



Foel Fach Wind Farm Limited.

Foel Fach Wind Farm - Environmental Statement Volume II

Main Written Statement – Chapter 10

Project Reference: 664094

This chapter is summarised within the Non-Technical Summary of this Environmental Statement

DECEMBER 2025



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VOLUME III: SUPPORTING TECHNICAL APPENDICES

Appendix 10.1 Wind Turbine Construction Noise Report

Appendix 10.2 Wind Turbine Operational Noise Report



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VOLUME IV: SUPPORTING FIGURES AND PLANS

Figure 10.1 Noise Assessment Locations for Construction of Wind Turbines

Figure 10.2 Noise Assessment Locations for Operational Wind Turbine Noise

10 NOISE

10.1 Introduction

- 10.1.1 This chapter considers the likely significant effects with respect to the noise associated with the construction and operation of the Proposed Development. The specific objectives of the chapter are to:
- describe the baseline following a noise survey which measured existing noise levels;
 - describe the potential noise impacts and relevant assessment methodology and significance criteria;
 - assess the potential effects, inclusive of potential cumulative effect with nearby other wind turbines / farms;
 - describe the mitigation measures proposed to address likely significant effects (where required); and
 - assess the residual effects remaining following the implementation of mitigation.
- 10.1.2 This chapter is supported by the following appendices presented in Environmental Statement (ES) Volume III:
- Appendix 10.1: Wind Turbine Construction Noise Report, and
 - Appendix 10.2: Wind Turbine Operational Noise Report.
- 10.1.3 This chapter is supported by the following figures presented in **ES Volume IV**:
- Figure 10.1: Noise Assessment Locations for Construction of Wind Turbines, and
 - Figure 10.2: Noise Assessment Locations for Operational Wind Turbine Noise.
- 10.1.4 This chapter summarises the findings of the accompanying Appendices **ES Volume III, Appendix 10.1: Wind Turbine Construction Noise Report** and **ES Volume III, Appendix 10.2: Wind Turbine Operational Noise Report**, both of which cover the two main noise topics and contain more detailed and technical information. Some other noise topics not covered in detail in the two appendices are covered within this chapter. Figures and technical appendices are referenced in the text where relevant.



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10.3 Consultation and Scope

Scoping Direction

- 10.3.1 The scope of this assessment has been established through an ongoing scoping process. This has involved the production of an EIA Scoping Report (provided in **ES Volume III, Appendix 1.1: EIA Scoping Report**), which was submitted to Planning and Environment Decisions Wales (PEDW) in July 2024. Further information on the scoping process can be found in **ES Volume II, Chapter 4: Approach to the EIA**.
- 10.3.2 The Scoping Direction, a copy of which is included in **ES Volume III, Appendix 1.2: EIA Scoping Direction and Addendum**, was received on 5 December 2024 and 18 December 2024. **Table 10.1** summarises the consultation responses received regarding noise and provides information on where and/or how they have been addressed in this assessment.

Table 10.1 Summary of Scoping Direction Comments Relevant to this Noise Assessment

| ID no. | Issue | Comment raised | Applicant response |
|--------|---|--|---|
| ID. 70 | Operational Wind Turbine Noise Assessment Methodology | <p>Gwynedd Council's Pollution Control Team agrees with the proposed assessment methodologies, specifically the use of ETSU-R-97 and the Institute of Acoustics (IOA) Good Practice Guide to assess operational noise.</p> <p>They highlight that the assessment should also consider the noise impact of the installation at nearby sensitive properties when considered in conjunction with any further proposed or existing turbines. They further recommend that the noise level predictions are also undertaken in accordance with the noise prediction framework set out in ISO 9613-2 'Acoustics – attenuation of sound during propagation outdoors - Part 2 General method of calculation', alongside the guidance from the IOA Good Practice Guide.</p> <p>The applicant's attention is further drawn to comments from Conwy County Borough Council (CCBC) advising two properties which should be included as noise sensitive receptors, including one at Gellioedd Uchaf to be considered as a monitoring location. PEDW welcomes that the SR states that the Noise Monitoring Locations will be agreed with the Local Authorities in advance of the baseline survey.</p> | <p>The assessment methodology follows ETSU-R-97 and the IOA Good Practice Guidance (which includes recommendations for set propagation parameters applied using ISO 9613-2).</p> <p>The two noise sensitive receptors have been incorporated as noise assessment locations, and the noise impacts have been assessed at these properties for cumulative considerations due to the proximity of Hafotty Uchaf and Bryn Ffynnon turbines. It should be noted though that predictions results confirmed these two receptors were too far from the Proposed Development, so the Proposed Development would have such low levels that it would not contribute to cumulative wind farm noise levels.</p> <p>Direct consultation with both Gwynedd Council and CCBC was undertaken regarding Noise Monitoring Locations and baseline methodology, further expanded in</p> <p>Additional Consultation</p> <p>10.3.3 Error! Not a valid bookmark self-reference. provides a summary of the additional consultation activities</p> |

| ID no. | Issue | Comment raised | Applicant response |
|--------|--|--|---|
| | | | <p>undertaken in support of the preparation of this assessment outside of the EIA Scoping process.</p> <p>Table 10.2. If was not judged necessary to monitor at Gellioedd Uchaf as this is a distant location where Foel Fach predicted noise levels are way below the typical threshold of 35dB(A) for selecting noise monitoring locations. However, Gellioedd Uchaf was duly considered as a noise assessment location, with predictions shown at this distant property.</p> |
| ID. 71 | Construction Environmental Management Plan (CEMP) | Good practice to be employed during construction to control noise will be set within an outline CEMP submitted with the ES. Gwynedd Council's Pollution Control Team welcomes this and highlights best practical methods should be used to reduce noise and vibration from the work and should consider the recommendations of British Standard 5228:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. | This ES includes a construction noise assessment in accordance with BS 5228. An outline CEMP is also being submitted along with this ES (ES Volume III, Appendix 2.1: Outline CEMP). |
| ID. 72 | Operational noise from Battery Energy Storage System (BESS) and transformers | The applicant's attention is drawn to comments from Gwynedd Council's Pollution Control Team, highlighting they expect an operational assessment specific to BESS and transformers, should the location of these be close to nearby receptors. They outline this should be undertaken in accordance with | The BESS is located a minimum of 1.2 km from receptors. Therefore, operational noise from the BESS has been scoped out. |

| ID no. | Issue | Comment raised | Applicant response |
|--------|---|--|--|
| | | BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound. | |
| ID. 73 | Wind Turbines Other Amplitude Modulation (OAM) | <p>The applicant's attention is drawn to comments from Gwynedd Council's Pollution Control team regarding OAM, including the noise-assessment and rating framework recommended in ETSU-R-97. As the wind farm should not emit greater-than expected amplitude-modulation noise, the Team states this should not be scoped out of the EIA.</p> <p>PEDW recommends the applicant liaises directly with Gwynedd Council's Pollution Control Team on this matter and if it is subsequently agreed these effects can be scoped out, a robust rationale for this should be provided in the ES.</p> | <p>As per PEDWs suggestion, direct consultation has been undertaken in July 2025 with Gwynedd Council to provide an update on the topic of OAM (Additional Consultation</p> <p>10.3.4 Error! Not a valid bookmark self-reference. provides a summary of the additional consultation activities undertaken in support of the preparation of this assessment outside of the EIA Scoping process.</p> <p>Table 10.2). Details of latest research on this topic is also included in this assessment.</p> |
| ID. 74 | Vibration | <p>The applicant's attention is drawn to comments from Gwynedd Council's Pollution Control Team stating that as the exact distance of the nearest Noise Sensitive Receptors is not known, they would expect a construction noise and vibration assessment to be undertaken in accordance with BS 5228 to gain an informed understanding of the likely noise and vibration levels arising from the Proposed Development. They therefore do not agree construction vibration can be scoped out.</p> | <p>As per PEDWs suggestion, direct consultation has been undertaken in July 2025 with Gwynedd Council on the topic of construction vibration, and distances to key working areas were provided (Additional Consultation</p> <p>10.3.5 Error! Not a valid bookmark self-reference. provides a summary of the additional consultation activities undertaken in support of the preparation</p> |

| ID no. | Issue | Comment raised | Applicant response |
|--------|-----------------------------------|---|---|
| | | PEDW agrees with these comments and as such it is not possible to scope out these effects at this stage and vibration during construction is therefore scoped in. PEDW recommends the applicant liaises directly with Gwynedd Council's Pollution Control Team on this matter. If, once exact distances to receptors are confirmed, it is agreed these effects can be scoped out, a robust rationale for this should be provided in the ES. | of this assessment outside of the EIA Scoping process. Table 10.2). |
| ID. 75 | Low frequency noise or infrasound | Given the comments from Gwynedd Council's Pollution Control Team, PEDW state that it is not currently possible to scope out the effects of low frequency/ infrasound. PEDW recommend liaising directly with Gwynedd Council's Pollution Control Team on this matter. Should it be agreed to scope out, a robust rationale should be provided in the ES. | As per PEDWs suggestion, direct consultation has been undertaken in July 2025 with Gwynedd Council to provide an update on the topic of Low Frequency / Infrasound (Additional Consultation 10.3.6 Error! Not a valid bookmark self-reference. provides a summary of the additional consultation activities undertaken in support of the preparation of this assessment outside of the EIA Scoping process. Table 10.2). Details of latest research on this topic is also included in this assessment. |
| ID. 76 | Cumulative effects | Attention drawn to two nearby wind farms, and PEDW welcome that the approach to the cumulative noise assessment will be agreed with the local authorities. | A comprehensive approach has been undertaken in the ES to consider potential cumulative noise from all relevant operating and consented wind turbines / |



| ID no. | Issue | Comment raised | Applicant response |
|--------|-------|----------------|--|
| | | | farms in the area and also inclusive of some at an early scoping stage (Table 10.17). |

Additional Consultation

10.3.7 Error! Not a valid bookmark self-reference. provides a summary of the additional consultation activities undertaken in support of the preparation of this assessment outside of the EIA Scoping process.

Table 10.2 Summary of Additional Consultation Undertaken

| Consultee | Date of Engagement | Summary of Matters Discussed | Applicant Response |
|--|--------------------|--|--|
| Gwynedd Council and Conwy County Borough Council | September 2024 | <p>Direct consultation by TNEI acoustic team with the council Environmental Health Officer (EHO) to agree baseline noise monitoring locations.</p> <p>The EHO at both councils agreed to the monitoring locations and baseline methodology and were invited to attend during installation of monitoring equipment.</p> | <p>The monitoring locations and the baseline methodology as agreed with both councils have been used in this assessment.</p> <p>Whilst the EHO were not able to attend installation of monitoring equipment, installation reports were sent, and no further comments were received.</p> |
| Gwynedd Council | July 2025 | <p>Update sent by TNEI to the Council regarding latest Low Frequency Noise (LFN) and Other Amplitude Modulation (OAM) research evidence implying these topics cannot be assessed at the planning stage. Update also provided on distances to construction areas implying construction vibration can be dealt within good practice.</p> | <p>The latest research on the topics of LFN and OAM are also presented in this noise assessment (full detail in Appendix 10.2) however ultimately these are not topics that can be assessed at the planning stage so have been scoped-out. Construction vibration is also scoped out and would managed in accordance with good practice guidance.</p> |



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Scope of the Assessment

10.3.8 The technical scope of this assessment has been established through an ongoing scoping process. As a result of this process, the technical scope of the assessment reported in this chapter comprises:

- construction noise onsite for wind turbines, infrastructure and associated tracks;
- construction noise offsite for construction vehicles arriving and departing the Site on the road network near the Site entrance (topic not suggested at scoping but included by the Applicant for completeness); and
- wind turbines operational noise overall noise levels, inclusive of cumulative impact with nearby other wind turbines / farms.

10.3.9 The following matters are considered unlikely to result in likely significant effects, and therefore have been scoped out of the assessment, as agreed through the EIA scoping process:

- Blade Laydown Area Construction Noise
- Abnormal Indivisible Loads Route (AILR) Points of Interest (POI) Construction Noise
- BESS Construction and Decommissioning Noise
- BESS and substation Operational Noise
- Wind Turbines Decommissioning
- Wind Turbines Operational Ground Borne Vibration
- Wind Turbines Operational Noise, Low Frequency, and
- Wind Turbines Operational Noise, Amplitude Modulation.

10.3.10 The rationale for matters scoped out is detailed below in **Table 10.3**.

Table 10.3 Receptor/Matters Scoped Out of Further Assessment

| Receptor/ Matter | Phase | Justification | Change since EIA Scoping? |
|---|--------------|--|---------------------------------|
| Blade Laydown Area Construction Noise | Construction | Activities that would occur during the construction of the Blade Laydown Area (BLA) will include earthwork in a field likely to be adjacent to the A487. The construction of the BLA will likely include activities near residential properties near the A487 but this will be of a relatively small scale and very short in duration and as such is unlikely to have a significant noise impact. Accordingly, it was not assessed, however good practice during construction will be employed. Similarly, the occurrences | No |



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| Receptor/ Matter | Phase | Justification | Change since EIA Scoping? |
|--|--------------|---|---------------------------------|
| | | of abnormal loads going through the BLA for AIL deliveries of large components will also be very short and rare occurrences so it was scoped-out. | |
| BESS Construction and Decommissioning Noise | Construction | The main construction activities will for the Proposed Development be those associated with the wind turbines (assessed in this ES) and comparatively construction from BESS are relatively light construction activities. As such no BESS construction and decommissioning noise assessment was undertaken. | No |
| BESS and substation Operational Noise | Operation | The BESS and substation element of this Proposed Development will be of a relatively small scale (up to 20 MW) and at least 1.2 km from the nearest receptor (Maespyllan). At such a scale and distance, it is very unlikely that operational noise from the BESS and substation would have a significant impact effect, therefore it was scoped-out. | No |
| Wind Turbines Decommissioning | Decommission | Decommissioning noise would be equal or less to construction noise. | No |
| Wind Turbines Operational Ground Borne Vibration | Operation | Ground borne vibration from the operation of wind turbines is known to be low therefore on that basis it is not considered necessary to carry out a specific assessment of perceptible vibration, so it has been scoped out. However, further information on this topic can be found in Appendix 10.2 . | No |
| Wind Turbines Operational Noise, Low Frequency | Operation | Appendix 10.2 details latest research on Low Frequency Noise (LFN) from operation wind turbines and concludes that 'It is therefore not considered necessary to carry out specific assessments of LFN and it has not been considered further in the noise | No |



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| Receptor/ Matter | Phase | Justification | Change since EIA Scoping? |
|--|-----------|--|---------------------------------|
| | | <p>assessment'. Furthermore, as shown in the above Table 10.1 and Additional Consultation</p> <p>10.3.11 Error! Not a valid bookmark self-reference. provides a summary of the additional consultation activities undertaken in support of the preparation of this assessment outside of the EIA Scoping process.</p> <p>Table 10.2 summarising the consultation responses, the requirement for assessing LFN was discussed with Gwynedd Council. Ultimately it is not a topic that can be assessed at the planning stage so was scoped-out.</p> | |
| Wind Turbines Operational Noise, Amplitude Modulation | Operation | <p>Appendix 10.2 details latest research on this topic and concludes that 'In light of the latest research and evidence on Other AM (also called Excess AM), there are no available method to assess the potential occurrence or significance of Other AM at a specific site when at the planning stage and no wind turbines are operating.' Furthermore, as shown in the above Table 10.1 and Additional Consultation</p> <p>10.3.12 Error! Not a valid bookmark self-reference. provides a summary of the additional consultation activities undertaken in support of the preparation of this assessment outside of the EIA Scoping process.</p> <p>Table 10.2 summarising the consultation responses, the requirement for assessing Other AM was discussed with Gwynedd Council. Ultimately it is not a topic that can</p> | No |



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| Receptor/ Matter | Phase | Justification | Change since EIA Scoping? |
|---------------------|-------|---|---------------------------------|
| | | be assessed at the planning stage so was scoped-out. | |

10.4 Methodology

- 10.4.1 This assessment has been undertaken in accordance with the following legislation, and with regard to the following planning policy and guidance. It should be noted that this chapter does not assess the compliance of the Proposed Development against relevant planning policy. Such an assessment is presented in the **Planning Statement**.

Legislation

- Control of Pollution Act 1974 (COPA) (UK Parliament, 1974) - To protect the amenity of local residents, construction noise activities would be controlled under the COPA), which includes provisions on the control of noise pollution. In particular, Part III Section 60 of the COPA refers to the control of noise on construction sites. It provides that a Local Planning Authority can serve a notice imposing requirements regarding the way in which works are to be carried out, including controlling noise from construction sites to prevent disturbance occurring. The COPA also includes provision that the Secretary of State may prepare codes of practice to give guidance on methods of minimising noise and requires the Secretary of State to approve a code of practice for carrying out works to which section 60 applies. BS 5228 has been approved as a code of practice by the Secretary of State.
- The Environmental Protection Act 1990 (UK Parliament, 1990) supersedes much of the COPA 74 (though COPA 74 is still relevant for construction noise), and Section 79 allows action to be taken where a noise is likely to be harmful to health or a nuisance. This legislation is, however, for 'after the event' i.e. for use if a harmful noise is present, and not for planning purposes, where a harmful noise is yet to be established.

National Planning Policy

- 10.4.2 The Proposed Development is considered as a Development of National Significance (DNS) therefore the planning application will have due regard to all material considerations, especially National Planning Policy such as Future Wales: The National Plan 2040 and Planning Policy Wales. Local Policies may also be relevant, albeit with a lower importance. The most relevant are:
- Future Wales: The National Plan 2040 (Welsh Government, 2021) - was published in February 2021; it is the national development framework for Wales and has Development Plan status. Policies 17 and 18 confirm that proposals for renewable and low carbon energy projects will be permitted subject to certain criteria including no unacceptable adverse noise impacts.



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- Planning Policy Wales (Welsh Government, 2024) - details the land use planning policies of the Welsh Government. Section 6.7 Air Quality and Soundscape (Para 6.7.15) – Identifies the importance of creating appropriate soundscapes to enhance well-being, highlighting that planning authorities should consider both the positive and negative impacts of noise.
- Designing for Renewable Energy in Wales (Design Commission for Wales, December 2023) - issued in December 2023 by the Design Commission for Wales sets out the key design objectives and considerations for the sensitive development of large-scale onshore wind and solar farms as well as ancillary development in Wales This document updates and expands on the previous Designing Wind Farms in Wales 2014 good practice guidance. The guidance states that the Welsh Government has endorsed the current UK wind turbine assessment guidance as set out in ETSU-R-97 and the Institute of Acoustics 'A Good Practice Guide...' (IOA GPG).
- Noise Soundscape Action Plan 2023–2028 (NSAP) (Welsh Government, June 2023) - Section 5.3 Onshore Wind Turbines states that ETSU-R-97 and the IOA GPG represent the most up-to-date professional guidance, and their use is endorsed by the Welsh Government. The document goes on to state that following the issue of the WSP Report (produced for the Department for Business, Energy & Industrial Strategy (BEIS)), current UK guidance would benefit from being updated. However no actual alternative guidance is proposed in the WSP BEIS Report, an no final¹ updated guidance by the UK Government has been issued at the time of writing this assessment. The NSAP also indicate that the old 1997 Technical Advice 11 (TAN 11) on Noise is being updated. At the time of writing, ETSU-R-97 and the IOA GPG represent the most relevant technical planning guidance for noise from wind farms in Wales.

Local Planning Policy

10.4.3 The Proposed Development and surrounding receptors are located within the administrative areas of Gwynedd Council. There are also very few remote and distant receptors within Conwy County Borough Council which are considered in this noise assessment. The following is judged to be the most relevant:

- Gwynedd Council Local Development Plan with Anglesey, adopted July 2021 - This plan covers parts of Conwy County Borough Council known as Plan Area which excludes Snowdonia National Park area. The LDP sets out key issues for the council to address in Gwynedd and specifically states:

'The Strategic Policy (PS 1) and Policies ADN 1 (Onshore Wind Energy), ADN 2 (Solar PV Energy) and ADN 3 (Other Renewable and Low Carbon Energy Technology) seek to ensure that the area fulfils its potential as a lead area for initiatives based on renewable or low carbon technologies as well as

¹ It is acknowledged that the UK Government issued a consultation document on 4 July 2025 for new wind turbine noise guidance, however the document cover page clearly states 'This draft guidance update does not represent a final position from government. It should not be used by local planning authorities during or after the consultation period in relation to ongoing planning applications.'



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balancing the impact of renewable energy developments on the environment and communities.'

10.4.4 Section 2.23 of the LDP also states (under Natural Resources Policy):

'In accordance with the Environment (Wales) Act 2016 the Welsh Government published a Natural Resources Policy (NRP) in August 2017. The focus of the NRP is the sustainable management of Wales' natural resources, to increase their contribution to achieving the aims of the Well-being of Future Generations Act. The NRP identifies three National Priorities: Finding nature-based solutions; increasing renewable energy and more efficient use of resources; and adopting a place-based approach. The NRP also sets the context for Area Statements (which will be produced by Natural Resources Wales), ensuring that the national priorities for the sustainable management of natural resources inform local delivery. Local Planning Authorities will need to have regard to the relevant area statement when preparing an LDP. Both the North West Area Statement and Marine Area Statement are of relevance to the JLDP area. The implications of the relevant NRP and Area Statement will be considered in the preparation of the Revised Plan.'

Guidance

- British Standard 5228-1: 2009+A1:2014 'Code of practice for noise and vibration control on construction and open developments – Noise' (BS 5228) (The British Standards Institution, 2025) - This noise guidance considered for construction noise.
- ETSU-R-97 'The Assessment and Rating of Noise from Wind Farms' (The Working Group on Noise from Wind Turbines, 1996) and the Institute of Acoustics 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise' from May 2013 (IOA GPG) (Institute of Acoustics, 2013) - For operational wind turbine noise and these are all described in more detail where relevant throughout this chapter.
- Design Manual for Roads and Bridges, LA 111 Noise and Vibration (2020) (Highways England, 2020)
- ISO 9613-2 Attenuation of sound during propagation outdoors Part 2: Engineering method for the prediction of sound pressure levels outdoors (International Standards Organisation, 2024)
- The Calculation of Road Traffic Noise (CRTN) (Department of Transport, 1988)

10.4.5 Further information on these documents can also be found in **Appendix 10.1** and **Appendix 10.2**

Baseline Characterisation

Extent of the Study Area

10.4.6 Only residential properties that lawfully exist or have extant planning permission are considered to be noise sensitive receptors. The study area includes the nearest



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receptors (i.e. residential properties) found in any wind direction from either the turbines or tracks. All most relevant receptors found are shown in **ES Volume IV, Figure 10.1: Noise Assessment Locations for Construction of Wind Turbines** and **ES Volume IV, Figure 10.2: Noise Assessment Locations for Operational Wind Turbine Noise**. Those assessed in detailed are shown as Construction Noise Assessment Locations in **ES Volume IV, Figure 10.1** and Noise Assessment Locations in **ES Volume IV, Figure 10.2**.

- 10.4.7 Other nearby wind turbines/farms found to be within 10 km of the Proposed Development were also considered at the core of the noise assessment (not as a separate topic at the end) due to the requirement of testing what is called “Total Noise Limits” against cumulative noise predictions at an early stage in the assessment process. Those identified and considered for cumulative noise are Hafotty Uchaf & Bryn Ffynnon (5 turbines operating 3.4 km to the north), Disgarth Uchaf & Ty'n Gwyn (2 turbines operating 5.7 km to the north-east), Gaerwen (9 turbines in planning (ES Submitted to PEDW) 6.4 km to the east) and Moel Chwa (12 turbines at scoping 5.7 km to the north-east), illustrated within **ES Volume IV, Figure 10.2**.

Construction Phase

- 10.4.8 The nearest and more sensitive receptors for construction noise would be these nearest to the site entrance and temporary construction compound. As examples, Ty'r Neuadd would be approximately 35 m from the access tracks at the site entrance junction, 190 m from the construction compound and 313 m from a borrow pit. Other receptors in this area found would also include for example Llywyn-y-brain, Llaithgwm, Ty Capel Glan yr Afon and Wern Fawr.
- 10.4.9 A total of nine Construction Noise Assessment Locations (CNALs) were chosen as representative of the nearest NSRs. The CNALs chosen were the closest receptors to proposed wind turbine access tracks, construction compound, borrow pit and wind turbine foundations and these are presented in **ES Volume IV, Figure 10.1**.
- 10.4.10 The CNALs refer to the position on the curtilage of a property where the predictions of construction noise levels have been made, as detailed in **Table 10.4** below.

Table 10.4 Construction Noise Assessment Locations

| Receptor | Eastings | Northings |
|------------------------------|----------|-----------|
| CNAL01-Greigwen | 292970 | 342354 |
| CNAL02-Ty'n-y-Ddol Uchaf | 292439 | 342182 |
| CNAL03-Maespyllan | 292377 | 341785 |
| CNAL04-Llwyn-y-brain | 291459 | 341346 |
| CNAL05-Llaithgwm (FI) | 292098 | 341041 |
| CNAL06-Ty Capel Glan yr Afon | 291036 | 341027 |
| CNAL07-Ty'r Neuadd | 291036 | 340933 |

| Receptor | Eastings | Northings |
|----------------------------|----------|-----------|
| CNAL08-Wern Fawr | 291373 | 340664 |
| CNAL09-Pentre-tai-yn-y-cwm | 295563 | 340272 |

Operational Phase

- 10.4.11 The more sensitive receptors for operational noise would be these nearest to the proposed wind turbines.
- 10.4.12 A total of twelve Noise Assessment Locations (NALs) were chosen as representative of the nearest NSRs and they are shown on **ES Volume IV, Figure 10.2** and detailed in **Table 10.5** below.
- 10.4.13 The NALs refer to the position in the curtilage of a property and predictions of wind turbine noise have been made at each of the NALs. This approach ensures that the assessment considers the worst case (highest) noise level expected at each NAL. **Table 10.5** also details which NML has been used to set noise limits for each NAL.

Table 10.5 Wind Farm Operational Noise Assessment Locations

| Receptor | Eastings | Northings | Elevation (m AOD) | Approximate distance to nearest proposed turbine* (m) | Background noise data used |
|-------------------------|----------|-----------|-------------------|---|----------------------------|
| NAL01 Greigwen | 292970 | 342354 | 316 | 1,032 (T02) | NML02 |
| NAL02 Ty'n Y Ddol Uchaf | 292439 | 342182 | 360 | 1,291 (T02) | NML02 |
| NAL03 Maespyllan | 292377 | 341785 | 383 | 1,074 (T01) | NML02 |
| NAL04 Llaithgwm | 292130 | 341006 | 385 | 928 (T01) | NML01 |
| NAL05 Penmaen Uchaf | 292953 | 339133 | 310 | 1,793 (T04) | NML04 |
| NAL06 Creigiau Uchaf | 294675 | 339377 | 366 | 1,264 (T04) | NML04 |
| NAL07 Pentre | 295563 | 340272 | 361 | 957 (T10) | NML03 |
| NAL08 Cwm Cywen | 296940 | 341252 | 359 | 1,876 (T10) | NML02 |
| NAL09 Cwm Llan | 296104 | 343009 | 414 | 1,801 (T05) | NML02 |
| NAL10 Rhyd Yr Ewig | 293355 | 343343 | 382 | 1,637 (T06) | NML02 |



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| Receptor | Eastings | Northings | Elevation (m AOD) | Approximate distance to nearest proposed turbine* (m) | Background noise data used |
|--|----------|-----------|----------------------|---|--|
| NAL11 Gellioedd Uchaf | 293067 | 344924 | 328 | 3,120 (T05) | N/A- Only predictions done at these two NALs. |
| NAL12 Castell | 292538 | 345169 | 376 | 3,600 (T05) | |
| * Please note the distances to nearest turbines quoted above may differ from those reported elsewhere in the ES. Distances for the noise assessment are taken from the nearest turbine to the closest edge of the amenity area (usually the garden). | | | | | |

- 10.4.14 It should be noted that the NALs 11-12 are distant from the Proposed Development and nearer the five operational wind turbines of Hafotty Huchaf and Bryn Ffynnon. They were selected for an initial test to determine if predictions from the Proposed Development are within 10 dB of the total noise immission level (predictions test only, no background / limits required), and it was found that the Proposed Development would not contribute to cumulative noise at these two receptors (i.e. at these receptor wind turbine noise will be from the existing operational turbines only). Therefore, NAL11 and 12 are not considered further.

Desk Study

- 10.4.15 Prior to the commencement of the baseline noise survey, initial desktop noise modelling was undertaken to identify nearby NSRs (i.e. residential properties) and suitable locations to monitor background noise. The list of identified receptors and proposed Noise Monitoring Locations (NMLs) were included in a consultation letter issued to Gwynedd Council and Conwy County Borough Council as part of the consultation process (



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10.4.16 **Additional Consultation**

10.4.17 Error! Not a valid bookmark self-reference. provides a summary of the additional consultation activities undertaken in support of the preparation of this assessment outside of the EIA Scoping process.

10.4.18 Table 10.2).

Field Study(s)

10.4.19 A baseline noise survey was undertaken between the 17 of October 2024 and 16 December 2024 at four Noise Monitoring Locations shown in **ES Volume IV, Figure 10.2**. This was to determine the existing background noise levels representative for the most relevant NSRs neighbouring the Proposed Development and details are included in the baseline condition **Section 10.5**.

Assessment Methodology

Wind Turbines Construction Noise (Onsite) Methodology

10.4.20 A construction noise assessment was undertaken for onsite work on the proposed tracks, substation, borrow pit and wind turbines. Onsite here is defined as being on the main site for the wind turbines and associated tracks leading to the junction with the B4501 road.

10.4.21 The onsite construction activities were assessed using guidance contained in BS 5228: Part 1 2009+A1:2014 (BS 5228), following these steps:

- identify the NSRs near potential construction activities and select representative Construction Noise Assessment Locations (CNALs);
- identify the applicable threshold of significant effects from BS 5228;
- predict the noise levels for various construction noise activities scenarios;
- compare predicted noise levels against the applicable threshold;
- where necessary, develop suitable mitigation measures to minimise any significant adverse effects during the construction phase; and, if required
- assess any residual adverse effects taking into account any identified mitigation measures.

10.4.22 Construction would be undertaken in several successive phases. During each phase the type of plant, the location of plant, and noise levels would be key parameters influencing the noise generated at the CNALs. The selection of plant and equipment to be used would be determined by the main contractor and detailed arrangements for onsite management would be decided at that time. This assessment has therefore been based upon a typical selection of plant for a project of this size and assesses a number of construction scenarios which have been chosen to represent the likely noisiest activities that would occur across the construction phases. For each scenario the plant has been modelled operating in the closest activity areas to each receptor for any given activity, whereas in reality



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plant will move around the Site and for much of the time would be operating at more distant locations.

10.4.23 The full construct period is anticipated to last 21 months. The core hours for construction activity are anticipated to be in accordance with Gwynedd Council preferred core hours of 08:00 - 18:00 Monday to Friday and 08:30 – 13:00 on Saturdays. No regular work is proposed in the evenings / nights or on Sundays. The requirement for out-of-hours work could arise, for example, from delivery and unloading of abnormal loads, foundation pours, or health and safety requirements, or to ensure optimal use is made of fair weather windows for the erection of turbines and the erection and dismantling of cranes. No scheduled construction is anticipated during the night-time, although, there may be a requirement for some plant to be operational during night-time, for example, a portable generator to provide lighting. Should there be work outside of these hours, it will be agreed in advance with Gwynedd Council.

10.4.24 For the purposes of this assessment noise modelling has been undertaken for a number of construction scenarios:

- Scenario 01 (Day) – Construction of tracks from the Site entrance to the compound.
- Scenario 02 (Day) – Construction of all tracks from the compound to the wind turbines.
- Scenario 03 (Day) - Construction of the turbine foundations.
- Scenario 04 (Day) – Turbine delivery and erection.
- Scenario 05 (Day) – Borrow pit works.
- Scenario 06 (Evening/night-time) - Generator left on at the compound (to consider potential occurrence of noise in the evening/night-time outside of the core hours).

10.4.25 The scenarios were modelled to represent some of the ‘noisiest’ anticipated scenarios. Other construction activities not included in the noise models would occur, however, the noise output from these would be less than those considered above and have been scoped out of further assessment.

10.4.26 The noise-generating equipment assessed for each construction phase is detailed in **Appendix 10.1**. It is noted that for much of the working day the noise associated with construction activities would be less than predicted, as the assessment has assumed all equipment is constantly operating at full power, and is located at the closest point to each receptor, whereas in practice equipment load and precise location would vary.

Wind Turbines Construction Noise (Offsite) Methodology

10.4.27 Offsite construction traffic was assessed to consider noise due to construction vehicles such as site workers cars and heavy goods vehicle (HGV) deliveries near the Site entrance along the B4501. The receptors found along the B4501 assessed as an example of receptors along that road are Ty'r Neuadd and Ty Capel Glan yr Afon near the site entrance.



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- 10.4.28 The baseline traffic on the B4501 (before anticipated construction start) was provided by the Transport Consultant as well as forecasted total traffic flows during the construction peak periods. The data was provided as AAWT 18h and % HGV and was used to calculate, in a noise modelling software, the noise levels from road traffic before construction and during construction.
- 10.4.29 The increase in noise levels due the change in traffic flows is assessed against Table 3.17 of the LA 111 Noise and Vibration from DMRB.

Wind Turbines Operational Noise Methodology

- 10.4.30 The wind farm operational noise assessment has been undertaken in accordance with ETSU-R-97 and the IOA GPG and a detailed assessment is included in **Appendix 10.2**.
- 10.4.31 ETSU-R-97 provides a robust basis for determining acceptable noise limits for wind farm developments. Limits in ETSU-R-97 differ between daytime and night-time periods. The daytime criteria are based upon background noise levels measured during the 'quiet periods of the day' comprising:
- All evenings from 18:00 - 23:00
 - Saturday afternoons from 13:00 - 18:00, and
 - All day Sunday 07:00 - 23:00.
- 10.4.32 For the avoidance of doubt the limits set based upon the background data collected during the quiet daytime period apply to the entire daytime period (07:00 – 23:00).
- 10.4.33 Night-time periods are defined as 23:00 - 07:00 with no differentiation made between weekdays and weekends.
- 10.4.34 ETSU-R-97 suggests that the daytime fixed minimum limit criteria should be set somewhere in the range between 35(A) and 40 dB(A). The choice of criterion level within the range 35 - 40 dB(A) depends on three factors, 1) the number of dwellings in the neighbourhood of the wind farm, 2) the effect of noise limits on the number of kWh generated and 3) the duration and level of exposure to any noise.
- 10.4.35 A detailed commentary is provided in **Appendix 10.2** to consider the three factors and it was found that the higher end of the range 35 – 40 dB(A) can be used due to the low number of properties in the surroundings, the scale of the development with status as DNS with potential renewable energy generating capacity up to 72 MW, the cumulative considerations (other wind turbines/farms) and TNEI's experience working on wind farms of this scale in the UK. As such, this assessment uses a daytime fixed minimum limit of 40 dB(A).
- 10.4.36 The standard also suggests the use of a 45 dB fixed minimum in situations where a receptor is considered Financially Involved (FI).



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- 10.4.37 The Total Noise Limits rely on the full ETSU criteria which is related to background levels or fixed minimums whichever is the greatest. The criteria used in this assessment is summarised as follows:
- Daytime Without Financial Involvement: 40 dB or Background +5 dB;
 - Night-time Without Financial Involvement: 43 dB or Background +5 dB; and
 - Daytime & Night-time with Financial Involvement: 45 dB or Background +5 dB.
- 10.4.38 The acceptable limits for wind turbine operational noise are clearly defined for all time periods by the application of the ETSU-R-97 methodology. Consequently, the test applied to operational noise is whether or not the predicted wind turbine noise levels at nearby noise sensitive properties lie below the ETSU-R-97 derived noise limits. Depending on the levels of background noise, the satisfaction of the ETSU-R-97 derived limits can lead to a situation whereby, at some locations under some wind conditions and for a certain proportion of the time, the wind turbine noise would be audible.
- 10.4.39 In addition to ETSU-R-97, the recommendations included in the IOA GPG have been considered in the noise assessment.
- 10.4.40 The exact model of turbine to be installed on the Site will be the result of a future tendering process should consent be granted. Achievement of the Total Noise Limits determined by this assessment will be a key determining factor in the final choice of turbine for the Proposed Development. Predictions of wind turbine noise for the Proposed Development were made, based upon the sound power level data for the candidate wind turbine, the Enercon E175-EP5 E2 7 MW with a hub heights of either 112.5 m or 132.5 m depending on turbine location. The selected candidate turbine is considered representative of the type of turbine that could be installed at the Site.
- 10.4.41 Noise predictions have been undertaken using the propagation model contained within Part 2 of International Standard ISO 9613-2, 'Acoustics – Attenuation of sound during propagation outdoors' (ISO, 1996). The model calculates on an octave band basis, attenuation due to geometric spreading, atmospheric absorption and ground effects. The noise model was set up to provide realistic noise predictions, including mixed ground attenuation ($G=0.5$) and atmospheric attenuation relating to 70% Relative Humidity and 10 °C and a receiver height of 4 m.
- 10.4.42 Typically, wind farm noise assessments assume all properties are downwind of all turbines at all times (as this would result in the highest wind turbine noise levels). However, where properties are located in between groups of turbines they cannot be downwind of all turbines simultaneously, so it is appropriate to consider the effect of wind direction on predicted noise levels; the impact of directivity has been considered in the assessment.

Assessment of Cumulative Effects

- 10.4.43 Predictions of other nearby wind turbines/farms were also considered. The noise assessment has considered schemes which are operational, consented, proposed (planning application submitted) and also some at pre-application (scoping) within

approximately 10 km. The schemes found to be relevant and considered in the predictions are Hafotty Uchaf & Bryn Ffynnon (5 turbines operating 3.4 km to the north), Disgarth Uchaf & Ty'n Gwyn (2 turbines operating 5.7 km to the north-east), Gaerwen (9 turbines in planning (ES submitted to PEDW) 6.4 km to the east) and Moel Chwa (12 turbines at scoping 5.7 km to the north-east).

Assessment Criteria

Wind Turbines Construction Noise Criteria (Onsite)

- 10.4.44 The significance criteria adopted for this assessment are based on the ABC method and especially the Category A threshold which is the most stringent (i.e. applicable for low noise rural environments). The ABC method is found in Appendix E part E.3.2 of BS 5228-1:2009+A1:2014 and summary of the criteria used are detailed in **Table 10.6** below.

Table 10.6 Construction Noise Category A Criteria

| Category / Time Periods | Criteria Thresholds | |
|--|---------------------|--------------------|
| | Criteria Met | Criteria Exceeded |
| Category A / Daytime (07:00 - 19:00) and Saturdays (07:00 - 13:00) | ≤65 dB LAeq, 12 hr | >65 dB LAeq, 12 hr |
| Category A / Evenings and Weekends (19:00 - 23:00) | ≤55 dB LAeq, 12 hr | >55 dB LAeq, 12 hr |
| Category A / Night-time (23:00 - 07:00) | ≤45 dB LAeq, 12 hr | >45 dB LAeq, 12 hr |

- 10.4.45 It should be noted that exceedance of the thresholds does not in itself indicate a significant effect, rather, the standard states *'If the site noise level exceeds the appropriate category value, then a potential significant effect is indicated. The assessor then needs to consider other project-specific factors, such as the number of receptors affected and the duration and character of the impact, to determine if there is a significant effect.'*

Construction Traffic Noise Criteria (Offsite)

- 10.4.46 The significance of the increase in noise levels due the change in traffic flows offsite on the local road network is assessed with regard to Table 3.17 of the LA 111 Noise and Vibration from DMRB, as summarised in **Table 10.7** below.

Table 10.7 Construction Traffic Noise (offsite) Increase Significance Criteria

| Effect | Criteria Thresholds | |
|---|---|--|
| | Criteria Met, No Significant Effect | Criteria Not Met, Significant Effect |
| Increase in traffic noise due to construction traffic offsite | 1-3 dB increase (Minor) Less than 1 dB increase (Negligible) | 3-5 dB increase (Moderate) >5 dB increase (Major) |

Wind Turbines Operational Noise Criteria

- 10.4.47 ETSU-R-97 does not define significance criteria but describes a framework for the assessment of wind farm noise and gives noise limits considered to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable restrictions on wind farm development which should be recognised as having wider national and global benefits. Achievement of ETSU-R-97 derived noise limits ensures that wind turbine noise will comply with current Government guidance.
- 10.4.48 The use of the term 'significance' in this chapter in relation to operational wind turbine noise refers to compliance/non-compliance with the ETSU-R-97 derived noise limits. For the purpose of this EIA, where predicted wind turbine noise meets or is less than the ETSU-R-97 noise limits then the noise effects are deemed to be not significant, and any breach of the ETSU-R-97 noise limits is deemed to result in a significant effect.

Key Parameters for Assessment

- 10.4.49 The wind turbine operational noise has been predicted based on a candidate wind turbine model and with the addition of other nearby wind turbines. The prediction assumptions, especially the prediction noise model input source data and geographical locations of turbines, are key assumption parameters for this noise assessment.

10.5 Baseline Conditions

Existing Baseline

- 10.5.1 The Site is located within a relatively remote area, north-east of the town of Bala, Gwynedd, within Gwynedd Council area, and close to the border with Conwy Council area which is to the north. The approximate UK eastings and northings of the centre of the Site is 293766, 341168.
- 10.5.2 The properties surrounding the Proposed Development are mainly single, rural dwellings, including farmhouses and holiday cottages which are scattered throughout the area.



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- 10.5.3 There are other operating wind turbines / farms in the area although these are relatively distant from the receptors which are nearest to the Proposed Development. The most relevant operational turbines are Hafotty Uchaf & Bryn Ffynnon (5 turbines operating 3.4 km to the north), Disgarth Uchaf & Ty'n Gwyn (2 turbines operating 5.7 km to the north-east). These operational wind turbines are too far away from any relevant noise monitoring proposed and undertaken for the Proposed Development, so are not considered to be part of the baseline at receptors closest to the Proposed Development.

Noise Monitoring Locations

- 10.5.4 A detailed noise survey was undertaken in accordance with the guidance contained within ETSU-R-97 and the IOA GPG.
- 10.5.5 Noise monitoring equipment was installed at four Noise Monitoring Locations (NMLs) on the 17 October 2024 as detailed in **Table 10.8**. An installation report was sent to the EHOs at both councils afterwards. The noise monitoring equipment were removed on 16 November at one location (at the request of resident) and on 16 December 2024 at the other three locations. The selection of the NMLs considered local noise sources such as watercourses and vegetation. More information on the NMLs including exact survey dates, noise monitoring equipment used, the maximum calibration drift and dominant noise sources noted is in Section 5 of **Appendix 10.2**.

Table 10.8 Summary of Noise Monitoring Locations

| NML/ Receptor Name | Easting | Northing | Measurement Period |
|--------------------------|---------|----------|--|
| NML1 - Llaithgwm | 292130 | 292130 | The soundscape at this location consisted of noise from small water courses, which were located all around the property, but in particular noise from a water course from a field to the north where it was judged too close to watercourse. The exact kit location was selected on the eastern edge of the field to move the kit away from watercourses and to remove the risk of damage from animals in the adjacent fields surrounding. The watercourses were faintly audible from this location and the dominant noise was the wind induced foliage noise. A number of farm animals such as sheep, goats, cows, and dogs were also audible on occasions. |
| NML2 – Greigwen | 292970 | 342354 | The soundscape at this location consisted of wind-induced noise, which was dominant, followed by wind induced foliage rustle. No other aspects of the soundscape have been identified. Very quiet isolated rural location relatively elevated above the valley and |



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| NML/ Receptor Name | Easting | Northing | Measurement Period |
|----------------------------|---------|----------|---|
| | | | exposed to south westerly winds (topography slope from south-west to north-east). |
| NML3 – Cwm Hwylfod | 296940 | 341252 | The noise monitoring equipment was installed in a field immediately north of the dwelling at Cym Hwylfod, which is also immediately south of Pentre. The soundscape at this location consisted of sheep calls, some foliage rustle, and a small watercourse towards the north which was faintly audible. |
| NML4 – Penmaen Uchaf | 292953 | 339133 | The noise monitoring equipment was installed in a field along the track between Penmaen Ganol and Penmaen Uchaf, where it was agreed with the landowner that cattle could not access the equipment. Another alternative location was considered with the landowner on the day, further south at the unoccupied dwelling of Penmaen Ganol, however this would have been within a few metres of another watercourse and may have required building fences to avoid cattle accessing the equipment so the alternative location was not used. The soundscape at this location consisted of wind-induced foliage rustle, which was dominant, there was also a water course towards the east which was audible. Very remote and isolated derelict property. |

10.5.6 A comprehensive dataset was analysed inclusive of measured noise levels at the NMLs, wind speed data collected on a LIDAR device onsite and also rain data collected on the ground near some NMLs.

10.5.7 In line with the recommendations included in Section 3.1.19 of the IOA GPG, a polynomial line of best fit has been derived through each dataset for the daytime and night-time periods to establish prevailing background noise levels per wind speed. Any data that has been excluded due to rain, directional filtering or manual exclusions (where data was considered to be atypical) are shown on the figures, and explained in detail in **Appendix 10.2**. Due to the presence of watercourse near the NMLs, an analysis of historical rainfall was undertaken, and it was found that rainfall during the survey was below average.

10.5.8 Wind speed data were measured using the LiDAR unit at several heights. The wind data measured at 140 m and 120 m heights was used to calculate 135 m height wind speeds, which was then standardised to a height of 10 m in accordance with current good practice. Thus, the background data and limits are to consider wind turbines up to 135 m hub height, and would be worst-case for wind turbines with lower hub height.

10.5.9 **Table 10.9** and **Table 10.10** provide a summary of the background noise levels measured during the monitoring period for the ETSU-R-97 quiet daytime and night-time periods. Further information of the data recorded during the noise survey can be found in Section 5 of **Appendix 10.2**.

Table 10.9 Background Noise Levels during Quiet Daytime (LA90, 10 mins dB)

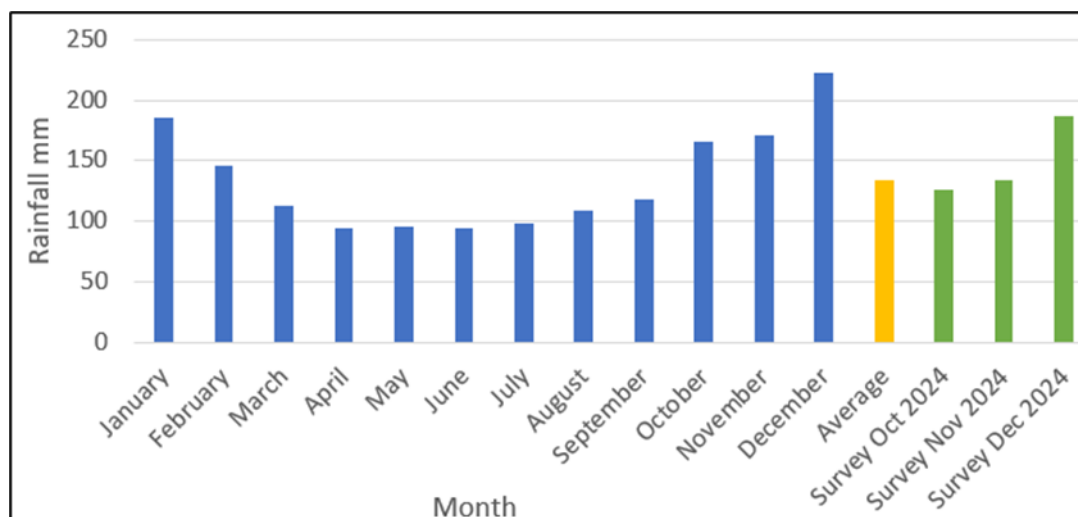
| Noise Monitoring Location (NML) | Wind Speed (m/s) as standardised to 10 m height | | | | | | | | | | | |
|---------------------------------|---|------|------|------|------|------|------|------|------|------|------|------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| NML1 | 36.2 | 36.2 | 36.5 | 36.9 | 37.5 | 38.2 | 39.2 | 40.3 | 41.5 | 43.0 | 44.6 | 46.4 |
| NML2 | 27.3 | 27.3 | 27.7 | 28.3 | 29.3 | 30.5 | 32.0 | 33.8 | 35.9 | 38.3 | 41.0 | 43.9 |
| NML3 | 40.9 | 41.6 | 42.2 | 42.8 | 43.5 | 44.1 | 44.7 | 45.4 | 46.0 | 46.7 | 47.3 | 47.9 |
| NML4 | 28.8 | 29.7 | 30.7 | 31.6 | 32.5 | 33.4 | 34.3 | 35.2 | 36.1 | 37.0 | 37.9 | 38.8 |

Table 10.10 Background Noise Levels during Night-time (LA90, 10 mins dB)

| Noise Monitoring Location (NML) | Wind Speed (m/s) as standardised to 10 m height | | | | | | | | | | | |
|---------------------------------|---|------|------|------|------|------|------|------|------|------|------|------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| NML1 | 35.2 | 35.6 | 36.0 | 36.7 | 37.4 | 38.3 | 39.3 | 40.4 | 41.6 | 43.0 | 44.5 | 46.1 |
| NML2 | 28.0 | 28.0 | 28.2 | 28.7 | 29.6 | 30.7 | 32.1 | 33.8 | 35.9 | 38.2 | 40.8 | 43.7 |
| NML3 | 40.9 | 41.4 | 41.9 | 42.4 | 42.9 | 43.5 | 44.0 | 44.5 | 45.0 | 45.5 | 46.1 | 46.6 |
| NML4 | 29.5 | 30.1 | 30.6 | 31.1 | 31.7 | 32.2 | 32.7 | 33.3 | 33.8 | 34.3 | 34.8 | 35.4 |

10.5.10 Graph 10.1 below presents a review of historical rain data (sourced from Met Office, for 10 year average) with the monthly rainfall during the survey in October to December 2024 (sourced from Met Office historical data for Wales). It shows that all months were below historical averages per individual month, and October and November were also below the yearly average.

Graph 10.1 Comparison of Long Term Rain Data and Rain Data recorded during Background Noise Survey



- 10.5.11 Upon review of the observations and data, it was noted that the running water noise was part of the environment at NML1, NML3 and NML4. At NML1, the influence was minimal as this was a minor unnamed stream of water through the courtyard near to where the outdoor residential amenity is found.
- 10.5.12 At NML3, the stream Nant Cefn-coch was approximately 35 m from the monitoring location, approximately 25 m from the nearby house of Pentre and 55 m from Cwn Hwylfod (both houses are intended to be represented by NML3). Given these relative distances and the fact that the survey at NML3 was only in October and November (not in December for this location) where historical rainfall was below average, it was judged that the measured data at NML3 should be representative of Pentre and Cwn Hwylfod.
- 10.5.13 At NML4, review of the time series indicated some unexpected changes in noise levels which could not be associated with a constant flow of water over the nearby local stream. The noise was at a certain level for a few days and suddenly would drop to much lower levels for several days and then suddenly raise again to much higher levels for several days, as if a generator of plant would come on at certain times and then switch off. This was investigated but the location is very remote (derelict property which is hard to access) and no human activities or plant was noted onsite. After a thorough investigation, it was found that a hydro-electric scheme operated on this stream, there is a reservoir above and pipeline underground not visible from the kit location. It is assumed that on some days the waterflow in the stream would be much higher when the water is not being released via the pipelines sending water to the generator station in the bottom of the valley. As can be seen on the time series and regression analysis graphics, a large amount of data was removed for all the days with elevated noise levels.

Future Baseline in the Absence of the Proposed Development

- 10.5.14 Noise limits for operational wind turbine noise would be set based on current background noise levels in the absence of wind turbine noise and would be set for the lifetime of the project. This is a likely worst-case assumption as it would not be expected that background levels would decrease over time (in the absence of the Proposed Development) in this rural location. The operator would be required to meet such limits for the duration of the consent.

10.6 Mitigation Embedded into the Design

- 10.6.1 No embedded mitigation is considered for construction noise.
- 10.6.2 For operational wind turbine noise, throughout the design process the layout of the Proposed Development was reviewed to optimise wind turbine numbers and locations, subject to a wide range of identified constraints inclusive of noise which was fully considered throughout the EIA process. Each layout modification was 'reviewed' by undertaking noise predictions to ensure noise limits could be met. The Site design process therefore satisfactorily minimised potential noise impacts, this is considered as embedded mitigation.

10.7 Assessment of Likely Effects (Without Additional Mitigation)

Wind Turbines Construction Noise (Onsite) Effects

- 10.7.1 The construction noise predictions are summarised in **Table 10.11** below. Further details of the modelling and assessment can be found in **Appendix 10.1**.

Table 10.11 Predicted Construction Noise Immission Levels

| CNAL | Immission Level, dB LAeq, t for each Scenario | | | | | |
|------------------------------|---|--------|--------|--------|--------|---------------------------|
| | S1 Day | S2 Day | S3 Day | S4 Day | S5 Day | S6 Evening/ Night-time |
| CNAL01-Greigwen | 19 | 28 | 29 | 28 | 19 | 14 |
| CNAL02-Ty'n-y-Ddol Uchaf | 21 | 31 | 30 | 30 | 19 | 17 |
| CNAL03-Maespyllan | 19 | 37 | 34 | 35 | 23 | 11 |
| CNAL04-Llwyn-y-brain | 44 | 40 | 39 | 40 | 31 | 39 |
| CNAL05-Llaithgwm (FI) | 25 | 55 | 29 | 51 | 46 | 13 |
| CNAL06-Ty Capel Glan yr Afon | 51 | 41 | 40 | 42 | 52 | 40 |
| CNAL07-Ty'r Neuadd | 61 | 41 | 39 | 46 | 52 | 39 |



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| CNAL | Immission Level, dB LAeq, t for each Scenario | | | | | |
|----------------------------|---|--------|--------|--------|--------|---------------------------|
| | S1 Day | S2 Day | S3 Day | S4 Day | S5 Day | S6 Evening/ Night-time |
| CNAL08-Wern Fawr | 43 | 40 | 34 | 39 | 50 | 33 |
| CNAL09-Pentre-tai-yn-y-cwm | 4 | 27 | 35 | 32 | 16 | Nil |

- 10.7.2 The Scenario S1 has the highest predicted levels of all daytime Scenarios S1-S5 due to the earthwork associated with building the tracks at the Site entrance along the B4501 immediately near CNAL07-Ty'r Neuadd. However, this work is temporary and levels are still predicted to be below the Category A daytime Threshold Levels of 65 dB(A). The results show that the predicted construction noise levels are below the Threshold Levels at all CNALs for all daytime scenarios S1-S5.
- 10.7.3 The predicted noise levels for the evening / night scenario S6 are well below the evening and weekend threshold level of 55 dB(A) and night-time threshold level of 45 dB(A).
- 10.7.4 Therefore, no significant effect from onsite construction activities for the wind turbines and access tracks are anticipated. Additional noise mitigation measure in the form of good practice is still suggested to keep the effects the lowest possible.

Wind Turbines Construction Noise Traffic (Offsite) Effects

- 10.7.5 The receptors found along the B4501 near the site entrance were assessed as an example of potential impact expected at all receptors along that road section. The receptors considered as Ty'r Neuadd and Ty Capel Glan yr Afon.
- 10.7.6 The traffic data provided by the transport consultant included 18h AAWT traffic flows for the B4501 for a '2035 Base' scenario (without Proposed Development) and a '2035 Base + Construction worst-case week' scenario (during construction, month 8 is the worst-case). The percentage of HGV was also provided for both scenarios. The traffic data is summarised as follows:
- 2035 Base: 1533 vehicles AAWT 18h and 12% HGV
 - 2035 Base + Construction worst-case week: 1636 vehicles AAWT 18h and 15% HGV
- 10.7.7 The traffic flow data and the percentage of HGV was modelled in CadnaA using the CRTN method to calculate a predicted noise level in dB LA10,18hr at each receptor for both scenarios, thus allowing an assessment of the change in noise levels associated by increased traffic caused by construction vehicles.
- 10.7.8 A +1 dB increase is predicted at the receptors along the A482, this is a Minor increase and no significant effect is anticipated for offsite construction traffic.



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Wind Farm Operational Noise Effects

- 10.7.9 The Daytime and Night-time Total Noise Limits have been established for each of the NALs based on Fixed Minimum values set out in the methodology section and based on the background noise levels from representative NMLs. The Total ETSU-R-97 Noise limits are included in **Table 10.12** and **Table 10.13** below.
- 10.7.10 A series of graphs are also included as Figures A1.3a-o within Annex 1 of **Appendix 10.2** to provide a graphical illustration of the noise impact assessment for each NAL. These figures show the predicted cumulative wind turbine noise (all wind farms / turbines considered operating together) compared to Total Noise Limits.
- 10.7.11 The cumulative noise predictions are also included in tabular form in **Table 10.12** and **Table 10.13** below along with exceedances results. A negative exceedance indicate that limits are met.

Table 10.12 Likely Cumulative Noise Assessment Daytime

| NAL | Limits, Predictions, Exceedances (in dB LA90) | Wind Speed (m/s) as Standardised to 10 m Height | | | | | | | | | |
|--------------------------|---|---|-------|------|------|------|------|------|------|------|-------|
| | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| NAL01- Greigwen | Total Noise Limit: ETSU-R-97 LA90 | 40 | 40 | 40 | 40 | 40 | 40 | 40.9 | 43.3 | 46 | 48.9 |
| | Predicted Cumulative Wind Turbine Noise LA90 | - | 30 | 34.9 | 38.4 | 39 | 39 | 39 | 39 | 39 | 39 |
| | Exceedance Level | - | -10 | -5.1 | -1.6 | -1 | -1 | -1.9 | -4.3 | -7 | -9.9 |
| NAL02- Ty'n Y Ddol Uchaf | Total Noise Limit: ETSU-R-97 LA90 | 40 | 40 | 40 | 40 | 40 | 40 | 40.9 | 43.3 | 46 | 48.9 |
| | Predicted Cumulative Wind Turbine Noise LA90 | - | 28.2 | 33.1 | 36.7 | 37.3 | 37.3 | 37.3 | 37.3 | 37.3 | 37.3 |
| | Exceedance Level | - | -11.8 | -6.9 | -3.3 | -2.7 | -2.7 | -3.6 | -6 | -8.7 | -11.6 |
| NAL03- Maespyll an | Total Noise Limit: ETSU-R-97 LA90 | 40 | 40 | 40 | 40 | 40 | 40 | 40.9 | 43.3 | 46 | 48.9 |
| | Predicted Cumulative Wind Turbine Noise LA90 | - | 29.2 | 34.2 | 37.8 | 38.3 | 38.3 | 38.3 | 38.3 | 38.3 | 38.3 |
| | Exceedance Level | - | -10.8 | -5.8 | -2.2 | -1.7 | -1.7 | -2.6 | -5 | -7.7 | -10.6 |



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| NAL | Limits, Predictions, Exceedances (in dB LA90) | Wind Speed (m/s) as Standardised to 10 m Height | | | | | | | | | |
|-----------------------------|--|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| NAL04- Llaithgw m | Total Noise Limit: ETSU-R-97 LA90 | 41.5 | 41.9 | 42.5 | 43.2 | 44.2 | 45.3 | 46.5 | 48 | 49.6 | 51.4 |
| | Predicted Cumulative Wind Turbine Noise LA90 | - | 28.8 | 33.8 | 37.4 | 37.9 | 37.9 | 37.9 | 37.9 | 37.9 | 37.9 |
| | Exceedance Level | - | -13.1 | -8.7 | -5.8 | -6.3 | -7.4 | -8.6 | -10.1 | -11.7 | -13.5 |
| NAL05- Penmaen Uchaf | Total Noise Limit: ETSU-R-97 LA90 | 40 | 40 | 40 | 40 | 40 | 40.2 | 41.1 | 42 | 42.9 | 43.8 |
| | Predicted Cumulative Wind Turbine Noise LA90 | - | 24.9 | 29.8 | 33.3 | 33.8 | 33.8 | 33.9 | 33.9 | 33.9 | 33.9 |
| | Exceedance Level | - | -15.1 | -10.2 | -6.7 | -6.2 | -6.4 | -7.2 | -8.1 | -9 | -9.9 |
| NAL06- Creigiau Uchaf | Total Noise Limit: ETSU-R-97 LA90 | 40 | 40 | 40 | 40 | 40 | 40.2 | 41.1 | 42 | 42.9 | 43.8 |
| | Predicted Cumulative Wind Turbine Noise LA90 | - | 27.4 | 32.3 | 35.9 | 36.4 | 36.4 | 36.4 | 36.4 | 36.4 | 36.4 |
| | Exceedance Level | - | -12.6 | -7.7 | -4.1 | -3.6 | -3.8 | -4.7 | -5.6 | -6.5 | -7.4 |
| NAL07- Pentre | Total Noise Limit: ETSU-R-97 LA90 | 47.2 | 47.8 | 48.5 | 49.1 | 49.7 | 50.4 | 51 | 51.7 | 52.3 | 52.9 |
| | Predicted Cumulative Wind Turbine Noise LA90 | - | 29.7 | 34.6 | 38.2 | 38.6 | 38.6 | 38.7 | 38.7 | 38.7 | 38.7 |
| | Exceedance Level | - | -18.1 | -13.9 | -10.9 | -11.1 | -11.8 | -12.3 | -13 | -13.6 | -14.2 |
| NAL08- Cwm Cywen | Total Noise Limit: ETSU-R-97 LA90 | 40 | 40 | 40 | 40 | 40 | 40 | 40.9 | 43.3 | 46 | 48.9 |
| | Predicted Cumulative Wind Turbine Noise LA90 | - | 25.1 | 29.7 | 33.1 | 33.6 | 33.6 | 33.7 | 33.7 | 33.7 | 33.7 |
| | Exceedance Level | - | -14.9 | -10.3 | -6.9 | -6.4 | -6.4 | -7.2 | -9.6 | -12.3 | -15.2 |

| NAL | Limits, Predictions, Exceedances (in dB LA90) | Wind Speed (m/s) as Standardised to 10 m Height | | | | | | | | | |
|---------------------------|--|---|-------|-------|------|------|------|------|-------|-------|-------|
| | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| NAL09- Cwm Llan | Total Noise Limit: ETSU-R-97 LA90 | 40 | 40 | 40 | 40 | 40 | 40 | 40.9 | 43.3 | 46 | 48.9 |
| | Predicted Cumulative Wind Turbine Noise LA90 | - | 23.8 | 28.5 | 32 | 32.7 | 32.8 | 32.9 | 32.9 | 32.9 | 32.9 |
| | Exceedance Level | - | -16.2 | -11.5 | -8 | -7.3 | -7.2 | -8 | -10.4 | -13.1 | -16 |
| NAL10- Rhyd Yr Ewig | Total Noise Limit: ETSU-R-97 LA90 | 40 | 40 | 40 | 40 | 40 | 40 | 40.9 | 43.3 | 46 | 48.9 |
| | Predicted Cumulative Wind Turbine Noise LA90 | - | 27 | 31.7 | 35.2 | 36.1 | 36.3 | 36.4 | 36.4 | 36.4 | 36.4 |
| | Exceedance Level | - | -13 | -8.3 | -4.8 | -3.9 | -3.7 | -4.5 | -6.9 | -9.6 | -12.5 |

Table 10.13 Likely Cumulative Noise Assessment Night time

| NAL | Limits, Predictions, Exceedances (in dB LA90) | Wind speed (m/s) as Standardised to 10 m Height | | | | | | | | | |
|-----------------------------------|--|---|------|------|------|------|------|------|------|------|------|
| | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| NAL01- Greigwen | Total Noise Limit: ETSU-R-97 LA90 | 43 | 43 | 43 | 43 | 43 | 43 | 43 | 43.2 | 45.8 | 48.7 |
| | Predicted Cumulative Wind Turbine Noise LA90 | - | 30 | 34.9 | 38.4 | 39 | 39 | 39 | 39 | 39 | 39 |
| | Exceedance Level | - | -13 | -8.1 | -4.6 | -4 | -4 | -4 | -4.2 | -6.8 | -9.7 |
| NAL02- Ty'n Y Ddol Uchaf | Total Noise Limit: ETSU-R-97 LA90 | 43 | 43 | 43 | 43 | 43 | 43 | 43 | 43.2 | 45.8 | 48.7 |
| | Predicted Cumulative Wind Turbine Noise LA90 | - | 28.2 | 33.1 | 36.7 | 37.3 | 37.3 | 37.3 | 37.3 | 37.3 | 37.3 |



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| NAL | Limits, Predictions, Exceedances (in dB LA90) | Wind speed (m/s) as Standardised to 10 m Height | | | | | | | | | |
|-----------------------------|--|---|-------|-------|------|------|------|------|-------|-------|-------|
| | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| | Exceedance Level | - | -14.8 | -9.9 | -6.3 | -5.7 | -5.7 | -5.7 | -5.9 | -8.5 | -11.4 |
| NAL03- Maespyll an | Total Noise Limit: ETSU-R-97 LA90 | 43 | 43 | 43 | 43 | 43 | 43 | 43 | 43.2 | 45.8 | 48.7 |
| | Predicted Cumulative Wind Turbine Noise LA90 | - | 29.2 | 34.2 | 37.8 | 38.3 | 38.3 | 38.3 | 38.3 | 38.3 | 38.3 |
| | Exceedance Level | - | -13.8 | -8.8 | -5.2 | -4.7 | -4.7 | -4.7 | -4.9 | -7.5 | -10.4 |
| NAL04- Llaithgw m | Total Noise Limit: ETSU-R-97 LA90 | 43 | 43 | 43 | 43.3 | 44.3 | 45.4 | 46.6 | 48 | 49.5 | 51.1 |
| | Predicted Cumulative Wind Turbine Noise LA90 | - | 28.8 | 33.8 | 37.4 | 37.9 | 37.9 | 37.9 | 37.9 | 37.9 | 37.9 |
| | Exceedance Level | - | -14.2 | -9.2 | -5.9 | -6.4 | -7.5 | -8.7 | -10.1 | -11.6 | -13.2 |
| NAL05- Penmaen Uchaf | Total Noise Limit: ETSU-R-97 LA90 | 43 | 43 | 43 | 43 | 43 | 43 | 43 | 43 | 43 | 43 |
| | Predicted Cumulative Wind Turbine Noise LA90 | - | 24.9 | 29.8 | 33.3 | 33.8 | 33.8 | 33.9 | 33.9 | 33.9 | 33.9 |
| | Exceedance Level | - | -18.1 | -13.2 | -9.7 | -9.2 | -9.2 | -9.1 | -9.1 | -9.1 | -9.1 |
| NAL06- Creigiau Uchaf | Total Noise Limit: ETSU-R-97 LA90 | 43 | 43 | 43 | 43 | 43 | 43 | 43 | 43 | 43 | 43 |
| | Predicted Cumulative Wind Turbine Noise LA90 | - | 27.4 | 32.3 | 35.9 | 36.4 | 36.4 | 36.4 | 36.4 | 36.4 | 36.4 |



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| NAL | Limits, Predictions, Exceedances (in dB LA90) | Wind speed (m/s) as Standardised to 10 m Height | | | | | | | | | |
|---------------------------|--|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| | Exceedance Level | - | -15.6 | -10.7 | -7.1 | -6.6 | -6.6 | -6.6 | -6.6 | -6.6 | -6.6 |
| NAL07- Pentre | Total Noise Limit: ETSU-R-97 LA90 | 46.9 | 47.4 | 47.9 | 48.5 | 49 | 49.5 | 50 | 50.5 | 51.1 | 51.6 |
| | Predicted Cumulative Wind Turbine Noise LA90 | - | 29.7 | 34.6 | 38.2 | 38.6 | 38.6 | 38.7 | 38.7 | 38.7 | 38.7 |
| | Exceedance Level | - | -17.7 | -13.3 | -10.3 | -10.4 | -10.9 | -11.3 | -11.8 | -12.4 | -12.9 |
| NAL08- Cwm Cywen | Total Noise Limit: ETSU-R-97 LA90 | 43 | 43 | 43 | 43 | 43 | 43 | 43 | 43.2 | 45.8 | 48.7 |
| | Predicted Cumulative Wind Turbine Noise LA90 | - | 25.1 | 29.7 | 33.1 | 33.6 | 33.6 | 33.7 | 33.7 | 33.7 | 33.7 |
| | Exceedance Level | - | -17.9 | -13.3 | -9.9 | -9.4 | -9.4 | -9.3 | -9.5 | -12.1 | -15 |
| NAL09- Cwm Llan | Total Noise Limit: ETSU-R-97 LA90 | 43 | 43 | 43 | 43 | 43 | 43 | 43 | 43.2 | 45.8 | 48.7 |
| | Predicted Cumulative Wind Turbine Noise LA90 | - | 23.8 | 28.5 | 32 | 32.7 | 32.8 | 32.9 | 32.9 | 32.9 | 32.9 |
| | Exceedance Level | - | -19.2 | -14.5 | -11 | -10.3 | -10.2 | -10.1 | -10.3 | -12.9 | -15.8 |
| NAL10- Rhyd Yr Ewig | Total Noise Limit: ETSU-R-97 LA90 | 43 | 43 | 43 | 43 | 43 | 43 | 43 | 43.2 | 45.8 | 48.7 |
| | Predicted Cumulative Wind Turbine Noise LA90 | - | 27 | 31.7 | 35.2 | 36.1 | 36.3 | 36.4 | 36.4 | 36.4 | 36.4 |



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| NAL | Limits, Predictions, Exceedances (in dB LA90) | Wind speed (m/s) as Standardised to 10 m Height | | | | | | | | | |
|-----|--|---|-----|-------|------|------|------|------|------|------|-------|
| | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| | Exceedance Level | - | -16 | -11.3 | -7.8 | -6.9 | -6.7 | -6.6 | -6.8 | -9.4 | -12.3 |

- 10.7.12 Figures A1.3a-o within Annex 1 of **Appendix 10.2** indicate that at NAL1-7 there is no contribution from any other nearby wind turbines / farms considered, only the Proposed Development contributes to the overall noise level. At NAL8-10, there is a very small contribution from other nearby wind turbines / farms considered but this includes some wind farms at scoping and Total ETSU-R-97 limits are still met by cumulative predictions. Overall, as shown in **Table 10.12** and **Table 10.13** above, the cumulative predictions meet the Total ETSU-R-97 limits at all properties, therefore there are no significant effect predicted from the Proposed Development wind turbines during operation.
- 10.7.13 A further step in the assessment was undertaken to consider the fact nearby wind farms may have the right to operate at higher levels than 'likely' predictions and also to consider potential noise conditions applicable to the Proposed Development on its own.
- 10.7.14 Site Specific Noise Limits for the Proposed Development operating on its own have been calculated as an apportionment of the Total ETSU-R-97 noise limits where required. At NAL1-7, the likely predictions level from other schemes were found to be more than 10 dB below the Total ETSU-R-97 Noise Limits and as such the entire noise limits has been allocated to the Proposed Development. At NALs 8-10, due to the small contribution from other nearby turbines, a 2 dB cautious buffer has been added to the nearby turbines noise predictions (to assume they could have the right to be louder) and the resulting 'cautious' predictions of cumulative existing wind turbine noise (without the Proposed Development) have then been logarithmically subtracted from the Total ETSU-R-97 Noise Limit to determine the Site Specific Noise Limit.
- 10.7.15 The noise predictions from the Proposed Development on its own and compared to the Site Specific Noise Limit is included in tabular form in **Table 10.14** and **Table 10.15** below along with exceedances results. A negative exceedance indicate that limits are met.



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Table 10.14 Site Specific Noise Assessment Daytime

| NAL | Limits, Predictions, Exceedances (in dB LA90) | Wind Speed (m/s) as Standardised to 10 m Height | | | | | | | | | |
|----------------------------|--|---|-------|-------|------|------|------|------|-------|-------|-------|
| | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| NAL01- Greigwen | Site Specific Noise Limit LA90 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.9 | 43.3 | 46.0 | 48.9 |
| | Predicted Proposed Development Noise LA90 | - | 29.8 | 34.8 | 38.3 | 38.8 | 38.8 | 38.8 | 38.8 | 38.8 | 38.8 |
| | Exceedance Level | - | -10.2 | -5.2 | -1.7 | -1.2 | -1.2 | -2.1 | -4.5 | -7.2 | -10.1 |
| NAL02-Ty'n Y Ddol Uchaf | Site Specific Noise Limit LA90 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.9 | 43.3 | 46.0 | 48.9 |
| | Predicted Proposed Development Noise LA90 | - | 27.8 | 32.7 | 36.4 | 36.8 | 36.8 | 36.8 | 36.8 | 36.8 | 36.8 |
| | Exceedance Level | - | -12.2 | -7.3 | -3.6 | -3.2 | -3.2 | -4.1 | -6.5 | -9.2 | -12.1 |
| NAL03- Maespyllan | Site Specific Noise Limit LA90 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.9 | 43.3 | 46.0 | 48.9 |
| | Predicted Proposed Development Noise LA90 | - | 28.9 | 33.9 | 37.5 | 38.0 | 38.0 | 38.0 | 38.0 | 38.0 | 38.0 |
| | Exceedance Level | - | -11.1 | -6.1 | -2.5 | -2.0 | -2.0 | -2.9 | -5.3 | -8.0 | -10.9 |
| NAL04- Llaithgwm | Site Specific Noise Limit LA90 | 41.5 | 41.9 | 42.5 | 43.2 | 44.2 | 45.3 | 46.5 | 48.0 | 49.6 | 51.4 |
| | Predicted Proposed Development Noise LA90 | - | 28.6 | 33.6 | 37.2 | 37.7 | 37.7 | 37.7 | 37.7 | 37.7 | 37.7 |
| | Exceedance Level | - | -13.3 | -8.9 | -6.0 | -6.5 | -7.6 | -8.8 | -10.3 | -11.9 | -13.7 |
| NAL05- Penmaen Uchaf | Site Specific Noise Limit LA90 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.2 | 41.1 | 42.0 | 42.9 | 43.8 |
| | Predicted Proposed Development Noise LA90 | - | 24.4 | 29.4 | 33.0 | 33.5 | 33.5 | 33.5 | 33.5 | 33.5 | 33.5 |
| | Exceedance Level | - | -15.6 | -10.6 | -7.0 | -6.5 | -6.7 | -7.6 | -8.5 | -9.4 | -10.3 |



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| NAL | Limits, Predictions, Exceedances (in dB LA90) | Wind Speed (m/s) as Standardised to 10 m Height | | | | | | | | | |
|--------------------------|--|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| NAL06- Creigiau Uchaf | Site Specific Noise Limit LA90 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.2 | 41.1 | 42.0 | 42.9 | 43.8 |
| | Predicted Proposed Development Noise LA90 | - | 27.1 | 32.1 | 35.7 | 36.1 | 36.1 | 36.1 | 36.1 | 36.1 | 36.1 |
| | Exceedance Level | - | -12.9 | -7.9 | -4.3 | -3.9 | -4.1 | -5.0 | -5.9 | -6.8 | -7.7 |
| NAL07-Pentre | Site Specific Noise Limit LA90 | 47.2 | 47.8 | 48.5 | 49.1 | 49.7 | 50.4 | 51.0 | 51.7 | 52.3 | 52.9 |
| | Predicted Wind Turbine Noise LA90 | - | 29.4 | 34.4 | 38.0 | 38.5 | 38.5 | 38.5 | 38.5 | 38.5 | 38.5 |
| | Exceedance Level | - | -18.4 | -14.1 | -11.1 | -11.2 | -11.9 | -12.5 | -13.2 | -13.8 | -14.4 |
| NAL08-Cwm Cywen | Site Specific Noise Limit LA90 | 40.0 | 40.0 | 40.0 | 40.0 | 39.5 | 39.5 | 40.9 | 43.3 | 46.0 | 48.9 |
| | Predicted Proposed Development Noise LA90 | - | 23.7 | 28.7 | 32.2 | 32.7 | 32.7 | 32.7 | 32.7 | 32.7 | 32.7 |
| | Exceedance Level | - | -16.3 | -11.3 | -7.8 | -6.8 | -6.8 | -8.2 | -10.6 | -13.3 | -16.2 |
| NAL09-Cwm Llan | Site Specific Noise Limit LA90 | 40.0 | 40.0 | 40.0 | 39.5 | 39.4 | 39.3 | 40.3 | 43.3 | 46.0 | 48.9 |
| | Predicted Proposed Development Noise LA90 | - | 22.8 | 27.8 | 31.3 | 31.7 | 31.7 | 31.7 | 31.7 | 31.7 | 31.7 |
| | Exceedance Level | - | -17.2 | -12.2 | -8.2 | -7.7 | -7.6 | -8.6 | -11.6 | -14.3 | -17.2 |
| NAL10-Rhyd Yr Ewig | Site Specific Noise Limit LA90 | 40.0 | 40.0 | 40.0 | 39.3 | 38.8 | 38.6 | 39.7 | 42.7 | 46.0 | 48.9 |
| | Predicted Proposed Development Noise LA90 | - | 25.9 | 30.9 | 34.4 | 34.9 | 34.9 | 34.9 | 34.9 | 34.9 | 34.9 |
| | Exceedance Level | - | -14.1 | -9.1 | -4.9 | -3.9 | -3.7 | -4.8 | -7.8 | -11.1 | -14.0 |



Energy for
generations



Table 10.15 Site Specific Noise Assessment Night-time

| NAL | Limits, Predictions, Exceedances (in dB LA90) | Wind Speed (m/s) as Standardised to 10 m Height | | | | | | | | | |
|----------------------------|--|---|-------|-------|-------|------|------|------|-------|-------|-------|
| | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| NAL01- Greigwen | Site Specific Noise Limit LA90 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.2 | 45.8 | 48.7 |
| | Predicted Proposed Development Noise LA90 | - | 29.8 | 34.8 | 38.3 | 38.8 | 38.8 | 38.8 | 38.8 | 38.8 | 38.8 |
| | Exceedance Level | - | -13.2 | -8.2 | -4.7 | -4.2 | -4.2 | -4.2 | -4.4 | -7.0 | -9.9 |
| NAL02-Ty'n Y Ddol Uchaf | Site Specific Noise Limit LA90 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.2 | 45.8 | 48.7 |
| | Predicted Proposed Development Noise LA90 | - | 27.8 | 32.7 | 36.4 | 36.8 | 36.8 | 36.8 | 36.8 | 36.8 | 36.8 |
| | Exceedance Level | - | -15.2 | -10.3 | -6.6 | -6.2 | -6.2 | -6.2 | -6.4 | -9.0 | -11.9 |
| NAL03- Maespyllan | Site Specific Noise Limit LA90 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.2 | 45.8 | 48.7 |
| | Predicted Proposed Development Noise LA90 | - | 28.9 | 33.9 | 37.5 | 38.0 | 38.0 | 38.0 | 38.0 | 38.0 | 38.0 |
| | Exceedance Level | - | -14.1 | -9.1 | -5.5 | -5.0 | -5.0 | -5.0 | -5.2 | -7.8 | -10.7 |
| NAL04- Llaithgwm | Site Specific Noise Limit LA90 | 43.0 | 43.0 | 43.0 | 43.3 | 44.3 | 45.4 | 46.6 | 48.0 | 49.5 | 51.1 |
| | Predicted Proposed Development Noise LA90 | - | 28.6 | 33.6 | 37.2 | 37.7 | 37.7 | 37.7 | 37.7 | 37.7 | 37.7 |
| | Exceedance Level | - | -14.4 | -9.4 | -6.1 | -6.6 | -7.7 | -8.9 | -10.3 | -11.8 | -13.4 |
| NAL05- Penmaen Uchaf | Site Specific Noise Limit LA90 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 |
| | Predicted Proposed Development Noise LA90 | - | 24.4 | 29.4 | 33.0 | 33.5 | 33.5 | 33.5 | 33.5 | 33.5 | 33.5 |
| | Exceedance Level | - | -18.6 | -13.6 | -10.0 | -9.5 | -9.5 | -9.5 | -9.5 | -9.5 | -9.5 |



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| NAL | Limits, Predictions, Exceedances (in dB LA90) | Wind Speed (m/s) as Standardised to 10 m Height | | | | | | | | | |
|--------------------------|--|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| NAL06- Creigiau Uchaf | Site Specific Noise Limit LA90 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 |
| | Predicted Proposed Development Noise LA90 | - | 27.1 | 32.1 | 35.7 | 36.1 | 36.1 | 36.1 | 36.1 | 36.1 | 36.1 |
| | Exceedance Level | - | -15.9 | -10.9 | -7.3 | -6.9 | -6.9 | -6.9 | -6.9 | -6.9 | -6.9 |
| NAL07-Pentre | Site Specific Noise Limit LA90 | 46.9 | 47.4 | 47.9 | 48.5 | 49.0 | 49.5 | 50.0 | 50.5 | 51.1 | 51.6 |
| | Predicted Wind Turbine Noise LA90 | - | 29.4 | 34.4 | 38.0 | 38.5 | 38.5 | 38.5 | 38.5 | 38.5 | 38.5 |
| | Exceedance Level | - | -18.0 | -13.5 | -10.5 | -10.5 | -11.0 | -11.5 | -12.0 | -12.6 | -13.1 |
| NAL08-Cwm Cywen | Site Specific Noise Limit LA90 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.2 | 45.8 | 48.7 |
| | Predicted Proposed Development Noise LA90 | - | 23.7 | 28.7 | 32.2 | 32.7 | 32.7 | 32.7 | 32.7 | 32.7 | 32.7 |
| | Exceedance Level | - | -19.3 | -14.3 | -10.8 | -10.3 | -10.3 | -10.3 | -10.5 | -13.1 | -16.0 |
| NAL09-Cwm Llan | Site Specific Noise Limit LA90 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.2 | 45.8 | 48.7 |
| | Predicted Proposed Development Noise LA90 | - | 22.8 | 27.8 | 31.3 | 31.7 | 31.7 | 31.7 | 31.7 | 31.7 | 31.7 |
| | Exceedance Level | - | -20.2 | -15.2 | -11.7 | -11.3 | -11.3 | -11.3 | -11.5 | -14.1 | -17.0 |
| NAL10-Rhyd Yr Ewig | Site Specific Noise Limit LA90 | 43.0 | 43.0 | 43.0 | 43.0 | 42.4 | 42.4 | 42.3 | 42.5 | 45.8 | 48.7 |
| | Predicted Proposed Development Noise LA90 | - | 25.9 | 30.9 | 34.4 | 34.4 | 34.9 | 34.9 | 34.9 | 34.9 | 34.9 |
| | Exceedance Level | - | -17.1 | -12.1 | -8.6 | -7.5 | -7.5 | -7.4 | -7.6 | -10.9 | -13.8 |



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- 10.7.16 The tables show that the predicted wind turbine noise immission levels when considering an Enercon E-175-EP5-E2 7 MW as a candidate meet the Site Specific Noise Limits under all conditions and at all locations for both daytime and night-time periods. The candidate turbine was chosen as it is considered to be representative of the type of turbine that could be installed at the Site. The Appendix 10.2 also includes in Annex 1 Figures A1.4a-A1.4j, which show predictions for a second candidate turbine that is slightly noisier but also meets the Site Specific Noise Limits. There are a number of wind turbine makes and models that may be suitable for the Proposed Development, should the proposal receive planning permission the final choice of turbine would be subject to a competitive tendering process. The final choice of turbine would have to meet the noise limits.

10.8 Additional Mitigation Measures

Construction Phase

- 10.8.1 In accordance with standard good practice, the construction phase of the Proposed Development would be undertaken in accordance with Best Practicable Means as set out in **Appendix 2.1** and summarised below.
- 10.8.2 Construction noise good practices would be implemented to minimise the likely effects. Section 8 of BS 5228-1:2009+A1:2014 recommends a number of simple control measures as summarised below that would be employed onsite:
- Keep local residents informed of the proposed working schedule, where appropriate, including the times and duration of any abnormally noisy activity that may cause concern;
 - Adhere to core construction work hours and ensure that any extraordinary site work continuing throughout 24 hours of a day (for example, crane operations lifting components onto the tower) would be programmed, when appropriate, so that haulage vehicles would not arrive at or leave the Site outside of core hours or other specific delivery hours, with the exception of abnormal loads that would be scheduled to avoid significant traffic flows.
 - Ensure all vehicles and mechanical plant would be fitted with effective exhaust silencers and be subject to programmed maintenance.
 - Select inherently quiet plant where appropriate - all major compressors would be 'sound reduced' models fitted with properly lined and sealed acoustic covers, which would be kept closed whenever the machines are in use.
 - Ensure all ancillary pneumatic percussive tools would be fitted with mufflers or silencers of the type recommended by the manufacturers.
 - Instruct that machines would be shut down between work periods or throttled down to a minimum.
 - Regularly maintain all equipment used on site, including maintenance related to noise emissions.
 - Vehicles would be loaded carefully to ensure minimal drop heights so as to minimise noise during this operation.
 - Ensure all ancillary plant such as generators and pumps would be positioned so as to cause minimum noise disturbance and if necessary, temporary acoustic screens or enclosures should be provided.



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Operational Phase

- 10.8.3 Following an appropriate choice of wind turbine model, the Site Specific Noise Limits would be met at all properties in all wind conditions and time periods. Predictions of wind turbine noise in this assessment are for information only; there are a number of wind turbine makes and models that may be suitable for the proposed wind farm development. Should the proposed wind farm development receive consent the final choice of turbine would be subject to a competitive tendering process and the chosen model and operational mode(s) would have to meet the noise limits contained within any condition imposed. Any chosen model should have a range of operational modes available (i.e. not only one full mode) which would allow reduction of noise in specific wind speed and time periods, if required.

10.9 Assessment of Residual Effects (with Additional Mitigation)

Construction Phase

- 10.9.1 **No significant residual effects** are predicted from onsite construction activities for the access track and wind turbines.
- 10.9.2 **No significant residual effects** are predicted from offsite construction traffic along the section of the B4501 near the site entrance junction.

Operational Phase

- 10.9.3 The adoptions of a noise condition which include Site Specific Noise Limits and selection of appropriate wind turbine model would ensure that cumulative wind turbine noise levels will meet the Total Noise Limits under all conditions and at all locations for both daytime and night time periods. At some locations, under some wind conditions and for a certain proportion of the time operational wind farm noise would be audible; however, it would be at an acceptable level in relation to the ETSU-R-97 guidelines and there would be **no significant residual effects** from operational wind turbine noise.
- 10.9.4 The residual effects are summarised in **Table 10.16**.

Table 10.16 Assessment of Likely Effects (With Additional Mitigation)

| Paragraph Number | Receptor / Receptor Groups | Description of Impact | Magnitude of Change | Description of Likely Effect | Monitoring |
|--|---|---|---|--|--|
| Table Key: P/T = Permanent or Temporary, D/I = Direct or Indirect, ST/MT/LT = Short Term, Medium Term or Long Term, N/A = Not Applicable | | | | | |
| Construction Phase | | | | | |
| 10.16.1 | Noise sensitive receptors (i.e. residential properties) | Potential wind turbines construction noise activities onsite (i.e. onsite activities such as earthwork on tracks and foundations, activities at the construction compound, and wind turbine delivery and erection). | N/A | No significant residual effect. Predicted, guideline noise levels are met. Additional noise mitigation measures suggested includes good practice and adhering to set construction hours. | No routine monitoring would be required during the construction phase. |
| 10.16.2 | Noise sensitive receptors (i.e. residential properties) | Potential wind turbines construction noise traffic offsite (i.e. construction vehicles, light and HGV, arriving and departing on the road near the Site entrance). | A minor increase in traffic noise due to construction traffic off-site. | No significant residual effect. Predicted, No additional noise mitigation measures required. No additional noise mitigation measures required | No routine monitoring would be required during the construction phase. |
| Operational Phase | | | | | |

| | | | | | |
|---------|--|---|-----|---|--|
| 10.16.3 | Noise sensitive receptors(i.e. residential properties) | Potential operational wind turbines noise effects | N/A | No significant residual effect predicted, guideline noise levels would be met with the candidate turbine assumed in the assessment. Mitigation suggested include implementation of a planning noise condition and selection of an appropriate candidate wind turbine. | No routine monitoring would be required during the operational phase although good practice does suggest planning condition which would require compliance monitoring triggered in the event of a noise complaint. |
|---------|--|---|-----|---|--|



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10.10 Difficulties and Uncertainties

- 10.10.1 Candidate construction plant and wind turbines have been used for predictions of construction and operational noise. The final models to be selected at procurement will very likely differ from that presented here and would need to comply with any applicable noise limits imposed through planning conditions.
- 10.10.2 Offsite construction traffic was predicted based on traffic flows provided by the Transport Consultant.
- 10.10.3 No other specific assumptions or data gaps have been identified, the noise survey was comprehensive and noise prediction of operational noise (the key noise topic) have been undertaken in accordance with current good practice.

10.11 Abnormal Indivisible Loads Route

- 10.11.1 There are expected to be minor works around highways junctions associated with the 'Abnormal Indivisible Load Route' (AILR) (Annex 1 of **ES Volume III, Appendix 11.1: Transport Assessment**), from the Port of Liverpool through to the access route junction of the Site and is required to facilitate transport of the large turbine components. Annex 1 identifies Points of Interest (POIs) where physical works will be required. The AILR has been reviewed for environmental constraints (**ES Volume III, Appendix 4.1: AILR Environmental Constraint**). Where environmental constraints were identified in relation to noise and vibration, these are further considered here.
- 10.11.2 As part of the AILR constraints screening, physical works for AIL POI 2, 3, 18, 27, 34, 35, 36, 38, 39, 40, 44, and 64 were identified as being located near residential receptors. The construction activities associated with these works would be relatively small scale and short in duration. It is assumed that good practice during construction will be employed to further minimise noise impact. As such the residential receptors will experience minimal exposure and are not likely to be subject to significant noise effects.

10.12 Inter-project Cumulative Effects

Screening Cumulative Developments Within the Zone of Influence

- 10.12.1 The inter-project cumulative impact assessment has been undertaken in accordance with Nationally Significant Infrastructure Projects: Advice on Cumulative Effects Assessment, as detailed in **ES Volume II, Chapter 4: Approach to the EIA**.
- 10.12.2 **Table 10.17** sets out the other operational or committed developments located within 10 km of the Site, a distance chosen as a conservative assumption for potential cumulative noise considerations. **Table 10.17** also sets out the findings of

a screening assessment undertaken to identify those schemes which have the potential to result in significant effects with the Proposed Development.

Table 10.17 Inter-project Cumulative Effects: Screening

| ID | Committed Development | Scheme Description | Potential for Cumulative Effects? |
|-----------|----------------------------|---|---|
| O1 | Hafotty Uchaf | <i>Operational, 3.4 km to the north. 4 x Vestas V52.</i> | Need to be considered for noise but unlikely to be significant cumulative effect. |
| O2 | Bryn Ffynnon | Operational, 3.4 km to the north near Hafotty Uchaf. 1 x Enercon E53 | Need to be considered for noise but unlikely to be significant cumulative effect. |
| O3 and O4 | Disgarth Uchaf & Ty'n Gwyn | Operational, 5.7 km north-east. 2 x Enercon E53 | Included for completeness. Unlikely to be significant cumulative effect. |
| C19 | Gaerwen | In planning (ES Submitted to PEDW) for 9 x wind turbines, scheme located 6.4 km to the east. Candidate turbine was suggested as the SG 6.0-155. | Included for completeness. Unlikely to be significant cumulative effect. |
| C18 | Moel Chwa | Scoping report submitted for 12 x wind turbines, scheme located 5.7 km to the north-east. Candidate turbine was not specified but a 200 m tip height and 79.2 megawatts (MW) was specified. | Included for completeness. Unlikely to be significant cumulative effect. |

Cumulative Assessment

Construction

- 10.12.3 It is very unlikely that other significant projects will be constructed at the same time as the Proposed Development with major noise sources operating near the same CNALs on the same day. As such, **no significant cumulative effect** due to construction noise are anticipated.

Operation

- 10.12.4 The operational wind farm noise assessment has fully taken into consideration cumulative impacts with other nearby wind turbines, as described in the above

assessment. The cumulative operational noise assessment shows that the Proposed Development can operate concurrently within the Total Noise Limits with the nearby relevant schemes, and therefore **no significant cumulative effect** due to operational wind turbine noise are predicted.

- 10.12.5 In addition, there are no cumulative effects anticipated between wind turbine noise and other noise sources within the Proposed Development such as those that may be found in the BESS and substation elements. Wind turbines generate noise in windy conditions and are assessed accordingly, whereas other noise sources would be assessed in low wind when wind turbines may not emit noise.

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