

Ballyfeeny Green Energy Project



Environmental Impact Assessment Report Volume II

Chapter 10 – Noise and Vibration September 2025

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10. Noise & Vibration

10.1 Introduction

This Chapter assesses the likely significant direct and indirect effects of the proposed Project from noise and vibration impact assessments that have been prepared for the construction, operational and decommissioning phases of the proposed Project. To inform these assessments, baseline noise levels have been measured at several representative Noise Monitoring Locations (NMLs) and noise predictions to the Noise Sensitive Locations (NSLs) within the study area have been prepared. The schedule of the NMLs and NSLs are set out in **Section 10.3.6**.

The proposed Project includes six no. turbines and all associated infrastructure including Turbine Foundations, Turbine Hardstands, Site Access Tracks, Wind Farm Internal Cabling, Grid Connection Route (GCR), Relay Tower, Onsite Substation and works required along the public road network for the two Turbine Delivery Route (TDR) options to facilitate the delivery of turbine components. A full description of the proposed Project is provided in **Chapter 2 – Project Description**

The Applicant is in receipt of a notification of opinion by the Local Authority on design flexibility. The notification is provided in **Appendix 1.5 – DFR-25-1 Notification of Opinion by Local Authority**. This opinion from the Local Authority confirmed that it was *‘appropriate that the proposed application be made and decided before the prospective applicant has confirmed certain details of the application’*.

Chapter 1 – Introduction, Section 1.6 Approach to Design Flexibility, outlines with respect to the notification of opinion by the Local Authority, the Applicant in this EIAR, proposes to assess three distinct Technology Options within the range outlined by the Local Authority and in accordance with the design flexibility parameters sought. **Chapter 1 – Introduction Table 1-3**, outlines the options and associated parameters that are used in the EIAR, comprising three potential turbines classified as Technology Option 1, 2 and 3.

The UK’s Department of Trade & Industry’s Energy Technology Support Unit publication **The Assessment and Rating of Noise from Wind Farms (1996)** (ETUS-R-97) is referenced in the **Wind Energy Development Guidelines for Planning Authorities** published by the Department of the Environment, Heritage and Local Government in 2006 (WEDG 2006), as providing a suitable methodology for the assessment of noise impacts and is adopted herein.

A stated strategic aim and objective of a development plan set out in WEDG 2006 includes:

“to secure the maximum potential from the wind energy resource of the planning authority’s area”.

To this end, the maximum capacity of wind energy generation in a given area may be shared by more than one wind farm. The noise limits and assessment methodologies provided in WEDG 2006 chime with ETSU-R-97 to ensure that the cumulative impacts of other wind farm developments (operational, permitted or proposed) are assessed and a schedule of such identified developments is provided in **Chapter 16 - Cumulative Effects Assessment**. Other non-wind turbine developments (operational, permitted or proposed) are not considered as relevant by WEDG 2006. In addition, the likely significant effects of vibration on the structural integrity of the wind turbines from blasting events from the nearby quarry has been assessed.

This Chapter is supported by the following:

- **Volume 4 – EIAR Figures;**
- **Appendix 1.3 – Scoping Consultation Responses;**
- **Appendix 2.1 – Construction Environmental Management Plan (CEMP);**
- **Appendix 2.1.4 – Decommissioning and Restoration Plan**
- **Appendix 10.1 – Glossary of Acoustic Terminology;**
- **Appendix 10.2 – Noise Survey Details, Instrumentation, Personnel and Photos.;**
- **Appendix 10.3 – Noise Sensitive Locations;**
- **Appendix 10.4 – Noise Modelling Calculation Parameters;**
- **Appendix 10.5 – Predicted Noise Levels;**
- **Appendix 10.6 – Directional Cumulative Assessment**
- **Appendix 10.7 – Cumulative Colour Noise Contour Plots; and**
- **Appendix 10.8 – Blasting Technical Note.**

The assessment should be read in conjunction with:

- **Chapter 5 – Population and Human Health**
- **Chapter 7 – Land Soils and Geology**
- **Chapter 12 – Traffic and Transport**
- **Chapter 16 – Cumulative Effects**

- **Chapter 17– Inter-Related Effects**

10.1.1 Statement of Authority

This assessment was prepared by the following staff of Enfonic Ltd.

Report drafted by: Aishaani Sharma, (Junior Consultant) graduated with an MSc in Environmental Science from Trinity College in 2024 and holds a BSc (Hons.) in Biotechnology and qualified with IOA Certificate in Environmental Noise Measurements (2024). Aishaani has undertaken many environmental noise assessments including baseline noise surveys and preparing noise and vibration EIAR chapters in relation to wind farms, other renewable energy schemes as well as commercial, industrial and residential developments. She also provides expertise in relation to impacts on biodiversity and sustainability.

Report reviewed by: David Courtney, BEng, MIOA (Senior Consultant) graduated with a BEng. in Mechatronic Engineering from DCU in 2017 and qualified with IOA Diploma in Acoustics and Noise Control (2019) & Certificate in Environmental Noise Measurements (2017). He has undertaken all types of noise and vibration surveys and assessment in relation to wind turbines, solar farms, other renewable energy schemes, IPPC & IE compliance, BS4142, BS5228 and BS8233 assessments, traffic noise, construction, building acoustics and occupational assessments. He has considerable expertise in the noise and vibration impact assessment of wind turbine and renewable energy schemes including noise modelling, and he has conducted numerous impact assessments for EIARs.

Report reviewed and approved by: Gary Duffy, BEng, MIOA (Principal Consultant) is the managing director of Enfonic with over 25 years' experience as an acoustic engineer and consultant. He has extensive knowledge in the field of noise measurement, prediction, and impact assessment. He co-wrote the EPA's original guidance note on noise and represented the Institute of Acoustics (IOA) on the technical advisory committee of the Department of the Environment's revision of Part E (Sound Insulation) of the Building Regulations. He is a founder member of the Irish branch of the Institute of Acoustics and a sitting member of the current committee. His expertise in wind turbine noise analysis, modelling and assessment is recognised industry-wide and he has delivered training courses on the subject to many of the country's acoustic consultants. As principle consultant, he ensures the acoustic and wider environmental technical aspects of our assessments are rigorously applied to our assessments. Moreover, he ensures that the information and insights in our reports are provided as concisely and understandably as possible.

10.1.2 Fundamentals of Noise

The audible range of sounds can be expressed in terms of Sound Pressure Levels (SPL) and ranges from 0dB (for the threshold of hearing) to 140dB (for the threshold of pain). It should be noted that a doubling in sound energy (such as may be caused by a doubling of traffic flows) increases the SPL by 3dB.

The frequency of sound is the rate at which a sound wave oscillates and is expressed in Hertz (Hz). The sensitivity of the human ear to different frequencies in the audible range is not uniform. For example, hearing sensitivity is most sensitive to the frequency range of language (300Hz - 3,000Hz) and decreases substantially as frequency falls.

It is necessary to adjust the measured noise level by an instrument to reflect the sensitivity response of human hearing and the 'A-weighting' system has been defined in the international standard, BS ISO 226:2003 Acoustics (BS ISO 226:2003 Acoustics, 2003) to do this. A SPL measured using 'A-weighting' is expressed in terms of Decibel Level (dBA).

An indication of the level of some common sounds on the dBA scale are outlined in **Table 10-1**.

Table 10-1: Common sounds of the dBA scale

Source	Decibel Level (dBA)
Threshold of Hearing	0
Rustling Leaves	10
Whisper	20
Quiet Rural Setting	30
Quiet Living Room	40
Suburban Neighbourhood	50
Normal Conversation	60
Busy Street Traffic	70
Vacuum Cleaner	80
Heavy Truck	90
Jackhammer	100
Front Row of Rock Concert	110
Threshold of Pain	130
Military Jet Take-off	140

A glossary of acoustic terminology used in this report is provided in **Appendix 10.1 – Glossary of Acoustic Terminology**.

10.2 Guidance

In the expertise and professional judgement of the authors, the appropriate guidance documents to provide the most consistent and transparent methodology for evaluating wind turbine noise are as follows:

- BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise;
- Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes (NRA, 2014);
- ETSU-R-96 – The Assessment and Rating of Wind Farm Noise (1997). It should be noted that ETSU-R-97 is currently subject to a review process by the UK government. The eventual updated guidance aims to balance opportunities for energy generation with the impacts of noise emissions from turbines by bringing guidance in line with available evidence, developments in turbine technology and wind turbine noise assessment methodologies;
- Institute of Acoustics (IOA), 2013. A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise;
- World Health Organization (WHO), 2018. Environmental Noise Guidelines for the European Region. Copenhagen: WHO Regional Office for Europe;
- Department for Environment, Food & Rural Affairs (Defra), 2005. Infrasound and Low Frequency Noise;
- Institute of Acoustics (IOA), 2014. Supplementary Guidance Note 5: Assessment of Operational Special Characteristics;
- Environmental Protection Agency (EPA), 2011. Guidance Note for Noise Assessment of Wind Turbine Operations at EPA Licensed Sites (NG3);
- Institute of Acoustics (IOA), 2016. A Method for Rating Amplitude Modulation (AM) in Wind Turbine Noise;
- International Organization for Standardization (ISO), 1996. ISO 9613-2: Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation;
- British Standards Institution (BSI), 2019. BS 4142:2014+A1:2019 Methods for Rating and Assessing Industrial and Commercial Sound: HSE Public Health Medicine Environment and Health Group;

- Guidelines on the information to be contained in Environmental Impact Assessment Reports (Environmental Protection Agency, 2022);
- Environmental Impact Assessment of Projects – Guidance on the Preparation of the Environmental Impact Assessment Report (European Commission (EC), 2017);
- Institute of Environmental Management and Assessment (IEMA), 2014. Environmental Impact Assessment Guide to Shaping Quality Development;
- Guidelines for Planning Authorities and An Bord Pleanála on Carrying Out Environmental Impact Assessment (Department of Environment, Community and Local Government (DECLG), August 2018); and
- Roscommon County Development Plan (CDP) 2022-2028.

A summary of the guidance applicable to the relevant aspects of the proposed project is provided in **Table 10-2**.

Table 10-2: Summary of Applicable Guidance for Project

Aspect	Appropriate Guidance
Planning	• Roscommon CDP 2022-2028; • DECLG Guidelines for Planning Authorities and An Bord Pleanála on Carrying Out Environmental Impact Assessment (2018); and • Environmental Impact Assessment of Projects – Guidance on the Preparation of the Environmental Impact Assessment Report (European Commission (EC), 2017)
Impact Assessment	• Guidelines on the information to be contained in Environmental Impact Assessment Reports ((EPA) Guidelines) (EPA, 2022);
Construction and Decommissioning Phase	• BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise
Operational Phase (Wind Farm)	• Wind Energy Development Guidelines 2006; • ETSU-R-96; and • IOA Supplementary Guidance Notes (SGNs).
Special Acoustic Characteristics	• IOA Supplementary Guidance Notes.
Operation Phase (Sub Station)	• BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound.

Further details on the above guidance is set out in the following sections.

10.2.1 Construction Phase Relevant Legislation and Guidance

The following guidance in this section is applicable to the assessment of the noise and vibration impacts of the proposed Project.

Noise

There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. Local authorities normally control construction activities by imposing limits on the hours of construction works and may consider noise limits at their discretion.

BS 5228-1:2009+A1:2014

In the absence of specific noise limits which may be set by the Local Authority, appropriate construction limits given in *BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise* have been adopted in this assessment.

The standard provides guidance on the 'threshold of significant effect' in respect to noise impacts at dwellings. The proposed 'ABC method' derives appropriate construction noise limits from existing ambient noise levels and the relevant categories are provided in **Table 10-3**.

Table 10-3: BS 5228 - BS 5228 Categorisation

Assessment Category and Threshold Value Period.	Threshold values in Decibel Level (dB)		
	Category A ^{A)}	Category B ^{B)}	Category C ^{C)}
Night-time (23.00–07.00)	45	50	55
Evenings and weekends ^{D)}	55	60	65
Daytime (07.00–19.00) and Saturdays (07.00–13.00)	65	70	75
NOTE 1 A potential significant effect is indicated if the $L_{Aeq, T}$ noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level.			
NOTE 2 If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total $L_{Aeq, T}$ noise level for the period increases by more than 3 dB due to site noise. NOTE 3 Applied to residential receptors only.			
A)	Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.		
B)	Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.		
C)	Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.		
D)	19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.		
Periods may be amended to suit local conditions.			

In general, the noise impact due to the construction phase will be from the specific items of plant used and the significant of the effect will depend on the duration and phasing of the construction methods, the time of day that each plant will be used and their location.

Construction methods are provided in **Chapter 2 – Project Description** and the Construction Environmental Management Plan (**Appendix 2.1 – CEMP**). Construction noise impact assessment is provided in **Section 10.6.2**.

The guidance requires that ambient noise levels are rounded to the nearest 5dB in order to derive the appropriate construction noise criteria.

10.2.2 Operational Phase Relevant Legislation and Guidance

Once operational, the turbines will emit an increasing level of noise as wind speed increases. The assessment of turbine noise emissions summarised in this chapter is in compliance with

current guidance and best practice in relation to acceptable levels of noise from wind farms as contained in the document *Wind Energy Development Guidelines for Planning Authorities* published by the Department of the Environment, Heritage and Local Government in 2006 (WEDG 2006)

These guidelines are in turn based on detailed recommendations set out in the UK's Department of Trade and Industry – Energy Technology Support Unit (ETSU) publication *The Assessment and Rating of Noise from Wind Farms (1996)*. The ETSU document has been used to supplement the guidance contained within WEDG 2006 where necessary.

Wind Energy Development Guidelines for Planning Authorities

Section 5.6 of the WEDG 2006 outlines the appropriate noise criteria in relation to wind farm developments. The following extract from it set outs the general aim of an impact assessment:

“An appropriate balance must be achieved between power generation and noise impact.”

It should be noted that there is no specific advice given by ‘WEDG’s 2006’ in relation to what constitutes an ‘appropriate balance’.

Furthermore, a NSL is defined as follows:

“In the case of wind energy development, a noise sensitive location includes any occupied house, hostel, health building or place of worship and may include areas of particular scenic quality or special recreational importance. Noise limits should apply only to those areas frequently used for relaxation of activities for which a quiet environment is highly desirable. Noise limits should be applied to external locations and should reflect the variation in both turbine source noise and background noise with wind speed.”

As can be seen from the calculations presented later in this chapter, the various topics identified in this extract have been incorporated into this assessment. It should be noted that the noise limits are defined in terms of the $L_{A90, 10min}$ parameter.

“In general, a lower fixed limit of 45dB(A) [$L_{A90, 10min}$] or a maximum increase of 5dB(A) above background noise at nearby noise sensitive locations is considered appropriate to provide protection to wind energy development neighbours.”

This represents the commonly adopted daytime noise criterion in relation to wind farm developments. However, an important caveat should be noted as detailed in the following extract.

“However, in very quiet areas, the use of a margin of 5 dB(A) above background noise at nearby noise sensitive properties is not necessary to offer a reasonable degree of protection and may unduly restrict wind energy developments which should be recognised as having wider national and global benefits. Instead, in low noise environments where background noise is less than 30 dB(A), it is recommended that the daytime level of the $L_{A90,10min}$ of the wind energy development be limited to an absolute level within the range of 35-40 dB(A).”

In relation to night-time periods the following guidance is given:

“A fixed limit of 43 dB(A) [$L_{A90,10min}$] will protect sleep inside properties during the night.”

It is proposed to adopt a lower daytime threshold of 40 dB $L_{A90,10min}$ for low noise environments where the background noise is less than 30 dB $L_{A90,10min}$.

A summary of the operational noise limits set out in WEDG 2006 is given in **Table 10-4**.

Table 10-4: Summary of the operational noise limits set out in WEDG 2006

Status ¹ / Period	Limit
Quiet Daytime	40dB
Normal Daytime	45dB or 5dB above background
Quiet / Normal Night-time	43dB or 5dB above background
¹ Quiet status applies to environments of less than 30dBA and Normal status applies to environments of greater than 30dBA at a given wind speed.	

It should be noted that while the caveat of an increase of 5dB above background for the night-time period is not explicit within the current guidance it is commonly applied in noise assessments prepared and is adopted in this assessment.

ETSU-R-97– The Assessment and Rating of Wind Farm Noise (1996)

Although originally developed in the UK, ETSU-R-97 has been widely adopted in Ireland due to its structured and evidence-based approach and the core of the noise impact assessment guidance contained within WEDG 2006 is based on ETSU.

ETSU calls for the control of wind turbine noise by the application of noise limits at the nearest noise sensitive locations. Wind turbine noise emissions increase as wind speed increases, but at a slower rate than wind generated background noise increases. It is therefore considered best practice is to adopt noise limits relative to background noise levels in the vicinity of the noise sensitive locations. A comprehensive noise monitoring programme as set out in **Section 10.4**, is therefore a critical aspect in the assessment of the likely effects of the proposed Project.

Institute of Acoustics Good Practice Guide (GPG)

The ETSU-R-7 concepts underwent standardisation and modernisation in 2013 with the IOA publication of the *A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise* and six accompanying SNGs shown in **Table 10-5**:

Table 10-5: Summary of IOA Good Practice Guide and Supplementary Guidance Notes (SGNs) for ETSU-R-97

SGN no.	Title
1	Data Collection
2	Data Processing & Derivation of ETSU-R-97 Background Curves
3	Sound Power Level Data
4	Wind Shear
5	Post Completion Measurements
6	Noise Propagation Over Water for On-Shore Wind Turbines

Period definitions

Period definitions adopted from the IOA GPG and applied to this assessment are as follows:

Daytime Amenity hours:

- All evening from 18:00 to 23:00hrs;

- Saturday Afternoons from 13:00 to 18:00 hrs, and;
- All day Sunday from 07:00 to 18:00hrs.

Night-time hours:

- 23:00 to 07:00hrs.

This publication which was issued by the Institute of Acoustics in May 2013, is endorsed by the UK, Department of Energy and Climate Change (DECC), the Northern Ireland Executive, the Scottish Executive and the Welsh Assembly and provides guidance on all aspects of the use of ETSU-R-97.

Based on the professional competence and expertise of the authors, the combination of guidance provided in WEDG 2006, ETSU, IOA GPG and SNGs, is considered best practice and have been adopted for this assessment.

Draft Wind Energy Guidelines 2019

In December 2019, the Draft Revised Wind Energy Development Guidelines December 2019 'Draft WEDG 2019' was published for consultation. During the public consultation process considerable concerns in relation to the proposals were expressed by various parties including members of the Institute of Acoustics and various experts in the field of wind turbines noise assessments.

It is acknowledged that this document remains the subject of detailed consultation with interested parties and stakeholders. At the time of writing this chapter, the document is still in draft format, therefore, in line with best practice, the assessment presented in this report is based on the guidance currently outlined in **Section 5.6** of WEDG 2006.

World Health Organization (WHO) Noise Guidelines for the European Region

The WHO Environmental Noise Guidelines for the European Region (2018) provides health-based recommendations based on average environmental noise exposure using noise indicators Lday/evening/night (Lden) and Lnight. These parameters have been adopted to describe a range of environmental sources including transportation and commercial noise however, in relation to wind turbine noise, the quality of evidence used to correlate these parameters with the effect associated with wind turbine noise is identified within the guidance as being 'Low'. Specifically, the document states the following:

"..it may be concluded that the acoustical description of wind turbine noise by means of Lden or Lnight may be a poor characterization of wind turbine noise and may limit the ability to observe associations between wind turbine noise and health outcomes..."

...Further work is required to assess fully the benefits and harms of exposure to environmental noise from wind turbines and to clarify whether the potential benefits associated with reducing exposure to environmental noise for individuals living in the vicinity of wind turbines outweigh the impact on the development of renewable energy policies in the WHO European Region.”

The recommendations for wind turbine noise are therefore conditional and based on the professional competence and expertise of the authors, the combination of guidance provided in WEDG 2006, ETSU, IOA GPG and SGNs is considered best practice and have been adopted for this assessment.

Special Audible Characteristics

Wind turbine noise emissions may exhibit some ‘Special Characteristics’ which would render the noise more annoying than the equivalent noise emission level without such characteristics. It may therefore be appropriate to apply a rating penalty to a noise level to account for this factor.

Warranties from the supplier will be sought to ensure some characteristics can never be present e.g. tonality. Others may be controlled by curtailment e.g. Amplitude Modulation. In all cases, it is not possible to predict the occurrence of any special characteristic at the planning stage. Post-construction monitoring programmes and campaigns following prescribed guidelines can objectively investigate these characteristics. It should also be noted that these are rare events associated with a limited number of wind farms. Nevertheless, the details and assessment of each is set out below.

Tonal Noise

Tonality is a characteristic that is applicable to a wide range of sound descriptions, such as ‘humming’, ‘droning’, ‘whining’, ‘whistling’, ‘buzzing’ etc, depending on the frequencies in the sound and its harmonic structure. These sounds are associated with concentrations of energy into very narrow parts of the frequency spectrum, which may include a single tone or multiple tones.

Tonal noise from wind turbines, characterized by a distinct “hum” or “whine” at a steady pitch, is relatively rare in modern turbines. This type of noise is typically caused by mechanical components or unusual wind currents interacting with turbine parts. Advances in turbine design have significantly reduced the occurrence of tonal noise, making it much less common in newer models

It should be noted that tonal noise is associated with wind turbine operation, and it is not possible to predict an occurrence of tonality at the planning stage. In the event of a complaint regarding tonality, a detailed assessment following the guidance outlined in the IOA GPG and Supplementary Guidance Note 5: Post Completion Measurements (July 2014) will be followed.

Furthermore, a warranty will be sought from the wind turbine supplier that no tonal component will manifest in the noise emissions.

Amplitude Modulation

AM is defined in the IOA Noise Working Group (Wind Turbine Noise) Amplitude Modulation Working Group (AMWG) document *A Method for Rating Amplitude Modulation in Wind Turbine* (IOA, 2016) as:

“Periodic fluctuations in the level of audible noise from a wind turbine (or wind turbines), the frequency of the fluctuations being related to the blade passing frequency (BPF) of the turbine rotor(s).”

It is now generally accepted that there are two mechanisms which can cause amplitude modulation:

- ‘Normal’ AM; and
- ‘Other’ AM (sometimes referred to ‘Excessive’ AM).

In both cases, the result is a regular fluctuation in amplitude at the BPF of the wind turbine blades (the rate at which the blades of the turbine pass a fixed point). For a three-bladed turbine rotating at 20 RPM, this equates to a modulation frequency of 1Hz.

‘Normal’ AM

An observer at ground level close to a wind turbine will experience ‘blade swish’ because of the directional characteristics of the noise radiated from the trailing edge of the blades as it rotates towards and then away from the observer.

This effect is reduced for an observer on or close to the turbine axis and therefore would not generally be expected to be significant at typical separation distances, at least on relatively level sites.

The Renewable UK AM project (Renewable UK, 2013) has coined the term ‘normal’ AM (NAM) for this inherent characteristic of wind turbine noise, which has long been recognised and was discussed in ETSU-R-97 in 1996.

'Other' AM

In some cases, AM is observed at large distances from a wind turbine (or turbines). The sound is generally heard as a periodic 'thumping' or 'whoomphing' at relatively low frequencies.

On sites where it has been reported, occurrences appear to be occasional, although they can persist for several hours under some conditions, dependent on atmospheric factors, including wind speed and direction.

It was proposed in the Renewable UK 2013 study that the fundamental cause of this type of AM is transient stall conditions occurring as the blades rotate, giving rise to the periodic thumping at the blade passing frequency.

Transient stall represents a fundamentally different mechanism from blade swish and can be heard at relatively large distances, primarily downwind of the rotor blade. The Renewable UK AM project report adopted the term 'Other AM' (OAM) for this characteristic. The terms 'enhanced' or 'excess' AM (EAM) have been used by others, although such definitions do not distinguish between the source mechanisms and presuppose a 'normal' level of AM, presumably relating back to blade swish as described in ETSU-R-97.

Prediction of AM

It should be noted that AM is associated with wind turbine operation, and it is not possible to predict an occurrence of AM at the planning stage. It should also be noted that it is a rare event associated with a limited number of wind farms. While it can occur, it is unlikely and is the exception rather than the rule.

Renewable UK Research Document states the following in relation to the matter:

"Even on those limited sites where it has been reported, its frequency of occurrence appears to be at best infrequent and intermittent."

"It has also been the experience of the project team that, even at those wind farm sites where AM has been reported or identified to be an issue, its occurrence may be relatively infrequent. Thus, the capture of time periods when subjectively significant AM occurs may involve elapsed periods of several weeks or even months."

"There is nothing at the planning stage that can presently be used to indicate a positive likelihood of OAM occurring at any given proposed wind farm site, based either on the site's general characteristics or on the known characteristics of the wind turbines to be installed."

Assessment of AM

Research and guidance in the area is ongoing with publications being issued by the IOA Noise working Group (Wind Turbine Noise) Amplitude Modulation Working Group (AMWG) namely, *A Method for Rating Amplitude Modulation in Wind Turbine Noise (August 2016)*. The document proposes an objective method for measuring and rating AM to adopt in the event of it's occurrence at an operational wind farm. The AMWG does not propose what level of AM is likely to result in adverse community response.

The AMWG does not propose any limits for AM but does provide information on noise penalty schemes in the event that AM is confirmed at an operational wind farm. The purpose of the group is simply to use existing research to develop a Reference Methodology for the measurement and rating of amplitude modulation. The definition of any limits of acceptability for AM, or consideration of how such limits might be incorporated into a wind farm planning condition, is outside the scope of the AMWG's work and is currently the subject of a separate UK Government funded study.

A suitable Noise Complaint Monitoring Programme (NCMP) will be implemented for the proposed Project. Should a noise complaint or evidence of an exceedance of the noise limits occur, a detailed assessment and appropriate mitigation measures such as a curtailment programme on the wind turbine operations will be undertaken. The NCMP will follow the guidance outlined in the IOA GPG and Supplementary Guidance Note 5: Post Completion Measurements (July 2014).

Infrasound and Low Frequency Noise

Low Frequency Noise is noise that is dominated by frequency components less than approximately 200Hz and Infrasound is typically described as sound at frequencies below 20Hz.

Infrasound is generally associated with older passive yaw type turbine technologies and not modern active yaw controlled turbine such as those being proposed. Low frequency noise is not also expected to be a significant factor at the separation distances.

There is therefore no risk of Infrasound or Low Frequency Noise occurring from the proposed Project.

ISO 9613-2:1996

ISO 9613-2 Acoustics — Attenuation of sound during propagation outdoors — Part 2: General method of calculation, is a widely adopted international standard used to predict environmental noise levels from various sources, including wind turbines. It has been adopted in this

assessment to predict wind turbine noise levels at the NSLs within the study area at a range of wind speeds. The schedule of NSLs is provided in **Section 10.3.5**.

BS 4142:2014

BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound described a method for assessing the impact of a proposed or existing industrial or commercial sound source. This guidance is appropriate for the assessment of non-turbine related noise sources including the onsite Substation.

The standard introduces the concept of a Rating Level (L_{Ar}) which considers particular noise characteristics which are likely to increase the likelihood of an adverse impact. These characteristics include tonal component to the noise which may make it more distinguishable and noise of an impulsive nature. Where applicable, penalties may be added to the measured or predicted Specific Noise Level (L_{Aeq}) to account for these.

The Rating Level (L_{Ar}) is compared to the typical Background Level (L_{A90}), measured in the absence of the noise under assessment, to determine the likelihood of an adverse impact.

ISO 1996-1-2016

ISO 1996 is an international standard that provides a framework for the description, measurement, and assessment of environmental noise including instrumentation, calibration, and measurement conditions.

It provides a protocol to extract ambient and background noise levels from the baseline noise data that can be used for the assessment of non-turbine operational noise such as the on-side sub-station, and also to set the appropriate construction noise limit.

Vibration

Ground borne vibration waves are attenuated rapidly as they propagate from a source through the substrate. Modern wind turbines do not generate sufficiently high levels of vibration to be perceptible at any distance much beyond the Turbine Foundations.

As a result, little research had been conducted on the subject however a report published by the State Office for the Environment, Measurement and Nature Conservation of the Federal State of Baden-Württemberg, Germany in 2016, *Low frequency noise incl. infrasound from wind turbines and other sources* conducted a vibration study for an operational Nordex N117 – 2.4MW wind turbine. The report confirmed that at distances of less than 300m from the

turbine vibration levels had dropped so far that they could no longer be differentiated from the background vibration levels.

Given that the closest NSL (NSL35) is some 599m from the nearest turbine (T02), operational vibration levels would be imperceptible and therefore are excluded from this assessment.

Operational Phase – Vehicular Activities

Some additional traffic is associated with the operational phase of the proposed Project, and it is appropriate to assess the effect by calculating the increase in traffic noise levels that will arise because of vehicular movements on the public road network.

The IEMA Guidelines set out in **Section 10.2.3** consider a change in traffic noise levels of 3 to 4.9 dBA would be noticeable, in excess of 5dBA would be clearly noticeable, and depending on the final noise level, the impact may be **Moderate** or **Significant**. A change in noise level of less than 3dB would be imperceptible.

Furthermore, the *UK Design Manual for Roads and Bridges* (DMRB, Volume 11, Section 3, Part 7) states that a change in noise level of 1dB $L_{A10,18h}$ is equivalent to a 25% increase or a 20% decrease in traffic flow, assuming other factors remain unchanged and a change in noise level of 3dB $L_{A10,18h}$ is equivalent to a 100% increase or a 50% decrease in traffic flow.

Typically, traffic accessing the site during the operational phase, will be vans and four wheeled drive vehicle. Operation phase site visits will occur approximately 24 times per year, i.e. twice per month as a minimum, incorporating a routine maintenance programme for the turbines. Unscheduled maintenance visits will also be required for resetting alarms, rectifying turbine faults and the occasional replacement of larger turbine component parts. **Chapter 12 Traffic and Transport** concludes that the significance of effects during the operational phase is **Long Term, Imperceptible** and **Not Significant**. Due to the imperceptible increase in traffic noise during the operational phase is also considered to be imperceptible.

10.2.3 Health Effects of Wind Farms

The peer reviewed research outlined in the preceding sections supports that there are no negative health effects on people with long term exposure to wind turbine noise. Please refer to **Chapter 5 – Population and Human Health** of the EIAR for further details of potential health effects with regards to noise and vibration associated with the proposed Project.

10.2.4 Policy

The overarching planning policy relevant to the proposed Project is detailed in **Chapter 4 – Planning and Policy**. A Planning Statement has been provided with the planning application documents.

There are no specific policies or objectives relating to wind farm noise in the Roscommon County Development Plan 2022 – 2028. As such the guidance set out above will be followed throughout this Chapter.

10.3 Methodology

10.3.1 Consultation

Scoping and consultation have been carried out in support of the proposed Project and in line with the EIA Directive, together with the EPA Guidelines and with due regard for the *Environmental Impact Assessment of Projects: Guidance on Scoping (European Commission, 2017)*.

An EIA Scoping Report was issued to 48 Statutory and non-statutory stakeholders via email in September 2024, of which 10 responded. All scoping consultation responses are provided in **Appendix 1-3 – Scoping Consultation Responses**.

Table 10-6 summarises issues raised during this consultation process and relevant to Noise and Vibration.

Table 10-6: Consultation responses relevant to Noise and Vibration

Stakeholder Details	Stakeholder Comment	How comment has been addressed in the EIAR
TII	The EIAR should consider the 'European Communities (Environmental Noise) Regulations, 2018, (S.I. no. 549 of 2018)', and, in particular, how the development will affect future action plans by the relevant competent authority. The developer may need to	The TII scoping response has been considered in the preparation of this chapter, including the incorporation of noise barriers to reduce noise and other mitigation proposals

Stakeholder Details	Stakeholder Comment	How comment has been addressed in the EIAR
	consider the incorporation of noise barriers to reduce noise impacts (see 'Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes (NRA, 2014)').	set out in the NRA 2014 good practice guidance.
Faillte Ireland	A link between tourism and this prescribed environmental factor, beyond the normal development impacts, is rare, however the impact upon tourism of issues of noise and vibration can be significant. Construction adjoining hotels for example should consider the sensitivity of the development and ensure mitigation is in place.	A Noise Assessment accounting for NSL has been presented in Section 10.6 Assessment of Effects.

10.3.2 Approach to Project Design

As set out in **Chapter 1 - Introduction**, under Section 32I of the Planning and Development Act 2000 (as amended), the Applicant is in receipt of an opinion on flexibility, relating to 3 no. options of Turbines. This opinion from the Local Authority confirmed that it was 'appropriate that the proposed application be made and decided before the prospective applicant has confirmed certain details of the application'

Each Technology Option (turbine) has different noise emissions. The effects of each Technology Option has therefore been considered separately in this assessment.

10.3.3 Approach to the Assessment

The methodology adopted for this noise impact assessment is summarised as follows:

- Review of applicable guidance to identify appropriate noise and vibration criteria for the construction, operational and decommissioning phases;
- Define the study area;
- Quantify the receiving environment through baseline noise surveys at representative NSLs within the study area;
- Undertake predictive calculations to assess the likely significant effects associated with the construction and decommissioning phases of the proposed Project;

- Undertake predictive calculations to assess the likely significant effects associated with the operational phase of the proposed Project;
- Evaluate the likely significant noise and vibration effects associated with the proposed Project;
- Specify mitigation measures to reduce, where necessary, the identified likely significant effects relating to noise and vibration from the proposed Project; and
- Assess the significance of the residual noise and vibration effects associated with the proposed Project.

10.3.4 Descriptions and Assessment of Effects

In addition to the appropriate impact assessment criteria set out in this chapter, The effects on Noise and Vibration are assessed using the methodology outlined in **Chapter 1 – Introduction** with the assessment and conclusions detailed within this Chapter. The significance of an effect was determined by considering the magnitude of the impact and the sensitivity of the receptor, with the classifications assigned in accordance with the EPA Guidelines, including **Imperceptible, Not Significant, Slight, Moderate, Significant, Very Significant** and **Profound**.

In considering the effects, criteria such as quality, duration, probability and type were also considered. These criteria are detailed in **Table 3.4** of the EPA Guidelines and are presented in **Table 1-6** of **Chapter 1 – Introduction**. As per the guidelines, all categories of these terms do not need to be used for every effect.

For the purpose of this assessment, effects rates as '**Significant**' or above are considered to be Significant in EIA terms. Effects identified as '**Moderate**' significance or below are considered **Not Significant** in EIA terms.

In order to determine the significance of effect, the EPA Guidelines (EPA, 2022) has provided a matrix which compares the character (magnitude) of the potential impact to the sensitivity of the receiving environment, see **Figure 10-1**.

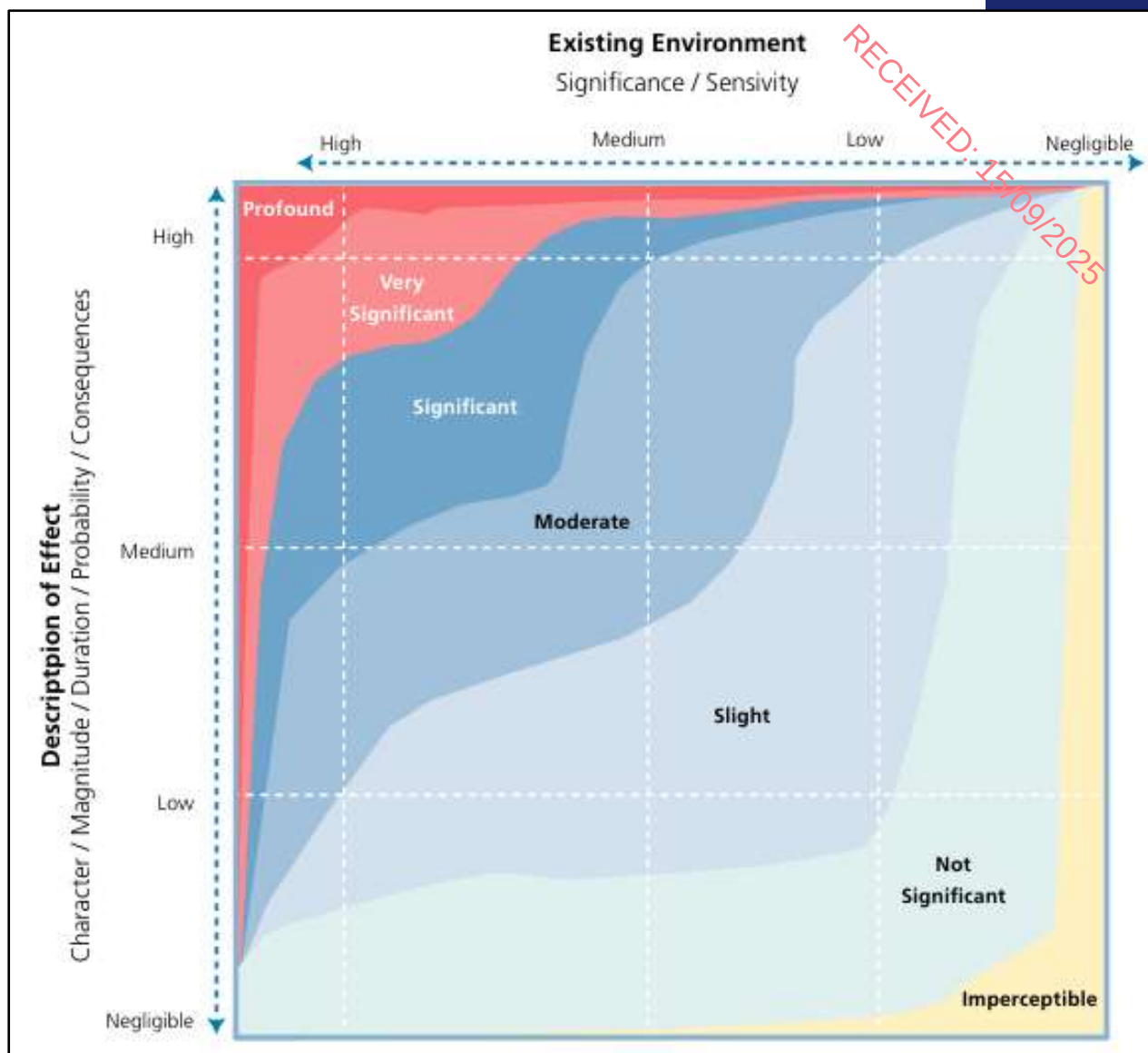


Figure 10-1: Typical Classification of the Significance of Effects (EPA, 2022)

The most important factor in describing a noise impact is the associated change in noise level.

The EPA Guidelines do not however quantify the effects in decibel terms. In the absence of such information, reference is made to IEMA Guidelines (IEMA, 2014). The IEMA Guidelines state similar terminology to the EPA Guidelines and quantifies the effect categories in decibel terms for various receptor categories, with residential receptors having the greatest sensitivity to noise.

Table 10-7 presents the effect descriptions and their respective noise level change for residential receptors.

Table 10-7: Effects Description (EPA Guidelines and IEMA Guidelines) and noise level change criteria

EPA Significance of Effect	IEMA Guidelines	Noise Level Change (dB)
Imperceptible	None/Not significant	Less than 2.9
Not Significant		
Slight	Slight	3.0 – 4.9
Moderate	Moderate	
Significant	Substantial	5.0 – 9.9
Very Significant	Very Substantial	Greater than 10
Profound		

The Noise Level Change is therefore the most appropriate measure to describe the significance of effects for the Construction, Decommissioning and Substation aspects of the proposed Project. For the purposes of this assessment, effects rated as '**Significant**' or above are deemed **Significant** in EIA terms. Effects identified as '**Moderate**' significance or below are **Not Significant** in EIA terms.

Duration of Effects

The duration of potential noise and vibration effects has been considered as part of this assessment. In line with EIAR guidance, duration refers to how long an effect is expected to last, ranging from momentary to permanent impacts. A summary is provided for each section in this assessment. **Table 10-8** presents the duration of effects.

Table 10-8: Duration of effects and their definition

Effect Type	Definition
-------------	------------

Momentary Effects	Effects lasting from seconds to minutes
Brief Effects	Effects lasting less than a day
Temporary Effects	Effects lasting less than a year
Short-term Effects	Effects lasting one to seven years
Medium-term Effects	Effects lasting seven to fifteen years
Long- term Effects	Effects lasting fifteen to sixty years
Permanent Effects	Effects lasting over sixty years

10.3.5 Study Area

Following the appropriate guidance set out in **Section 10.2**, the study area for the operational and construction/decommissioning phases was established.

The study area for the Construction and decommissioning phases is defined as the closest Noise Sensitive Location to the construction activity. As the noise propagates from the construction activity noise level diminish so the likely effect at the nearest NSL represents a worst-case assessment.

The study area for the operation phase is defined in the IOA GPG as:

“The study area should cover at least the area predicted to exceed 35dB L_{A90} up to 10m/s wind speed from all existing and proposed turbines.”

An initial noise propagation model at the rated wind speed of the turbine Technology Option with the highest noise emission levels was used to identify the NSLs within the study area.

A total of 219 no. NSLs were identified, and the coordinates are listed in **Appendix 10.3 – Noise Sensitive Locations**.

10.3.6 Approach to Baseline Conditions

Baseline Noise Survey of Receiving Environment

A noise survey programme is used to quantify the existing baseline conditions. Analysis of the measured data is used for two purposes:

1. The minimum wind-speed dependant L_{A90} values are used to derive the operational noise limits for the wind turbines, and
2. The average ambient daytime L_{Aeq} noise levels are used to derive the construction noise limits and for the purposes of describing the EPA effects.

Noise Survey

As required by *ETSU-R-97* a noise monitoring programme is required to establish the background noise levels across a range of wind speeds in the receiving environment.

Several NMLs were identified as being suitable to represent the ambient noise conditions within the study area and noise monitoring was conducted at the locations shown in **Figure 10-2** and detailed in **Table 10-9**. These locations were chosen based on their proximity to key NSLs, primarily residential dwellings, and typical site conditions. Notwithstanding that some locations will experience higher background noise levels than others, for example those closer to roads, the minimum measured noise levels are used to set the operational criteria. This provides for the most conservative impact assessment for all NSLs.

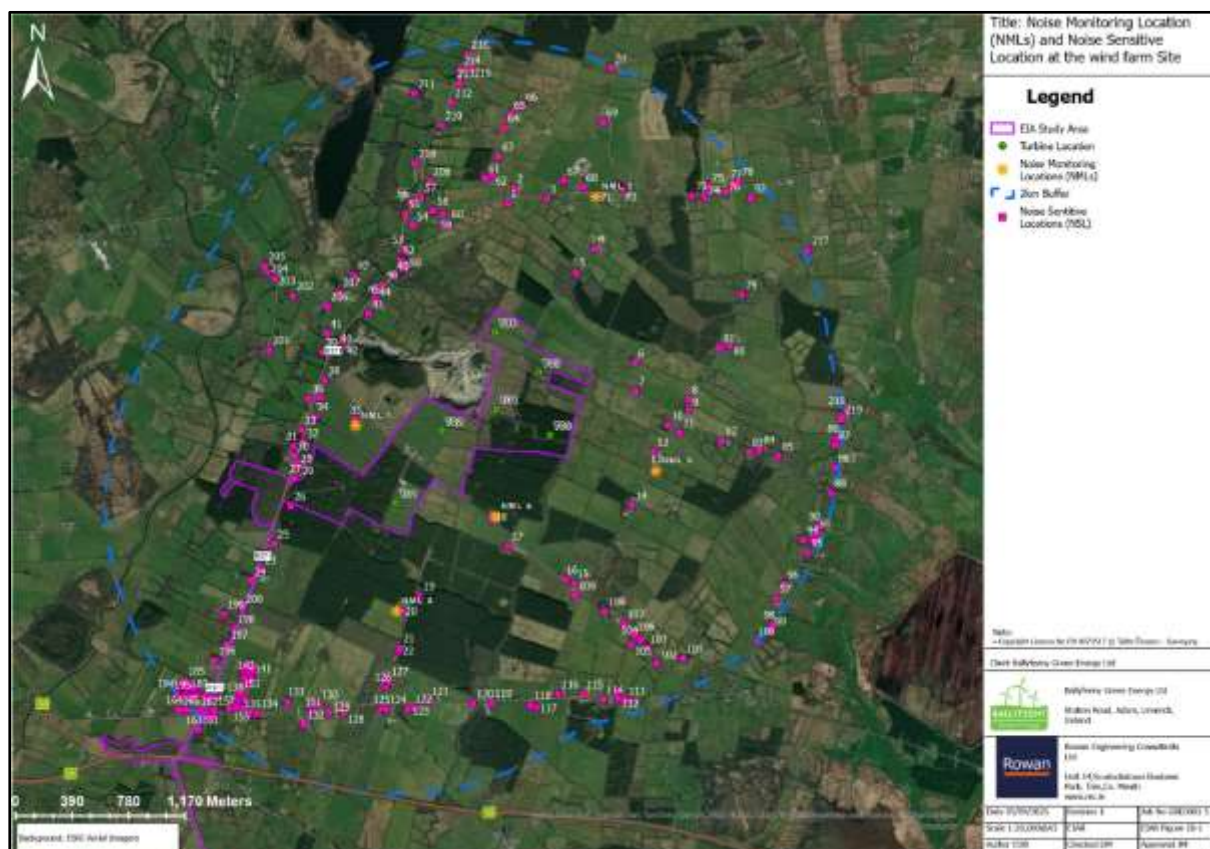


Figure 10-2: Noise Monitoring Locations (Ref: EIAR Figure 10-2 (Volume 4))

Table 10-9 NMLs coordinates and descriptions.

Location	ITM X	ITM Y	Description of noise sources
NML 1	597751.8	781896.0	Bird song, potential livestock noises nearby
NML 2	599411.9	783468.6	Bird song, potential rustling of vegetation, dogs nearby, Local Road traffic
NML 3	599820.2	781584.7	Bird song, potential for rustling vegetation. Livestock nearby
NML 4	598714.8	781271.1	Bird song, potential stream nearby, rustling vegetation
NML 5	598032.6	780621.1	Bird song, aircraft passing during installation, constant distant road traffic, livestock noise in distance

Suitable noise monitoring instruments which satisfy the requirements of the *IOA Good Practice Guidance No.1* was installed at each of the locations in **Table 10-9** and photographs of the installations are given in **Appendix 10.2 – Noise Survey Details, Instrumentation, Personnel and Photos**.

Survey Period

Sections 2.9.1 of the IOA GPG states:

“The duration of a background noise survey is determined only by the need to acquire sufficient valid data over the range of wind speeds (and directions, if relevant). It is unlikely that this requirement can be met in less than 2 weeks.”

The survey period was between 15-03-2024 and 10-04-2024. The survey period was of sufficient duration to satisfy the IOA GPG requirement to measure adequate data to determine suitable representative background noise levels across an appropriate range of wind speeds.

Instrumentation

The noise monitoring installed at each NML consisted of a class 1 Sound Level Meter (SLM), outdoor microphone, secondary windscreen, batteries etc. which fully meet the requirements set out in ETSU and IOA GPG.

Before and after the measurements, the instruments were field calibrated using a Brüel & Kjær type 4231 Sound Level Calibrator. See **Appendix 10.2 – Noise Survey Details, Instrumentation, Personnel and Photos**.

The data allowed the removal of noise data during precipitation, in line with best practice outlined in *IOA GPG Supplementary Guidance Note 2: Data Processing and Derivation of ETSU-R-97 Background Curves*.

The microphones were all fitted with double windscreens, mounted between 1.2m and 1.5m above ground level and, situated between 3.5m and 260m from dwellings. The noise meters were located away from obvious sources of noise such as boiler flues, fans and ephemeral running water. The meters were situated away from hard reflective surfaces such as solid fences and walls.

Noise levels in terms of measurement parameters $L_{Aeq,10min}$ and $L_{A90,10min}$ were logged by each NML.

Consideration of Wind Shear

Wind shear can be defined as the changes in the relationship between wind speed at different heights, for example, hub height wind speeds will differ from those close to ground level. Noise emission levels of wind turbines are related to the wind speed at hub height but are reported at standardised 10 metre high wind speeds to order to provide consistent results for regardless of their hub heights.

The IOA GPG provides suitable guidance to calculate this wind shear effect and have been applied to this assessment. The guidance presents the following equations in relation to the derivation of a standardised wind speed at 10m above ground level.

Equation A

Shear Exponent Profile:

$$U = U_{ref} \left[\frac{H}{H_{ref}} \right]^m$$

Where:

- U calculated wind speed.
- U_{ref} measured wind speed.
- H height at which the wind speed will be calculated.
- H_{ref} height at which the wind speed is measured.
- m shear exponent.

Equation B

Roughness Length Shear Profile:

$$U_1 = U_2 \frac{\ln(H_1/z)}{\ln(H_2/z)}$$

Where:

H_1 the height of the wind speed to be calculated (10m)

H_2 the height of the measured wind speed.

U_1 the wind speed to be calculated.

U_2 the measured wind speed.

z the roughness length.

Note: A roughness length of 0.05m is used to standardise hub height wind speeds to 10m reference height in the *IEC 61400-11:2003* standard, regardless of what the actual roughness length seen on a site may have been. This 'normalisation' procedure was adopted for comparability between test results for the three Technology Options.

Any reference to wind speed herein should be understood to be the 10m height standardised wind speed reference unless otherwise stated.

The background noise data has also been analysed with respect to a 10m standardised height in accordance with the guidance contained in the IOA GPG in order to provide consistency regardless of the turbine Technology Options and their respective hub heights

Meteorological Data

In accordance with the IOA GPG, background noise measurements should be correlated with wind speed measurements performed at the proposed wind farm site, such that operating noise levels from the turbines may be compared with the noise levels that would otherwise be experienced at a dwelling.

To facilitate the calculation of noise results at the standardised 10 metre height, wind speed and wind direction data were provided by an on-site LiDAR which was installed c. 150m north of the turbine T01 location. The coordinates of the LiDAR installation are provided in the **Table 10-10**.

Table 10-10: LiDAR Co-ordinates

Device	ITM X	ITM Y
LiDAR	198106	281512

Figure 10-3 shows the distribution of the measured wind speed and directions recorded.

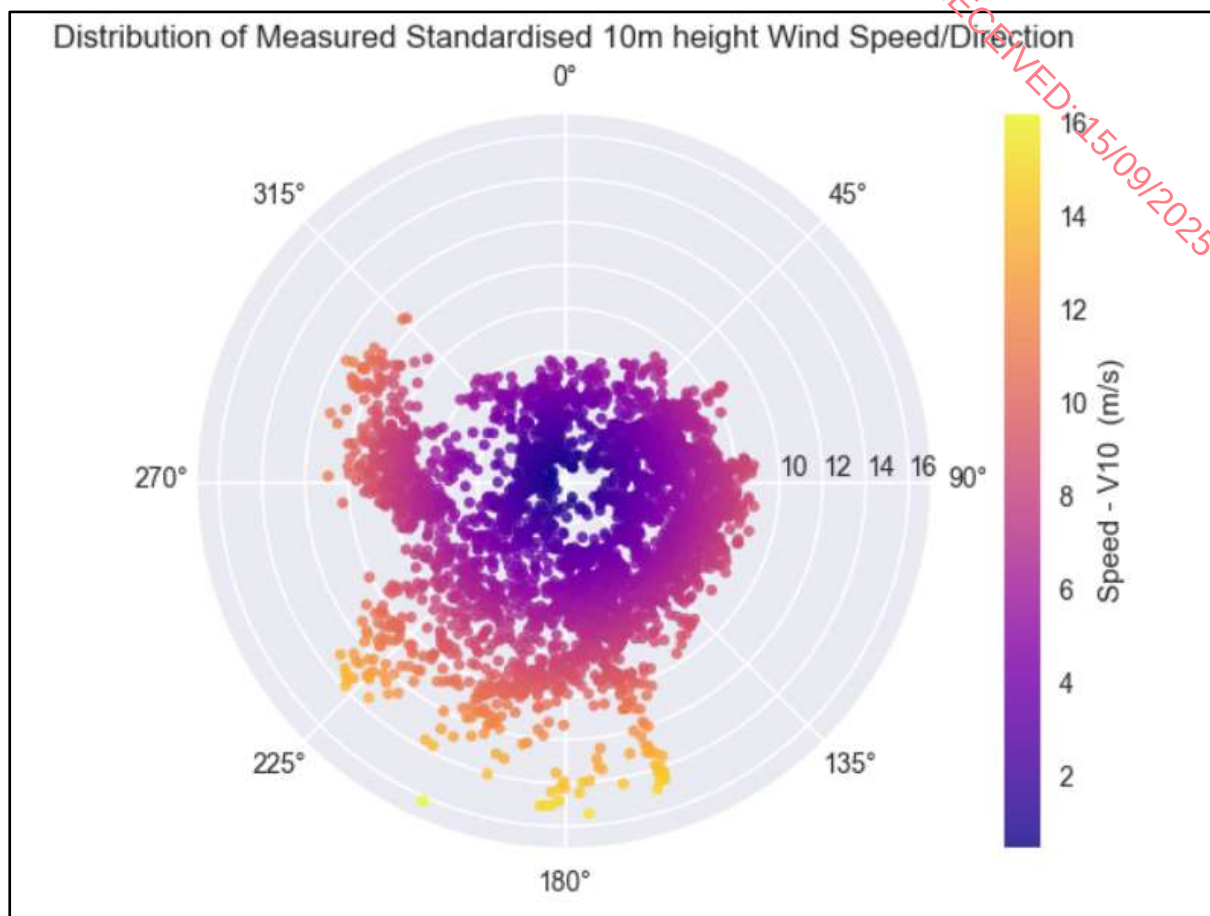


Figure 10-3: Distribution of Measured Standardised 10m height Wind Speed/Direction

Filtering and Analysis of Background Noise Data

Following assessment methods contained in the IOA GPG, the data sets have been filtered to remove issues such as the dawn chorus and the influence of other atypical noise sources. In addition, sample periods affected by rainfall or when rainfall resulted in prolonged periods of atypical noise levels have also been screened from the data sets.

The results presented in the following sections refer to the filtered noise data collated for Daytime and Night-time Amenity periods as described in **section 10.1.3**.

10.4 Baseline Environment

10.4.1 Noise Survey Results

In general, the significant noise sources in the area were noted to be local and distant traffic, domestic activity in and around the residences, wind generated noise from local foliage and other typical anthropogenic sources typically found in such rural settings.

Following IOA GPG and *SNG No. 2 Data Collection* guidance, for the purposes of setting the noise criteria, the prevailing measured background noise levels are calculated using a best fit

regression line through the measured $L_{A90,10min}$ noise data. These are presented for the Daytime amenity and Night-time periods with green and yellow lines respectively, as shown in **Figure 10-4** to **Figure 10-13**.

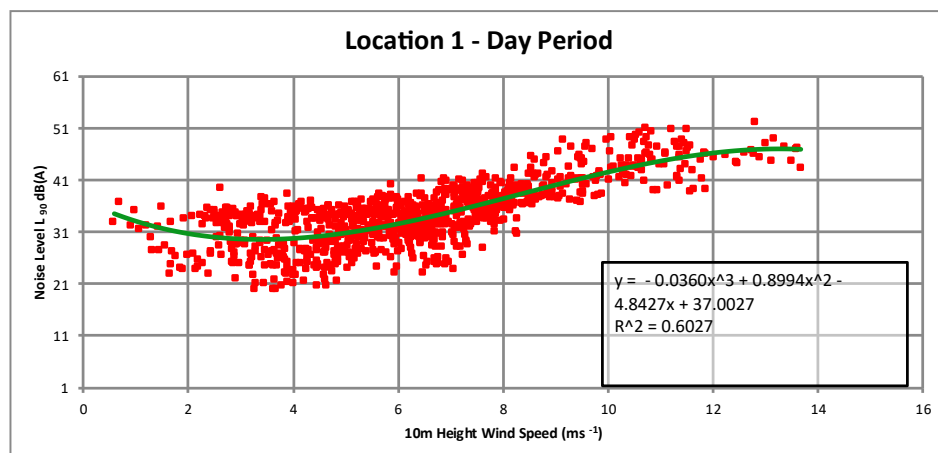


Figure 10-4: NML1 – Background Noise – Daytime period

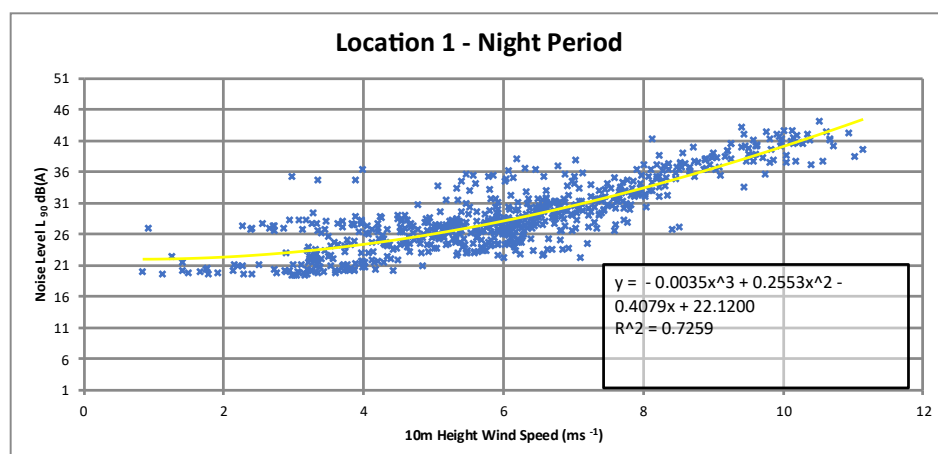


Figure 10-5: NML1 – Background Noise – Night-time period

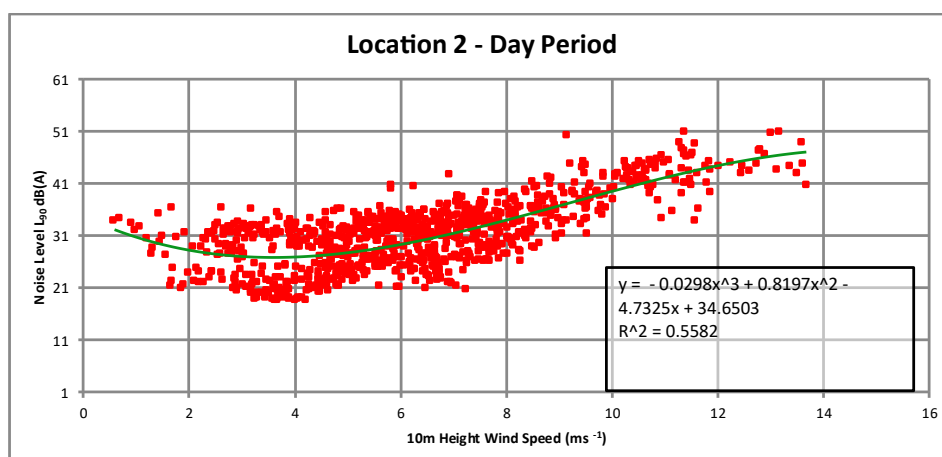


Figure 10-6: NML2 – Background Noise – Daytime period

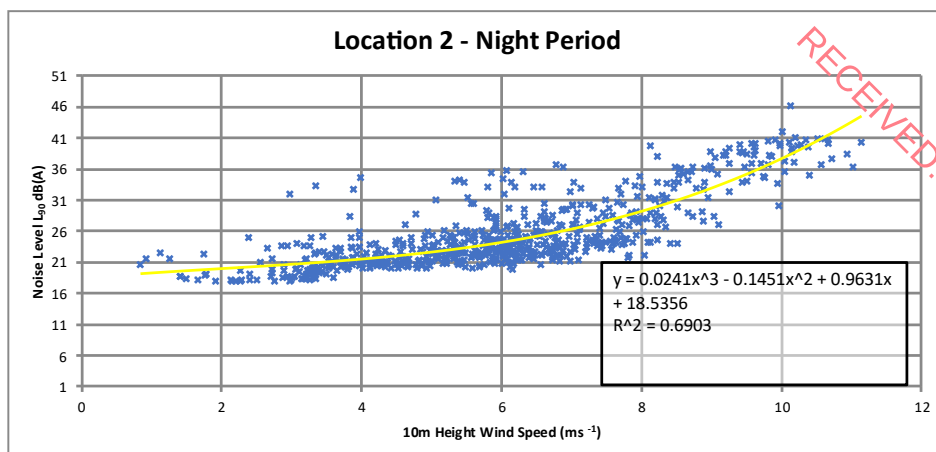


Figure 10-7: NML2 – Background Noise – Night-time period

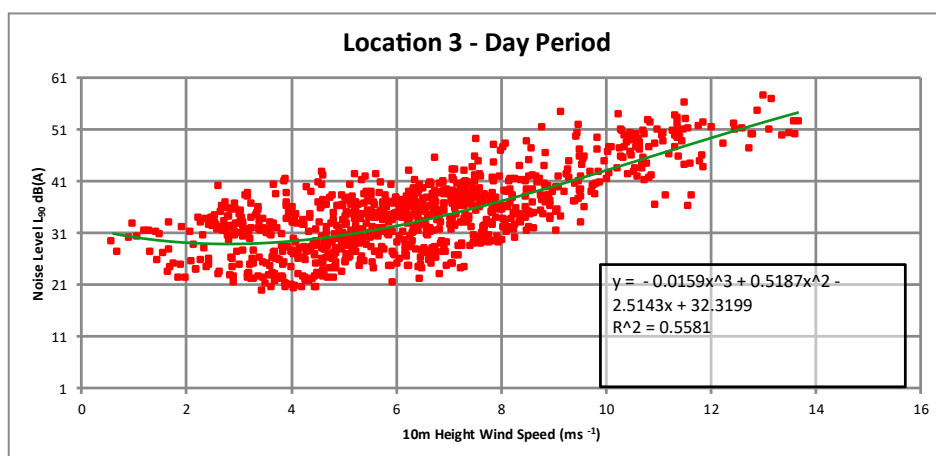


Figure 10-8: NML3 – Background Noise – Daytime period

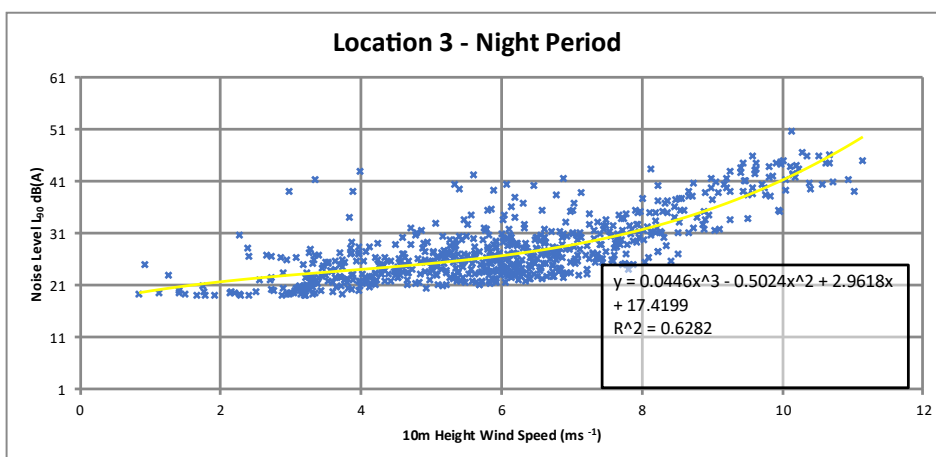


Figure 10-9: NML3 – Background Noise – Night-time period

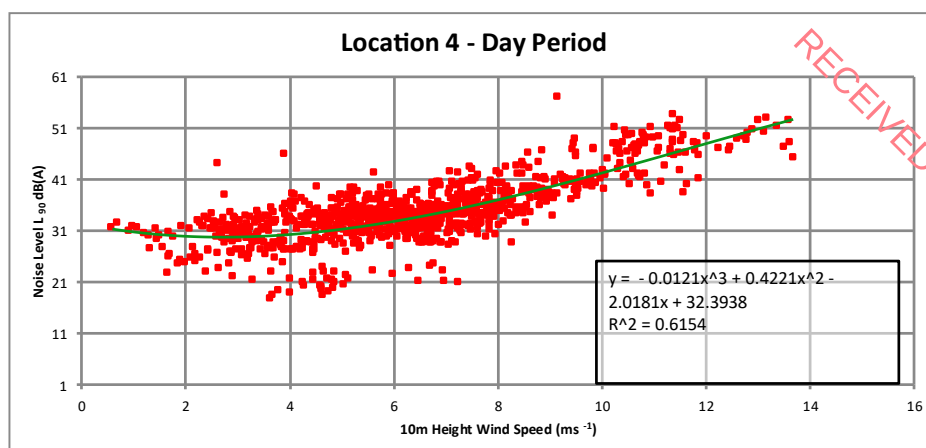


Figure 10-10: NML4 – Background Noise – Daytime period

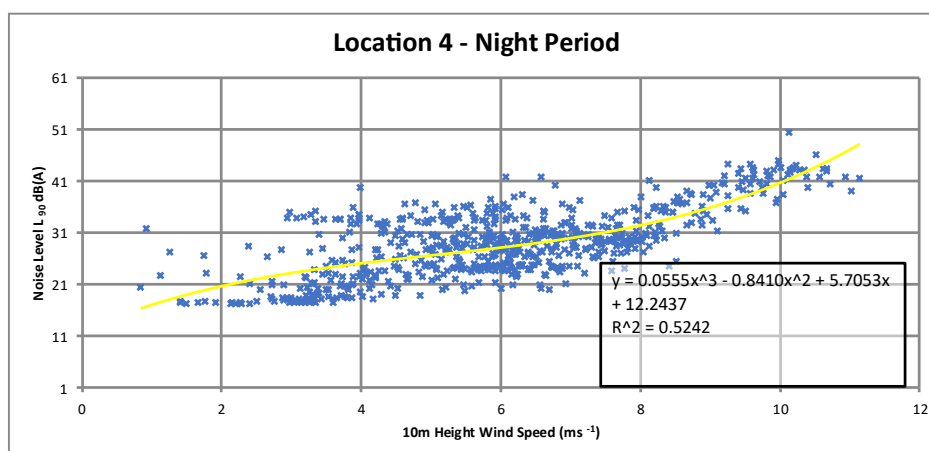


Figure 10-11: NML4 – Background Noise – Night-time period

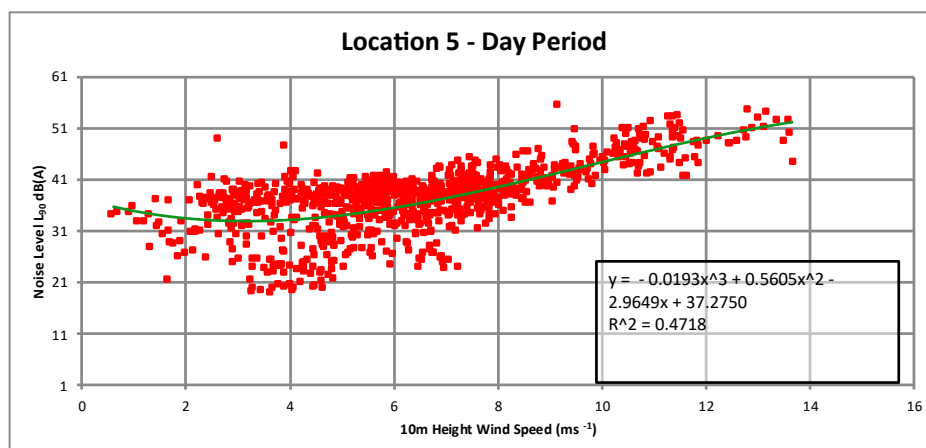


Figure 10-12: NML5 – Background Noise – Daytime period

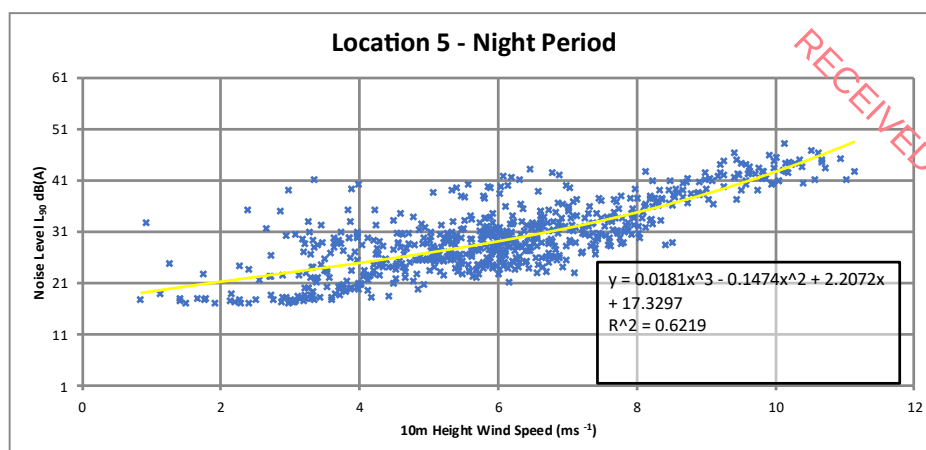


Figure 10-13: NML5 – Background Noise – Night-time period

10.4.2 Summary of Background Noise Levels

The derived $L_{A90,10\min}$ noise levels for each of the NMLs for Daytime and Night-time amenity hours **Table 10-11**.

Table 10-11: Derived levels of $L_{A90,10\min}$ for various wind speeds

Location	Period	Derived $L_{A90,10\min}$ Levels (dB) at Standardised 10m Height Wind Speeds (m/s)									
		3	4	5	6	7	8	9	10	11	12
NML1	Day	30	30	31	33	35	37	40	43	45	46
	Night	23	24	26	28	31	33	37	40	44	48
NML2	Day	27	27	28	29	31	34	37	40	42	44
	Night	21	22	23	24	26	29	33	38	44	51
NML3	Day	29	30	31	32	35	37	40	43	46	49
	Night	23	24	25	27	29	32	36	41	49	58
NML4	Day	30	30	31	33	35	37	40	42	45	48
	Night	23	25	27	28	30	32	36	41	47	56
NML5	Day	33	33	34	35	37	40	42	44	47	49
	Night	23	25	27	29	32	35	38	43	48	54
Nominal	Day	27	27	28	29	31	34	37	40	42	44
	Night	21	22	23	24	26	29	33	38	44	48

The Nominal criteria from **Table 10-11** is the lowest background level from all NMLs. The Nominal criteria are used to set the wind turbine operational noise limits for all NSLs, and a worst-case impact is therefore assessed.

It should be noted that the criterion for daytime low noise conditions as mentioned in Section 10.3.3 is satisfied at wind speeds between 3 m/s and 6 m/s.

10.4.3 Ambient Noise Levels

In addition to setting the appropriate wind turbine noise criteria over the range of wind speeds, the data from the baseline noise survey also serves to provide the typical ambient noise levels in terms of L_{Aeq} and L_{A90} levels. This data is in turn used to enable the assessment of the following:

- Set the appropriate construction noise limit (L_{Aeq}).
- Provide baseline level (L_{Aeq}) for the BS4142 impact assessment of the Onsite Substation.

Following guidance provided in ISO1996-1:2016, noise levels at wind speeds below 5m/s¹ were derived and are presented in **Table 10-12**.

Table 10-12: Summary of Ambient Noise Levels

Period	L_{Aeq} (dB)	L_{A90} (dB)
Daytime	40	33
Night-time	32	26

10.4.4 Quarry Vibration

The suitability of the site of the proposed turbines was assessed in relation to the ground-borne vibration levels as a result of blasting activities at the nearby Ballyfeeny Rock quarry. A blasting event may present a sufficiently significant source of vibration and appropriate guidance on the matter has been provided by the Wind Energy Converter (WEC) manufacturer. This document *Specification Foundation soil tremor Status: 2017-09-028* as follows:

“The determined value for the vibration velocity on the WEC foundation as the result of a non-stationary tremor should not exceed a defined reference value.”

The “defined reference value” for non-stationary tremors is provided as a vibration velocity of 10mms⁻¹. This is therefore the appropriate criteria for this assessment.

¹ Wind speeds were taken from the on-site LiDAR and adjusted to the noise measurement height of 1.5m using the wind shear calculation set out in Section 10.3.6.

To quantify the vibration levels associated with the blasting activity, a vibration survey was conducted by Enfonic on January 9, 2025 during a scheduled blasting event.

Measurements were taken at proxy locations from the closest proposed turbine location to the quarry boundary. The investigation demonstrated that vibration tremor levels were detected however, the turbine manufacturer confirmed that the energy is of such duration and frequency as not to pose any risk to the structural integrity of the turbine tower.

The site is therefore suitable from a vibration perspective for the proposed wind turbines. This is considered further in **Chapter 7 – Land, Soils and Geology**.

The **Blasting Technical Report** detailing the findings of the investigation is provided in **Appendix 10.8**.

10.5 Embedded Mitigation

Through the development of the proposed Project, measures have been adopted as part of the evolution of the design to avoid or reduce adverse effects on the environment. These measures are referred to as ‘embedded mitigation’ and are effectively built into the impact assessment. Embedded mitigation relevant to population and human health is set out below. Where additional mitigation measures are proposed, these are detailed after the impact assessment (**Section 10.9**).

The process of site selection and the consideration of alternatives (**Chapter 3 – Consideration of Reasonable Alternatives**) has considered alternative locations, designs and processes for the proposed Project.

The process included a multi staged assessment which was guided by the ‘Methodology for Local Authority Renewable Energy Strategies’ Report from the SEAI (SEAI, 2013) and which included the consideration of environmental effects.

10.6 Assessment of Effects

10.6.1 Do Nothing Scenario

If the proposed Project is not progressed the existing noise environment will remain largely unchanged. Traffic noise is currently the most significant noise source in the area. In the absence of the proposed Project, increases in traffic volumes on the local road network would be expected over time. This would likely result in a low level of increase in the overall baseline noise levels and would be considered an **Imperceptible** effect. In EIA terms, the effect is considered as **Not Significant**.

10.6.2 Construction Phase

Permitted times for construction works will be prescribed by the planning authority. However, these are proposed to be: 07.00 – 19.00hrs, Monday to Friday and 07.00 to 14.00hrs on Saturdays.

Using the background noise levels from **Section 10.3.2** and following the methodology from *BS 5228-1:2009+A1:2014* set out in **Table 10-3**, the NSLs have been afforded with a Category A designation and the appropriate construction noise limits are as follows:

- Monday to Friday 07:00 – 19:00: $L_{Aeq, 1hr}$ 65dB
- Saturdays 07:00 – 14:00: $L_{Aeq, 1hr}$ 65dB

To ensure that optimal use is made of good weather periods or at critical periods (i.e., concrete pours or to accommodate delivery of large turbine components along public routes), it may be necessary to work outside of these hours. Any such out of hours working will be agreed in advance with the Local Authority and lower construction noise limits may be applicable

Construction Methods

Details on the construction methods are set out in **Chapter 2 – Project Description** and **Appendix 2.1 – CEMP**, and their impacts assessed here.

A summary of the activities is provided in **Table 10-13**.

Table 10-13: Summary of Proposed Construction Methods from Chapter 2 and Appendix 2.1 – CEMP

Element
Site Access Track and Site Entrances
Forestry Felling
Accommodating Works for Turbine Delivery Route
Turbine Delivery Route
Onsite Substation
Turbine Hardstands & Foundations
Turbine Erection
Relay Tower
Material Volumes (construction phase traffic)
Grid Connection Route Works
Horizontal Directional Drilling (HDD)
Temporary Construction Compound

Element

Vibration

The noise impact associated with each construction stage is estimated using expected typical construction methods as well as items of plant and their associated noise emission levels. These have been acquired from similar constructions and/or using guidance set out in *British Standard BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise*.

Using this information the noise impacts have been predicted to the nearest NSLs to the works and the results compared with the appropriate criteria. The results are set out in the following sections.

Site Access Track and Site Entrances

The noise impact associated with the installation of the site entrances and the Site Access Track, as outlined in **Chapter 2 – Project Description** and the **CEMP (Appendix 2.1)** are assessed here.

The distance to the nearest 3no. NSLs (NSL 26, NSL 27 and NSL 28) are approximately 74m, 118m and 198m from the closest point of the Site Access Track respectively, as shown in **Figure 10-14**.



Figure 10-14: Location of Internal Site Access Track and nearest NSLs

The works can be separated into two phases: a) site preparation/filling and; b) surface finishing. Within each phase a sequence of activities will take place and the identified items of construction plant, their noise emission levels, percentage on-times (accounting for the construction sequence) and the predicted combined noise impact at the closest NSL for each phase are given in **Table 10-14** and **Table 10-15** respectively.

Table 10-14 Indicative Site Access Track and Site Entrance Noise Emission Levels – Phase 1

Item (BS 5228 Ref.)	Activity/Notes	Plant Noise level at 10m Distance (dBA)	% on- time ¹	Predicted Noise level at nearest NSL (dBA)		
				NSL 26	NSL 27	NSL 28
Dozer (14 tonne) (C5.12)	Spreading Chipping / fill	77	33	55	51	46
Wheeled loader (C10.5)	Loading Lorries.	80	33	58	54	49
Tilt dump truck (40 tonne) (C9.24)	Distribution of Material	85	33	63	59	54
Totals				64	60	56
¹ Typical/best practice assumption.						

Table 10-15 Indicative Site Access Track and Site Entrance Noise Emission Levels – Phase 2

Item (BS 5228 Ref.)	Activity/Notes	Plant Noise level at 10m Distance (dBA)	% on- time ¹	Predicted Noise level at nearest NSL (dBA)		
				NSL 26	NSL 27	NSL 28
Road planer (17 tonne) (C5.7)	Road Planing	82	33	60	56	51
Road roller (22 tonne) (C5.19)	Rolling and compaction	80	33	58	54	49
Asphalt paver (+ tipper lorry) (C5.32)	Paving	84	33	62	58	53
Totals				65	61	56
¹ Typical/best practice assumption.						

The construction noise limit of 65dB L_{Aeq, 1hr} is not expected to be exceeded at the NSLs for either construction phase.

The significance of the effect is therefore expected to be **Temporary, Adverse** and **Not Significant**. In EIA terms, the effect is **Not Significant**.

Enabling Works for the Turbine Delivery Route

The noise impact associated with construction activities on the public road for the TDR, as set out in **Chapter 12 – Traffic and Transport** and **Section 5.6.5 of CEMP (Appendix 2.1)**, are assessed here.

To facilitate abnormal load vehicle wheel over-run, some localised temporary widening and stoning of public road verges and roundabouts may be required on the proposed TDR. In addition, hedge cutting as well as temporary / permanent relocation of utility overhead lines, poles, lampposts, signage, and other street furniture may also be necessary.

The exact nature of the works is not defined at this stage of the proposed project but based on the author's expertise and professional judgement, the significance of the effect is likely to be **Brief, Adverse** and **Slight** as the works are expected to be minor and completed within one day. In EIA terms, the effect is considered as **Not Significant**.

Forestry Felling

Felling of some hedgerows and portions of existing woodland may be required to accommodate the construction of the turbine foundations and associated hardstands.

The distance to the nearest NSL (NSL 35) from the forestry felling works c. 550m west of T02 as shown in **Figure 10-15**.



Figure 10-15: Location of the nearest NSL to a turbine hardstand/foundation

The identified items of construction plant, their noise emission levels and the predicted combined noise impact at the closest NSL are given in **Table 10-16**.

Table 10-16: Indicative Forestry Felling Noise Emission Levels

Item	Plant Noise level at 10m Distance (dBA)	% on-time ¹	Predicted Noise level at nearest NSL (dBA)
Forwarder	79	80	43
30-50T Excavator	79	80	43
Chainsaw	83	80	47
Total			50
¹ Typical/best practice assumption.			

A total construction noise level of 50dB L_{Aeq} has been predicted which is below the limit of 65dB $L_{Aeq,1hr}$. The works at this location are expected to be completed within one day.

As the predicted noise level remains below the limit, the significance of the effect is considered **Adverse** and **Slight**, and the duration of the effect is **Brief**. In EIA terms, the effect is considered as **Not Significant**.

Turbine Delivery

Due to their abnormal size, blades and towers are proposed to be delivered at night to avoid disruption to daytime traffic using a convoy of slow moving vehicles. The exact specification of the transport convoy is not yet defined at this stage of the proposed project but based on the author's expertise and professional judgement, the noise impact of the operation can be suitably assessed using formula F.2.5 from BS 5228-1:2009+A1:2014 and the noise level has been calculated as 35dB L_{Aeq} at the closest NSLs (approximately 10m from the turbine delivery route).

This noise level is marginally above the measured ambient night-time noise level of 32 dB L_{Aeq} as given in **Table 10-12**, however this 3dB increase would be subjectively imperceptible. The predicted level is also considerably below the 45dB maximum façade noise level recommended by the WHO to prevent sleep disturbance. As the increase in noise is minimal and well below the recommended thresholds, the significance of the effect is considered **Adverse** and **Imperceptible**. The works will quickly move along the route and therefore the duration of the effect is **Brief**. In EIA terms, this is **Not Significant**.

Onsite Substation

The noise impact associated with the construction of the Onsite Substation, as outlined in **Chapter 2 – Project Description** and the **CEMP (Appendix 2.1)**, is assessed here. The distance to the nearest NSL (NSL35) from the Onsite Substation is c.330 m west as shown in **Figure 10-16**.



Figure 10-16: Location of Onsite Substation

The identified items of construction plant, their noise emission levels and the predicted combined noise impact at the closest NSL are given in **Table 10-17**.

Table 10-17: Indicative Onsite Substation Construction Noise Emission Levels

Item (BS 5228 Ref.)	Plant Noise level at 10m Distance (dBA)	% on- time ¹	Predicted Noise level at nearest NSL (dBA)
Telescopic Handler (C2.35)	71	80	40
Mobile Crane (C3.29)	70	80	39
Tracked Excavator (22 t) (C6.10)	79	80	48
Tracked Excavator (22 t) (C2.3)	78	80	47
Vibratory Roller (12t) (C5.21)	80	80	49
Articulated Dump truck (C4.2)	78	80	47
Tractor (towing trailer) (C4.75)	79	80	48
Wheeled Excavator (14 t) (C4.12)	77	80	46

Item (BS 5228 Ref.)	Plant Noise level at 10m Distance (dBA)	% on time ¹	Predicted Noise level at nearest NSL (dBA)
Mini tracked excavator (5 t) (C4.68)	69	80	38
Diesel Generator (C4.76)	61	80	30
Total			55
¹ Typical/best practice assumption.			

A total construction noise level of 55dB L_{Aeq} has been predicted which is below the limit of 65dB $L_{Aeq,1hr}$.

As the predicted noise level remains below the limit, the significance of the effect is considered **Adverse** and **Slight**, and the duration of the effect is **Temporary**. In EIA terms, the effect is considered as **Not Significant**.

Turbine Hardstands & Foundations

The noise impact associated with the construction of the Turbine Hardstands and Foundations during the construction phase, as described in **Chapter 2 – Project Description** and the **Appendix 2.1 – CEMP**, is assessed here.

The distance to the nearest NSL (NSL 35) from a turbine foundation and hardstand is c. 599m west of Turbine T02 as shown in **Figure 10-17**.



Figure 10-17: Location of the nearest NSL to a turbine hardstand/foundation

The identified items of construction plant, their noise emission levels and the predicted combined noise impact at the closest NSL are given in **Table 10-18**.

Table 10-18: Indicative Construction Noise Emission Levels for the Installation of Turbine Foundations and Hardstands

Item (BS 5228 Ref.)	Activity/Notes	Plant Noise level at 10m Distance (dBA)	% on- time ¹	Predicted Noise level at nearest NSL (dBA)
HGV Movement (C.2.30)	Removing soil and transporting fill and other materials.	79	100	43
Tracked Excavator (C.4.64)	Removing soil and rubble in preparation for foundation.	77	80	40
Excavator Mounted Rock Breaker (C9.12)	Excavation in rocky areas	85	80	48
Piling Operations (C.12.14)	Standard pile driving	88	50	49
General Construction (Various)	All general activities plus deliveries of materials and plant	84	80	47

Item (BS 5228 Ref.)	Activity/Notes	Plant Noise level at 10m Distance (dBA)	% on time ¹	Predicted Noise level at nearest NSL (dBA)
Concrete Mixer Truck and Concrete Pump (C.4.27)	Turbine Foundations	75	80	38
Dumper Truck (C.4.4)	Backfilling Turbine Foundations	76	80	39
Mobile Telescopic Crane (C.4.39)	Turbine Erection	77	80	40
Dewatering Pumps (D.7.70)	If required	80	80	43
JCB (D.8.13)	For services, drainage and landscaping.	82	100	46
Vibrating Rollers (D.8.29)	Road surfacing	77	80	40
Total				55
¹ Typical/best practice assumption.				

A total construction noise level of 55dB L_{Aeq} has been predicted which is below the limit of 65dB $L_{Aeq,1hr}$.

As the predicted noise level remains below the limit, the significance of the effect is considered **Adverse** and **Slight**, and the duration of the effect is **Temporary**. In EIA terms, the effect is considered as **Not Significant**.

Noise control and mitigation measures provided in BS 5228-1:2009 are described in **Section 10.9**.

Turbine Erection

The noise impact associated with the wind turbine erection, as described in **Chapter 2 – Project Description** and the **CEMP (Appendix 2.1)**, is assessed here.

It is proposed that the erection of wind turbines will occur during the final months of the construction phase, with the process following a carefully coordinated schedule and using specialist lifting equipment with an average rate of one turbine being erected per week. The turbine erection process is a precision operation that relies on specialist plant and favourable weather conditions to ensure safe and accurate installation.

The distance to the nearest NSL (NSL 35) from a turbine erection is c. 599m. The identified items of construction plant, their noise emission levels, estimated operation on-times during a typical construction period and the predicted combined noise impact at the closest NSL are given **Table 10-19**.

Table 10-19: Indicative Turbine Erection Construction Noise Emission Levels

Item (BS 5228 Ref.)	Plant Noise level at 10m Distance (dBA)	% on-time ¹	Predicted level NSL(dBA)	Noise nearest
2no. Mobile Telescopic Cranes (C.4.39)	83	100	47	
Total			47	
¹ Typical/best practice assumption.				

A total construction noise level of 47dB L_{Aeq} has been predicted which is below the limit of 65dB $L_{Aeq,1hr}$.

As the predicted noise level remains below the limit, the significance of the effect is considered **Adverse** and **Imperceptible**, and the duration of the effect is **Temporary**. In EIA terms, the effect is considered as **Not Significant**.

These activities may occur outside of normal construction periods in order to take advantage of favourable weather conditions in which case a lower noise limit may be applicable. Nevertheless, the works will take place during the daytime period and the lowest criteria from **Table 10-3** (identified as 55dB). The effect therefore would remain as **Not Significant** in EIA terms.

Relay Tower

The noise impact associated with the Relay Tower, as highlighted in **Chapter 2 – Project Description** and the **CEMP (Appendix 2.1)**, is assessed here.

The location is <50m north of the Onsite Substation and the construction works will be similar to that of the Onsite Substation construction in **Section 10.3.2**. A similar total construction noise level of 55dB L_{Aeq} is expected at the nearest NSL (NSL35) which is below the limit of 65dB $L_{Aeq,1hr}$.

As the predicted noise level remains below the limit, the significance of the effect is considered **Adverse** and **Imperceptible**, and the duration of the likely effect is **Temporary**. In EIA terms, the effect is considered as **Not Significant**.

Material Volumes (Construction Phase Traffic)

The noise impact associated with the traffic associated with the construction phase, specifically the movement of materials as set out in **Chapter 2 – Project Description** and the **Appendix 2.1 CEMP** is re-assessed here.

Stone aggregate fill, concrete and steel will be delivered to Site via Ridged and Articulated Heavy Goods Vehicles (HGV). The peak period for stone and aggregate fill deliveries will be during Access Track and Turbine Hardstand construction. During this period there will be up to 5 deliveries to Site per hour, over a 10-hour period for up to 2 weeks. This peak period may not be continuous and could be divided into a number of sub-periods. Outside this period there will be up to 15 deliveries of stone aggregate to Site per day (equates to 1.25 deliveries per hour).

The peak period for concrete deliveries will be Turbine Foundation pouring. During this period there will be up to 9 deliveries to Site per hour for a 12-hour period for each Turbine Foundation.

Construction traffic will be carried on the existing public road network and the closest NSL (NSL 35) lies approximately 40m from the Construction Delivery Route (as defined in **Chapter 1 – Introduction**) as shown in **Figure 10-18**.

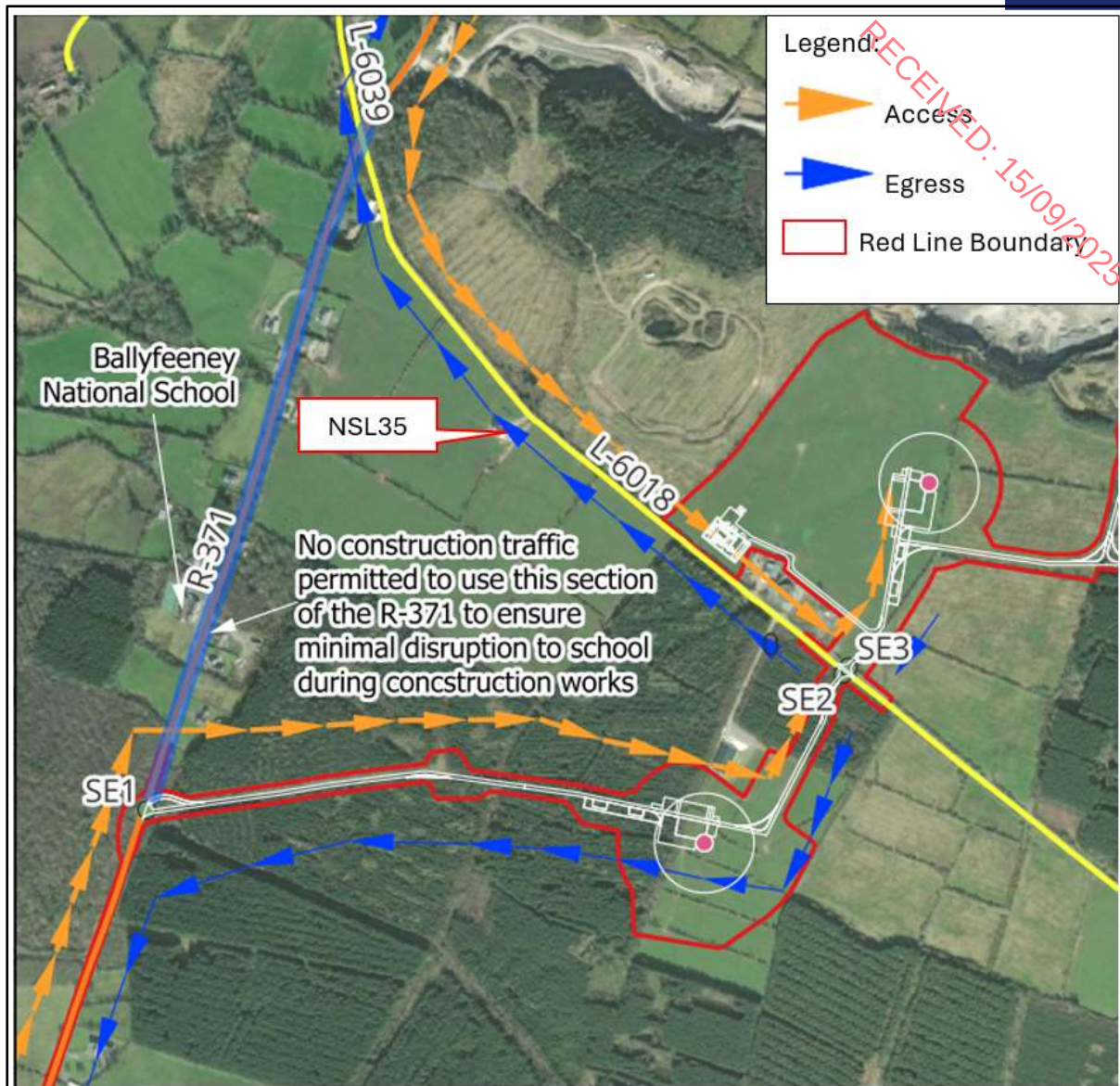


Figure 10-18: Construction Traffic Route with Closest NSL

Using formula F.2.5 from *BS 5228-1:2009+A1:2014*, the associated noise level has been calculated at NSL 35 as shown in **Table 10-20**:

Table 10-20: Predicted Construction Traffic Noise Levels at Nearest NSL (Using BS 5228-1:2009+A1:2014)

Phase	Period	Predicted Noise Level at nearest NSL (dBA)
Stone aggregate fill, concrete and steel	Typical (1.25 HGVs per hour)	31
	Peak (5 HGVs per hour)	37
Turbine Foundation concrete pouring	9 HGVs per hour	40

The IEMA Guidelines set out in **Section 10.2.3** consider a change in traffic noise levels of 3dB to 4.9dB would be noticeable, in excess of 5dBA would be clearly noticeable, and depending on the final noise level, the impact may be **Slight/Moderate** or **Significant**. A change in noise level of less than 3dB would be imperceptible.

Notwithstanding the HGVs will be on the construction site, it is appropriate to assess construction related traffic on public roads by comparing the noise level change. The measured existing ambient noise level was 40dB L_{Aeq} as set out in **Table 10-12** and therefore the noise level changes are as follows:

- Stone aggregate fill, concrete and steel (typical): -9dB i.e. below ambient
- Stone aggregate fill, concrete and steel (peak): -3dB i.e. below ambient
- Turbine Foundation concrete pouring: 0dB

The change in noise level is therefore expected to be **Adverse** and **Imperceptible** for all phases and the duration of the likely effects is **Brief**. In EIA terms, the effect is expected to be **Not Significant**.

Grid Connection Route Works

The GCR to the Sliabh Bawn 110kV Substation is described in **Chapter 2 Project Description**. The works can be separated into two phases: a) trenching, duct works and filling and; b) reinstatement. Within each phase a sequence of activities will take place and the identified items of construction plant, their noise emission levels, percentage on-times (accounting for the construction sequence) and the predicted combined noise impact at the closest NSL for each phase are given in

Distances to the nearest NSL along the route vary considerably and it is therefore appropriate to calculate the potential noise emissions at various distances. The identified items of construction plant, their noise emission levels and the predicted combined noise impact at various distances are given in **Table 10-21** and **Table 10-22**.

Table 10-21: Indicative GCR Noise Emission Levels – Phase 1

Item (BS 5228 Ref.)	Noise Emission Levels ¹ (dBA) at Various Distances		
	20m	30m	40m
HGV Movement (C.2.30)	62	58	56
Tracked Excavator (C.4.64)	61	57	55
Excavator Mounted Rock Breaker (D8.12)	70	66	64
Total	70	67	64

¹Typical/best practice 50% on-time applied.

A maximum calculated construction noise level of 70dB L_{Aeq} at 20m has been predicted, which exceeds the limit of 65dB L_{Aeq,1h}. At distances greater than 40m the construction noise limit is not expected to be exceeded.

Table 10-22: Indicative GCR Noise Emission Levels – Phase 2

Item (BS 5228 Ref.)	Noise Emission Levels ¹ (dBA) at Various Distances		
	20m	30m	40m
HGV Movement (C.2.30)	62	58	56
Tracked Excavator (C.4.64)	61	57	55
Vibrating Rollers (D.8.29)	69	65	63
Total	70	67	64

¹Typical/best practice 50% on-time applied.

A maximum calculated construction noise level of 70dB L_{Aeq} at 20m has been predicted, which exceeds the limit of 65dB L_{Aeq,1h}. At distances greater than 40m the construction noise limit is not expected to be exceeded.

The significance of the effect will vary depending on the distance from the works, with effects being **Adverse** and **Imperceptible (Not Significant)** in EIA terms) at distances greater than 40m and **Slight (Not Significant)** in EIA terms) for receptors closer to the active construction area. Approximately 100m of Grid Connection works is expected to be constructed per day and the duration of the likely effect is therefore **Brief**.

Horizontal Directional Drilling

The noise impact associated with the Horizontal Directional Drilling (HDD) works for the proposed GCR at the N5/R371 junction, as described in **Chapter 2 – Project Description** and the **CEMP (Appendix 2.1)**, is assessed here. The nearest identified NSL is estimated to be approximately 80m from the HDD site at the N5/R371 junction. Indicative noise sources have been identified and predictions of the potential noise emissions at these distances have been calculated and are given in **Table 10-23**.

Table 10-23: Indicative HDD Noise Emission Levels

Item (BS 5228 Ref.)	Plant Noise level at 10m Distance (dBA)	% on-time ¹	Predicted Noise Level at nearest NSL (dBA)
Directional drill (C.2.44)	77	66	57
Mud Pump (D.7.70)	80	66	60
Diesel Pump (C4.88)	68	66	48
Tractor (D.10.220)	86	66	66
Dumper Truck (C.4.4)	76	66	56
Total			68

¹Typical/best practice assumption.

A total construction noise level of 68 dB L_{Aeq} has been predicted which exceeds the limit of 65dB $L_{Aeq,1hr}$. The significance of effect is considered **Adverse** and **Slight**. The works are expected to be completed within between 1.5 weeks and will not operate outside of normal construction hours. The duration of the likely effect is therefore **Temporary**. In EIA terms, the effect is considered as **Not Significant**.

Temporary Construction Compound

The noise impact associated with the Temporary Construction Compound, as described in **Chapter 2 Project Description** is assessed here.

Two (2no.) temporary construction compounds and welfare facilities will be constructed. The distance to the nearest NSL (NSL35) from the construction compound is 570m west as shown in **Figure 10-19**.

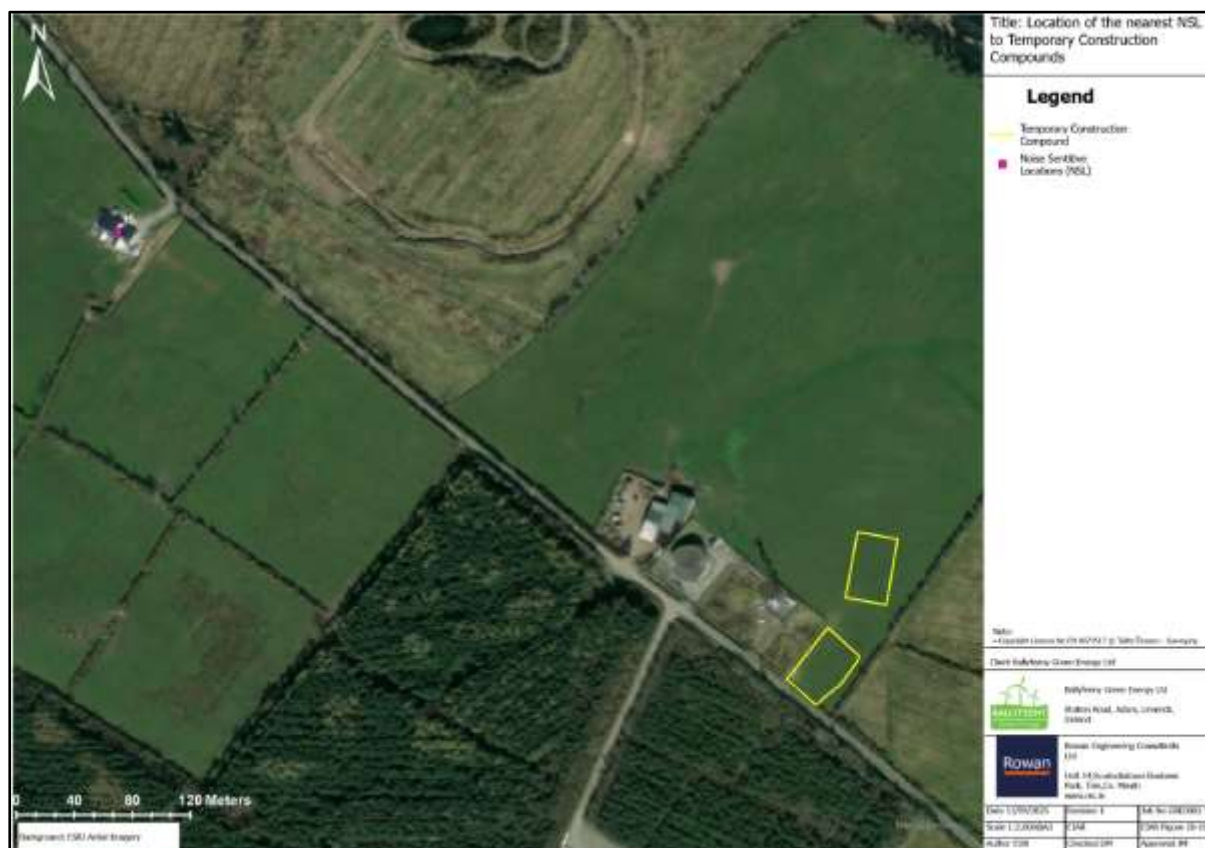


Figure 10-19: Location of the nearest NSL to Temporary Construction Compounds

The associated items of construction plant, their noise emission levels, estimated operation on-times during a typical construction period and the predicted combined noise impact at the closest NSL are given in **Table 10-24**.

Table 10-24: Indicative Temporary Compound Construction Noise Emission Levels

Item (BS 5228 Ref.)	Plant Noise level at 10m Distance (dBA)	% on-time ¹	Predicted Noise level at nearest NSL (dBA)
Telescopic Handler (C2.35)	71	80	35
Mobile Crane (C3.29)	70	80	34
Tracked Excavator (22 t) (C6.10)	79	80	43
Tracked Excavator (22 t) (C2.3)	78	80	42
Vibratory Roller (12t) (C5.21)	80	80	44
Articulated Dump truck (C4.2)	78	80	42
Tractor (towing trailer) (C4.75)	79	80	43
Wheeled Excavator (14 t) (C4.12)	77	80	41
Mini tracked excavator (5 t) (C4.68)	69	80	33
Diesel Generator (C4.76)	61	80	25
Total			51
¹ Typical/best practice assumption.			

A total construction noise level of 51dB L_{Aeq} has been predicted which is below the limit of 65dB L_{Aeq,1hr}.

As the predicted noise level remains below the limit, the significance of the effect is considered **Adverse** and **Slight**, and the duration of the effect is **Temporary**. In EIA terms, the effect is considered as **Not Significant**.

Vibration

There are no substantial sources of vibration for example blasting or piling activities associated with the construction phase. The largest item of construction plant for any phase is likely to be excavators operating during ground clearance works. Vibration emissions from such activities is relatively low and as the empirical data provided in BS5228-2:2009 demonstrates, ground borne vibration waves are attenuated rapidly as they propagate from a source through the substrate. Given the distances to the nearest NSLs and the nature of the construction activities and plant, vibration levels at the nearest noise sensitive locations are therefore expected to be negligible. The significance of effects from construction phase vibration is therefore

expected to be **Neutral** and **Imperceptible**. The duration of the likely effect is **Temporary**. In EIA terms, the effect is considered **Not Significant**.

10.6.3 Operational Phase

Once operational, the turbines and the Onsite Substation will generate noise which will propagate into the receiving environment. The potential effects are described in the following sections.

Turbines

Each of the three Technology Options and associated turbine types were considered in the assessment, as set out in **Table 10-25**.

Table 10-25: Turbine options and associated turbine model

Technology Option	Hub Height (m)	Rotor Diameter (m)
Technology Option 1	92	136
Technology Option 2	90	133
Technology Option 3	90	138

The final turbine type will be confirmed by the Applicant prior to installation on site. All modelled turbines include serrated trailing edges on the blades based on industry best practice.

A total of 6 no. turbines at the locations in **Table 10-26** are scheduled.

Table 10-26: Turbine Co-ordinates

Turbine Ref.	Co-ordinates	
	ITM X	ITM Y
T01	598031.59	781362.24
T02	598343.31	781861.24
T03	599090.87	781830.81
T04	598721.79	782009.47
T05	599014.97	782261.43
T06	598712.62	782537.14

The noise impacts for each Technology Option have been assessed separately.

Turbine Noise Criteria

Following a detailed review of the background noise data set out in **Section 10.3.2**, appropriate noise criteria between cut-in and the rated power wind speeds for the three modelled turbine technology types have been calculated and are given in **Table 10-27**.

Table 10-27: Summary of Operational Phase Noise Criteria

Location	Period	Noise Limit Criteria (dB) at Standardised 10m Wind Speeds							
		3ms ⁻¹	4ms ⁻¹	5ms ⁻¹	6ms ⁻¹	7ms ⁻¹	8ms ⁻¹	9ms ⁻¹	10ms ⁻¹
NML1	Day	40	40	45	45	45	45	45	48
	Night	43	43	43	43	43	43	43	45
NML2	Day	40	40	40	40	45	45	45	45
	Night	43	43	43	43	43	43	43	43
NML3	Day	40	40	45	45	45	45	45	48
	Night	43	43	43	43	43	43	43	46
NML4	Day	40	45	45	45	45	45	45	47
	Night	43	43	43	43	43	43	43	46
NML5	Day	45	45	45	45	45	45	47	49
	Night	43	43	43	43	43	43	43	48
Nominal	Day	40	40	40	40	45	45	45	45
	Night	43	43	43	43	43	43	43	43

The Nominal criteria are the minimum values derived from the data. This criteria is applicable to all NSLs considered within the study area and therefore represents a worst-case assessment.

The assessment has been undertaken in accordance with best practice guidance outlined in the *IOA GPGs* and calculated to the *ISO 9613-2* standard. It should be noted that the predicted noise levels assume that all receptors (Noise Sensitive Locations) are downwind of all turbines simultaneously and therefore represents a worst-case assessment for each Technology Option.

Noise Prediction

A computer-based noise propagation model has been prepared to predict the noise levels from the turbines. This section discusses the methodology behind the noise modelling process and presents the results.

Noise Prediction Software

The proprietary software used (DGMR's iNoise Pro) calculates noise levels in accordance with *ISO 9613:1996 Acoustics – Attenuation of sound during propagation outdoors* which satisfies the requirements of guidance from WEDG 2006, ETSU and IOA GPG and SGNs.

The resultant noise levels are calculated considering a range of factors affecting the propagation of the sound, including:

- The magnitude of the noise source in terms of A-weighted sound power levels (L_{WA});
- The distance between the source and the receiver;
- Topography;
- The presence of obstacles such as screens or barriers in the propagation path;
- The presence of reflecting surfaces;
- The acoustic property of the ground between the source and receiver; and
- Attenuation due to atmospheric absorption

Input Data Assumption

Sound power levels (L_{WA}) used in the noise models are provided by the manufacturers' for Sound Optimised Modes. Some data are provided at standardised reference 10m wind speeds (V_{10}), others at hub height wind speeds (V_{hh}) and are presented in **Table 10-28** for each technology option.

Table 10-28: Turbine Sound Power (L_{AW}) levels

Technology Option	Operational Mode	Sound Power Level L_{AW} (dB) per Wind speed at stated height							
		3 ms^{-1}	4 ms^{-1}	5 ms^{-1}	6 ms^{-1}	7 ms^{-1}	8 ms^{-1}	9 ms^{-1}	>10 ms^{-1}
Technology Option 1 ¹	PO4-0S	90.9	91.9	92.9	96	99.9	102.9	103.9	103.9
Technology Option 2 ²	0	93.0	94.4	100.0	104.2	104.5	104.5	104.5	104.5
Technology Option 1 ¹	0s	-	-	96.3	99.0	101.9	104.7	105.8	105.9

¹Vhh
²V10

In addition, **Table 10.29** presents the Octave Band Sound Power Levels (L_w) for each technology option as used in the noise models.

Table 10.29: Summary of Octave Band Sound Power Levels

Technology Option	Octave Band (Hz) Sound Power Level L_w (dB)								
	31	63	125	250	500	1k	2k	4k	8k
Technology Option 1	70.8	82.1	90.3	95.6	97.9	98.5	93.5	86.5	77.2
Technology Option 2	75.5	86.2	93.2	97	97.9	98.4	97.1	92.8	83.6
Technology Option 3	75.4	84.9	91.2	95.5	98.9	100.3	97.1	88.6	71.2

Appendix 10.4 – Noise Modelling Calculation Parameters presents full details on the noise model calculation parameters and settings.

Predicted Noise Levels

Predicted noise levels are given in terms of the L_{Aeq} parameter and best practice guidance in the IOA GPG states that:

" L_{A90} levels should be determined from calculated L_{Aeq} levels by subtraction of 2dB."

Therefore, a 2dB conversion has been applied to the predicted noise levels and all levels in this report are therefore presented in terms of $L_{A90,10min}$.

Uncertainty

Uncertainty in the noise assessment ought to be considered and following the IOA GPG in the absence of specific information, the data used in this report has an uncertainty of +2dB applied.

Cumulative Assessment

The IOA GPG states that cumulative noise exceedances should be avoided and where existing or permitted development is at the noise limit and any new turbine noise sources should be designed to be 10 dB below the limit value.

Section 5.1 of the relevant IOA GPG states the following:

"...absolute noise limits and margins above background should relate to the cumulative effect of all wind turbines in the area which contribute to the noise received at the properties in question..."

If an existing wind farm has permission to generate noise levels up to ETSU-R-97 limits, planning permission noise limits set at any future neighbouring wind farm would have to be at least 10 dB lower than the limits set for the existing wind farm to ensure there is no potential for cumulative noise impacts to breach ETSU-R-97 limits (except in such cases where a higher fixed limit could be justified)". Such an approach could prevent any further wind farm development in the locality, and a more detailed analysis can be undertaken on a case-by-case basis.

During scoping of a new wind farm development consideration should be given to cumulative noise impacts from any other wind farms in the locality. If the proposed wind farm produces noise levels within 10 dB of any existing wind farm/s at the same receptor location, then a cumulative noise impact assessment is necessary.

Equally, in such cases where noise from the proposed wind farm is predicted to be 10 dB greater than that from the existing wind farm (but compliant with ETSU-R-97 in its own right), then a cumulative noise impact assessment would not be necessary."

The identified wind farm developments listed in **Chapter 16 – Cumulative Effects** of the EIA were considered.

Permitted, or operational wind farms within a 20km radius of the proposed Project for the purposes of the cumulative noise assessment were identified as follows:

- Sliabh Bawn (constructed): 20 no. Siemens SWT-3.0-101 wind turbines with a hub height of 78m.

Operational turbine information for this site including turbine models, hub heights and sound power data was made available, and noise levels predicted following the same methodology set out in **Section 10.3.4**.

Predicted Noise Levels

For information purposes, a summary of the 10 no. NSLs with the maximum noise levels are provided in **Table 10-27**, **Table 10-28** and **Table 10-30** for each Technology Option.

Table 10-30: Summary of top 10 noise levels at NSLs - Technology Option 1

Location	3 ms ⁻¹	4 ms ⁻¹	5 ms ⁻¹	6 ms ⁻¹	7 ms ⁻¹	8 ms ⁻¹	9 ms ⁻¹	10 ms ⁻¹
Daytime Limits	40 dBA	40 dBA	40 dBA	40 dBA	45 dBA	45 dBA	45 dBA	45 dBA
Night-time Limits	43 dBA	43 dBA	43 dBA	43 dBA	43 dBA	43 dBA	43 dBA	43 dBA
5	25.5	26.5	33.5	36.5	37.5	37.5	37.5	37.5
6	25.9	26.9	33.9	36.9	37.9	37.9	37.9	37.9
7	26.4	27.4	34.4	37.4	38.4	38.4	38.4	38.4
12	24.2	25.2	32.2	35.2	36.2	36.2	36.2	36.2
17	25.5	26.4	33.4	36.4	37.4	37.5	37.5	37.5
18	27.6	28.6	35.6	38.6	39.6	39.6	39.6	39.6
19	24.1	25.1	32.0	35.0	36.1	36.1	36.1	36.1
35	27.0	28.0	35.0	38.0	39.0	39.0	39.0	39.0
43	23.8	24.8	31.8	34.8	35.8	35.8	35.8	35.8
50	23.9	24.9	31.9	34.9	35.9	35.9	35.9	35.9

Technology Option 1 will operate within the noise limits set out in this Chapter and in accordance with the WEDG 2006 criteria at all wind speeds. The significance of the effect from the operational phase of the proposed Project is therefore **Long Term, Adverse** and **Not Significant**. This is considered to be **Not Significant** in EIA terms.

Table 10-31: Summary of top 10 noise levels at NSLs - Technology Option 2

Location	3 ms ⁻¹	4 ms ⁻¹	5 ms ⁻¹	6 ms ⁻¹	7 ms ⁻¹	8 ms ⁻¹	9 ms ⁻¹	10 ms ⁻¹
Daytime Limits	40BA	40 dBA	40 dBA	40 dBA	45 dBA	45 dBA	45 dBA	45 dBA
Night-time Limits	43dBA	43 dBA	43 dBA	43 dBA	43 dBA	43 dBA	43 dBA	43 dBA
5	26.5	27.3	33.2	36.3	37.8	38.0	38.0	38.0
6	27.0	27.7	33.7	36.7	38.3	38.5	38.5	38.5
7	27.4	28.1	34.1	37.1	38.7	38.9	38.9	38.9
12	25.2	26.0	32.0	35.0	36.6	36.7	36.7	36.7
17	26.5	27.2	33.2	36.2	37.8	38.1	38.1	38.1
18	28.7	29.5	35.4	38.5	40.0	40.2	40.2	40.2
19	25.3	25.9	31.8	34.9	36.5	36.9	36.9	36.9
35	28.1	28.8	34.8	37.8	39.4	39.6	39.6	39.6
43	24.8	25.6	31.5	34.6	36.1	36.3	36.3	36.3
50	24.9	25.7	31.6	34.7	36.2	36.4	36.4	36.4

Technology Option 2 will operate within the noise limits set out in this Chapter and in accordance with the WEDG 2006 criteria at all wind speeds. The significance of the effect from the operational phase of the proposed Project is therefore **Long Term, Adverse** and **Not Significant**. This is considered to be **Not Significant** in EIA terms.

Table 10-32: Summary of top 10 noise levels at NSLs - Technology Option 3

Location	3 ms ⁻¹	4 ms ⁻¹	5 ms ⁻¹	6 ms ⁻¹	7 ms ⁻¹	8 ms ⁻¹	9 ms ⁻¹	10 ms ⁻¹
Daytime Limits	40 dBA	40 dBA	40 dBA	40 dBA	45 dBA	45 dBA	45 dBA	45 dBA
Night-time Limits	43 dBA	43 dBA	43 dBA	43 dBA	43 dBA	43 dBA	43 dBA	43 dBA
5	--	29.8	35.4	38.2	39.3	39.4	39.4	39.4
6	--	30.2	35.8	38.6	39.7	39.8	39.8	39.8
7	--	30.6	36.2	39.0	40.1	40.2	40.2	40.2

Location	3 ms ⁻¹	4 ms ⁻¹	5 ms ⁻¹	6 ms ⁻¹	7 ms ⁻¹	8 ms ⁻¹	9 ms ⁻¹	10 ms ⁻¹
12	--	28.5	34.1	36.9	38.0	38.1	38.1	38.1
17	6.2	29.7	35.3	38.1	39.2	39.3	39.3	39.3
18	4.6	32.0	37.6	40.4	41.5	41.6	41.6	41.6
19	10.7	28.4	33.8	36.8	37.9	38.1	38.1	38.1
35	4.1	31.3	36.9	39.7	40.8	40.9	40.9	40.9
43	--	28.0	33.6	36.4	37.5	37.6	37.6	37.6
50	--	28.1	33.7	36.5	37.6	37.7	37.7	37.7

Technology Option 3 will operate within the noise limits in accordance with the WEDG 2006 criteria with the exception of an apparent exceedance of 0.4dB at NSL 18 at 6 m/s wind speeds. However, the predicted noise levels are omni-directional and as previously stated, the operations of the proposed project will not result in a worst case condition of all NSLs being downwind of all turbines at the same time i.e. omni-directional. Where noise predictions indicate that adopted criteria may be exceeded, the effects of propagation in different wind directions can therefore be considered.

To understand this exceedance, a directional analysis of the noise levels at NSL 18 was conducted in accordance with the IOA GPG Guidance.

For any given wind direction, a NSL can be assigned one of the following classifications in relation to turbine noise propagation:

- Downwind (i.e. $0^\circ \pm 80^\circ$);
- Crosswind (i.e. $90^\circ \pm 10^\circ$ and $270^\circ \pm 10^\circ$); and
- Upwind (i.e. $180^\circ \pm 70^\circ$).

Figure 10-20 illustrates the directivity attenuation factor that can be applied to turbines when considering noise propagation in downwind conditions.

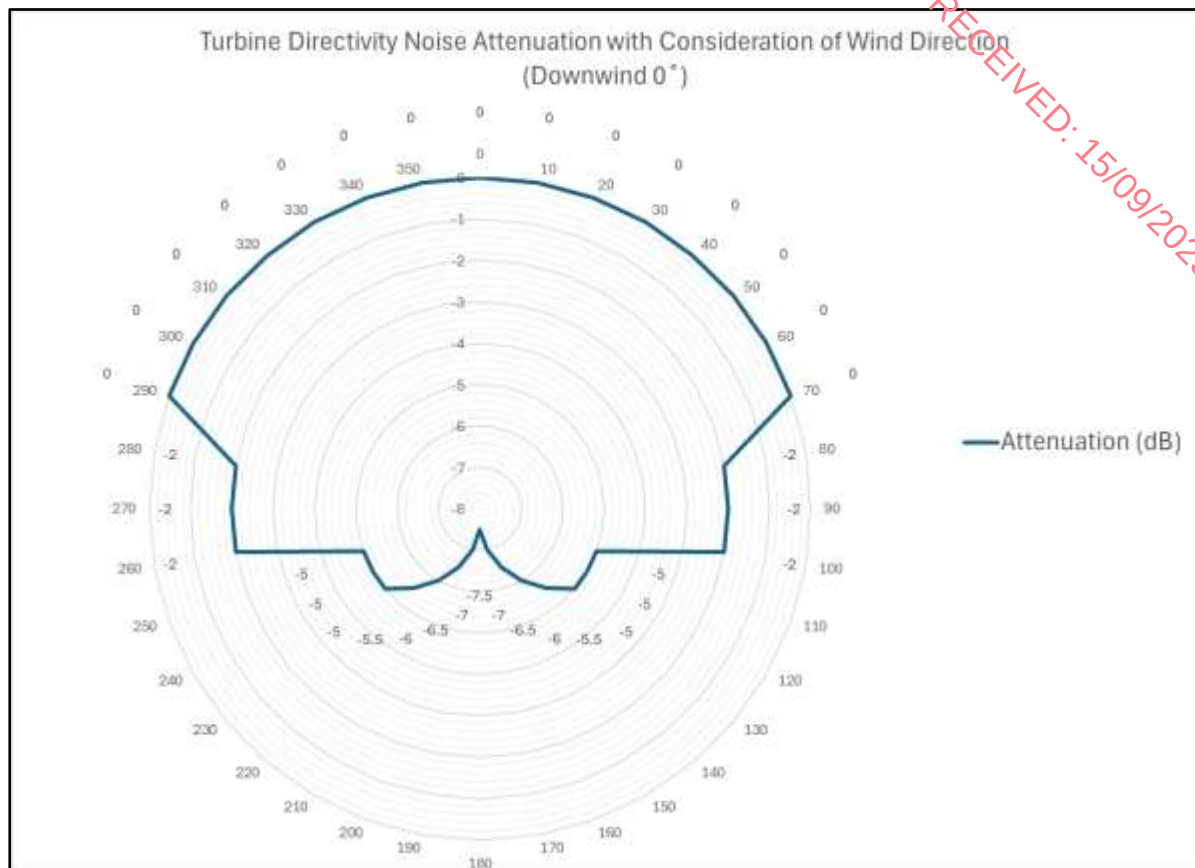


Figure 10-20: Turbine Directivity Noise Attenuation with Consideration of Wind Direction

By applying the methodology set out in the IOA GPG Guidance, a directional analysis for NSL 18 was undertaken, and the results are presented in **Table 10-33**.

Table 10-33: Summary of Cumulative Directional Results for Wind Turbine Technology Option 3 at NSL18

	Noise Limits (dBA) per Standardised Wind Speeds V10						
	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s
Daytime Limit	40	40	40	45	45	45	45
Nighttime Limit	43	43	43	43	43	43	43
Wind Direction	Predicted Cumulative Noise Levels (dBA)						
North 0°	27.2	32.8	35.6	36.7	36.8	36.8	36.8
Northeast 45°	28.8	34.4	37.2	38.3	38.4	38.4	38.4
East 90°	30.5	36.1	38.9	40.0	40.1	40.1	40.1
Southeast 135°	31.6	37.2	39.9	41.1	41.2	41.2	41.2
South 180°	31.5	37.1	39.9	41.0	41.1	41.1	41.1
Southwest 225°	30.9	36.5	39.3	40.4	40.5	40.5	40.5
West 270°	29.4	35.0	37.8	38.9	39.0	39.0	39.0
Northwest 315°	27.3	32.9	35.7	36.8	36.9	36.9	36.9

The results demonstrate that when taking into account the directional analysis in accordance with the IOA GPG Guidance, the noise levels for Technology Option 3 will be below the noise criteria at NSL 18 for all wind speeds and wind directions.

Consequently, Technology Option 3 will operate within the noise limits in accordance with the WEDG 2006 criteria at all wind speeds. The significance of the effect from the operational phase of the proposed Project is therefore **Long Term, Adverse** and **Not Significant**. This is considered to be **Not Significant** in EIA terms.

The directional calculations are provided in **Appendix 10.6 – Directional Cumulative Assessment**.

A full list of the results at all NSLs for each Turbine Technology is provided in **Appendix 10.5 – Predicted Noise Levels**.

Cumulative noise contour plots for each Technology Option are provided in **Appendix 10.7 – Cumulative Colour Noise Contour**.

Tonality

A warranty will be sought from the eventual supplier of turbines for the proposed Project that the turbines will emit no tonal component.

In the event of a complaint regarding tonality once the turbines are operational, a detailed assessment following the guidance outlined in the IOA GPG and Supplementary Guidance Note 5: Post Completion Measurements (July 2014) will be followed. See **Section 10.14**.

Description of Effects - Noise

As demonstrated above, the proposed Project is expected to operate within the established criteria, therefore, in EIA terms, effects are considered as **Not Significant**.

Operational noise emissions assume no special audible characteristics including Amplitude Modulation, Tonality or Infrasound/Low Frequency Noise apply as these cannot be foreseen at this stage.

Description of Effects – Vibration

Wind turbines generate minimal vibration levels when operational, which is too weak to be felt by people or affect buildings and structures. As a result, no noticeable impact on nearby receptors or structures are anticipated. The significance of the effect is therefore considered **Imperceptible**. In EIA terms, the effect is considered as **Not Significant**.

10.6.4 Onsite Substation Noise Impact Assessment

Unlike wind turbine noise emissions, the operation of the Onsite Substation is not wind speed dependant and appropriate noise assessment methodology is provided in BS 4142:2014.

The guidance compares the noise emission level (L_{Aeq}) as a result of the Substation (the “Specific” noise) at NSLs with the typical measured “Background” (L_{A90}) noise level. The former is calculated using the sound power level of the source and the propagation path to the NSL and the latter is derived from the baseline noise survey as detailed in **Section 10.4.3**. In addition, a ‘Rating’ level includes penalties applicable when special acoustic characteristics are presents e.g. tonality or impulsivity, which are added to the Specific noise level.

The operational sound power emission level associated with a typical Substation that would support a development of this nature is in the order of 93dB L_{WA} . The selection and specification of the proposed Substation shall be carried out on the basis of 93dB L_{WA} being the maximum permissible sound power level.

As the Substation will operate continuously, it is appropriate to assess the night-time period as a worst case. The corresponding night-time Background (L_{A90}) level from the baseline noise survey is 26dB.

The nearest NSL (NSL 35) is located c. 330m from the Onsite Substation, and the Specific noise levels has been calculated at this location as 9dB L_{Aeq} i.e. 17dB below the Background level.

There are no Tonal or other special acoustic characteristics assumed and a warranty will be sought from the eventual supplier of the 38kV transformer for the Onsite Substation. It is proposed the Onsite Substation will emit no adverse tonal component during the operational phase.

A summary of the BS4142:2014 impact assessment is given in **Table 10-34**.

Table 10-34: BS4142 Impact Assessment Summary

Parameter	Results	Commentary
Measured Background sound level, (L_{AF90})	26 dB	Typical night-time level
Calculated Specific sound level, L_s (L_{Aeq})	9 dB	At closest NSL (NSL 35)
Acoustic feature correction	0 dB	Tone Standard: ISO 1996-2:2007 (simplified)
Rating level, L_{Ar}	9 dB	
Excess of rating over background sound level	-17 dB	
Assessment indicates a likely adverse impact?	No, not likely	

The significance of the effect from the Onsite Substation at the nearest NSL during the operational phase is therefore considered **Long-Term, Adverse** and **Imperceptible**, which is **Not Significant** in EIA terms.

10.6.5 Operational Phase – Summary of Effects

Table 10-35 summarises the description of effects during the operational phases.

Table 10-35: Summary of the Description of Noise Effects During the Operational Phase.

Aspect	Quality	Duration	Significance
Noise	Adverse	Long-term	Not Significant (Not Significant in EIA terms)
Vibration	Adverse	Long-term	Imperceptible (Not Significant in EIA terms)
On-Site Substation	Adverse	Long-term	Imperceptible (Not Significant in EIA terms)

10.6.6 Decommissioning Phase

The noise impact associated with the decommissioning phase, as outlined in **Chapter 2 – Project Description** and **Appendix 2.1.4 – Decommissioning and Restoration Plan** is considered here.

During the decommissioning phase of the proposed Project, there will be some effects on nearby noise sensitive properties due to noise emissions from site traffic and other on-site activities. Similar overall noise levels as those calculated for the construction phase would be expected, as similar tools and equipment

However, certain infrastructure components will not be decommissioned, meaning there will not be an associated noise impact at certain locations. Specifically, the Onsite Substation and the GCR will remain part of the national infrastructure and will not be removed. Additionally, the Relay Tower will continue to serve as a part of the telecommunications network and will not be decommissioned.

As the decommissioning phase works are **Short-Term**, the significance of the effects is considered **Adverse** and **Slight**. In EIA terms, the effect on nearby receptors is considered as **Not Significant**.

Summary of Decommissioning Phase Noise Effects

The potential worst-case effects associated with the above aspects of the construction phase are derived by comparing the predicted noise levels with the existing ambient levels given in

Section 10.3.3 the criteria given in **Section 10.2.3** is applied and the results are presented in **Table 10-36**.

It should be noted that the significance levels provided are based on pre-mitigation conditions.

Vibration effects are assessed against background vibration levels which as set out in **Section 10.1.3 Vibration** are expected to be **Brief, Adverse, Imperceptible** and therefore **Not Significant** in EIA terms.

Table 10-36: Summary of Description of Pre-mitigation Construction and Decommissioning Noise Effects

Aspect	Quality	Duration	Significance
Decommissioning	Adverse	Temporary	Slight (not significant in EIA terms)

10.7 Mitigation Measures

Although no likely significant effects have been predicted in Section 10.6, this section outlines mitigation measures that will be implemented as part of the proposed Project, during the construction, operation and decommissioning phases, in line with best practice and proven techniques for Noise and Vibration.

10.7.1 Construction Phase

Regarding construction activities, reference shall be made to *BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise*, which offers guidance on the control of noise and vibration from construction activities. Best management practices will be adopted during construction as required, including the following:

- Prior to the commencement of construction an active community engagement exercise shall be undertaken by the community liaison officer. Letter drops shall take place in advance of the works. The nature of the information letters provided details of the Project, specifically:
 - Contractor name and contact details;
 - Project description;
 - Expected duration of works; and
 - A commitment to implement procedures and measures to minimise noise and vibration.

This community notification exercise should be repeated in the event of an expected intensification of works in any area and/or in advance of works that occur outside of the permitted construction operating hours (any such works will be subject to prior agreement with the Local Authority).

- A site representative responsible for matters relating to noise and vibration will be appointed;
- The construction programme will be managed to ensure that plant with the highest levels of noise and vibration emissions are not operated simultaneously and for the minimum amount of time as practicable; and
- The hours of construction activity will be limited to avoid unsociable hours where possible. Construction operations shall be restricted to between 07:00hrs and 19:00hrs weekdays and between 07:00hrs and 14:00hrs on Saturdays. However, to ensure that optimal use is made of good weather period or at critical periods within the programme (i.e., concrete pours) or to accommodate delivery of large turbine component along public routes it could be necessary on occasion to work outside of these hours. Any such out of hours working will be agreed in advance with the Local Authority.

Noise

The Appointed Contractor undertaking the construction of the works will be obliged to take specific noise abatement measures when deemed necessary to comply with the recommendations of *BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction on open sites – Noise*. The following list of additional noise control measures will be implemented to ensure compliance with the relevant construction noise criteria:

- Erection of site hoarding and temporary noise screening of the noisiest plant;
- Selection of plant with low inherent potential for generation of noise and/or vibration;
- Placing of noisy/vibratory plant as far away from sensitive receptors as permitted by site constraints;
- The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations;
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working for the duration of the contract;
- Compressors will be attenuated models, fitted with properly lines and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers;

- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use;
- Any plant, such as generators or pumps, which is required to operate before 07:00hrs or after 19:00hrs will be surrounded by an acoustic enclosure or portable screen; and
- Keeping the surface of the Site Access Tracks even to mitigate the potential for vibration from lorries;

These mitigation measures for the construction phase are captured in **Chapter 2 – Project Description** and the **CEMP (Appendix 2.1)**.

Vibration

No likely significant effects due to vibration were identified for the construction works and no mitigation measures are therefore required. A Blasting Coordination and Cooperation Plan in relation to the adjacent Ballyfeeny Rock quarry (**Appendix 2.1.5 – Blasting Coordination and Cooperation Plan**) has been prepared that will ensure effective communication and safety and health, control measures are implemented during the construction, operational and decommissioning phases.

Noise Monitoring

Noise and vibration monitoring in accordance with the guidance contained in BS 5228-1:2009 during the construction and decommissioning phases will be undertaken to ensure compliance with the criteria or if noise complaints are received.

10.7.2 Operational Phase

The noise levels associated with the proposed Project's three Technology Options have been assessed using practice criteria contained in the '*Wind Energy Development Guidelines for Planning Authorities, 2006*' and have been assessed following guidance from ETSU-R-97 and the IOA GPG and its supplementary guidance notes, and no likely significant effects are predicted to arise during the operational phase. No specific mitigation measures are therefore required.

If the proposed Project is permitted and constructed, a post-commissioning noise surveys will be carried out in accordance with best practice.

As discussed in Section 10.2.2, a suitable NCMP will be implemented for the proposed Project. Should a noise complaint or evidence of an exceedance of the noise limits occur, a detailed assessment and appropriate mitigation measures such as a curtailment programme on the wind turbine operations will be undertaken. The NCMP will follow the guidance outlined in the

IOA GPG and Supplementary Guidance Note 5: Post Completion Measurements (July 2014).
For more information on Post-Construction Monitoring please refer to **Section 10.14**.

Onsite Substation and Vibration

The impact assessment has demonstrated that there is no likely significant effect with respect to noise and vibration on the NSLs during the operational phase and therefore no mitigation is required.

10.7.3 Decommissioning Phase

Activities and noise levels associated with the decommissioning phase are expected to be similar to the construction phase. The mitigation measures that will be implemented in relation to any decommissioning of the site are the same as those proposed for the construction phase of the Project.

10.8 Residual Effects

This section provides a summary of the likely residual noise and vibration effects associated with the proposed Project following the implementation of mitigation measures.

10.8.1 Construction Phase

During the construction phase of the proposed Project, the significance of noise effect ranges from **Imperceptible (Not Significant in EIA terms)** to **Slight (Not Significant in EIA terms)** depending on the activity and distance to the NSL.

After the proposed mitigation measures have been adopted, the range of residual noise effects will be minimised. These mitigation measures, in accordance with the EPA Guidelines along with the application of binding limits, working hour restrictions, and implementation of appropriate noise control measures, will ensure that noise and vibration effects are kept to a minimum.

The duration of the works is brief or temporary and the assessment has considered the worst-case scenario in which all the equipment is operating simultaneously, which is not expected to occur.

10.8.2 Operational Phase

Wind Turbines – Noise

As has been demonstrated, no likely significant effects have been identified for the operational phase for any of the 3no. Technology Options. No mitigation measures are therefore required

and the residual noise effect remain as **Not Significant**. In EIA terms, the effect is considered as **Not Significant**.

Wind Turbines – Vibration

No mitigation measures are required in relation to vibration emissions from the wind turbines and the residual vibration effects will remain as **Imperceptible**. In EIA terms, the effect is considered as **Not Significant**.

Onsite Substation

No mitigation measures are required in relation to the operation of the substation and the residual noise effects will remain as **Imperceptible**. In EIA terms, the effect is considered as **Not Significant**.

10.8.3 Decommissioning Phase

With the adoption of mitigation measures outlined in Section 10.6.7, the significance of the residual effects will be **Imperceptible** to **Slight** depending on the activity and distance to the NSL. In EIA terms, the effect is considered as **Not Significant**.

Summary

A summary of the likely residual noise and vibration effects associated with the operational phase, is presented in **Table 10-37**.

Table 10-37: Summary of Description of Residual Effects

Aspect	Quality	Duration	Significance
Wind Turbines – Noise	Adverse	Long- Term	Not Significant in EIA terms
Wind Turbines – Vibration	Adverse	Long-term	Imperceptible (Not Significant in EIA terms)
Onsite Substation	Adverse	Long-term	Imperceptible (Not Significant in EIA terms)

Decommissioning Phase	Adverse	Long-term	Imperceptible (Not Significant in EIA terms)
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10.9 Unplanned Events

According to EPA Guidelines unplanned events can include spill from traffic accidents, floods or landslides affecting the site, fire, collapse or equipment failure on site. Additionally, the 2014

EIA Directive refers to “major accidents, and/or natural disasters (such as flooding, sea level rise or earthquakes)

Owing to the relatively short-term construction works of a standard nature and regulations to be followed, together with the rural location of the proposed Project, the vulnerability of the development to unplanned noise events is considered to be unlikely.

There are no unplanned events associated with the construction, operation or decommissioning of the proposed Project, that would result in likely significant noise and vibration effects.

10.10 Cumulative Effects

10.10.1 Construction Phase

It is not anticipated that there will be any construction activities associated with the projects listed on **Appendix 16.1 – Long List of other projects for the cumulative effects assessment**, that would give rise to significant cumulative effects. These other projects will be controlled by mitigation measures in their planning applications and by any conditions imposed by their grant of planning.

In this regard, if any of the construction phases did actually overlap, with the mitigation measures outlined in **Section 10.7** and those imposed by the grant of planning for other projects, there would be no significant cumulative effects during the construction phase. The cumulative effect is considered as **Not Significant**, which is **Not Significant** in EIA terms.

10.10.2 Operational Phase

Other Wind Farms

This assessment has considered the potential cumulative impacts of the proposed Project in combination with other wind energy developments in the area as required by best practice guidance discussed in **Section 10.6**. It was concluded that the predicted cumulative noise levels for all Technology Options from the proposed Project including the Sliabh Bawn Farm at all NSLs were below the noise limit criteria.

Ballyfeeny Rock Quarry

Planning conditions for the quarry restrict noise emissions to 55dB(A) over a continuous 4 hour period during the hours of operation, outside any dwelling house in the vicinity of the quarry. Noise emissions from the quarry operations were included in the baseline noise level and it was observed that it was not a major contributor to ambient noise levels. It is considered that the quarry will not cause wind farm noise criteria to be exceeded. The cumulative effect is considered as **Not Significant**, which is **Not Significant** in EIA terms.

N5 Ballaghaderreen to Scramoge Realignment Scheme

The scheme is currently in construction and is expected to be operational in c. 2027. The closest point of the scheme to the proposed Project is c. 3km away.

The EIAR for the road scheme outlines that mitigation measures in the form of bunds or barriers or a combination of both are required at a number of locations. With these mitigation

measures in place, all locations along the road scheme will comply with the adopted noise criteria.

Given the distance between the two developments, it not considered that the road scheme would contribute to noise levels within the noise Study Area for the proposed Project. The road scheme will not cause wind farm noise criteria to be exceeded. The cumulative effect is considered as **Not Significant**, which is **Not Significant** in EIA terms.

10.11 Inter-Related Effects

Chapter 17 Inter-Related Effects describes any interactions between noise effects on different environmental aspects.

10.12 Post-construction Monitoring

Compliance with the prescribed limits as set out in **Section 10.6.3, Table 10-27** may be demonstrated by a suitable post-construction NCMP. The NCMP will adopt the guidance in *IOA SGN No.5 Post Completion Measurements*.

A detailed methodology shall be agreed in writing with the planning authority prior to the commissioning of the wind farm but the following are appropriate:

- Monitoring to be conducted under downwind conditions (45 degree sector);
- Wind turbines to operate in normal mode i.e. without any additional restrictions;
- Monitoring to be conducted at one or more Noise Monitoring Location(s) (where pre-commissioning background noise levels are available) or at representative/nearest Noise Sensitive Location(s); and
- Synchronised 10-minute wind speeds at standardised 10m height to be derived from upwind anemometer or from turbine power output curves.

It will usually be necessary to carry out noise monitoring for around 1 month to obtain the necessary range of wind speeds and wind directions to enable a conclusive evaluation of whether noise limits are being met for worst case downwind propagation conditions. However, extended periods of noise monitoring may be necessary to capture sufficient conditions and will be carried out as necessary.

Some periods of wind turbine shut-down may be required to facilitate the NCMP and will be carried out as necessary.

The instrumentation used will comply with *IOA SGN No. 1 Data Collection* and conducted by a professionally competent organisation.

Where the results of the measurements to demonstrate an exceedance of the permitted noise levels, a mitigation strategy will be formulated to reduce turbine noise levels to within the prescribed noise limits. The noise monitoring will then be repeated with such mitigation measures in place to demonstrate compliance with the conditions and for the operator to continue to run the site in this way unless circumstances change.

As outlined in Section 10.2.2 Special Audible characteristics (such as OAM), is not a factor that can be foreseen at planning stage, but its presence can be measured and rated, typically in the event of a complaint, post construction. The NCMP will include standard practice methodology for OAM to be investigated, only in the event of complaint, and, where the investigation verifies its presence, mitigation measures will be put in place to address the identified turbine OAM noise characteristics.

10.13 References

- Amplitude Modulation Working Group (AMWG), 2016. A Method for Rating Amplitude Modulation in Wind Turbine Noise. https://www.IOA.org.uk/sites/default/files/AMWG%20Final%20Report-09-08-2016_0.pdf
- British Standards Institution (BSI), 2019. BS 4142:2014+A1:2019 – Methods for rating and assessing industrial and commercial sound.
- BS 5228-1:2009+A1:2014, C. of practice for noise and vibration control on construction and open sites – P. 1: N., 2014. Code of practice for noise and vibration control on construction and open sites.
- Cand Hoare Lea Acoustics Robert Davis Associates Chris Jordan, M.R., Hayes Hayes McKenzie Partnership Ltd Richard Perkins, M., 2014. Supplementary Guidance Notes Number Title Information 1 Data Collection Equipment specifications; measurement surveys: Practical considerations and set-up guidance and examples. 2 Data Processing & Derivation of ETSU-R-97 background curves. <http://www.IOA.org.uk/publications/good-practice-guide>
- Department of Housing, P. and L.G., 2019. Draft Revised Wind Energy Development Guidelines. <https://assets.gov.ie/static/documents/draft-revised-wind-energy-development-guidelines-december-2019-385c92c2-16f9-4511-80bf.pdf>
- Department of Housing, P. and L.G., 2018. Guidelines for Planning Authorities and An Bord Pleanála on Carrying Out Environmental Impact Assessment. <https://assets.gov.ie/static/documents/guidelines-for-planning-authorities-and-an-bord-pleanala-on-carrying-out-environmental.pdf>
- Environmental Protection Agency (EPA), 2022. Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR). https://www.epa.ie/publications/monitoring--assessment/assessment/EIAR_Guidelines_2022_Web.pdf
- Environmental Protection Agency (EPA), 2016. Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4). [https://www.epa.ie/publications/monitoring--assessment/noise/NG4-Guidance-Note-\(January-2016-Update\).pdf](https://www.epa.ie/publications/monitoring--assessment/noise/NG4-Guidance-Note-(January-2016-Update).pdf)
- Environmental Protection Agency (EPA), 2003. Advice Notes on Current Practice in the Preparation of Environmental Impact Statements. Environmental Protection Agency. https://www.epa.ie/publications/monitoring--assessment/assessment/EPA_Advice_Notes-on_Current-Practice-on-prep-EIS_2003.pdf
- Health Service Executive (HSE); HSE Public Health Medicine Environment and Health Group, 2017. Position paper on wind turbines and public health Item Type Report. <https://www.lenus.ie/bitstream/handle/10147/621467/HSE+PHMEHG+Wind+Final+P+Feb+2017.pdf?sequence=3>
- Institute of Acoustics, 2013. A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise. <https://www.IOA.org.uk/sites/default/files/IOA%20Good%20Practice%20Guide%20on%20Wind%20Turbine%20Noise%20-%20May%202013.pdf>

- International Organization for Standardization (ISO), 1996. ISO 9613-2: Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation.
- Lantieri, A., McNeill, A., McGuinn, J., Lukacova, Z., 2017. Environmental Impact Assessment of Projects – Guidance on the Preparation of the Environmental Impact Assessment Report. <https://doi.org/10.2779/8247>
- McAleer, M.S., McKenzie, H., McKenzie, A., Company and Timoney, F., 2011. Guidance Note on Noise Assessment of Wind Turbine Operations at EPA Licensed Sites (NG3). https://www.epa.ie/publications/monitoring--assessment/noise/Wind_Turbine_web.pdf
- National Health and Medical Research Council, 2015. Information Paper: Evidence on Wind Farms and Human Health. National Health and Medical Research Council.
- Rosciszewska, A., Buszkiewicz, M., Dobrzynska-Kobylec, G., Klichowska, A., Przybyla, T., Nagy, B.B., Wicher, A., Klichowski, M., 2025. Cognitive neuroscience approach to explore the impact of wind turbine noise on various mental functions. Humanit Soc Sci Commun 12. <https://doi.org/10.1057/s41599-025-04645-x>
- Roscommon County Council, 2022. Roscommon County Development Plan 2022–2028. <https://www.rosdevplan.ie/roscommon-county-development-plan-2022-2028/>
- The Working Group on Noise from Wind Turbines, 1996. The Assessment and Rating of Noise from Wind Farms. London. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/49869/ETSU_Full_copy__Searchable_.pdf
- Transport Infrastructure Ireland, 2014. Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes. Dublin. https://www.tii.ie/media/nv0bnge2/guidance_for_the_treatment_of_noise_during_the_planning_of_national_road_schemes.pdf
- World Health Organization, 2018. Environmental noise guidelines for the European Region. <http://www.euro.who.int/pubrequest>