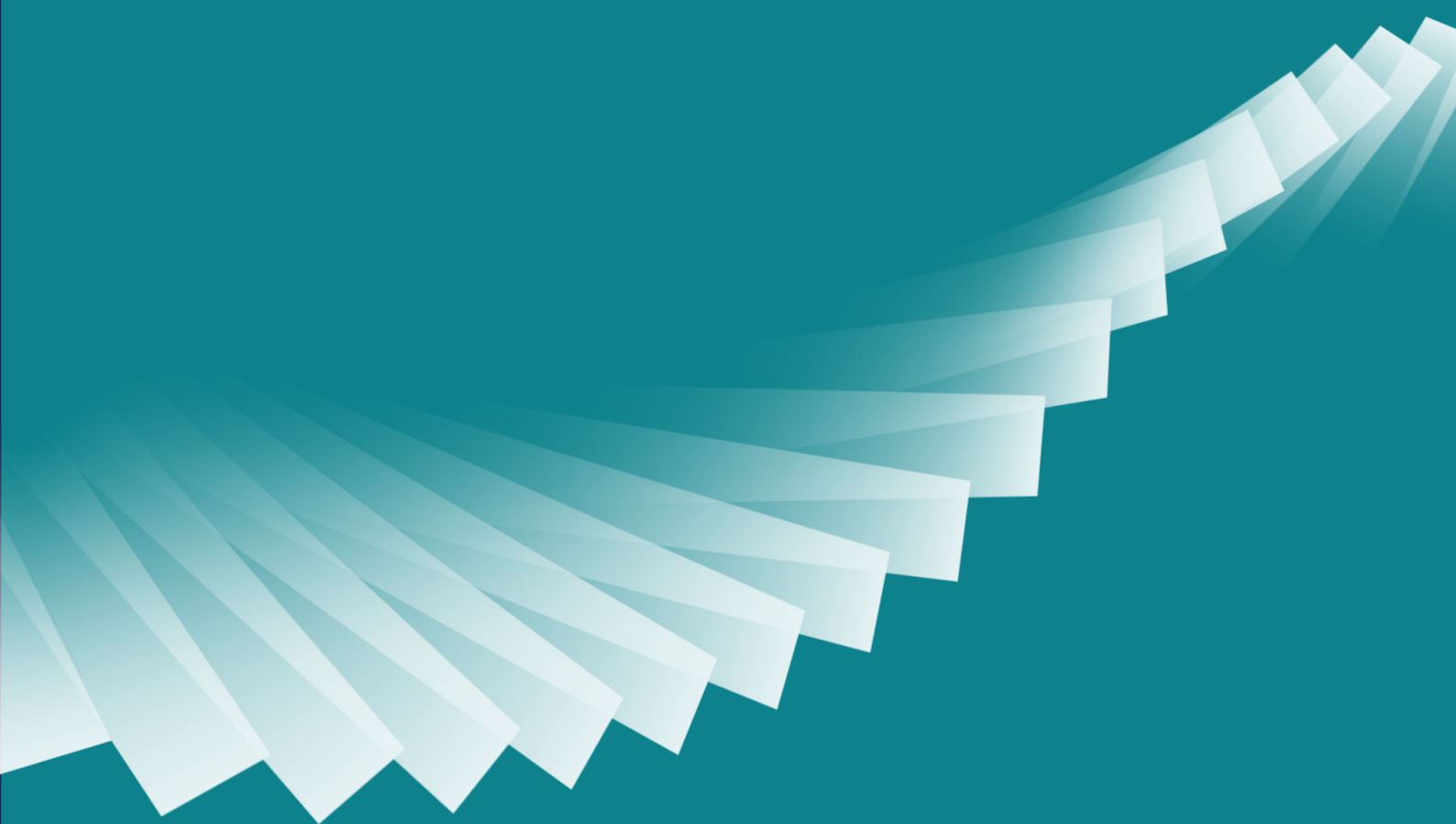




Bute Energy
Aberedw Energy Park

Environmental Statement

Chapter 10: Noise and Vibration



Chapter 10

Noise and Vibration

Introduction

10.1 This chapter presents the findings of the assessment of potential significant noise and vibration effects of the Proposed Development on residents of nearby dwellings.

10.2 The chapter has been prepared by Hoare Lea LLP (HL) (see **Appendix 1.1: Statement of Expertise**).

10.3 The assessment considers the likelihood of significant noise effects of the construction and operation of the Proposed Development. Assessment of the cumulative operational noise effects accounts for the effects of the Proposed Development with another operational wind turbine.

10.4 For the construction phase, details of relevant working practices, traffic routes, and proposed working hours are considered, with the assessment of noise and vibration from traffic associated with the construction work based on the assessment presented in **Chapter 11: Transport and Access**.

10.5 This chapter is supported by a **Figure 10.1** which can be found in **Volume 2**.

10.6 The following appendix should be read in conjunction with the chapter and can be found in **Volume 3**.

■ Appendix 10.1: Environmental Noise Assessment

10.7 Further details and explanation of chapter-specific terminology are provided in **Appendix 10.1**.

Assessment Methodology

Legislation, Policy and Guidance

Legislation

10.8 The following legislation is relevant to this topic:

- Control of Pollution Act (CoPA) 1974;
- The Environmental Protection Act 1990¹ (EPA); and
- The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017².

10.9 The EPA defines the powers for local authorities to investigate and control statutory nuisance from noise. Local authorities also have powers under the CoPA to control noise and vibration from construction activities. Notwithstanding these powers, the aim of the planning system is to minimise and control where required construction and operational noise levels from commercial developments, as described in the policy and guidance referenced below.

Policy

10.10 This assessment is carried out in accordance with the principles contained within the following policy:

- Future Wales³ – The National Plan 2040 (2021).
- Planning Policy Wales (PPW) Edition 12 (February 2024)⁴;
- Noise and Soundscape Plan for Wales (2023)⁵;
- Designing for Renewable Energy in Wales (2023)⁶; and,

¹ Environmental Protection Act, Part III, HMSO, 1990.

² Welsh Government (2017) The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017

³ Future Wales: The National Plan 2040, Welsh Government, 2021.

⁴ Planning Policy Wales, Edition 12, Welsh Government, 7 February 2024.

⁴ The Welsh Government (2023) Noise and Soundscape Plan for Wales 2023 to 2028

⁶ Welsh Government (2023) Designing for Renewable Energy in Wales

- Powys Local Development Plan 2011-2026 (2018)⁷.

10.11 A description of these policy documents and their relevance to noise is provided in **Appendix 10.1**.

Guidance

10.12 This assessment is carried out in accordance with the principles contained within the following documents:

- The Assessment and Rating of Noise from Wind Farms (ETSU-R-97)⁸;
- Institute of Acoustics, a Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise (IOA GPG)⁹;
- British Standard BS 5228 'Noise control on construction and open sites', Parts 1¹⁰ & 2¹¹;
- British Standard BS 4142:2014 'Methods for rating and assessing industrial and commercial sound'¹²;
- Technical Advice Note (Wales) 11: Noise¹³ (TAN11); and,
- Minerals Technical Advice Note (Wales) 1: Aggregates (MTAN1)¹⁴.

10.13 These guidance documents and their relevance to noise is summarised below, with further detail is provided in **Appendix 10.1**.

10.14 The ETSU-R-97 assessment procedure and associated Good Practice Guide (GPG) are referenced in PPW. This guidance specifies that noise limits should be set relative to existing background noise levels at the nearest noise sensitive receptors (NSRs) and that these limits should reflect the variation in both turbine source noise and background noise with wind speed.

7 Powys Council (2018) Local Development Plan

8 ETSU-R-97, The Assessment and Rating of Noise from Wind Farms, Final Report for the Department of Trade & Industry, September 1996. The Working Group on Noise from Wind Turbines.

9 A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise, M. Cand, R. Davis, C. Jordan, M. Hayes, R. Perkins, Institute of Acoustics, May 2013.

10 BS 5228-1:2009-A:2014 'Code of practice for noise and vibration control on construction and open sites – Part 1: Noise'.

11 BS 5228-2:2009-A:2014 'Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration'.

12 BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound'.

13 Planning Guidance (Wales), Technical Advice Note (Wales) 11, Noise, 1997.

14 Minerals Planning Policy (Wales), Minerals Technical Advice Note (Wales) 1: Aggregates, National Assembly for Wales, 2004

ETSU-R-97 also specifies that the noise limits apply to the cumulative noise of all wind turbines, although the IOA GPG clarifies that if the contribution from other turbines is 10 dB or more below that of the wind turbines considered, this can be considered negligible and not require further consideration.

10.15 Separate noise limits apply for the daytime and night-time which equate to a lower fixed limit or 5 dB above the prevailing background noise, whichever is greater. The lower fixed portion of the daytime noise limit is in the range of 35 dB(A) to 40 dB(A), the precise choice of value depends on several factors as set out below and discussed further specifically for the Proposed Development in paragraph 10.72:

- The number of noise-affected properties;
- The likely duration and level of exposure; and,
- The consequences of the choice on the potential power generating capability of the wind farm.

10.16 The lower fixed portion of the night-time noise limit recommended in ETSU-R-97 is 43 dB(A). The prevailing background noise level for the daytime is derived from noise data measured during the quiet daytime periods¹⁵ and, for the night-time from noise measured during 23:00 to 07:00 hours.

10.17 The exception to the setting of both the daytime and night-time lower fixed limits occurs in instances where a property occupier has a financial involvement in the Proposed Development. Where this is the case then the lower fixed portion of the noise limit at that property may be increased to 45 dB(A) during both the daytime and the night-time periods alike.

10.18 TAN11 references the guidance of BS 5228¹⁶ for the assessment and control of noise and vibration from construction. Additional guidance specific to stone extraction from borrow pits can be found in MTAN1.

¹⁵ Quiet daytime periods are defined in ETSU-R-97 as: all evenings from 18:00 to 23:00, plus Saturday afternoon from 13:00 to 18:00, plus all day Sunday 07:00 to 18:00.

¹⁶ Although TAN11 references a previous version of the BS 5228 standard, it was updated in 2009 (amended 2014) and consolidated into two parts: BS 5228-1¹⁰ for noise and BS 5228-2¹¹ for vibration.

Consultation

10.19 In undertaking the assessment, consideration has been given to the Scoping responses and other consultation which has been undertaken as detailed in **Table 10.1**.

Table 10.1 Consultation Responses

Consultee and Date	Scoping/Other Consultation	Issue Raised	Response/Action Taken
Scoping response received from Powys County Council (PCC) Environmental Protection 06 February 2024	Formal Scoping Consultation	PCC satisfied with intended application of ETSU-R-97 and IOA guidance in noise assessment.	Noted.
PCC's appointed noise consultant (Dick Bowdler) 21 March 2024	Other consultation	PCC's appointed noise consultant responded on 21 March 2024 to a letter proposed monitoring locations and outlining the noise assessment (issued on 20 March 2024). The response was positive, broadly agreeing with the proposed approach and caution was advised when allocating proxy locations, particularly if the survey location is influenced by water noise.	Care was taken when determining baseline measurement locations as proxies to other assessment receptors, despite some access difficulties. No strong influence of watercourse noise was observed in data trends, due to careful siting of measurement equipment at properties based on observations at identified survey properties.

Consultee and Date	Scoping/Other Consultation	Issue Raised	Response/Action Taken
PCC's appointed noise consultant (Dick Bowdler) 30 April 2024	Other consultation	Joint site visit took place on 30 April 2024 with Hoare Lea and Dick Bowdler to review the area surrounding the Proposed Development and the vicinity of the then installed measurement locations and discuss the basis for the choice of the installed monitoring locations.	The chosen survey locations were discussed in further detail in a subsequent meeting on 04 September 2024 (see below).
PCC's appointed noise consultant (Dick Bowdler) 04/09/2024	Other consultation	Further consultation with PCC undertaken to review the background noise survey findings and discuss noise limits and alternate measurement locations due to access difficulties. The data measured at Wern-heulog Farm was discussed as PCC had initial concerns that further exclusions may be required.	An agreement was reached in the meeting with PCC that data at Wern-heulog Farm and all other survey locations was appropriate. The final measurement locations were agreed to be representative for the purpose of an ETSU-R-97 assessment and in line with current good practice. It was also agreed that 40 dB LA90 is an appropriate value for the lower fixed portion of the daytime noise limit for residential properties, in

Consultee and Date	Scoping/Other Consultation	Issue Raised	Response/Action Taken
			accordance with ETSUR97 guidance, provided that the value is also applied as the lower fixed portion of the night-time noise limit to prevent the risk of increase in turbine operational noise at night.

Study Area

10.20 The study area for the assessment of operational noise includes the noise-sensitive residential properties nearest to the proposed location of wind turbines, in line with the ETSU-R-97 methodology and relevant guidance. This also included properties relevant to the assessment of the proposed substation. The assessment locations considered are listed below in **Table 10.2 and** shown on the map of **Figure 10.1**. The list of receptor locations is not intended to be exhaustive but sufficient to be representative of noise levels typical of those receptors closest to the Proposed Development.

Table 10.2 Table 10.2: Noise assessment receptors

Receptor Name	Easting	Northing	Survey location referenced
Ffynnonau	309263	253036	1 - Graig-yr-Onen
Fforest Fields Yurts	309956	253107	1 - Graig-yr-Onen
Fforest Cottages	311006	253970	2 - Wern-heulog Farm
Woodbury	312368	252299	1 - Graig-yr-Onen
Pen Y Cae	312297	252148	1 - Graig-yr-Onen
Gwarallt	312184	251495	1 - Graig-yr-Onen
Pen-y-banc Cregina	311853	251090	3 - Pen-y-banc
Lower Llatho	311452	251021	3 - Pen-y-banc
The Park	311832	250577	3 - Pen-y-banc
Penberth	310900	249232	3 - Pen-y-banc
Lower Blaenmilo	309216	249374	4 - Lower Blaenmilo Farm
Tyn Llwyn	306935	251176	1 - Graig-yr-Onen
Woodcroft	308336	253246	2 - Wern-heulog Farm
Graig-yr-Onen*	311637	253342	1 - Graig-yr-Onen
Penarth	312075	252813	1 - Graig-yr-Onen
Church House Farm	306889	250746	1 - Graig-yr-Onen
Upper Blaenmilo Farm*	309582	250478	4 - Lower Blaenmilo Farm
Pen Y Bank Llanfaredd	306947	250359	1 - Graig-yr-Onen
Treallt	307564	252659	1 - Graig-yr-Onen
<i>* Financially involved landowner noise assessment properties with the Proposed Development</i>			

10.21 The assessment of construction noise has considered the same residential properties as the operational assessment, as well as dwellings located alongside the proposed routes for

access to the Proposed Development such as public highways and at the site entrance and exits.

Desk Based Research and Data Sources

10.22 The following data sources have informed the assessment:

- Ordnance Survey information concerning the locations of noise-sensitive receptors in the vicinity of the Site;
- British Standard (BS) reference material for the sound emission characteristics of various construction activities associated with the Proposed Development;
- Manufacturer data for the candidate Nordex N163 wind turbine (chosen as a worst-case for the purpose of the noise assessment, see paragraph 10.36),
- Suitable turbine data for the cumulative wind turbine considered, as set out in **Appendix 10.1**;
- Noise emission sound power levels for the plant equipment that may be used for the substation as set out in **Appendix 10.1**; and
- Consent conditions (where available) for the wind turbines considered in the cumulative assessment.

Field Survey

10.23 A background noise survey at four nearby noise sensitive receptor locations was completed, with measurement positions agreed through consultation with PCC's appointed noise consultant following installation and review of survey findings (see **Table 10.1** for consultation details and **Annex C** of **Appendix 10.1** for position details). The baseline survey was over a period of just over four weeks between April and May 2024. Full details of the survey locations and analysis of background noise are presented in **Appendix 10.1**. The results of the background noise surveys are considered to be representative for the purposes of an ETSU-R-97 assessment and consistent with IOA GPG requirements (see **Annex D** and **Annex E** of **Appendix 10.1**). **Table 10.2** details the relevant choice of representative survey location, which

was assigned to each assessment location, in accordance with IOA GPG guidance and discussed in consultation with PCC (see **Table 10.1**).

Assessing Significance

Sensitivity

10.24 Sensitivity has been determined on the basis that all noise sensitive receptors considered in this chapter are residential and therefore of high sensitivity.

Magnitude

10.25 For construction noise, the assessment of magnitude of noise impact uses a scale from negligible through minor to moderate and major: see **Table 10.3**.

Table 10.3 Criteria for Construction Noise

Impact Magnitude / Effect Significance	Definition (Noise Level dB L _{Aeq} averaged over working day)
Major	Construction noise is generally greater than 75 dB L _{Aeq} during the construction period, or with periods of more than 85 dB L _{Aeq} lasting 1 to 4 weeks.
Moderate	Construction noise is generally less than or equal to 75 dB L _{Aeq} during the construction period, with periods of up to 85 dB L _{Aeq} lasting 1 to 4 weeks.
Minor	Construction noise is generally less than or equal to 65 dB L _{Aeq} during the construction period, with periods of up to 75 dB L _{Aeq} lasting 1 to 4 weeks.
Negligible	Construction noise is generally less than or equal to 55 dB L _{Aeq} , with periods of up to 65 dB L _{Aeq} lasting 1 to 4 weeks.

10.26 Assessment of construction related traffic on public roads has been completed using the methodology provided by Calculation of Road Traffic Noise (CRTN) and the guidance of the Design Manual for Roads and Bridges (DMRB). For low flow conditions on public roads, the assessment has been completed in line with BS 5228 methodology. The relevant magnitude criteria for construction traffic noise are set out in **Section 3.4** of **Appendix 10.1**, with an impact scale from negligible (less than 1 dB increase) through minor (1 to 3 dB) to moderate (3 to 5 dB) and major (more than 5 dB increase), where moderate and major are significant in EIA terms.

10.27 For operational wind turbine noise, no impact magnitude is defined, and the assessment of operational noise determines whether noise levels (including cumulative contributions from other turbines) are below or above the ETSU-R-97 criteria.

10.28 Cumulative effects from a nearby single small-scale (27 m tip height) operational turbine near Tremaen (planning reference: P/2013/0489) were considered. Other, more distant wind farms were not considered as they do not make an acoustically relevant contribution to cumulative noise levels.

10.29 For operational noise from the proposed substation, noise effects are assessed using BS 4142. This uses the same scale as construction noise i.e. from negligible through minor to moderate and major. The rating level is defined as the L_{Aeq} noise level with the addition of penalty which account for characteristics of the sound such as tonality. The assessment of magnitude is set out in **Table 10.4**, based in part on comparing the rated noise levels to existing background noise levels in line with BS 4142 guidance. An important factor when considering the context is the absolute level of sound, and this is also taken into account¹⁷ in the derived criteria.

¹⁷ BS 4142 states that "Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night." The standard offers no guidance about what background and rating levels are considered low; however, the 1997 version of the standard stated that background sound levels below around 30 dB L_{A90} , and rating levels below 35 dB, were considered very low and therefore outside the scope of the assessment method. Therefore, for rating levels below 35 dB levels, minor impacts will result at most.

Table 10.4 Criteria for substation operational noise

Impact Magnitude/Effect significance	Definition
Major	Rating level exceeds background by 10 dB or more, and is greater than 35 dB
Moderate	Rating level exceeds background by 5 dB to 10 dB, and is greater than 35 dB
Minor	Rating level exceeds background, by a maximum of 5 dB, or is less than 35 dB
Negligible	Rating level equal to, or less than, background and less than 35 dB

10.30 Potential cumulative operational noise effects from the substation when added to the turbine noise were assessed on the basis of professional judgment.

Significance

10.31 For construction noise and operational noise from the substation, the magnitude of impacts translate directly to the effect significance, given all receptors are of high sensitivity, with a scale of significance from negligible, through minor to moderate and major (see **Table 10.3** and **Table 10.4**). Major and moderate effects are considered **Significant** in the context of the EIA Regulations.

10.32 For operational wind turbine noise, acceptable limits for wind turbine noise are clearly defined in ETSU-R-97; accordingly, predicted operational noise levels which are below the ETSU-R-97 criteria are considered adverse but Not Significant in the context of the EIA Regulations. For properties located outside the study area, with predicted levels below the lowest limit set out in ETSU-R-97, the associated effects are considered to be negligible and Not Significant. If predicted noise levels are above the ETSU-R-97 criteria, effects are considered to be adverse and **Significant** in the context of the EIA Regulations.

Assessment Assumptions and Limitations

10.33 For construction noise, predicted noise levels are based on assuming standard machinery and equipment are used and that these are operated in the way intended by their manufacturers. It is also assumed that these items of equipment are all used at the closest point to receptor locations, which is considered to be a precautionary assumption, with noise levels lower than predicted for much of the construction period. Whilst assumptions have been made to provide the construction predictions, it is considered that there is sufficient information to enable an informed decision to be taken in relation to the identification and assessment of likely significant environmental effects due to construction noise.

10.34 For the substation, the operational noise assessment is based upon electrical and mechanical plant of the type suitable for the Proposed Development, with noise emission levels which are either supplied from manufacturer specification, or where unknown, based upon data from experience of similar schemes and typical associated noise emission levels representative of what could be used, on a relatively worst-case basis. However, the final electrical equipment selection and installation arrangements will need to be made on the basis of meeting the proposed noise limit. Whilst different equipment may be chosen for construction of these elements of the Proposed Development, there is sufficient information to enable an informed decision to be taken in relation to the identification and assessment of likely significant environmental effects, related to operational noise from the substation.

10.35 Although **Chapter 4: Development Description** explains that the proposed substation elements such as transformers will be enclosed within a building, the acoustic performance of that building is not defined at this stage and it has therefore been assumed as a worst-case that the building will not offer any noise reduction (for example due to ventilation openings).

10.36 The exact model of wind turbine to be used for the Proposed Development will be the result of a future tendering process and therefore a representative turbine model has been assumed for this noise assessment. For the operational wind turbine noise assessment, the Nordex N163 was selected as a representative worst-case assumption for noise. The noise emission levels for this turbine model are towards the upper end of the range for the type and size of turbine that will be used for the Proposed Development. In line with the IOA GPG

guidance, an allowance of +2 dB was added to the manufacturer noise information for this turbine, in the absence of specific information on uncertainty in this data.

10.37 The assumed model, as with most modern wind turbines, is a variable-speed, pitch-regulated machine with a rotor diameter of 163 m, a hub height of 118.5 m and tip height of 200 m used on the Proposed Development. Due to its variable speed operation, the sound power output of the turbine varies considerably with wind speed, being quieter at the lower wind speeds when the blades are rotating more slowly.

10.38 The turbines were all assumed to be operating in its worst-case (noisiest) operational mode (7 MW generation capacity, “mode 1b”), with the following exceptions:

- T13 and T14 operate in noise reduced mode 5.a;
- T16 operates in reduced noise mode 3.a; and
- T7 operates in reduced noise mode 2.a.

10.39 The assumptions made in terms of turbine operational modes were chosen to illustrate how compliance with the applicable noise limits could be achieved in practice. However, compliance could be demonstrated in a similar way using other operational management schemes, depending on the final choice of turbine model for the Proposed Development. Furthermore, in practice, the use of reduced noise operation modes will likely only be required in certain wind conditions.

10.40 Whilst some assumptions have been identified, it is considered that there is sufficient information to enable an informed decision to be taken in relation to the identification and assessment of likely significant noise and vibration effects.

Existing Conditions

10.41 The study area for the Proposed Development includes residential dwellings located closest to both the Proposed Development (up to 1.5 km from the proposed turbines): **Table 10.2**. This study area was determined in accordance with the IOA GPG to include residential properties where the predicted wind farm noise immission level is greater than 35 dB L_{A90}, at up to 10 m/s wind speed. The nearest residential properties along the proposed construction traffic route are also considered as part of the assessment of construction traffic.

10.42 The Proposed Development is located in an area of relatively low population density. The noise environment in the surrounding area is generally characterised by ‘natural’ sources, such as wind-disturbed vegetation, birds and farm animals. For those receptors nearer the A481 trunk road and B4567 road to the north and west of the Site respectively, the noise environment has a component from road traffic noise. Distant water flow noise was observed at the Lower Blaenmilo measurement property near the Proposed Development; however, this source was minimised at the installed position via terrain screening and the distance of the equipment from the watercourse in the valley. Other sources of noise at measurement properties included occasional distant agricultural vehicle movements in the area from distant farm operations and occasional distant aircraft.

10.43 Despite some access difficulties, a total of four noise monitoring locations were determined as being representative of the background noise environment for the assessment locations nearest to the Proposed Development. This was agreed with PCC’s appointed noise consultant. The four survey locations are listed in **Table 3** of **Appendix 10.1** and also shown on the plan in **Figure 10.1**. Full details of the measurement positions, as well as details of equipment used are provided in **Annex C** in **Appendix 10.1**. Survey data were analysed in accordance with the methodology in ETSU-R-97 and guidance on good practice (IOA GPG) and presented in **Appendix 10.1 Annex D** and **Annex E** to determine typical background noise levels and how these varied with wind speed conditions on the Proposed Development. **Table 5** and **Table 6** of **Appendix 10.1** show the resulting background noise levels derived at the four measurement locations.

10.44 Data from these four survey locations were used to represent baseline conditions at those locations surveyed as well as other locations which require assessment, as specified in **Table 10.2**. The use of the baseline data in this way is justified by choosing assessment locations likely to have similar background noise levels, through proximity to similar background noise sources, as well as the setting and location of those properties being represented by those which were surveyed. This approach is consistent with the guidance provided by ETSU-R-97 and current good practice as set out in the IOA GPG.

10.45 **Table 10.5** outlines the ETSU-R-97 noise limits derived for both day-time and night-time periods, applicable to all 19 assessment locations based on the surveyed baseline data. A full

description of the ETSU-R-97 assessment methodology and derivation of the ETSU-R-97 noise limits is provided in **Section 5 of Appendix 10.1**. Tables of the noise limits derived from each of the measurement locations are shown in **Table 7** and **Table 8** of **Appendix 10.1** for day-time and night-time periods respectively at the four measurement locations **Table 10.2** indicates the assignment of the derived noise limits from the measurement locations to each assessment location. The resulting noise limits applicable to the Proposed Development in isolation is set as the minimum of the day and night limit for each of the assessment locations (following consultation with PCC), and is shown in **Table 15** of **Appendix 10.1**, which is reproduced here as **Table 10.5**. Graig-yr-Onen and Upper Blaenmilo Farm are financially involved properties, and the lower absolute limit is therefore increased to 45 dB(A).

Table 10.5 Site-specific Noise Limits L_{A90} (dB) derived for the Proposed Development alone, as a function of standardised wind speeds (m/s)

Property	≤4	5	6	7	8	9	10	11	12
Ffynnonau	40	40	40	40	40	40	40	40	40
Fforest Fields Yurts	40	40	40	40	40	40	40	40	40
Fforest Cottages	40	40	40	40	40	40	40	40	40
Woodbury	40	40	40	40	40	40	40	40	40
Pen Y Cae	40	40	40	40	40	40	40	40	40
Gwarallt	40	40	40	40	40	40	40	40	40
Pen-y-banc Cregrina	40	40	40	40	40	41	46	48	48
Lower Llatho	40	40	40	40	40	41	46	48	48
The Park	40	40	40	40	40	41	46	48	48
Penberth	40	40	40	40	40	41	46	48	48
Lower Blaenmilo	40	40	40	40	40	40	42	45	45

Property	≤4	5	6	7	8	9	10	11	12
Tyn Llwyn	40	40	40	40	40	40	40	40	40
Woodcroft	40	40	40	40	40	40	40	40	40
Graig-yr-Onen	45	45	45	45	45	45	45	45	45
Penarth	40	40	40	40	40	40	40	40	40
Church House Farm	40	40	40	40	40	40	40	40	40
Upper Blaenmilo Farm	45	45	45	45	45	45	45	45	45
Pen Y Bank Llanfaredd	40	40	40	40	40	40	40	40	40
Treallt	40	40	40	40	40	40	40	40	40

10.46 Assessment of operational noise from the substation also referenced background noise levels that were measured at the Wern-heulog Farm location to represent likely background noise levels at the Woodcroft property, which is located closest (130 m) to the proposed substation, when considering low wind speeds in line with the BS 4142 methodology. The corresponding baseline noise levels are shown in **Table 5** and **Table 6** of **Appendix 10.1** and are typically of around 35 dB L_{A90} (at low wind speeds) during quiet day-time periods and around 22-23 dB L_{A90} during night-time periods.

Implications of Climate Change for Existing Conditions

10.47 The effects of climate change are not expected to significantly affect the baseline conditions found at the Site. The generalised noise sources found at dwellings neighbouring the Site will remain the same regardless. However, it is accepted that the effects of climate change may alter the timing of increased rainfall and the potential for relative drought during certain times of the year which, in turn, will affect the timing for which higher or lower background noise

levels should normally be expected without a change in climate. The noise environment at many of the nearby noise sensitive receptors is heavily influenced by water flow noise. Potentially background noise levels during winter times (with increased flows) could have a greater influence from the sound of water flow. Conversely, it is possible that with lower flows in summertime this contribution could reduce.

10.48 The background noise survey has been undertaken in a manner that minimises the influence of water flow in the current background noise environment, by placing equipment away from atypical extraneous sources of noise where practicable, by excluding data where water noise is considered to have had an important influence on measured noise levels and by excluding periods during and following rainfall. Accordingly, it is considered that the baseline background noise levels will remain representative for the purposes of an ETSU-R-97 assessment when considering the potential effects of climate change.

Future Baseline in the Absence of the Proposed Development

10.49 In the absence of the Proposed Development, environmental noise levels in the area are likely to remain largely similar to those currently experienced, with the exception of any major developments that would affect these levels.

Embedded Design Mitigation

10.50 The turbine layout of the Proposed Development has been iteratively developed to avoid significant operational wind turbine noise effects, based on a representative worst-case turbine model, whilst maintaining as far as possible the generation capacity of the Proposed Development (in addition to other design considerations). This included consideration of the cumulative effects with neighbouring wind farms.

10.51 Specifically, the process involved the calculation of noise emission levels for the initial turbine layout, and advice was provided on this basis to the design team to ensure compliance with successive iterations including the final layout, based on the derived ETSU-R-97 noise limits, whilst considering cumulative effects where relevant from the operation of other wind farms.

10.52 The location of the proposed substation was also determined with consideration of the proximity of noise-sensitive locations while considering other design constraints.

Good Practice Measures

10.53 To reduce the potential effects of construction noise, the following good practice measures are proposed:

- Those activities that may give rise to audible noise at the surrounding properties and heavy goods vehicle (HGV) deliveries to the Site (except for abnormal loads) will be limited to the hours 07:00 to 19:00 Monday to Friday and 07:00 to 13:00 on Saturdays. Those activities that are unlikely to give rise to noise audible at noise-sensitive receptors may continue outside of the stated hours, such as small deliveries. Concrete pours for foundation or turbine component lifting may also be required outside the above working hours, but this will not include the associated preparation and mobilisation work which will be restricted to the above working hours.
- Traffic movements will be managed by a Construction Traffic Management Plan (CTMP) (see **Appendix 11.2**) as part of the Outline Construction Environmental Management Plan (CEMP) (**Appendix 4.2**). Turbine and other abnormal load deliveries will only take place outside these times with the prior consent of PCC and relevant authorities, and this will be controlled by an Abnormal Load Transport Management Plan as part of the CTMP.
- All construction activities shall adhere to good practice as set out in BS 5228.
- All equipment will be maintained in good working order and any associated noise attenuation such as engine casing and exhaust silencers shall remain fitted at all times.
- Where flexibility exists, construction activities will be separated from residential neighbours by the maximum possible distances.
- Construction plant capable of generating significant noise and vibration levels will be operated in a manner to restrict the duration of the higher magnitude levels.
- If blasting is used at the proposed borrow pits:

- Blasting should take place under strictly controlled conditions with the agreement of PCC and relevant authorities, at regular times within the working week, that is, Mondays to Fridays, between the hours of 10.00 and 16.00.
- Good practices during the setting and detonation of charge should be followed, in order to control air overpressure, in line with guidance set out in Minerals Technical Advice Note (Wales) 1 (MTAN1) and British Standard BS 5228-2.
- Vibration levels at the nearest sensitive properties are best controlled through onsite testing processes, with progressively increased charges, carried out in consultation with PCC.

10.54 The above measures will be implemented as part of the CEMP which will be secured through a planning condition and include measures to control construction noise as set out above.

Micrositing

10.55 Micrositing the infrastructure up to 50 m is not considered likely to result in acoustically important changes to predicted noise immission levels, during either operation or construction of the Proposed Development, for the turbines. For the substation, a micrositing allowance of 50 m was taken into account in the assessment as it could affect the outcomes of the assessment.

Scope of the Assessment

Effects Assessed in Full

10.56 Noise and vibration that arises from the construction of the Proposed Development is a factor which should be taken into account when considering the total effect of the Proposed Development. However, when assessing the effects of construction noise, the temporary nature of the associated works can be taken into account. The main work locations for construction of the proposed turbines will be distant from the nearest noise sensitive residences and will be unlikely to cause significant effects. The construction and use of access tracks and some of the required infrastructure may, however, occur at lesser separation distances. Assessment of the temporary effects of construction noise is primarily aimed at understanding the need for dedicated management measures and, if so, the types of measures that are required.

10.57 Once constructed and operating, wind turbines may emit two types of noise. Firstly, aerodynamic noise is a 'broad band' noise, sometimes described as having a characteristic modulation, or 'swish', which is produced by the movement of the rotating blades through the air. Secondly, mechanical noise may emanate from components within the nacelle of a wind turbine. This is a less natural sounding noise, which is generally characterised by its tonal content. Traditional sources of mechanical noise comprise gearboxes or generators. Due to the acknowledged lower acceptability of tonal noise in otherwise 'natural' noise settings such as rural areas, modern turbine designs have evolved to minimise mechanical noise radiation from wind turbines. Aerodynamic noise tends to be perceived when the wind speeds are low, although at very low wind speeds the blades do not rotate or rotate very slowly and so, at these wind speeds, negligible aerodynamic noise is generated. In higher winds, aerodynamic noise is generally masked by the normal sound of wind blowing through trees and around buildings. The level of this natural 'masking' noise relative to the level of wind turbine noise determines the subjective audibility of the development. The relationship between wind turbine noise and the naturally occurring masking noise at residential dwellings lying around the project area will therefore generally form the basis of the assessment of the levels of noise against accepted standards.

10.58 A substation forms part of the Proposed Development, which will emit noise during operation from electrical and mechanical plant including cooling units and transformers.

10.59 The following effects have been assessed in full:

- The potential effect of noise and vibration during construction of the Proposed Development (including construction traffic and blasting).
- The potential effect of noise during operation of the wind turbines including cumulative noise effects a single small-scale turbine (operational) near Tremaen (Planning Reference P/2013/0489).
- The potential effect of noise during operation of the substation transformers. Additionally, their cumulative effects with the proposed wind turbines, based on professional judgement.

Effects Scoped Out

10.60 The following effects have been ‘scoped out’ as proposed in the Scoping Report and subsequently agreed by PEDW and PCC (see **Table 10.1**):

- The results of previous research (detailed in Annex A of **Appendix 10.1**) have demonstrated that vibration resulting from the operation of wind turbines is imperceptible at typical separation distances. Therefore, vibration effects during operation do not warrant detailed assessment and have not been considered further as part of this assessment.
- Traffic during the operational phase of the Proposed Development is likely to be very low and is considered unlikely to have any noise effects and is therefore also proposed to be scoped out.
- The consensus from research in the UK and elsewhere (detailed in Annex A of **Appendix 10.1**) is that infrasound and low frequency noise from wind turbines at typical separation distance (such as for the Proposed Development) will be at low or imperceptible levels and that this is therefore not a source of significant noise impacts. The current recommendation from PPW is that ETSU-R-97 should continue to be used for the assessment and rating of operational noise from wind farms. Therefore, it is not proposed to undertake specific assessments of infrasound and low frequency noise, and this aspect of the assessment is therefore scoped out.
- Decommissioning noise effects have not been assessed, on the basis that construction noise effects will be more intensive and therefore represent the worst-case noise levels.
- The review in **Technical Appendix 11.1: Transport Assessment** did not identify any cumulative onshore wind farm or energy related consented developments which should be included within the traffic assessment. Therefore, cumulative construction traffic noise impacts on dwellings along surrounding roads are not assessed.

10.61 On the basis of the desk-based work undertaken, the professional judgement of the EIA team, experience from other relevant projects and policy guidance or standards

- Occasional momentary vibration can arise when heavy vehicles pass dwellings at very short separation distances, but this is not sufficient to constitute a risk of significant effects.

Therefore, although the effects of construction traffic noise are assessed in this chapter, associated vibration effects are not considered further.

- Given that the nearest proposed wind farms are located more than 5 km from the Proposed Development Site, cumulative effects from construction activities are unlikely to be significant, and the associated cumulative construction effects are therefore scoped out.
- The effects of noise or vibration from the Proposed Development on users of Public Rights of Way have not been assessed due to the nature of their use (for leisure) associated with a reduced sensitivity to noise. Whilst users of Public Rights of Way may experience audible construction or operational noise, depending on the proximity to the sources and nature of the noise environment, this will be on a transient basis and unlikely to be associated with any significant adverse effects. This is therefore scoped out from the assessment.
- Cumulative operational noise effects from a turbine near Tremaen (see paragraph 10.28) were considered. Other, more distant wind turbines were not considered further as they represent a relatively negligible contribution to predicted noise levels.

Assessment of Effects

Construction Effects

Predicted Construction Effects

10.62 Predicted noise levels at the closest non-involved noise sensitive receptors for each of the key activities during construction of the Proposed Development are presented in **Table 9** of **Appendix 10.1**. The majority of the proposed construction activities will generally occur distances of at least 600 m or more from the residential properties considered, such that the resulting short-term predicted worst-case noise levels at receptors vary between 50 and 63 dB L_{Aeq} , and therefore not exceed 65 dB L_{Aeq} . With reference to the construction noise criteria set out in **Table 10.3**, the temporary adverse noise effects from these activities will be considered **negligible to minor**, which are **Not Significant** in EIA terms.

10.63 Some of the site access track upgrades works are located in closer proximity (less than 100 m) to the receptor location Graig-yr-Onen, resulting in increased noise levels of up to 70 dB L_{Aeq} predicted on a worst-case basis. These noise levels are likely to represent those which

could occur for a very short-term period. Noise levels will quickly diminish as track upgrading progresses, quickly moving the activity further from the property. Considering the short duration of the work, along with the likelihood of the levels being lower in practice and the construction noise criteria, the associated effect is predicted to also be minor at most. Construction activity noise related to the temporary site compounds (90 m minimum distance) are predicted to reach levels of up to 70 dB L_{Aeq} at the Graig-yr-Onen receptor. The financially involved nature of the Graig-yr-Onen property will reduce its sensitivity and the temporary impact of construction noise in practice such that a **minor** adverse effect will result based on professional judgement, which is **Not Significant** in EIA terms.

10.64 For the site access track upgrade works that are closest to the nearest non-involved residential receptor; Craiglea, predicted noise levels of up to 85 dB L_{Aeq} are predicted on a worst-case basis, although this represents a very short-term period when these works are closest to the receptor (25 m distance). Noise levels will also quickly diminish as construction progresses. Despite the short-term nature of this activity, the likelihood of elevated noise levels (under worst-case assumptions) categorises the impact to be of moderate magnitude on a high sensitivity receptor. This will potentially result in a **moderate** temporary adverse effect which is **Significant** in EIA terms.

10.65 Given the separation distances between the location of borrow pits and the nearest noise sensitive receptor of approximately 480 m (Penarth), noise and vibration from blasting activity may be temporarily experienced at nearby receptors. Therefore, if blasting is employed to quarry the proposed borrow pits, this will be controlled through a monitoring programme following the use of good practice during the setting and detonation of charges. When managed in consultation with PCC, as proposed in section 0 of this chapter, effects from blasting borrow pits will be **Not Significant** in EIA terms.

10.66 In addition to onsite activities, construction-related traffic passing to and from the Proposed Development will also represent a potential source of noise to surrounding properties. Construction traffic movements on existing offsite local surrounding roads represents a potential source of noise effects to surrounding residential properties. On the basis of the projected worst-case changes in traffic flow set out in **Chapter 11** (Month eight and nine), and using the methodology set out in CRTN, **Appendix 10.1** predicts a maximum potential increase of 1.9 dB

for properties along the A481, west of access to Fforest Fields. This represents a **minor** temporary impact according to the CRTN criteria.

10.67 Based on the prediction methodology in BS 5288 for two identified low traffic flow routes, where the CRTN methodology cannot be applied, the worst-case predicted noise level due to heavy vehicles moving on the C1336, near the Site access route at the closest dwelling (Craiglea) is of 58 dB L_{Aeq} . This assumes 14 HGVs per hour travelling at 70 km per hour as a worst case. This is below the level of 65 dB L_{Aeq} and represents a **minor** impact magnitude. Further details of these predictions are set out within **Appendix 10.1**.

10.68 Overall, construction traffic is predicted to result at most in minor impact magnitude on high sensitivity receptors, resulting in **minor** temporary adverse effects. These effects are **Not Significant** in EIA terms.

Committed Additional Mitigation

10.69 The assessment identified the potential for significant effects during the construction phase associated with site access track upgrade works in proximity to Craiglea (within 100 m of the property). Additional measures, to be set out in the CEMP, will be taken to minimise the impact of these Site access track construction works, including notifying the residents of Craiglea for works taking place in proximity to this property and use of quieter construction techniques where reasonably practicable. This and the relative short duration of the works, similar to road improvement works, will reduce the impact of these works to a minor magnitude.

Residual Construction Effects

10.70 Implementing the additional mitigation measures set out above for the short-term Site access track upgrade construction works near the residential property Craiglea, will reduce the impact of these works to a minor magnitude, resulting in a **minor** temporary adverse effect which is **Not Significant** in EIA terms. Therefore, all construction noise effects will be associated with **negligible to minor adverse effects**, which are **Not Significant** in EIA terms.

Operational Effects

Predicted Operational Effects

10.71 18 turbines have been modelled using the layout as indicated on **Figure 10.1**.

Predictions of operational wind turbine noise for the Proposed Development in isolation at the assessment locations are detailed in **Table 12** of **Appendix 10.1**, which is reproduced here as **Table 10.6**. These vary between 23-35 dB LA90 at low wind speeds and 35-44 dB LA90 at medium to high wind speeds.

Table 10.6 Predicted LA90 (dB) wind farm noise immission levels at each of the noise assessment locations as a function of standardised wind speed for the Proposed Development.

Property	4	5	6	7	8	9	10	11	12
Ffynnonau	30	35	39	39	39	39	39	39	39
Fforest Fields Yurts	31	36	40	40	40	40	40	40	40
Fforest Cottages	27	31	35	36	36	36	36	36	36
Woodbury	28	33	37	38	38	38	38	38	38
Pen Y Cae	29	33	38	38	38	38	38	38	38
Gwarallt	28	33	37	38	38	38	38	38	38
Pen-y-banc Cregina	30	35	39	40	40	40	40	40	40
Lower Llatho	30	35	39	40	40	40	40	40	40
The Park	27	32	36	37	37	37	37	37	37
Penberth	27	32	36	37	37	37	37	37	37
Lower Blaenmilo	30	35	39	40	40	40	40	40	40
Tyn Llwyn	26	31	35	36	36	36	36	36	36

Property	4	5	6	7	8	9	10	11	12
Woodcroft	27	31	36	36	36	36	36	36	36
Graig-yr-Onen	30	35	39	40	40	40	40	40	40
Penarth	30	35	39	40	40	40	40	40	40
Church House Farm	26	31	35	36	36	36	36	36	36
Upper Blaenmilo Farm	34	39	43	44	44	44	44	44	44
Pen Y Bank Llanfared	26	30	35	36	36	36	36	36	36
Treallt	26	31	35	36	36	36	36	36	36

10.72 As discussed in paragraph 10.45, **Table 10.5** presents a table setting out the applicable wind turbine noise limits for the Proposed Development set as the lowest of both the day and night noise limits. This was determined based on a lower limit of 40 dB L_{A90} for both daytime and night-time periods, as agreed in consultation with PCC, taking into account factors such as the scale of the Site, the number of surrounding noise-sensitive properties and the level and duration of exposure. Graig-yr-Onen and Upper Blaenmilo Farm are all financially involved properties, and the lower absolute limit is therefore increased to 45 dB(A).

10.73 **Table 10.7** confirms that predicted wind turbine noise levels from operation of the Proposed Development are compliant with the noise limits at all assessment locations. Therefore, wind turbine noise from the Proposed Development, can remain within the ETSU-R-97 noise limits, and the effect is therefore considered to be **Not Significant** in EIA terms.

Table 10.7 Difference between the noise limits of Table 10.5 and the predicted levels of Table 10.6 (dB). Negative values indicate the noise immission level is below the limit.

Property	4	5	6	7	8	9	10	11	12
Ffynnonau	-10	-5	-2	-1	-1	-1	-1	-1	-1
Fforest Fields Yurts	-9	-4	0	0	0	0	0	0	0
Fforest Cottages	-14	-9	-5	-4	-4	-4	-4	-4	-4
Woodbury	-12	-7	-3	-2	-2	-2	-2	-2	-2
Pen Y Cae	-12	-7	-2	-2	-2	-2	-2	-2	-2
Gwarallt	-12	-7	-3	-2	-2	-2	-2	-2	-2
Pen-y-banc Cregina	-10	-5	-1	0	0	-2	-6	-8	-8
Lower Llatho	-10	-5	-1	0	0	-2	-6	-8	-8
The Park	-13	-8	-4	-3	-3	-5	-9	-11	-11
Penberth	-13	-8	-4	-3	-3	-5	-9	-11	-11
Lower Blaenmilo	-10	-5	-1	0	0	0	-2	-5	-5
Tyn Llwyn	-14	-9	-5	-4	-4	-4	-4	-4	-4
Woodcroft	-14	-9	-5	-4	-4	-4	-4	-4	-4
Graig-yr-Onen*	-15	-10	-6	-6	-6	-6	-6	-6	-6
Penarth	-11	-10	-5	-1	0	0	0	0	0
Church House Farm	-14	-10	-5	-4	-4	-4	-4	-4	-4

Property	4	5	6	7	8	9	10	11	12
Upper Blaenmilo Farm*	-11	-6	-2	-1	-1	-1	-1	-1	-1
Pen Y Bank Llanfaredd	-14	-10	-5	-5	-5	-5	-5	-5	-5
Treallt	-14	-9	-5	-4	-4	-4	-4	-4	-4

10.74 ETSU-R-97 also requires consideration of cumulative operational noise from other wind turbines, and this is considered below from paragraph 10.85.

10.75 The precise choice of equipment which will be used to construct the substation as part of the Proposed Development will be the result of a future design and tendering process. The noise assessment is based upon assumed indicative transformer noise specification data for those likely to be installed on the Proposed Development. Predictions of operational noise for the substation at the nearest assessment location, Woodcroft, (see **Section 5.10 of Appendix 10.1**) have been completed using precautionary assumptions about operational noise emissions of these components, neglecting any potential screening from the substation enclosure as well as further reductions due to other screening elements.

10.76 At the Woodcroft receptor located nearest to the substation, approximately 130 m away, rated noise levels of L_{Ar} 39 dB are predicted on this basis, when accounting for the potential tonal characteristics of the noise from the transformers. A further 3 dB increase may occur due to micrositeing. This will result in maximum levels of +15 to +18 dB above the existing background noise levels expected at the property of around 24 dB L_{A90} , as determined by measurements taken at Wern-heulog Farm during low wind speed conditions at night (see paragraph 10.46). Similar rated noise levels could also be experienced at the Tynrheol property (easting/northing 308629 / 253534) also located in proximity to the substation. BS 4142 requires consideration of several contextual factors including the nature of the source and the environment, but also the absolute levels of the noise. Given these factors when assessed

against the criteria derived in **Table 10.4**, this will correspond to a **major** impact on a highly sensitive receptor or a noise effect which is **Significant** in EIA terms prior to mitigation.

Committed Additional Mitigation

10.77 The Proposed Development has been designed such that predicted operational noise levels associated with the Proposed Development can meet the limits derived in accordance with ETSU-R-97 with assumed operation of T13, T14, T16 and T7 in reduced noise modes and the remainder of the turbines operating unconstrained, based on the assumed candidate turbine. Given the robust assumptions made (see paragraph 10.36), if another turbine model than the Nordex N163 is selected, it is likely that a similar conclusion will be reached, and less or no turbines may need to operate in noise-reduced operation. Prior to the final decision on which turbine will be erected at the Proposed Development, the Applicant will consider the models available at that time and how they compare to the assumptions inherent within the assessment in this chapter (see paragraph 10.36). Due diligence of the noise parameters of the chosen turbine will be undertaken, such that compliance with the noise limits of **Table 10.5** will be achieved at the surrounding properties. These specific noise limits for the Proposed Development are based on the lowest of the resulting day-time and night-time ETSU-R-97 noise limits.

10.78 As potential significant adverse associated with the substation were identified, additional mitigation measures are considered. Mitigation of noise from the substation can be achieved through selection of suitable plant and design of the transformer enclosure building, considering layout and ventilation to minimise noise break-out, to provide effective sound insulation of the transformer noise. Any externally located plant such as cooling units can also be located and/or attenuated as needed. These measures can be designed to achieve a reduction of at least 5 to 8 dB on the assumed emission levels, such that the total rated noise level following mitigation will no more than L_{Ar} 35 dB at the nearest residential properties.

Residual Operational Effects

10.79 Based on the above considerations, residual operational effects from the wind turbines of the Proposed Development are **Not Significant**.

10.80 Following implementation of the proposed additional mitigation, the operational noise from the substation will reduce to a minor impact magnitude on the nearest highly sensitive receptors (Woodcroft and Tynrheol), resulting in a **minor** adverse effect which is **Not Significant** in EIA terms.

Cumulative Effects During Construction

Predicted Cumulative Effects During Construction

10.81 There are no known construction projects that will result in any additional noise being received at the assessment or neighbouring properties during the potential construction phase of the Proposed Development, for both construction activity noise and construction traffic noise. As a result, this effect is considered **Not Significant**.

10.82 The review in **Appendix 11.1 Transport Assessment** did not identify any cumulative onshore wind farm or energy related consented developments which should be included within the traffic assessment. Therefore, no cumulative construction traffic noise impacts are expected.

Committed Additional Mitigation

10.83 Due to the above, no additional mitigation measures are required.

Residual Cumulative Effects During Construction

10.84 There are no known construction projects that will result in any additional noise being received at the assessment or neighbouring properties during the potential construction phase of the Proposed Development. As a result, this effect is considered **Not Significant**.

Cumulative Effects During Operation

Predicted Cumulative Effects During Operation

10.85 Cumulative considerations accounted for operational noise from a single operational turbine near the Tremaen property (Planning Reference: P/2013/0489).

10.86 **Section 5.7** of **Appendix 10.1** considered the potential cumulative operational noise contributions, on a precautionary basis, from both the Proposed Development and the single turbine near the Tremaen property. Predicted noise levels from the single turbine near the

Tremaen property will not exceed 35 dB LA90 at the nearest property considered in the assessment of the Proposed Development, Treallt, and will likely be lower than this in practice. As predicted levels from the Proposed Development at Treallt do not exceed 36 dB, the cumulative total with the existing small turbine (assuming it is operating at its limits) is less than 39 dB LA90. This is below the derived noise limits of at least 40 dB LA90 which applies at Treallt (see **Table 10.5**). Therefore, cumulative operational wind turbine noise effects were determined as **Not Significant** in EIA terms.

10.87 Due to the conclusions of the assessment of substation and wind turbine noise, the nature of the sources and the different guidance documents applicable in each case, it is considered based on professional judgement that there will be negligible in-combination operational noise impacts from the wind turbine noise in addition to that from the substation. Therefore, cumulative effects from the substation and wind turbine noise are Not Significant in EIA terms.

Committed Additional Mitigation

10.88 Due to the above, no mitigation for cumulative effects is required.

Residual Cumulative Effects During Operation

10.89 Cumulative effects will remain as **Not Significant**.

Interrelationship Between Effects

10.90 The assessment of construction noise impacts considered the effects of traffic based on the assessment presented in **Chapter 11**.

10.91 Based on recent reviews of the available evidence (such as that of the World Health Organisation, 2018), the only potential health effect for which there is some evidence of a relationship with noise levels typically occurring in the vicinity of wind farm is annoyance. However, given the proposed noise limits for the wind farm, which are in line with national guidelines, no significant effects are expected in terms of annoyance. There is no clear evidence for any other direct health effects associated with wind turbine noise.

Monitoring

10.92 It is proposed that if planning consent is granted for the Proposed Development, conditions attached to the planning consent should include the requirement that, in the event of a noise complaint, noise levels resulting from the operation of the wind turbines on the Proposed Development are measured in order to demonstrate compliance with the conditioned noise limits (based on **Table 15** of **Appendix 10.1**). Such monitoring should be done in full accordance with ETSU-R-97 and include penalties for characteristics of the noise (if present).

Summary of Effects

10.93 **Table 10.8** below summarises the predicted significant effects of the Proposed Development on noise prior to mitigation. No significant effects were identified with the other aspects considered in the present chapter, including operational noise.

Table 10.8 Summary of Significant Effects

Predicted Effects	Sensitivity	Magnitude	Significance	Committed Additional Mitigation	Significance of Residual Effect
		Construction Noise			
Noise from the short-term Site entrance construction works on the Proposed Development: temporary moderate adverse effect.	High	Moderate Adverse	Significant	Liaison with the residents at the property Craiglea for works in proximity to the property and minimise associated noise levels where reasonably practicable.	Not Significant
		Operational Noise			
Operational noise from the proposed	High	Major Adverse	Significant	Mitigation through selection of suitable plant,	Not Significant

Predicted Effects	Sensitivity	Magnitude	Significance	Committed Additional Mitigation	Significance of Residual Effect
substation transformers				layout arrangement and design of the enclosure building and external plant, to achieve rated noise levels of no more than L _{Ar} 35 dB at neighbouring dwellings.	