difference wrt noise limit	-2.1	-2.1	-2.1	-2.1	-2.1	-3.5	-3.5	-3.5	-3.5
R7 - Tir-Ysgubor-Ddu, Blaen-Y-cwm Road									
Background noise curve	28.0	29.2	30.8	33.0	35.9	39.4	39.4	39.4	39.4
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	44.4	44.4	44.4	44.4
Wind Farm turbine noise	43.2	43.2	43.2	43.2	43.2	43.2	43.2	43.2	43.2
Difference wrt noise limit	+0.2	+0.2	+0.2	+0.2	+0.2	-1.2	-1.2	-1.2	-1.2
R8 - 2 Ty Gwyn Cottages, Pantygasseg									
Background noise curve	27.6	30.3	33.1	35.9	38.6	41.0	41.0	41.0	41.0
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.6	46.0	46.0	46.0	46.0
Wind Farm turbine noise	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6
Difference wrt noise limit	-1.4	-1.4	-1.4	-1.4	-2.0	-4.4	-4.4	-4.4	-4.4
R9 - Ty Mari Hari Farm, Pantygasseg									
Background noise curve	27.6	30.3	33.1	35.9	38.6	41.0	41.0	41.0	41.0
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	46.0	46.0	46.0	46.0
Wind Farm turbine noise	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6
Difference wrt noise limit	-4.4	-4.4	-4.4	-4.4	-4.4	-5.4	-5.4	-5.4	-5.4
R10 - Cefn-y-Crib Farm, Blaen-Y-cwm Road									
Background noise curve	27.6	30.3	33.1	35.9	38.6	41.0	41.0	41.0	41.0
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.6	46.0	46.0	46.0	46.0
Wind Farm turbine noise	39.6	39.6	39.6	39.6	39.6	39.6	39.6	39.6	39.6
Difference wrt noise limit	-3.4	-3.4	-3.4	-3.4	-4.0	-6.4	-6.4	-6.4	-6.4
R11 - The Old School House, Pantygasseg									
Background noise curve	27.6	30.3	33.1	35.9	38.6	41.0	41.0	41.0	41.0
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.6	46.0	46.0	46.0	46.0
Wind Farm turbine noise	38.4	38.4	38.4	38.4	38.4	38.4	38.4	38.4	38.4
Difference wrt noise limit	-4.6	-4.6	-4.6	-4.6	-5.2	-7.6	-7.6	-7.6	-7.6

Noise parameter, dB L _{A90,10 m}	Standardised 10 m wind speed, ms ⁻¹								
	4	5	6	7	8	9	10	11	12
R12 - 2 - 9 Bush Terrace, Pantygasseg									
Background noise curve	27.6	30.3	33.1	35.9	38.6	41.0	41.0	41.0	41.0
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.6	46.0	46.0	46.0	46.0
Wind Farm turbine noise	37.2	37.2	37.2	37.2	37.2	37.2	37.2	37.2	37.2
Difference wrt noise limit	-5.8	-5.8	-5.8	-5.8	-6.4	-8.8	-8.8	-8.8	-8.8
R13 - Mountain View House, Pantygasseg									
Background noise curve	27.6	30.3	33.1	35.9	38.6	41.0	41.0	41.0	41.0
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.6	46.0	46.0	46.0	46.0
Wind Farm turbine noise	37.2	37.2	37.2	37.2	37.2	37.2	37.2	37.2	37.2
Difference wrt noise limit	-5.8	-5.8	-5.8	-5.8	-6.4	-8.8	-8.8	-8.8	-8.8
R14 - 1 - 6 Ty-Bwmpyn Road, Pontypool									
Background noise curve	27.6	30.3	33.1	35.9	38.6	41.0	41.0	41.0	41.0
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.6	46.0	46.0	46.0	46.0
Wind Farm turbine noise	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5
Difference wrt noise limit	-3.5	-3.5	-3.5	-3.5	-4.1	-6.5	-6.5	-6.5	-6.5
R15 - Blaenant y Caws, PlasyCoed Rd									
Background noise curve	28.0	29.2	30.8	33.0	35.9	39.4	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	48.4	48.4	48.4	48.4	48.4	48.4	48.4	48.4	48.4
Difference wrt noise limit	+3.4	+3.4	+3.4	+3.4	+3.4	+3.4	+3.4	+3.4	+3.4
R16 - Cwmffrwdoer Farm, Cwmffrwdoer									
Background noise curve	28.0	29.2	30.8	33.0	35.9	39.4	39.4	39.4	39.4
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	44.4	44.4	44.4	44.4
Wind Farm turbine noise	36.7	36.7	36.7	36.7	36.7	36.7	36.7	36.7	36.7
Difference wrt noise limit	-6.3	-6.3	-6.3	-6.3	-6.3	-7.7	-7.7	-7.7	-7.7
R17 - Yew Tree Cottage, Pentrepiod									
Background noise curve	28.0	29.2	30.8	33.0	35.9	39.4	39.4	39.4	39.4
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	44.4	44.4	44.4	44.4
Wind Farm turbine noise	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9
Difference wrt noise limit	-6.1	-6.1	-6.1	-6.1	-6.1	-7.5	-7.5	-7.5	-7.5
R18 - Tal-ochor Farm, Pentrepiod									
Background noise curve	28.0	29.2	30.8	33.0	35.9	39.4	39.4	39.4	39.4
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	44.4	44.4	44.4	44.4
Wind Farm turbine noise	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2
Difference wrt noise limit	-3.8	-3.8	-3.8	-3.8	-3.8	-5.2	-5.2	-5.2	-5.2
R19 - Pistyll Gwyn, Pentwyn, Abersychan									
Background noise curve	27.1	27.6	29.2	32.5	35.9	39.4	39.4	39.4	39.4
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	44.4	44.4	44.4	44.4
Wind Farm turbine noise	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2

Noise parameter,	Standardised 10 m wind speed, ms ⁻¹									
	4	5	6	7	8	9	10	11	12	
dB L _{A90,10 m}										
Difference wrt noise limit	-3.8	-3.8	-3.8	-3.8	-3.8	-5.2	-5.2	-5.2	-5.2	-5.2
R20 - British Road, Abersychan										
Background noise curve	28.4	29.9	31.7	33.7	35.9	38.4	38.4	38.4	38.4	38.4
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.4	43.4	43.4	43.4	43.4
Wind Farm turbine noise	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4
Difference wrt noise limit	-8.6	-8.6	-8.6	-8.6	-8.6	-9.0	-9.0	-9.0	-9.0	-9.0

- 13.9.17 The results show that predicted turbine noise levels are below the lowest daytime fixed noise limits at some of the receptors during the daytime, and at all but two receptors during the night-time.
- 13.9.18 During the daytime, predicted turbine noise levels are up to 8.2 dB above the daytime limits at R4 to R8 and R10 to R19. During the night-time, predicted turbine noise levels are between 0.2 to 3.4 dB above the night-time noise limits at R7 and R15.
- 13.9.19 The exceedances outlined above do not confirm a significant effect, but indicate the potential for significant effects where exceedances of the limits are greatest. Potentially significant effects are considered further in the cumulative assessment in **Section 13.10**.

Other operational noise issues

Infrasound and low frequency noise

- 13.9.20 Infrasound is generally defined as pressure waves with a frequency below 20 Hz. The human hearing threshold is much reduced below 20 Hz compared to higher frequencies. The exact definition of low frequency noise varies, but generally spans the infrasonic and audible ranges from around 10 Hz to 200 Hz.
- 13.9.21 Information published by the British Wind Energy Association (BWEA, now RenewableUK) 'Low Frequency Noise and Wind Turbines'³¹ presents a review of a number of sources of information on low frequency noise. Based upon these sources, it is concluded that levels for wind turbines lie below the threshold of perception even for those who are particularly sensitive to such noise.
- 13.9.22 The report 'The Measurement of Low Frequency Noise at three UK Wind Farms'³² presents the results of a number of measurements taken at wind farm sites throughout the UK. The study concluded that modern wind turbines are not sources of infrasound at levels which could be injurious to the health of a wind farm neighbour. At all of the measurement sites, low frequency noise associated with traffic movement along local roads was greater than that associated with the wind farm.
- 13.9.23 Furthermore, in its discussions of wind farm noise, TAN 8 states in paragraph 2.17:
- "There is no evidence that ground transmitted low frequency from wind turbines is at a sufficient level to be harmful to human health."*

³¹ The British Wind Energy Association (2005). *Low Frequency Noise and Wind Turbines*. [online] Available at: http://www.windmeasurementinternational.com/Info/bwea_low_frequency_noise_report.pdf [Accessed 25 January 2022].

³² Hayes McKenzie Partnership (2006). *The Measurement of Low Frequency Noise at Three UK Wind Farms*. Department of Trade and Industry, London.

Other Amplitude Modulation (OAM)

- 13.9.24 Amplitude Modulation (AM) is a normal characteristic of noise from a rotating turbine when stood close to it. AM is a variation in noise level over time, often described by observers as a repeating 'blade swish' noise. The AM of the aerodynamic noise observed close to the turbine is principally caused by trailing-edge noise from the rotating blades and is termed 'Normal' Amplitude Modulation (NAM).
- 13.9.25 The noise limits derived following the procedure recommended by the ETSU-R-97⁵ Guidance takes into account the phenomenon of NAM and thus afford receptors some protection. However, in unusual and rare occurrences where AM occurs outside the definition and mechanisms of NAM, this is known as 'Other' Amplitude Modulation (OAM). Examples of OAM include circumstances where AM is detected in the far-field downwind from the wind turbines or resulting in greater than expected variations in magnitude. Observers of OAM often describe the noise as a 'thump' in character rather than a 'swish'.
- 13.9.26 The DTI (Department of Trade and Industry), now Department for Business, Energy and Industrial Strategy (BEIS) study undertaken by Hayes McKenzie into low frequency noise³³ referred to above also investigated the phenomenon of OAM. It was found that internal noise levels associated with aerodynamic modulation were above the threshold of audibility at some properties. While measurements within the report indicated these were not high enough to wake occupiers of a room, they could result in difficulties returning to sleep once awoken.
- 13.9.27 Following publication of the report³⁴ in 2005, the DTI published a guidance note in 2006 to advise planning authorities on the issue³⁵. It states that concerns apparently relating to the phenomenon have been expressed at five out of the (then) 126 operational wind farms throughout the UK. It is categorically stated that the ETSU-R-97⁵ Guidance should continue to be used for the assessment of noise from wind farms and it was not considered necessary to further consider the issue of OAM for the Proposed Development.
- 13.9.28 The DTI Noise Working Group commissioned Salford University to investigate the occurrence of the phenomenon in more detail. A survey was conducted of local authorities to investigate the extent of OAM, and complaint histories were analysed to determine the number of complainants. The phenomenon was considered to be a factor in four of the sites at which there had been complaints and a possible factor at eight further sites. It was found that meteorological conditions were such that the effect would prevail for between 7 – 15% of the time and could persist for several days. The report concluded that given the low incidence of OAM and the low numbers of people involved it is difficult to justify further research; however, they do state it may be prudent to attempt to improve our understanding as the phenomenon cannot be predicted at present.
- 13.9.29 Following publication of the report in 2007, BERR released a statement as follows:
- "Based on these findings, Government does not consider there to be a compelling case for further work into AM and will not carry out any further research at this time; however, it will continue to keep the issue under review."*

³³ Department of Trade and Industry (2006). *Advice on findings of the Hayes McKenzie report on noise arising from wind farms*. DTI, London.

³⁴ University of Salford (2007). *Research into aerodynamic modulation of wind turbine noise*. Department of Business Enterprise and Regulatory Reform, Salford.

³⁵ RenewableUK (2013). *Wind Turbine Amplitude Modulation: Research to Improve Understanding as to its Cause and Effects*. [online] Available at: [https://cdn.ymaws.com/www.renewableuk.com/resource/collection/4E7CC744-FEF2-473B-AF2B-135FF2AA3A43/ruk_wind_turbine_amplitude_modulation_dec_2013_v2_\(1\).pdf](https://cdn.ymaws.com/www.renewableuk.com/resource/collection/4E7CC744-FEF2-473B-AF2B-135FF2AA3A43/ruk_wind_turbine_amplitude_modulation_dec_2013_v2_(1).pdf) [Accessed 25 January 2022].

- 13.9.30 It is noted that the Institute of Acoustics Noise Working Group (IOA NWG) tasked with putting together the IOA GPG¹² at the time of publication were unwilling to propose a method for predicting OAM. In relation to OAM, the IOA GPG states:
- “The evidence in relation to ‘Excess’ or ‘Other’ Amplitude Modulation (AM) is still developing. At the time of writing, current practice is not to assign a planning condition to deal with AM.”*
- 13.9.31 In December 2013, RenewableUK published Wind Turbine Amplitude Modulation: Research to Improve Understanding as to its Cause and Effects. The RenewableUK report comprises detailed scientific research into the identification of occurrence and mitigation of OAM. The mechanisms for the occurrence of OAM were found to be generally site specific therefore any proposed mitigation would likely have to be tailored on a site by site basis. As part of the research, members of the Institute of Acoustics developed a proposed planning condition that could be used by Local Authorities and tools for confirming its detection.
- 13.9.32 More recently, BS 8233:2014 Guide on sound insulation and noise reduction for buildings³⁶ states:
- “Excess AM can sometimes occur. However, it cannot be predicted at the planning stage with the current state of the art.”*
- 13.9.33 Given that the current understanding of the mechanisms of OAM are still in development and that an exact choice of turbine is yet to be determined for the Proposed Development, accurate predictions of the likelihood of its occurrence are not possible. It has therefore been determined that it is not necessary to apply a penalty for OAM at the planning stage.
- 13.9.34 Should an occurrence of OAM occur that gives rise to a Statutory Nuisance, then remedies remain available to the Local Authority under the Environmental Protection Act 1990.

13.10 Assessment of cumulative (inter-project) effects

- 13.10.1 A Cumulative Effects Assessment (CEA) has been undertaken for the Proposed Development which considers the combined impacts with other developments on the same single receptor or resource (inter-project effects) and constitutes the significance of effect from the development.
- 13.10.2 **Table 13.23** and **Table 13.24** present the information summarised in the modelling approach for all wind farms contributing to the noise levels at the receptors listed in **Table 13.16**.
- 13.10.3 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 13.23 Noise assessment – cumulative daytime

Noise parameter,	Standardised 10 m wind speed, ms ⁻¹								
	4	5	6	7	8	9	10	11	12
dB L_{A90,10m}									
R1 - Woodview Cottages, Cwmnantygroes									
Background noise curve	27.3	28.2	29.3	33.7	35.9	38.4	38.4	38.4	38.4
ETSU-R-97 derived noise limit	40.0	40.0	40.0	40.0	40.9	43.4	43.4	43.4	43.4

³⁶ British Standards Institution (2014). *BS 8233:2014 Guide on sound insulation and noise reduction for buildings*. BSI, London.

Noise parameter, dB L _{A90,10 m}	Standardised 10 m wind speed, ms ⁻¹								
	4	5	6	7	8	9	10	11	12
Wind Farm turbine noise	39.8	39.9	40.0	39.9	39.9	39.9	39.9	39.9	39.9
Difference wrt noise limit	-0.2	-0.1	0.0	-0.1	-1.0	-3.5	-3.5	-3.5	-3.5
R2 - Gilfach Wen Farm, Blaen-Y-cwm Road									
Background noise curve	27.3	28.2	29.3	33.7	35.9	38.4	38.4	38.4	38.4
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	43.5	43.5	43.5	43.6	43.6	43.6	43.6	43.6	43.6
Difference wrt noise limit	-1.5	-1.5	-1.5	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4
R3 - Ty-Dafydd Farm, Six Bells									
Background noise curve	27.3	28.2	29.3	33.7	35.9	38.4	38.4	38.4	38.4
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	43.8	43.7	43.7	43.8	43.7	43.7	43.7	43.7	43.7
Difference wrt noise limit	-1.2	-1.3	-1.3	-1.2	-1.3	-1.3	-1.3	-1.3	-1.3
R4 - Blaencuffin Barn Farm, Blaen-Y-cwm Road									
Background noise curve	27.3	28.2	29.3	33.7	35.9	38.4	38.4	38.4	38.4
ETSU-R-97 derived noise limit	40.0	40.0	40.0	40.0	40.9	43.4	43.4	43.4	43.4
Wind Farm turbine noise	42.6	42.5	42.4	42.4	42.4	42.4	42.4	42.4	42.4
Difference wrt noise limit	+2.6	+2.5	+2.4	+2.4	+1.5	-1.0	-1.0	-1.0	-1.0
R5 - Maescynew Farm, Hyde Place									
Background noise curve	27.1	27.6	29.2	32.5	35.9	39.4	39.4	39.4	39.4
ETSU-R-97 derived noise limit	40.0	40.0	40.0	40.0	40.9	44.4	44.4	44.4	44.4
Wind Farm turbine noise	40.6	40.5	40.4	40.4	40.4	40.4	40.4	40.4	40.4
Difference wrt noise limit	+0.6	+0.5	+0.4	+0.4	-0.5	-4.0	-4.0	-4.0	-4.0
R6 - 5 Incline Cottages, Llanhilleth									
Background noise curve	27.1	27.6	29.2	32.5	35.9	39.4	39.4	39.4	39.4
ETSU-R-97 derived noise limit	40.0	40.0	40.0	40.0	40.9	44.4	44.4	44.4	44.4
Wind Farm turbine noise	42.0	41.9	41.8	41.8	41.8	41.8	41.8	41.8	41.8
Difference wrt noise limit	+2.0	+1.9	+1.8	+1.8	+0.9	-2.6	-2.6	-2.6	-2.6
R7 - Tir-Ysgubor-Ddu, Blaen-Y-cwm Road									
Background noise curve	27.1	27.6	29.2	32.5	35.9	39.4	39.4	39.4	39.4
ETSU-R-97 derived noise limit	40.0	40.0	40.0	40.0	40.9	44.4	44.4	44.4	44.4
Wind Farm turbine noise	44.1	44.0	43.8	43.8	43.8	43.8	43.8	43.8	43.8
Difference wrt noise limit	+4.1	+4.0	+3.8	+3.8	+2.9	-0.6	-0.6	-0.6	-0.6
R8 - 2 Ty Gwyn Cottages, Pantygasseg									
Background noise curve	27.3	29.4	32.6	37.0	38.6	41.0	41.0	41.0	41.0
ETSU-R-97 derived noise limit	40.0	40.0	40.0	42.0	43.6	46.0	46.0	46.0	46.0
Wind Farm turbine noise	43.4	43.1	42.8	42.7	42.7	42.7	42.7	42.7	42.7
Difference wrt noise limit	+3.4	+3.1	+2.8	+0.7	-0.9	-3.3	-3.3	-3.3	-3.3
R9 - Ty Mari Hari Farm, Pantygasseg									
Background noise curve	27.3	29.4	32.6	37.0	38.6	41.0	41.0	41.0	41.0

Noise parameter, dB L _{A90,10m}	Standardised 10 m wind speed, ms ⁻¹								
	4	5	6	7	8	9	10	11	12
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	46.0	46.0	46.0	46.0
Wind Farm turbine noise	43.4	43.0	42.7	42.4	42.4	42.4	42.4	42.4	42.4
Difference wrt noise limit	-1.6	-2.0	-2.3	-2.6	-2.6	-3.6	-3.6	-3.6	-3.6
R10 - Cefn-y-Crib Farm, Blaen-Y-cwm Road									
Background noise curve	27.3	29.4	32.6	37.0	38.6	41.0	41.0	41.0	41.0
ETSU-R-97 derived noise limit	40.0	40.0	40.0	42.0	43.6	46.0	46.0	46.0	46.0
Wind Farm turbine noise	43.5	43.0	42.6	42.3	42.3	42.3	42.3	42.3	42.3
Difference wrt noise limit	+3.5	+3.0	+2.6	+0.3	-1.3	-3.7	-3.7	-3.7	-3.7
R11 - The Old School House, Pantygasseg									
Background noise curve	27.3	29.4	32.6	37.0	38.6	41.0	41.0	41.0	41.0
ETSU-R-97 derived noise limit	40.0	40.0	40.0	42.0	43.6	46.0	46.0	46.0	46.0
Wind Farm turbine noise	44.3	43.7	43.1	42.7	42.7	42.7	42.7	42.7	42.7
Difference wrt noise limit	+4.3	+3.7	+3.1	+0.7	-0.9	-3.3	-3.3	-3.3	-3.3
R12 - 2 - 9 Bush Terrace, Pantygasseg									
Background noise curve	27.3	29.4	32.6	37.0	38.6	41.0	41.0	41.0	41.0
ETSU-R-97 derived noise limit	40.0	40.0	40.0	42.0	43.6	46.0	46.0	46.0	46.0
Wind Farm turbine noise	44.8	44.1	43.5	42.9	42.9	42.9	42.9	42.9	42.9
Difference wrt noise limit	+4.8	+4.1	+3.5	+0.9	-0.7	-3.1	-3.1	-3.1	-3.1
R13 - Mountain View House, Pantygasseg									
Background noise curve	27.3	29.4	32.6	37.0	38.6	41.0	41.0	41.0	41.0
ETSU-R-97 derived noise limit	40.0	40.0	40.0	42.0	43.6	46.0	46.0	46.0	46.0
Wind Farm turbine noise	44.6	43.9	43.2	42.7	42.7	42.7	42.7	42.7	42.7
Difference wrt noise limit	+4.6	+3.9	+3.2	+0.7	-0.9	-3.3	-3.3	-3.3	-3.3
R14 - 1 - 6 Ty-Bwmpyn Road, Pontypool									
Background noise curve	27.3	29.4	32.6	37.0	38.6	41.0	41.0	41.0	41.0
ETSU-R-97 derived noise limit	40.0	40.0	40.0	42.0	43.6	46.0	46.0	46.0	46.0
Wind Farm turbine noise	41.5	41.1	40.9	40.7	40.7	40.7	40.7	40.7	40.7
Difference wrt noise limit	+1.5	+1.1	+0.9	-1.3	-2.9	-5.3	-5.3	-5.3	-5.3
R15 - Blaenant y Caws, PlasyCoed Rd									
Background noise curve	27.1	27.6	29.2	32.5	35.9	39.4	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	48.7	48.6	48.6	48.5	48.5	48.5	48.5	48.5	48.5
Difference wrt noise limit	+3.7	+3.6	+3.6	+3.5	+3.5	+3.5	+3.5	+3.5	+3.5
R16 - Cwmffrwdroer Farm, Cwmffrwdroer									
Background noise curve	27.1	27.6	29.2	32.5	35.9	39.4	39.4	39.4	39.4
ETSU-R-97 derived noise limit	40.0	40.0	40.0	40.0	40.9	44.4	44.4	44.4	44.4
Wind Farm turbine noise	39.1	38.7	38.4	38.2	38.2	38.2	38.2	38.2	38.2
Difference wrt noise limit	-0.9	-1.3	-1.6	-1.8	-2.7	-6.2	-6.2	-6.2	-6.2
R17 - Yew Tree Cottage, Pentrepiod									

Noise parameter, dB L _{A90,10 m}	Standardised 10 m wind speed, ms ⁻¹								
	4	5	6	7	8	9	10	11	12
Background noise curve	27.1	27.6	29.2	32.5	35.9	39.4	39.4	39.4	39.4
ETSU-R-97 derived noise limit	40.0	40.0	40.0	40.0	40.9	44.4	44.4	44.4	44.4
Wind Farm turbine noise	39.0	38.6	38.4	38.2	38.2	38.2	38.2	38.2	38.2
Difference wrt noise limit	-1.0	-1.4	-1.6	-1.8	-2.7	-6.2	-6.2	-6.2	-6.2
R18 - Tal-ochor Farm, Pentrepiod									
Background noise curve	27.1	27.6	29.2	32.5	35.9	39.4	39.4	39.4	39.4
ETSU-R-97 derived noise limit	40.0	40.0	40.0	40.0	40.9	44.4	44.4	44.4	44.4
Wind Farm turbine noise	40.2	40.0	39.9	39.9	39.9	39.9	39.9	39.9	39.9
Difference wrt noise limit	+0.2	0.0	-0.1	-0.1	-1.0	-4.5	-4.5	-4.5	-4.5
R19 - Pistyll Gwyn, Pentwyn, Abersychan									
Background noise curve	27.1	27.6	29.2	32.5	35.9	39.4	39.4	39.4	39.4
ETSU-R-97 derived noise limit	40.0	40.0	40.0	40.0	40.9	44.4	44.4	44.4	44.4
Wind Farm turbine noise	40.3	40.1	40.0	39.9	39.9	39.9	39.9	39.9	39.9
Difference wrt noise limit	+0.3	+0.1	0.0	-0.1	-1.0	-4.5	-4.5	-4.5	-4.5
R20 - British Road, Abersychan									
Background noise curve	27.3	28.2	29.3	33.7	35.9	38.4	38.4	38.4	38.4
ETSU-R-97 derived noise limit	40.0	40.0	40.0	40.0	40.9	43.4	43.4	43.4	43.4
Wind Farm turbine noise	37.2	37.1	37.0	37.0	37.0	37.0	37.0	37.0	37.0
Difference wrt noise limit	-2.8	-2.9	-3.0	-3.0	-3.9	-6.4	-6.4	-6.4	-6.4

Table 13.24 Noise assessment – cumulative night-time

Noise parameter, dB L _{A90,10 m}	Standardised 10 m wind speed, ms ⁻¹								
	4	5	6	7	8	9	10	11	12
R1 - Woodview Cottages, Cwmnantygroes									
Background noise curve	28.4	29.9	31.7	33.7	35.9	38.4	38.4	38.4	38.4
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.4	43.4	43.4	43.4
Wind Farm turbine noise	39.8	39.9	40.0	39.9	39.9	39.9	39.9	39.9	39.9
Difference wrt noise limit	-3.2	-3.1	-3.0	-3.1	-3.1	-3.5	-3.5	-3.5	-3.5
R2 - Gilfach Wen Farm, Blaen-Y-cwm Road									
Background noise curve	28.4	29.9	31.7	33.7	35.9	38.4	38.4	38.4	38.4
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	43.5	43.5	43.5	43.6	43.6	43.6	43.6	43.6	43.6
Difference wrt noise limit	-1.5	-1.5	-1.5	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4
R3 - Ty-Dafydd Farm, Six Bells									
Background noise curve	28.4	29.9	31.7	33.7	35.9	38.4	38.4	38.4	38.4
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	43.8	43.7	43.7	43.8	43.7	43.7	43.7	43.7	43.7
Difference wrt noise limit	-1.2	-1.3	-1.3	-1.2	-1.3	-1.3	-1.3	-1.3	-1.3
R4 - Blaencuffin Barn Farm, Blaen-Y-cwm Road									

Noise parameter, dB L _{A90,10 m}	Standardised 10 m wind speed, ms ⁻¹								
	4	5	6	7	8	9	10	11	12
Background noise curve	28.4	29.9	31.7	33.7	35.9	38.4	38.4	38.4	38.4
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.4	43.4	43.4	43.4
Wind Farm turbine noise	42.6	42.5	42.4	42.4	42.4	42.4	42.4	42.4	42.4
Difference wrt noise limit	-0.4	-0.5	-0.6	-0.6	-0.6	-1.0	-1.0	-1.0	-1.0
R5 - Maescynew Farm, Hyde Place									
Background noise curve	28.0	29.2	30.8	33.0	35.9	39.4	39.4	39.4	39.4
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	44.4	44.4	44.4	44.4
Wind Farm turbine noise	40.6	40.5	40.4	40.4	40.4	40.4	40.4	40.4	40.4
Difference wrt noise limit	-2.4	-2.5	-2.6	-2.6	-2.6	-4.0	-4.0	-4.0	-4.0
R6 - 5 Incline Cottages, Llanhilleth									
Background noise curve	28.0	29.2	30.8	33.0	35.9	39.4	39.4	39.4	39.4
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	44.4	44.4	44.4	44.4
Wind Farm turbine noise	42.0	41.9	41.8	41.8	41.8	41.8	41.8	41.8	41.8
Difference wrt noise limit	-1.0	-1.1	-1.2	-1.2	-1.2	-2.6	-2.6	-2.6	-2.6
R7 - Tir-Ysgubor-Ddu, Blaen-Y-cwm Road									
Background noise curve	28.0	29.2	30.8	33.0	35.9	39.4	39.4	39.4	39.4
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	44.4	44.4	44.4	44.4
Wind Farm turbine noise	44.1	44.0	43.8	43.8	43.8	43.8	43.8	43.8	43.8
Difference wrt noise limit	+1.1	+1.0	+0.8	+0.8	+0.8	-0.6	-0.6	-0.6	-0.6
R8 - 2 Ty Gwyn Cottages, Pantygasseg									
Background noise curve	27.6	30.3	33.1	35.9	38.6	41.0	41.0	41.0	41.0
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.6	46.0	46.0	46.0	46.0
Wind Farm turbine noise	43.4	43.1	42.8	42.7	42.7	42.7	42.7	42.7	42.7
Difference wrt noise limit	+0.4	+0.1	-0.2	-0.3	-0.9	-3.3	-3.3	-3.3	-3.3
R9 - Ty Mari Hari Farm, Pantygasseg									
Background noise curve	27.6	30.3	33.1	35.9	38.6	41.0	41.0	41.0	41.0
ETSU-R-97 derived noise limit	45.0	45.0	45.0	45.0	45.0	46.0	46.0	46.0	46.0
Wind Farm turbine noise	43.4	43.0	42.7	42.4	42.4	42.4	42.4	42.4	42.4
Difference wrt noise limit	-1.6	-2.0	-2.3	-2.6	-2.6	-3.6	-3.6	-3.6	-3.6
R10 - Cefn-y-Crib Farm, Blaen-Y-cwm Road									
Background noise curve	27.6	30.3	33.1	35.9	38.6	41.0	41.0	41.0	41.0
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.6	46.0	46.0	46.0	46.0
Wind Farm turbine noise	43.5	43.0	42.6	42.3	42.3	42.3	42.3	42.3	42.3
Difference wrt noise limit	+0.5	0.0	-0.4	-0.7	-1.3	-3.7	-3.7	-3.7	-3.7
R11 - The Old School House, Pantygasseg									
Background noise curve	27.6	30.3	33.1	35.9	38.6	41.0	41.0	41.0	41.0
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.6	46.0	46.0	46.0	46.0
Wind Farm turbine noise	44.3	43.7	43.1	42.7	42.7	42.7	42.7	42.7	42.7
Difference wrt noise limit	+1.3	+0.7	+0.1	-0.3	-0.9	-3.3	-3.3	-3.3	-3.3

Noise parameter, dB L _{A90,10 m}	Standardised 10 m wind speed, ms ⁻¹								
	4	5	6	7	8	9	10	11	12
R12 - 2 - 9 Bush Terrace, Pantygasseg									
Background noise curve	27.6	30.3	33.1	35.9	38.6	41.0	41.0	41.0	41.0
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.6	46.0	46.0	46.0	46.0
Wind Farm turbine noise	44.8	44.1	43.5	42.9	42.9	42.9	42.9	42.9	42.9
Difference wrt noise limit	+1.8	+1.1	+0.5	-0.1	-0.7	-3.1	-3.1	-3.1	-3.1
R13 - Mountain View House, Pantygasseg									
Background noise curve	27.6	30.3	33.1	35.9	38.6	41.0	41.0	41.0	41.0
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.6	46.0	46.0	46.0	46.0
Wind Farm turbine noise	44.6	43.9	43.2	42.7	42.7	42.7	42.7	42.7	42.7
Difference wrt noise limit	+1.6	+0.9	+0.2	-0.3	-0.9	-3.3	-3.3	-3.3	-3.3
R14 - 1 - 6 Ty-Bwmpyn Road, Pontypool									
Background noise curve	27.6	30.3	33.1	35.9	38.6	41.0	41.0	41.0	41.0
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.6	46.0	46.0	46.0	46.0
Wind Farm turbine noise	41.5	41.1	40.9	40.7	40.7	40.7	40.7	40.7	40.7
Difference wrt noise limit	-1.5	-1.9	-2.1	-2.3	-2.9	-5.3	-5.3	-5.3	-5.3
R15 - Blaenant y Caws, PlasyCoed Rd									
Background noise curve	28.0	29.2	30.8	33.0	35.9	39.4	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	48.7	48.6	48.6	48.5	48.5	48.5	48.5	48.5	48.5
Difference wrt noise limit	+3.7	+3.6	+3.6	+3.5	+3.5	+3.5	+3.5	+3.5	+3.5
R16 - Cwmffrwdoer Farm, Cwmffrwdoer									
Background noise curve	28.0	29.2	30.8	33.0	35.9	39.4	39.4	39.4	39.4
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	44.4	44.4	44.4	44.4
Wind Farm turbine noise	39.1	38.7	38.4	38.2	38.2	38.2	38.2	38.2	38.2
Difference wrt noise limit	-3.9	-4.3	-4.6	-4.8	-4.8	-6.2	-6.2	-6.2	-6.2
R17 - Yew Tree Cottage, Pentrepiod									
Background noise curve	28.0	29.2	30.8	33.0	35.9	39.4	39.4	39.4	39.4
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	44.4	44.4	44.4	44.4
Wind Farm turbine noise	39.0	38.6	38.4	38.2	38.2	38.2	38.2	38.2	38.2
Difference wrt noise limit	-4.0	-4.4	-4.6	-4.8	-4.8	-6.2	-6.2	-6.2	-6.2
R18 - Tal-ochor Farm, Pentrepiod									
Background noise curve	28.0	29.2	30.8	33.0	35.9	39.4	39.4	39.4	39.4
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	44.4	44.4	44.4	44.4
Wind Farm turbine noise	40.2	40.0	39.9	39.9	39.9	39.9	39.9	39.9	39.9
Difference wrt noise limit	-2.8	-3.0	-3.1	-3.1	-3.1	-4.5	-4.5	-4.5	-4.5
R19 - Pistyll Gwyn, Pentwyn, Abersychan									
Background noise curve	27.1	27.6	29.2	32.5	35.9	39.4	39.4	39.4	39.4
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	44.4	44.4	44.4	44.4
Wind Farm turbine noise	40.3	40.1	40.0	39.9	39.9	39.9	39.9	39.9	39.9

Noise parameter,	Standardised 10 m wind speed, ms ⁻¹								
	4	5	6	7	8	9	10	11	12
dB L_{A90,10 m}									
Difference wrt noise limit	-2.7	-2.9	-3.0	-3.1	-3.1	-4.5	-4.5	-4.5	-4.5
R20 - British Road, Abersychan									
Background noise curve	28.4	29.9	31.7	33.7	35.9	38.4	38.4	38.4	38.4
ETSU-R-97 derived noise limit	43.0	43.0	43.0	43.0	43.0	43.4	43.4	43.4	43.4
Wind Farm turbine noise	37.2	37.1	37.0	37.0	37.0	37.0	37.0	37.0	37.0
Difference wrt noise limit	-5.8	-5.9	-6.0	-6.0	-6.0	-6.4	-6.4	-6.4	-6.4

- 13.10.4 The results of the cumulative noise assessment show compliance at the majority of receptors during the daytime period, resulting in a **not significant** effect. Exceedances of the daytime limits of up to 4.8 dB are indicated at receptors R4 to R8 and R10 to R15 resulting in a potential **significant** effect. During the night-time, compliance is predicted at the majority of receptors, resulting in a **not significant** effect. Exceedances of the night-time limits of up to 3.7 dB are indicated at receptors R7, R8, R10 to R13 and R15 resulting in a potential **significant** effect.
- 13.10.5 It should be noted that directivity effects may have a significant influence at the majority of receptors where exceedances are predicted, due south/ south west/ west of the proposed turbines. The cumulative noise at these receptors is dominated by the Proposed Development turbines 3, 4, 6, 7 and 8. Contributions from sound from the proposed turbines at Mynydd Maen Wind Farm (noting that sound power levels have been assumed at this stage) are also dominant or significant contributors for receptors due south of the Proposed Development (R10 to R13). Many of the receptors identified above will tend to be upwind of the Proposed Development turbines. During typical upwind conditions, the contribution from these turbines will be reduced, which in turn will reduce the cumulative noise at these receptors. If further analysis indicates that these turbines still contribute to an exceedance of the limits, then reduced power operating modes can be specified for these turbines to ensure compliance with the limits. Where the information is available, the sound levels predicted from the proposed Mynydd Maen Wind Farm will be updated in order to review where reduced power modes may be required from that wind farm, assuming it would be under the same planning constraints.

13.11 Significance conclusions

- 13.11.1 The results of the assessment of operational noise indicates that the ETSU-R-97⁵ derived noise limits are likely to be exceeded at R4 to R8 and R10 to R15 during the daytime and at receptors R7, R8, R10 to R13 and R15 during the night-time, resulting in potential significant effects.
- 13.11.2 For the majority of receptors where exceedances are identified, turbines associated with the Proposed Development are dominant. If, in the Final ES, exceedances are still indicated at these receptors, it should be possible to avoid exceedances by specifying reduced power operating modes for the wind turbines at the Proposed Development.
- 13.11.3 However, at R10 to R13, contributions from sound from the proposed turbines at Mynydd Maen Wind Farm (at this stage predicted using assumed turbine types) are dominant or significant contributors.
- 13.11.4 The assessment has been undertaken assuming a worst-case scenario of all receptors downwind of all turbines. The assessment also includes the IOA GPG recommended correction for wind shear when using data from a 10 m height met mast which involves shifting all predicted sound levels 3 m/s to the left (i.e. predicted sound levels for 9 ms⁻¹

become results for 6 ms^{-1} , and so on). As such, it is possible that, when updating the assessment for the Final ES with wind speed data acquired with the full height met mast, many of the exceedances may be significantly reduced and/ or avoided.

- 13.11.5 Based on the above, it is considered that the identified exceedances may be reduced, when accounting for directivity and Site specific wind shear. If, after further analysis, exceedances are still predicted at these receptors, then reduced power operating modes can be specified for proposed turbines 3, 4, 5, 6, 7 and 8 to ensure compliance with the limits. On this basis, the effect of operational noise on residences would be **not significant**.
- 13.11.6 A summary of the results of the preliminary noise assessment is provided in **Table 13.25**.

Table 13.25 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 430 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 noise daytime: All NSRs	High	Likely negligible, subject to assessment in Final ES.	Likely not significant, subject to assessment in Final ES.	Limits contained in BS 5228-2:2009+A1:2014 are considered unlikely to be exceeded due to the separation distances between proposed turbines and the nearest dwellings.
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 be most unlikely to cause a material increase in road traffic noise. On the less trafficked portion of the construction routes a short term increase in traffic noise may be perceptible but absolute road traffic noise levels are considered most unlikely to give rise to adverse effects.
Operational daytime: R4 to R8 inclusive, R10 to R15 inclusive, R18 and R19.	High	High	Significant	ETSU-R-97 noise limits may be exceeded during the daytime period. However, when accounting for directivity and Site specific wind shear it is considered that exceedances would be reduced. If, following further analysis, exceedances are still indicated, then reduced power operating modes for proposed turbines 3 to 8, and specific Mynydd Maen Wind Farm turbines (subject to confirmation of location and turbine type) can be specified to ensure compliance with the limits and reduce residual effects such that they are not significant.
Operational daytime: All other NSRs	High	Negligible	Not Significant	ETSU-R-97 noise limits are unlikely to be exceeded during the daytime period.

Receptor and summary of predicted effects	Sensitivity/importance/value of receptor ¹	Magnitude of change ²	Significance ³	Summary rationale
Operational night-time: R7, R8, R10 to R13 inclusive, R15	High	High	Significant	ETSU-R-97 noise limits may be exceeded during the daytime period. However, when accounting for directivity and Site specific wind shear it is considered that exceedances would be reduced. If, following further analysis, exceedances are still indicated, then reduced power operating modes for proposed turbines 4, 6, 7 and 8, and specific Mynydd Maen Wind Farm turbines (subject to confirmation of location and turbine type) can be specified to ensure compliance with the limits and reduce residual effects such that they are not significant.
Operational night-time: All other NSRs	High	Negligible	Not Significant	ETSU-R-97 noise limits are unlikely to be exceeded during the night-time period.

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.

Implementation of environmental measures

- 13.11.7 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-97⁵ limits as outlined in **Section 13.10**. Compliance of these limits can be proven with measurements taken at residential receptor locations once the wind farm is operational.
- 13.11.8 As discussed above it is considered that the exceedances identified are likely to be an overestimate. If, following further analysis, exceedances are still indicated, then reduced power operating modes for turbines associated with the Proposed Development can be specified to ensure compliance with the limits and reduce residual effects such that they are not significant. Further analysis will be undertaken and presented in the Final ES.

13.12 Further work

- 13.12.1 Prior to undertaking the surveys and assessments to be presented in the Final ES, it is proposed to undertake consultation with TCBC and BGCBC on the survey and assessment methodology.
- 13.12.2 It is proposed that an additional baseline survey, alongside the full height met mast, will be undertaken to inform the revised assessment that will be presented in the Final ES.
- 13.12.3 If, following further analysis, exceedances of the ETSU-R-97⁵ derived noise limits are still indicated, then reduced power operating modes will be determined that will ensure compliance with the limits and reduce residual effects such that they are not significant.