Environmental Impact Assessment Report

Ballydermot Wind Farm, Co. Offaly & Co. Kildare

Chapter 12 Noise and Vibration



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GLOSSARY OF TERMS

Term	Definition
A – Weighting	The "A" suffix denotes the fact that the sound levels have been "A-weighted" in order to account for the non-linear nature of human hearing.
Background Noise	The noise level rarely fallen below in any given location over any given time period, often classed according to daytime, evening or nighttime periods. The $L_{A90,10min}$ is the parameter that is used to define the background noise level in this instance. L_{A90} is the sound level that is exceeded for 90% of the sample period. It is typically used as a descriptor for background noise.
dB (decibel)	The unit normally employed to measure the magnitude of sound. It is defined as 20 times the logarithm of the ratio between the RMS pressure of the sound field and the reference pressure of 20 micro-pascals (20 µpa)
dB(A)	An 'A-weighted decibel' – a measure of the overall noise level of sound across the audible frequency range (20 Hz – 20 kHz) with A-frequency weighting (i.e. A – Weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies
Hertz (Hz)	The unit of sound frequency in cycles per second
$L_{Aeq,T}$	This is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period (T). The closer the L_{Aeq} value is to either the L_{AF10} or L_{AF90} value indicates the relative impact of the intermittent sources and their contribution. The relative spread between the values determines the impact of intermittent sources such as traffic on the background
L_{den}	Refers to the L_{Aeq} noise levels over a whole day, but with a penalty of 10 dB(A) for night-time noise (23:00-07:00) and 5 dB(A) for

Term	Definition
	evening noise (19:00-23:00), also known as the day evening night noise indicator
Low Frequency Noise	LFN - noise which is dominated by frequency components towards the lower end of the frequency spectrum
Noise	Sound that evokes a feeling of displeasure in the environment in which it is heard, and is therefore unwelcomed by the receiver
Noise Sensitive Location (NSL)	Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or other area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels
Octave band	A frequency interval, the upper limit of which is twice that of the lower limit. For example, the 1,000Hz octave band contains acoustical energy between 707Hz and 1,414Hz. The centre frequencies used for the designation of octave bands are defined in ISO and ANSI standards
Pascal (Pa)	Pascal is a unit of pressure and so sound pressures are measured in Pascals
Sound Power Level (L_W)	The sound power level radiated by a source is defined as: $$L_W = 10\log_{10}\left(\frac{W}{W_0}\right)\ \text{dB}$$ where W is the acoustic power of the source in Watts (W) and W_0 is a reference sound power chosen in air to be 10^{-12} W
Sound Pressure Level (L_p)	The sound pressure level at a point is defined: $$L_P = 20\log_{10}\left(\frac{P}{P_0}\right)\ \text{dB}$$ where P is the sound pressure and P_0 is a reference pressure for propagation of sound in air and has a value of $2\text{x}10^{-5}$Pa
Tonal	Sounds which cover a range of only a few Hz which contains a clearly audible tone i.e. distinguishable, discrete or continuous noise (whine, hiss, screech, or hum etc.) are referred to as being 'tonal'
10 Minute Average Wind Speed (m/s)	The wind speed measured by an anemometer at a specified height above ground level, averaged over a 10-minute period
Wind Shear	The increase of wind speed with height above ground

GLOSSARY OF ACRONYMS

Acronym	Definition
AM	Amplitude Modulation
AMWG	Amplitude Modulation Working Group
BERR	UK Department of Business, Enterprise and Regulatory Reform
BPF	Blade Passing Frequency
CLG	UK Department of Communities and Local Government
CNT	Construction noise threshold
dB	Decibels
DEFRA	UK Department of Environment Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges
GDG	WHO Guideline Development Group
IEC	International Electrotechnical Commission
IOA	Institute of Acoustics
NG3	Guidance Note for Noise Assessment of Wind Turbine Operations
NML	Noise Monitoring Location
NRA	National Roads Authority
NSL	Noise-sensitive location
PPV	Peak Particle Velocity
SPL	Sound Pressure Levels
WHO	World Health Organisation

12. NOISE AND VIBRATION

12.1 Introduction

12.1.1 Background and Objectives

This chapter of the EIAR describes the assessment undertaken of the potential noise and vibration effects and likely significant effects associated with the proposed Ballydermot Wind Farm (the Proposed Project). As detailed in Section 1.1.1 in Chapter 1, for the purposes of this EIAR, the various project components are described and assessed using the following references: 'Proposed Project', 'Proposed Enhancement Areas', 'Proposed Construction Haul Routes', 'Proposed Turbine Delivery Route', 'Project Site', 'Proposed Wind Farm', 'Proposed Turbines', 'Proposed Grid Connection', 'Proposed Onsite Substation', and 'Proposed Offsite Substation'.

The Proposed Project includes 46 no. wind turbines, associated access tracks and hardstands, Proposed Grid Connection infrastructure, peat and spoil areas, 2 no. meteorological masts, 2 no. telecommunications towers, a relay mast, temporary construction compounds, underground internal cabling, internal amenity tracks, and all ancillary works and apparatus. A full description of the Proposed Project is provided in Chapter 4 of this EIAR.

Noise and vibration impact assessments have been prepared for the construction, decommissioning, and operational phases of the Proposed Project at Noise Sensitive Locations (NSLs). To inform this assessment, background noise levels have been measured at representative NSLs in the vicinity of the Proposed Wind Farm site. Noise predictions for the nearest NSLs have been prepared for all elements of the Proposed Project that have the potential for noise and vibration impacts and effects.

For a glossary of terms used in this chapter, refer to Appendix 12-1.

This chapter is supported by material in the following appendices:

- Appendix 12-1: Glossary of Acoustic Terms
- Appendix 12-2: Summary of Background Survey
- Appendix 12-3: Noise Modelling Assumptions and Parameters
- Appendix 12-4: Predicted Noise Contours
- Appendix 12-5: Tabulated Predicted Noise Results
- Appendix 12-6: Noise Compliance Management Plan

12.1.2 Consultation

Consultation forms an integral part of the Environmental Impact Assessment (EIA) process and has informed the scope and methodology of the noise and vibration assessment presented in this chapter.

Consultation relevant to noise and vibration for the Proposed Project has been undertaken through the broader EIA scoping and pre-application process, as described in Chapter 2 of the EIAR. This process has included engagement with:

- An Coimisiún Pleanála (ACP) in the context of Strategic Infrastructure Development (SID) pre-application consultations;
- Relevant Local Authorities, including Offaly County Council and Kildare County Council;
- The Environmental Protection Agency (EPA) where relevant to guidance and IPC licensing context; and
- The Applicant (BnM) and project design team.

Through this consultation process, key matters relevant to noise and vibration were identified, including:

- The requirement to adopt best practice guidance for wind farm noise assessment, including ETSU-R-97/ARWTN and the IOA Good Practice Guide (IOA GPG);
- The need to consider construction, operational and decommissioning phases, including traffic-related effects;
- The requirement to assess cumulative noise effects, including interaction with existing and permitted wind farms; and
- The increasing expectation from ACP and statutory consultees that EIAR chapters consider the likely future baseline, including activities associated with site rehabilitation under the existing IPC licence.

No project-specific concerns were raised by consultees that necessitated deviation from established standard assessment methodologies. However, the above consultation outcomes have been incorporated into the scope of assessment and are reflected throughout this chapter, particularly in relation to cumulative assessment and baseline definition.

12.1.3 Scoping

12.1.3.1 Scope Overview

The scoping process has defined the extent of the noise and vibration assessment having regard to:

- The characteristics of the Proposed Project;
- The nature of the receiving environment;
- Applicable legislation, policy and guidance; and
- Consultation feedback from ACP and other stakeholders.

The noise and vibration assessment underwent scoping to ensure potential noise and vibration effects arising during the construction, operational and decommissioning phases of the Proposed Project are addressed.

12.1.3.2 Scope of Assessment

The following potential sources of noise and vibration have been included within the assessment:

Construction and Decommissioning Phases Noise

- Site preparation works, including peat and spoil management;
- Construction of Proposed Turbines, hardstands, site roads and construction compounds;
- Construction of Proposed Grid Connection infrastructure;
- Tree felling and Proposed Enhancement Areas works;
- Traffic associated with the Proposed Construction Haul Routes.

Vibration

- Construction-related vibration (human perception and structural criteria);

Operational Phase Noise

- Wind turbine noise assessed in accordance with WEDG 2006, ETSU-R-97/ARWTN and IOA GPG;

- Fixed plant noise from the Proposed Onsite Substation and Proposed Offsite Substation assessed using EPA NG4 and BS4142;
- Operational traffic maintenance and monitoring activities.

Vibration

- Operational vibration (scoped out as no likely significant effects are identified due to distance, refer to Section 12.3.8).

12.1.4 Statement of Authority

This chapter has been prepared by Miguel Cartuyvels of AWN Consulting Ltd:

Miguel Cartuyvels (Acoustic Consultant) holds a BEng (Hons) in Industrial Engineering and is a member (AMIOA) of the Institute of Acoustics. Miguel previously worked in the construction industry and has worked in the field of acoustics since 2021 (5+ years' experience), where he has contributed to numerous projects related to environmental surveying, noise modelling, and impact assessment for various sectors, including wind energy, industrial, commercial, and residential.

The chapter has been reviewed by Dermot Blunnie and Alistair Maclaurin of AWN Consulting Ltd:

Dermot Blunnie (Associate Director) holds a BEng (Hons) in Sound Engineering, MSc in Applied Acoustics and has completed the Institute of Acoustics (IOA) Diploma in Acoustics and Noise Control. He has been working in the field of acoustics since 2008 (18+ years' experience) and is a member of the Institute of Engineers Ireland (MIEI) and the Institute of Acoustics (MIOA). He has extensive knowledge and experience in relation to commissioning noise monitoring and impact assessment of wind farms as well as a detailed knowledge of acoustic standards and proprietary noise modelling software packages. He has commissioned noise surveys and completed noise impact assessments for numerous wind farm projects within Ireland.

Alistair Maclaurin (Senior Acoustic Consultant) holds a BSc in Creative Music and Sound Technology and a Diploma in Acoustics and Noise Control. He is a member of the Institute of Acoustics. Alistair has worked in the field of acoustics since 2012 (14+ years' experience). He has been the lead noise consultant across various sites on major infrastructure projects such as Crossrail and Thames Tideway Tunnel, specialising in construction noise assessment and control. Additionally, he has undertaken environmental noise assessments for various wind farm developments throughout Ireland.

12.2 Fundamentals of Acoustics

A sound wave travelling through the air is a regular disturbance of the atmospheric pressure. These pressure fluctuations are detected by the human ear, producing the sensation of hearing. To take account of the vast range of pressure levels that can be detected by the ear, it is convenient to measure sound in terms of a logarithmic ratio of sound pressures. These values are expressed as Sound Pressure Levels (SPL) in decibels (dB).

The audible range of sounds expressed in terms of SPL is 0dB (for the threshold of hearing) to 120dB (for the threshold of pain). In general, a subjective impression of doubling of loudness corresponds to a tenfold increase in sound energy which conveniently equates to a 10dB increase in SPL. It should be noted that a doubling in sound energy (i.e., as a result of a doubling of traffic flows) increases the SPL by 3 dB.

The frequency of sound is the rate at which a sound wave oscillates expressed in Hertz (Hz). The sensitivity of the human ear to different frequencies in the audible range is not uniform. For example, hearing sensitivity decreases markedly as frequency falls below 250Hz. In order to rank the SPL of various noise sources, the measured level is adjusted to give comparatively more weight to the

frequencies that are readily detected by the human ear. The 'A-weighting' system defined in the international standard, BS ISO 226:2003 Acoustics. Normal Equal-loudness Level Contours has been found to provide the best correlations with human response to perceived loudness. SPL's measured using 'A-weighting' are expressed in terms of dB(A).

An indication of the level of some common sounds on the dB(A) scale is presented in Figure 12-1.

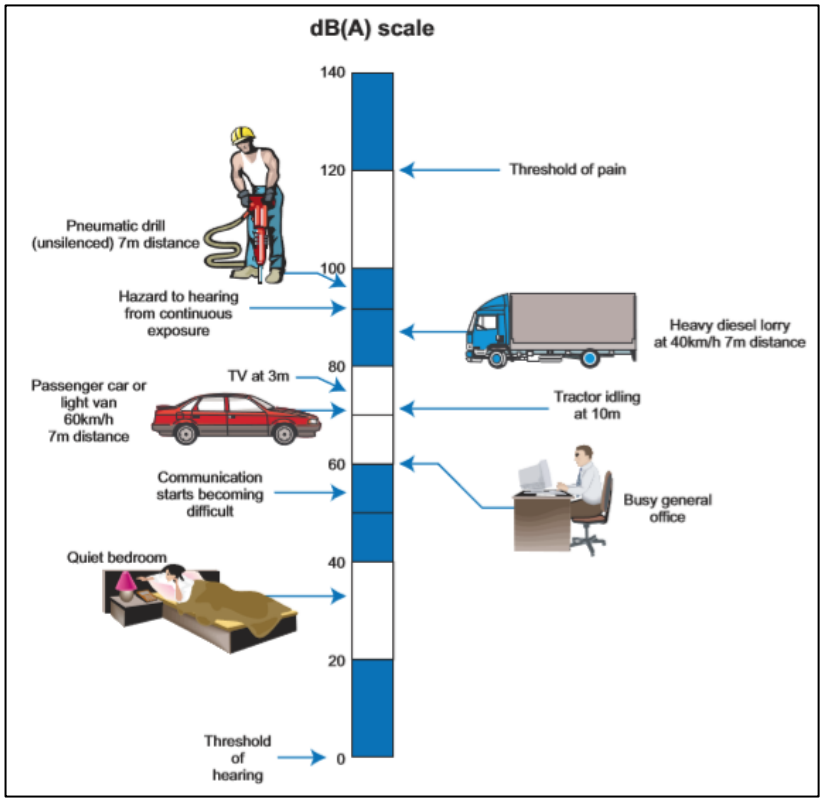


Figure 12-1 The level of typical common sounds on the dB(A) scale (NRA Guidelines for the Treatment of Noise and Vibration in National Road Schemes, 2004)

For a glossary of terms used in this chapter, refer to Appendix 12-1.

12.3 Legislation, Policy and Guidance

The assessment of effects for the Proposed Project has been undertaken with reference to the most relevant guidance documents relating to environmental noise and vibration.

12.3.1 Environmental Protection Agency (EPA) Description of Effects

The significance of effects of the Proposed Project will be described in accordance with the EPA guidance document '*Guidelines on the Information to be Contained in Environmental Impact Assessment Reports'* (EIAR), (EPA, 2022). Details of the methodology for describing the significance of the effects are provided in Section 1.7.3 of Chapter 1: Introduction.

The effects associated with the Proposed Project are described in the relevant sections of this chapter in accordance with the EPA guidance set out in Chapter 1: Introduction of the EIAR.

12.3.2 Guidance Documents and Assessment Criteria

The assessment of effects for the proposed project has been undertaken with reference to published standards and guidelines that are applicable to the development and/or considered to represent best practice for the assessment of environmental noise and vibration impacts.

The following guidance documents have been consulted when preparing this chapter of the EIAR:

- Environmental Protection Agency, Guidelines on the information to be contained in Environmental Impact Assessment Reports (EPA, 2022);
- Wind Energy Development Guidelines for Planning Authorities, Department of the Environment, Heritage, and Local Government (2006) (WEDG 2006) with cognisance of *Draft Revised Wind Energy Development Guidelines* 2019 Department of Housing, Local Government and Heritage (Draft WEDG 2019);
- The Assessment and Rating of Noise from Wind Farms, Department of Trade, and Industry (UK) Energy Technology Support Unit (ETSU) (1996);
- Assessment and Rating of Wind Turbine Noise, Department for Energy Security and Net Zero (UK), (ARWTN, 2026)
- A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise and its Supplementary Guidance Notes (IOA GPG) (2013);
- Guidelines for the Treatment of Noise and Vibration in National Road Schemes, Transport Infrastructure Ireland (TII) (formerly National Roads Authority (NRA) (2004).
- Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes, Transport Infrastructure Ireland (TII) (formerly National Roads Authority (NRA) (2014);
- British Standard BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise (BS5228-1);
- British Standard BS 5228-2:2009+A1:2014 Code of practice for vibration control on construction and open sites – Vibration (BS5228-2);
- British Standard BS 7385 – Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration (BSI, 1993);
- Design Manual for Roads and Bridges (DMRB) Sustainability & Environment Appraisal LA 111 Noise and Vibration Revision 2 (National England (now National Highways) 2020);
- ISO 1996: 2017: Acoustics – Description, measurement, and assessment of environmental noise (ISO 1996);
- ISO 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors - Part 2: General method of calculation (ISO 9613-2, 1996);
- ISO 9613-2:2024 Acoustics – Attenuation of sound during propagation outdoors - Part 2: Engineering method for the prediction of sound pressure levels outdoors (ISO 9613-2, 2024);
- EPA document Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) (EPA, 2016);
- British Standard BS 4142: 2014 + A1: 2019: Methods for rating and assessing industrial and commercial sound (BS 4142)

During the preparation of this Chapter, an update to ETSU-R-97, Assessment and Rating of Wind Turbine Noise, was published by the UK Department for Energy Security and Net Zero on 19 June 2026. The updated guidance retains the core methodology of the original ETSU-R-97 for the assessment of noise from wind farm developments. The references to ETSU-R-97 within this chapter remain applicable and consistent with current best practice guidance and provides clarity on acoustic characteristics to be followed. Baseline noise data collected in accordance with the IOA GPG are unaffected and remain valid for the purposes of this assessment. The Irish Wind Energy Development

Guidelines (WEDG 2006) continue to apply as the noise criteria applicable at receptors for proposed wind farms in Ireland. On this basis, the updated UK guidance has no material impact on the methodology, baseline data, or conclusions of the noise assessment presented in the below noise and vibration assessment.

General context guidance in the following documents has also been considered but not directly applied:

- World Health Organisation (WHO) Environmental Noise Guidelines for the European Region (2018);
- Department for Business, Energy & Industrial Strategy Wind Turbine AM Review: Phase 2 Report Project Number: 3514482A Issue: 3 Issued August 2016;
- EPA document Guidance Note for Noise Assessment of Wind Turbine Operations at EPA Licensed Sites (NG3) (EPA, 2011);
- International Electrotechnical Commission (IEC) Technical Specification 61400-11-2 (Edition 1.0, 2024) Wind Energy Generation Systems – Part 11-2: Acoustic noise measurement techniques – Measurement of wind turbine sound characteristics in receptor position (Hereafter TS 61400-11-2)

12.3.3 Construction and Decommissioning Phase - 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 operation and may consider noise limits at their discretion.

In the absence of specific noise limits, appropriate criteria relating to permissible construction noise levels for a renewable energy project of this scale may be found in the '*British Standard BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites*' – Noise (BS5528-1). This standard is commonly accepted as best practice and used in Ireland.

The approach adopted here calls for the designation of an NSL into a specific category (A, B or C) based on existing ambient noise levels in the absence of construction noise. A threshold noise value is applied to each category. Exceedances (construction noise only) of the threshold value, at the facade of a NSL during construction, indicates a potential significant noise impact associated with the construction activities. The threshold values are applicable to both construction and decommissioning noise. It should be noted that this assessment method is only valid for residential properties.

The threshold values recommended by BS5228-1 are depicted in Table 12-1 which, if exceeded, potentially signify a significant effect.

Table 12-1 Example Threshold of Potential Significant Effect at Residential Noise Sensitive Locations

Assessment category and threshold value period (T)	Threshold values, $L_{Aeq,T}$ dB		
	Category A Note A	Category B Note B	Category C Note C
Night-time (23:00 to 07:00hrs)	45	50	55
Evenings and weekends Note D	55	60	65
Daytime (07:00 – 19:00hrs)	65	70	75

Note A Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.
Note B Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.

Note C Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.
Note D 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

BS 5228-1 states that:

> *'If the site noise level exceeds the appropriate category value [the CNT], then a potential significant effect is indicated. The assessor then needs to consider other project-specific factors, such as the number of receptors affected and the duration and character of the impact, to determine if there is a significant effect.'*

Refer to Section 12.3.3.3 for further information on interpretation of the construction noise thresholds of the Proposed Project.

12.3.3.1 Commercial Receptors

BS5228-1:2009+A1 gives several examples of acceptable limits for construction or demolition noise, the most simplistic being based upon the exceedance of fixed noise limits. For example, paragraph E.2 states:

> *"Noise from construction and demolition sites should not exceed the level at which conversation in the nearest building would be difficult with the windows shut."*

Paragraph E.2 goes on to state:

> *"Noise levels, between say 07.00 and 19.00 hours, outside the nearest window of the occupied room closest to the site boundary should not exceed:*
>
> *70 decibels (dBA) in rural, suburban areas away from main road traffic and industrial noise;*
>
> *75 decibels (dBA) in urban areas near main roads in heavy industrial areas".*

For commercial locations it is considered appropriate to adopt the 70 dB(A) criterion during the day. The non-residential properties are only considered to be noise sensitive during office hours.

12.3.3.2 Linear Construction Works

A fixed noise limit is proposed for elements of the construction that are linear and progressive in nature, namely access roads, cabling and underground electrical cabling. This is deemed appropriate in that noise from associated construction activities is variable and typically occurs for a short period of time only and is at its highest when closest to the NSL. As the works progress, construction noise levels at the NSL will reduce due to the works taking place at greater distances, resulting overall in a shorter duration of exposure to noise impacts.

In relation to an appropriate fixed noise limit value, BS 5228-1 paragraph E.2 states:

> *"Noise from construction and demolition sites should not exceed the level at which conversation in the nearest building would be difficult with the windows shut."*

Paragraph E.2 goes on to state:

> *"Noise levels, between say 07.00 and 19.00 hours, outside the nearest window of the occupied room closest to the site boundary should not exceed:*

- *70 decibels (dBA) in rural, suburban areas away from main road traffic and industrial noise;*
- *75 decibels (dBA) in urban areas near main roads in heavy industrial areas".*

The Transport Infrastructure Ireland (TII) (formerly National Roads Authority (NRA)) document '*Good Practice Guidance for the Treatment of Noise and Vibration in National Road Schemes'* (NRA, 2014) proposes daytime period (Monday to Friday 0700 – 1900 hrs) construction noise limits of 70 dB $L_{Aeq,1hr}$ and 65 dB $L_{Aeq,1hr}$ for Saturdays between 0800 – 16:30hrs.

Considering the above guidance, a construction noise threshold of 70 dB $L_{Aeq,1hr}$ is proposed for linear construction activities on weekdays (i.e. forestry felling, internal 33kV cabling, and Proposed Grid Connection 220kV underground cabling). Noise levels above 70 dB $L_{Aeq,1hr}$ would indicate a potential significant impact depending on the duration and frequency of occurrence (Section 12.3.4.1 below).

12.3.3.3 Interpretation of the Construction Noise Thresholds

In order to assist with interpretation of the construction noise thresholds (CNT), Table 12-2 includes guidance as to the likely magnitude of impact associated with construction activities, relative to the CNT. This guidance is derived from guidance in the document published by Highways England (now National Highways) '*Design Manual for Roads and Bridges Sustainability & Environment Appraisal LA 111 Noise and Vibration*' (Revision 2) (hereafter referred to as DMRB). The DMRB is considered appropriate and best practice as it provides a well-established, internationally recognised framework with objective criteria for assessing construction noise and vibration impacts, which aligns closely with the relevant significance effects from EPA, 2022. Table 3.16 from the DMRB therein has been adapted to include the relevant significance effects from EPA, 2022.

Table 12-2 Description of the magnitude of impacts. Adapted from DMRB Table 3.16

Construction Noise Level	Magnitude of Impact (DMRB)	EPA Significance of Effect	Determination
Below or equal Baseline Noise Level	Negligible	Not Significant	Depending on CNT, Construction noise level and baseline noise level
Above Baseline and below or equal to CNT	Minor	Slight – Moderate	
Above CNT and below or equal to CNT + 5dB	Moderate	Moderate – Significant	
Above CNT + 5dB	Major	Significant – Very Significant	

The adapted DMRB guidance outlined will be used to assess the predicted construction noise levels (CNL) at NSLs and comment on the likely effects during the construction phase.

12.3.4 Construction and Decommissioning Phase - Additional Vehicular Activity on Public Roads

In the absence of any national guidelines in Ireland, for the assessment of potential noise impacts from construction related traffic along public roads it is proposed to adopt the DMRB. The DMRB is considered appropriate and best practice as it provides a well-established, internationally recognised

framework with objective criteria for assessing construction noise and vibration impacts, which aligns closely with the relevant significance effects from EPA 2022.

As traffic from the Proposed Project will make use of existing roads already carrying traffic volumes, it is appropriate to assess the calculated increase in traffic noise levels that will arise because of vehicular movements associated with the Proposed Project.

To assist with interpretation of a predicted CNL, relative to the CNT, reference is made to Table 3.16 in DMRB which forms the basis of and has been adapted by AWN to include the relevant significance effects from EPA, 2022 to assess the likely magnitude of impact associated with construction activities, as presented in Table 12-3.

Table 12-3 Classification of magnitude of traffic noise changes in the short-term (Source DMRB, 2020)

Change in Sound Level (dB(A))	Subjective Reaction	DMRB Magnitude of Impact (Short-term)	EPA Significance of Effect
Less than 1 dB	Inaudible	No Change	Not Significant
1.0 – 2.9	Barely Perceptible	Minor	
3.0 – 4.9	Perceptible	Moderate	Significant
≥5	Up to a doubling of loudness	Major	

The DMRB will be used to assess the predicted increases in traffic levels on public roads associated with the Proposed Project which includes the Proposed Turbine Delivery Route and Proposed Construction Haul Routes and will comment on the likely 'short-term' impacts during the construction phase. Where a major or moderate impact is identified due to the change in traffic noise level, reference will be made to the overall predicted noise level from construction/decommissioning traffic in the context of the construction noise threshold values outlined previously in Section 12.3.3.

12.3.4.1 Consideration of Duration When Assessing Effects

Section 3.19 of the DMRB states that both the construction and decommissioning noise shall constitute a significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:

- 10 or more days or nights in any 15 consecutive days or nights; or,
- A total number of days exceeding 40 in any 6 consecutive months.

12.3.5 Construction and Decommissioning Phase – Vibration

Vibration standards come in two varieties: those dealing with human comfort and those dealing with cosmetic or structural damage to buildings. With respect to the Proposed Project, the range of relevant criteria used for building protection is expressed in terms of Peak Particle Velocity (PPV) in mm/s.

In the absence of statutory Irish guidelines for the assessment of construction-related vibration, the following published standards and guidance have been considered in the assessment. These documents provide industry-recognised thresholds and assessment methodologies that align with EIAR requirements:

- BS 7385 – Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration (1993); and

- BS 5228 – Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration (2009+A1:2014).
- Transport Infrastructure Ireland (TII) '*Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes'* (TII, 2014) (NRA Guidelines)

12.3.5.1 Human Perception

It is acknowledged that humans are particularly sensitive to vibration stimuli and that any perception of vibration may lead to concern (See Section B.2 of BS5228-2). In the case of traffic, vibration is perceptible at around 0.5mm/s and may become disturbing or annoying at higher magnitudes. Higher levels of vibration, however, are typically tolerated for single events or events of short duration. For example, during piling, one of the primary sources of vibration during construction, vibration levels may typically be tolerated at up to 2.5mm/s. This guidance is applicable to the daytime only; it is unreasonable to expect people to be tolerant to such activities during the night-time (or if they are trying to sleep during the daytime).

BS 5228-2 also provides a useful guide relating to the assessment of human response to vibration in terms of the peak particle velocity (PPV). Table 12-4 below summarises the range of vibration values and the associated potential effects on humans.

Table 12-4 Human perception to vibration

Vibration Level, mm/s PPV (BS5228-2)	BS5228-2 Effect	Likely Effect (DMRB)	Significance Ratings (EPA)
≥10	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments	Major	Moderate to Significant to Very Significant
≥1 to <10		Moderate	Moderate to Significant
≥0.3 to <1	It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior warning and explanation has been given to residents.	Minor	Not Significant to Slight
≥0.14 to 0.3	Vibration might be just perceptible in residential environments.	Negligible	Imperceptible to Not significant
Less than 0.14	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.		Imperceptible

12.3.5.2 Building Response to Vibration

BS7385 states that there should typically be no cosmetic damage if transient vibration does not exceed 15 mm/s at 4 Hz rising to 20 mm/s at 15 Hz and 50 mm/s at 40 Hz and above. These guidelines relate to relatively modern buildings and should be reduced to 50% or less for more critical buildings.

BS 5228-2 recommends that, for soundly constructed residential property and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a PPV of 15 mm/s for transient vibration at frequencies below 15 Hz and 20 mm/s at frequencies above 15 Hz. Below these vibration magnitudes minor damage is unlikely, although where there is existing damage, these limits may be reduced by up to 50%. In addition, where continuous vibration is generated, the limits discussed above may need to be reduced by 50%.

The NRA Guidelines also contains information on the permissible construction vibration levels during the construction phase as shown in Table 12-5.

Table 12-5 Allowable Transient Vibration at Properties

Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of*		
Less than 10Hz	10 to 50Hz	50 to 100Hz (and above)
8 mm/s	12.5 mm/s	20 mm/s

**Based on the suggested vibration criteria discussed above from BS7385, BS5228-2 and NRA Guidelines*

The values in Table 12-5 taken from the NRA Guidelines are considered appropriate for this assessment as they provide nationally recognised, conservative PPV thresholds specifically developed for Irish infrastructure and construction works, ensuring a robust assessment in the absence of statutory Irish vibration limits.

12.3.6 Operational Phase Noise – Wind Turbines

The noise assessment documented in this chapter is based on guidance in relation to acceptable levels of noise from wind farms as contained in the WEDG 2006. The WEDG 2006 are based on detailed recommendations set out in ETSU-R-97, which has been superseded by the ARWTN in June 2026. The ARWTN document has been used to supplement the guidance contained within the WEDG 2006, where appropriate and relevant.

12.3.6.1 Wind Energy Development Guidelines for Planning Authorities

Section 5.6 of the WEDG 2006 addresses noise and outlines the appropriate noise criteria in relation to wind farm developments.

The following statement from WEDG 2006 represents the widely accepted daytime noise criterion curve in relation to wind farm developments.

> *"In general, a lower fixed limit of 45dB(A) 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."*

An important caveat should be noted as detailed in the following extract.

"However, in very quiet areas, the use of a margin of 5dB(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 30dB(A), it is recommended that the daytime level of the LA90, 10min of the wind energy development be limited to an absolute level within the range of 35 – 40dB(A)."

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

"A fixed limit of 43dB(A) will protect sleep inside properties during the night."

This limit is defined in terms of the $L_{A90,10min}$ parameter. This represents the commonly adopted night time noise criterion curve in relation to wind farm developments.

In summary, the WEDG 2006 outlines the following guidance to identify appropriate wind turbine noise criteria curves at NSLs:

- An appropriate absolute limit level in the range of 35 – 40 dB L_{A90} for quiet daytime environments with background noise levels of less than 30 dB L_{A90},10min;
- 45 dB $L_{A90,10min}$ or a maximum increase of 5 dB above background noise (whichever is higher), for daytime environments with background noise levels equal to or greater than 30 dB $L_{A90,10min}$ and;
- 43 dB $L_{A90,10min}$ for night time periods or a maximum increase of 5 dB above background noise (whichever is higher).

While the caveat of an increase of 5dB(A) above background for night-time operation is not explicit within the WEDG 2006, an allowance for same is commonly applied in noise assessments prepared and is accepted as detailed in numerous examples of planning conditions issued by An Coimisiún Pleanála (ACP). This is supported by the guidance in ETSU-R-97 and the IOA GPG and is based on the principle that when background noise levels are sufficiently elevated, the potential impact of wind turbine noise is less significant, provided it does not exceed 5dB above the background level. This approach is also consistent with the daytime criteria in WEDG 2006, which allow the limit to increase by up to 5 dB above background where this exceeds the fixed threshold level.

12.3.6.2 The Assessment and Rating of Noise from Wind Farms – ETSU-R-97

ETSU-R-97 advises regulating wind turbine noise by establishing noise limits at the properties most sensitive to noise. The document suggests that applying fixed noise limits across all wind speeds may not be appropriate for wind turbine projects. Instead, it recommends setting noise limits in relation to the prevailing background noise levels at sensitive locations. A crucial step in assessing noise for wind turbine projects involves identifying the existing background noise levels through on-site surveys.

Page 58 of ETSU-R-97 states: *"...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..."*. Therefore, the noise contribution from all wind turbine projects (existing, permitted and proposed) in the area should be considered in the assessment.

The ETSU-R-97 guidance allows for a higher level of turbine noise operation at properties that have an involvement in the Proposed Project, both as a higher fixed level of 45 dB L_{A90} and/or a higher level above the prevailing background noise level.

12.3.6.3 Key updates introduced by the Assessment and Rating of Wind Turbine Noise – ARWTN

The operational noise assessment for the Proposed Project is based on the guidance set out in the WEDG 2006, supported by ETSU-R-97 and IOA GPG. The Assessment and Rating of Wind Turbine Noise (ARWTN) (2026) replaces ETSU-R-97 and provides updated technical guidance for the assessment and control of operational wind turbine noise. The ARWTN document is reviewed here primarily to identify relevant updates and clarifications. The ARWTN retains the fundamental principles of ETSU-R-97, including the assessment of wind turbine noise at noise sensitive receptors, the use of background noise measurements to inform noise limits, and the requirement to consider cumulative noise from all acoustically relevant wind energy developments.

The guidance increases emphasis on the assessment of cumulative operational noise and confirms that the combined contribution from existing, permitted and proposed wind energy developments should be considered where relevant. ARWTN also provides updated procedures for operational compliance monitoring, including refined methodologies for the assessment of tonal noise and amplitude modulation (AM). These characteristics are intended to be addressed through post-construction compliance monitoring and planning conditions, rather than through the application of penalties at the planning assessment stage.

A notable update within ARWTN is the confirmation that certain acoustical characteristics do not require specific assessment during the planning process: namely infrasound, ground-borne vibration and low frequency noise. The guidance confirms that infrasound generated by modern wind turbines will be below the threshold of perception at typical receptor distances, that ground-borne vibration levels are significantly below those detectable by humans, and that low frequency noise can be adequately controlled through the standard noise assessment criteria and tonal assessment procedures. Consequently, assessment of these characteristics is scoped out of the operational noise assessment for the Proposed Project.

12.3.6.4 Institute of Acoustics Good Practice Guide

The original ETSU-R-97 concepts underwent a thorough standardisation and modernisation in 2013 with the Institute of Acoustics publication of the '*A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise*' (IOA GPG) including 6 Supplementary Guidance Notes. These documents bring together the combined experience of acoustic consultants in the UK and Ireland in the application of the assessment methods. Numerous improvements in the accuracy and robustness are described including the treatment of wind shear and the general adaptation to larger wind turbines. The guidance contained within IOA GPG is considered to represent best practice and has been adopted for this assessment.

12.3.6.5 Background Noise Surveys

The IOA GPG provided guidance on the duration and requirements for background noise surveys and states that at a minimum, continuous background noise monitoring should be carried out for typically a two-week period and should capture a representative sample of wind speeds in the area (i.e., from cut in speeds to the wind speed that generate the highest sound power output from the proposed turbine(s)). Background noise measurements (i.e., $L_{A90,10min}$) should be related to wind speed measurements that are collated at the site of the wind turbine development. Regression analysis is used on the data sets to calculate background noise levels at different wind speeds; the resulting background noise curve can be used to establish appropriate turbine noise criteria at each location.

For guidance on the methodology for the background noise survey, the IOA GPG has been adopted.

12.3.6.6 Noise Prediction Calculations

The noise levels associated with the wind turbines have been calculated in accordance with ISO 9613-2:1996, incorporating the IOA GPG parameter settings for wind-turbine screening limits and valley correction.

ISO 9613-2 is a noise prediction standard that accounts for attenuation due to distance, ground absorption, source directivity, and atmospheric absorption, among other factors. The IOA GPG notes that when assessing cumulative noise impacts, the influence of different wind directions on propagation may be considered. Where any directional attenuation factors are applied, these should be clearly reported within the assessment.

Additional details on the noise prediction calculation settings are provided in Appendix 12-3.

12.3.6.7 Cumulative Assessment Screening

All existing, permitted and proposed wind turbine developments are considered cumulatively in the noise impact assessment. To determine whether a particular wind farm development can be scoped out of the final assessment, the '10 dB rule' is applied. This rule is grounded in established acoustic principles, whereby if the contribution from an individual source is 10 dB below the total cumulative noise level, it contributes an insignificant amount to the overall noise level. Therefore, in accordance with this methodology, where the predicted contribution from another wind farm is at least 10 dB below the applicable noise limits at the nearest sensitive locations within the study area, it can be scoped out of the final assessment.

Section 5.1 of the IOA GPG provides criteria to determine if a cumulative turbine noise assessment is necessary:

> *"5.1.4 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.*
>
> *5.1.5 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."*

Review of nearby wind farms has determined that two wind farms, Cloncreen Wind Farm (21 no. wind turbines) and Cushaling Wind Farm (9 no. wind turbines), both existing, are to be included in the cumulative noise assessment.

12.3.6.8 Future Potential Guidance Changes

In December 2019, the Draft Wind Energy Development Guidelines (Draft WEDG 2019) were published for consultation and at the time of writing, no updated guidelines have been published. It is important to note that during the public consultation on the Draft WEDG 2019, several concerns relating to the proposed approach of the Draft WEDG 2019 have been expressed by various parties. Specific concerns expressed by a group of acoustic professionals working in the field are most relevant. The group was made up of acousticians who act for wind farm developers, Councils, Government bodies and residents' groups (all of whom are members of the Institute of Acoustics, IOA). The group contained several of the authors / contributors to ETSU-R-97, ARWTN, the IOA GPG and the IOA Amplitude Modulation Working Group, which are all referenced extensively in the Draft WEDG 2019. Comment on the statement from the party group can be reviewed at:

https://www.ioa.org.uk/wind-energy-development-guidelines-wedg-consultation-irish-department-housing-planning-community-and

Wherein it is stated that:

> *"a number of acousticians working in the field have raised serious concerns over the significant amount of technical errors, ambiguities and inconsistencies in the content of the draft WEDG and these were highlighted during the consultation process by a group of acousticians"*

A copy of the group's consultation response in full can be viewed at:

https://awnconsulting.com/wp-content/uploads/2026/03/WEDG-consultation-joint-response-R0.pdf

In a written answer to Parliamentary Question on 19 June 2025, the Minister for Housing, Local Government and Heritage stated that the review of the 2006 Wind Energy Development Guidelines is ongoing and that, when finalised, the revised Guidelines "*will be issued under section 28 of the Planning and Development Act 2000, as amended or, subject to commencement of the Planning and Development Act 2024, as a National Planning Statement, as appropriate*". The Minister further stated that "*The current 2006 Wind Energy Development Guidelines remain in force, pending the finalisation of the review.*" The full written answer is available from the Houses of the Oireachtas: Wind Energy Guidelines, Dáil Éireann Debate, 19 June 2025[1]

The assessment of wind turbine noise presented in this EIAR is based on the guidance outlined in WEDG 2006 and has been supplemented with best practice guidance from ARWTN, ETSU-R-97 and the IOA GPG. If updated Wind Energy Guidelines are published during the application process for the Proposed Project it is anticipated that any relevant changes affecting the noise will be addressed through an appropriate planning condition, or where a supplementary assessment is necessary, through provision of additional information.

12.3.6.9 World Health Organisation (WHO) Noise Guidelines for the European Region

The WHO '*Environmental Noise Guidelines for the European Region'* (2018) (WHO Environmental Noise Guidelines) provide guidance on protecting human health from exposure to environmental noise. They set health-based recommendations based on average environmental noise exposure of several sources of environmental noise, including wind turbine noise. Recommendations are rated as either 'strong' or 'conditional'.

A strong recommendation, "*can be adopted as policy in most situations*" whereas a conditional recommendation, "*requires a policy-making process with substantial debate and involvement of various stakeholders. There is less certainty of its efficacy owing to lower quality of evidence of a net benefit, opposing values and preferences of individuals and populations affected or the high resource implications of the recommendation, meaning there may be circumstances or settings in which it will not apply".*

The objective of the WHO Environmental Noise Guidelines is to provide recommendations for protecting human health from exposure to environmental noise from transportation, wind farm and leisure sources of noise. The WHO Environmental Noise Guidelines present recommendations for each noise source type in terms of L_{den} and L_{night} levels above which there is risk of adverse health risks.

In relation to wind turbine noise, the WHO Guideline Development Group (GDG) state the following:

[1] https://www.oireachtas.ie/en/debates/question/2025-06-19/308/

> *"For average noise exposure, the GDG **conditionally** recommends reducing noise levels produced by wind turbines below 45 dB L_{den}, as wind turbine noise above this level is associated with adverse health effects.*
>
> *No recommendation is made for average night noise exposure L_{night} of wind turbines. The quality of evidence of night-time exposure to wind turbine noise is too low to allow a recommendation.*
>
> *To reduce health effects, the GDG **conditionally** recommends that policy-makers implement suitable measures to reduce noise exposure from wind turbines in the population exposed to levels above the guideline values for average noise exposure. No evidence is available, however, to facilitate the recommendation of one particular type of intervention over another."*

The quality of evidence used by the WHO to support the recommendation of a 45 dB L_{den} exposure threshold for wind turbine noise is classified within the guidelines as 'low'. The document also acknowledges that no evidence is available to justify implementing the L_{den} parameter as an appropriate noise criterion for wind turbines.

The WHO Environmental Noise Guidelines aim to support the legislation and policy-making process on local, national, and international level, thus should be considered by Irish policy makers for any future revisions of Irish National Guidelines.

There is potential for increased uncertainty due to the parameter used by the WHO for assessment of exposure (i.e., L_{den}), which it is acknowledged may be a poor characterisation of wind turbine noise and may limit the ability to observe associations between wind turbine noise and health outcomes, as stated below, from within the WHO Environmental Noise Guidelines:

> *"Even though correlations between noise indicators tend to be high (especially between L_{Aeq}-like indicators) and conversions between indicators do not normally influence the correlations between the noise indicator and a particular health effect, important assumptions remain when exposure to wind turbine noise in L_{den} is converted from original sound pressure level values. The conversion requires, as variable, the statistical distribution of annual wind speed at a particular height, which depends on the type of wind turbine and meteorological conditions at a particular geographical location. Such input variables may not be directly applicable for use in other sites. They are sometimes used without specific validation for a particular area, however, because of practical limitations or lack of data and resources. This can lead to increased uncertainty in the assessment of the relationship between wind turbine noise exposure and health outcomes. Based on all these factors, it may be concluded that the acoustical description of wind turbine noise by means of L_{den} or L_{night} 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 WHO recommended average noise exposure level (i.e. 45 dB L_{den}) is not an appropriate target noise criterion for an existing or proposed wind turbine development in Ireland. It is not industry best practice to implement an L_{den} limit for wind turbine noise, as it is considered a poor characterisation of wind turbine noise. The WHO Environmental Noise Guidelines recommendation for average noise exposure of 45 dB L_{den} is conditional, meaning that the available scientific data for wind turbine noise was not strong enough to justify a strong recommendation.

12.3.6.10 Low Frequency Noise and Infrasound

As stated in the ARWTN and discussed in Section 12.3.6.3, low frequency noise and infrasound do not require specific assessment as they are generally below the threshold of perception at typical receptor distances and are not expected to result in any significant effect at the NSLs. Consequently, no assessment criteria for low-frequency noise or infrasound have been adopted as part of this EIAR.

12.3.6.11 Tonality

A tone is the concentration of acoustic energy into a very narrow frequency range, with a noticeable character (such as a "hum" or "whine" for example). The audibility of any tones can be assessed by comparing the narrow band level of such tones with the masking level contained in a band of frequencies around the tone. Several objective methodologies to assess tonal audibility are available, such as the one included in ARWTN or that of ISO 1996-2 (2017).

Mechanical noise may emanate from components within the nacelle of a wind turbine. This is a less natural sounding noise which can be characterised in some cases by its tonal content, particularly if resonances in the mechanical noise are not suitably controlled. However, modern wind turbine designs have evolved to minimise mechanical noise radiation and resonances.

Wind farm noise guidelines such as those of ARWTN assume that wind turbine noise contains no clearly audible tones. However, it is not possible to predict the occurrence of tonality on a project as this would not normally be expected from standard wind turbine designs. The unlikely occurrence of tonality in the Proposed Turbines will be managed through the commitments provided by the Applicant (i.e., BnM) in Section 12.7.2.1.1 below.

12.3.6.12 Amplitude Modulation

In the context of this assessment, 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).

The result is a regular fluctuation in amplitude at the Blade Passing Frequency (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 1 Hz.

'Normal' AM	An inherent characteristic of wind turbine noise, often described as "blade swish." This effect is typically observed relatively close to the turbine and is produced as the trailing edge of the blade rotates toward and then away from the observer.
'Other' AM	A more pronounced form of AM, generally observed at greater distances from the turbine or turbines. It is often perceived as a periodic low-frequency "thumping" or "whoomphing".

While AM is acknowledged as an intrinsic feature of wind turbine noise, the earlier terms Normal AM and Other AM were used to distinguish between the typical (expected AM), and the more pronounced

form that may cause disturbance. Normal AM is accounted for in noise impact assessments, whereas Other AM may require additional mitigation if it presents at NSL during turbine operation.

The IOA AMWG now provides a clear, objective definition and rating method for AM, reducing the need for the older terminology.

12.3.6.12.1 Frequency of Occurrence of AM

Research by Salford University commissioned by the Department of Environment Food and Rural Affairs (DEFRA), the Department of Business, Enterprise and Regulatory Reform (BERR) and the Department of Communities and Local Government (CLG) investigated the issue of AM associated with wind turbine noise. The results were reviewed and published in the report '*Research into Aerodynamic Modulation of Wind Turbine Noise*' (2007). The conclusions of this report were that aerodynamic modulation was only considered to be an issue at four, and a possible issue at a further eight, of 133 sites in the UK that were operational at the time of the study and considered within the review. At the four sites where AM was confirmed as an issue, it was considered that conditions associated with AM might occur between about 7 and 15% of the time. It also emerged that for three out of the four sites the complaints have subsided, in one case due to the introduction of a turbine control system.

It is not possible to predict an occurrence of AM at the planning stage. While OAM can occur, it is noted that the research has shown that it is a rare event associated with a limited number of wind farms.

RenewableUK Research Document (2013) states the following in relation to this matter:

Page 68 Module F	*"even on those limited sites where it has been reported, its frequency of occurrence appears to be at best infrequent and intermittent."*
Page 6 Module F	*"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."*
Page 61 Module F	*"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."*

12.3.6.12.2 Concluding Comments on AM

It is critical in the discussion of amplitude modulation (AM) to recognise it is an intrinsic feature of wind turbine noise. A distinction must be made between 'Normal' AM, which is generated by all wind turbines, generally limited in magnitude and reduces with separation distance, and 'Other' or 'Excessive' AM, which can be more pronounced and potentially intrusive. As normal AM is assumed to be part of normal wind turbine noise, the noise limits set out in applicable guidelines discussed in this section take this into account and are relatively stringent as a result. Excessive AM, should it occur, may lead to additional impacts at sensitive receptors in some cases. The term AM is commonly used without these descriptions; however, where AM is referenced in this chapter, it should be understood to refer to unacceptable or excessive AM with the potential to result in additional adverse impacts, unless otherwise stated.

The Institute of Acoustics (IOA) Noise working Group (Wind Turbine Noise) Amplitude Modulation Working Group (AMWG) published, A Method for Rating Amplitude Modulation in Wind Turbine Noise (August 2016) (The Reference Method). The IOA AMWG does not propose thresholds for adverse community response or recommend specific limits for AM. The purpose of the group is to

consolidate existing research and to establish a consistent methodology for the objective measurement and rating of AM.

A 2016 report commissioned by the UK government BEIS AM Review Phase 2, completed by WSP Parsons Brinckerhoff, recommended the use of a penalty scheme as a potential planning condition for AM to cover periods of complaints due to unacceptable AM. This penalty scheme is based on the AMWG method and other potential AM rating methods were dismissed as not sufficiently robust and was not adopted by the UK or devolved Governments. The report included the following caveat:

"*Any condition developed using the elements proposed in this study should be subject to a period of testing and review. The period should cover a number of sites where the condition has been implemented and would be typically in the order of 2-5 years from planning approval being granted.*"

It is noted that the WSP report recommended that AM be controlled specifically during period of complaints. The key point is that while excessive amplitude modulation (AM) may occur during the operation of the wind farm, it may not necessarily result in any adverse impacts. The WSP report states "*at present it is not possible to predict whether AM will or will not be prevalent on a site*".

As per the discussion on the research presented previously in this Section, excessive/other AM is considered an atypical phenomenon, and the duration, conditions and specific location or locations at which it presents cannot be predicted in the planning stage. For these reasons, the assessment of AM is typically triggered in response to complaints where the contributing factors aligning to the period of the complaint such as meteorological conditions and turbine operations can be investigated.

ARWTN confirms that the Reference Method as the relevant methodology for quantifying AM and describes the application of a noise level rating to account for the presence of AM in line with that developed in the WSP Parsons Brinckerhoff document. This rating level is only applied in the context of compliance monitoring only. There is no requirement in ARWTN to assess AM at the planning stage.

The International Electrotechnical Commission (IEC) published Technical Specification 61400-11-2 (Edition 1.0, 2024) Wind Energy Generation Systems – Part 11-2: Acoustic noise measurement techniques – Measurement of wind turbine sound characteristics in receptor position, in 2024. This document introduces a standardised methodology for measuring and rating AM at receptor locations. The method broadly aligns with the AMWG approach but includes some minor differences.

To date there is no clear industry and Governmental consensus on how AM should be regulated or managed through the planning and operational stage. Planning conditions imposing AM limits are therefore not considered best practice. In the absence of clear policy in Ireland to control AM from wind turbines, the commitments outlined in the Section 12.7.2.1 are considered to represent best practice to control AM and will be adopted in the event that a complaint relating to excessive AM is reported.

12.3.6.13 Factors to Consider when Assessing Wind Turbine Operational Noise Effects

The applicable guidelines (WEDG 2006), along with additional best practice guidance discussed in Section 12.3.6, provide a framework for identifying appropriate noise limits at nearby NSLs. The turbines to be installed will be selected and designed to operate within these limits during the operational phase of the Proposed Wind Farm. Where predicted turbine noise levels remain within best practice thresholds, the effect can be considered not significant.

Noise levels at low wind speeds are expected to increase at certain NSLs with the operation of the Proposed Wind Farm. However, although there will be new sources to the existing soundscape, the

noise levels will remain below the criteria indicated in the applicable guidelines (detailed in Section 12.3 above).

12.3.7 Operational Phase Noise – Fixed Plant Items

The Proposed Grid Connection is comprised of the Proposed Onsite Substation, Proposed Offsite Substation, the 13.1km 220kV underground cabling connection from the Proposed Onsite Substation to the Proposed Offsite Substation, and overhead line (OHL) connecting to the existing Maynooth-Dunstown 220kV OHL, and all ancillary works and apparatus.

The Proposed Onsite Substation is located in the eastern section of the Proposed Wind Farm, northeast of Lodge Bog, Co. Kildare, in the townland of Lullymore East and will include 1 no. 220kV Gas-Insulated Substation (GIS) building, 1 no. 110kV GIS building, one control building, a 36m telecom tower, and all ancillary infrastructure. The Proposed Offsite Substation is located within an agricultural field east of the Proposed Wind Farm, in the townland of Killybegs, Co. Kildare and will consist of 1 no. 220kV GIS building, a 36m telecom tower, 2 no. steel masts, and 2 no. new gantry structures and tall ancillary apparatus.

There is no published statutory Irish guidance relating to the maximum permissible noise level from fixed mechanical and electrical plant that would be associated with the Proposed Onsite Substation, Proposed Offsite Substation and associated equipment (fixed mechanical and electrical plant). In the absence of specific noise limits, appropriate criteria relating to fixed mechanical and electrical plant, reference is made to best practice guidance contained in the following published guidelines and standards.

12.3.7.1 EPA NG4

EPA publication, '*Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities 2016,* (hereafter NG4) is used in Ireland to determine suitable noise thresholds for EPA licensed industrial sites. While not directly applicable to other sites, in the absence of applicable published threshold NG4 is commonly used to determine suitable thresholds for plant noise. The NG4 approach to determining suitable noise thresholds is presented below.

In order to establish whether the NSLs would be considered 'low background noise' areas as defined in the 'NG4 guidance, the noise levels measured during the environmental noise survey need to satisfy the following criteria:

- Arithmetic Average of L_{A90} During Daytime Period ≤40 dB L_{A90}, and;
- Arithmetic Average of L_{A90} During Evening Period ≤35 dB L_{A90}, and;
- Arithmetic Average of L_{A90} During Night-time Period ≤30 dB L_{A90}.

Table 12-6 outlines the noise criteria detailed in the NG4 for areas of low background noise and all other areas.

Table 12-6 NG4 Approach for Determining Appropriate Noise Criteria

Scenario	Daytime Noise Criterion, dB $L_{Ar,T}$ (07:00 to 19:00hrs)	Evening Noise Criterion, dB $L_{Ar,T}$ (19:00 to 23:00hrs)	Night Noise Criterion, dB $L_{Aeq,T}$ (23:00 to 07:00hrs)
Areas of Low Background Noise	45	40	35

All other Areas	55	50	45

It is important to consider the likelihood of adverse noise impacts when assessing noise from fixed plant. The NG4 guidance refers to the assessment method prescribed in '*Methods for rating and assessing industrial and commercial sound*' BS 4142 that can be used to assess the likelihood of complaints from specific plant noise sources.

12.3.7.2 BS4142

BS 4142 is the industry standard method for analysing fixed plant sound emissions to residential receptors. BS 4142 describes methods for rating and assessing sound of an industrial and/or commercial nature. The methods described in this British Standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

For a BS 4142 assessment it is necessary to compare the measured external background sound level (i.e. the $L_{A90,T}$ level measured in the absence of plant items) to the rating level ($L_{Ar,T}$) of the various plant items, when operational. Where sound emissions are found to be tonal, impulsive, intermittent or to have other sound characteristics that are readily distinctive against the residual acoustic environment, BS 4142 recommends that penalties be applied to the specific level to arrive at the rating level.

The subjective method for applying a penalty for tonal sound characteristics outlined in BS 4142 recommends the application of a 2 dB penalty for a tone which is just perceptible at the receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible. In relation to intermittency, BS 4142 recommends that if the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied. The following definitions as discussed in BS 4142 are summarised below:

"ambient sound level, LAeq,T	*equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at any given time, usually from many sources near and far, at the assessment location over a given time interval, T.*
residual sound level, LAeq,T	*equivalent continuous A-weighted sound pressure level of the residual sound (i.e. ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound) at the assessment location over a given time interval, T.*
specific sound level, LAeq, T	*equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T.*
Rating level, LAr,T	*specific sound level plus any adjustment for the characteristic features of the sound.*
background sound level, LA90,T	*A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels."*

To establish an initial estimate of impact, BS 4142 states the following:

"Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level from the rating level and consider the following:

a. Typically, the greater this difference, the greater the magnitude of the impact.

b. A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.

c. A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

d. The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

Note: Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact."

BS4142 contains the following pertinent factor that must be considered with respect to the context of the sound, which is relevant to this assessment as the background noise levels are typically low at NSL's during periods of low wind speeds:

"The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.

Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night."

The guidance discussed above provides a framework in line with national guidelines for identifying appropriate noise limits at nearby NSLs.

Ambient noise levels during night time periods may increase at certain NSLs with the operation of the Proposed Grid Connection. However, the resulting noise will be at a relatively low level due to the distance to the nearest NSL. It is acknowledged that the introduction of the Proposed Onsite Substation and the Proposed Offsite Substation will contribute new sound sources to the existing soundscape.

The proposed criteria have been derived in line with the EPA NG4 guidelines and the BS4142 standard and is set out in Section 12.5.4.

12.3.8 Operational Phase - Vibration

Vibration generated from the operation of a wind turbine unit will decrease rapidly with distance. Typically, at 100 m from a 1 MW turbine unit the level of vibration associated with a turbine is in the order of 10^{-5} mm/s.

A report from Germany published by the State Office for the Environment, Measurement and Nature Conservation of the Federal State of Baden-Württemberg in 2016, *'Low frequency noise incl. infrasound from wind turbines and other sources'* conducted vibration measurements study for an operational Nordex N117 – 2.4 MW wind turbine. The report concluded that at distances of less than 300 m from

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

The shortest distance from any Proposed Turbine to the nearest NSL is in excess of 880 m (i.e., H005 is 894m from T16). At that distance, the level of vibration will be significantly below any thresholds for perceptibility. Therefore, there are no likely significant effects in terms of vibration from the Proposed Turbines and vibration criteria are not specified for the operational phase.

An IOA statement in Respect of Wind Farm Noise Assessment dated December 2024 and published on the IOA website[2] stated the following in relation to Vibration:

> *"Vibration from operational wind turbines has been measured by extremely sensitive measurement equipment such as seismic arrays. but in terms of human perception, measured vibration levels are well below perception thresholds even on the actual wind turbine sites. There is, therefore, no need to assess vibration affecting people for operational wind turbine developments."*

The above is confirmed in ARWTN, where it is stated that levels of ground-borne vibration from wind turbines are very low and significantly below the human perception threshold.

There are no known vibrational issues associated with the Proposed Onsite Substation, Proposed Offsite Substation, or other sources likely to give rise to any perceptible vibration at NSLs during the operation of the Proposed Project. The assessment of operational phase vibration has therefore been scoped out of this assessment.

12.3.9 Additional Traffic on Surrounding Roads

There are no specific guidelines or limits relating to traffic related sources along the local or surrounding roads. Given that the traffic resulting from the construction phase of the Proposed Project will make use of existing roads already carrying traffic volumes, it is appropriate to assess the calculated increase in traffic noise levels that will arise because of vehicular movements associated with the development. In order to assist with the interpretation of the noise associated with additional vehicular traffic on public roads, Table 12-7, taken from DMRB offers guidance as to the likely degree of impact associated with any long-term change in traffic noise level.

Table 12-7 Significance in Change of Noise Level

Change in Sound Level (dB)	Subjective Reaction	DMRB Magnitude of Impact	EPA Significance of Effect
0	Inaudible	No impact	Imperceptible
0.1 – 2.9	Barely Perceptible	Negligible	Not significant
3 – 4.9	Perceptible	Minor	Slight, Moderate
5 – 9.9	Up to a doubling of loudness	Moderate	Significant
10+	Doubling of loudness and above	Major	Very significant

[2] Microsoft Word - IOA Statement Final 18.12.24

The guidance outlined in Table 12-7 will be used to assess the predicted increases in traffic levels on public roads associated with the Proposed Project.

12.4 Assessment Methodology

The outline methodology adopted for this assessment is summarised as follows:

- Review of best practice guidance to identify appropriate noise and vibration criteria for the construction, operational and decommissioning phases;
- Characterise the receiving environment through noise surveys at various NSLs surrounding the Proposed Project site;
- Undertake predictive calculations to assess the potential effects associated with the construction, decommissioning and operational phase of the Proposed Project;
- Specify mitigation measures to reduce, where necessary, the identified potential effects relating to noise and vibration from the Proposed Project; and,
- Describe the significance of the residual noise and vibration effects associated with the Proposed Project.

12.4.1 Study Area

The study area for the noise and vibration impact assessment was defined by the area where there is potential for noise and vibration impacts at NSLs associated with the Proposed Project during the construction, operational, and decommissioning phases.

12.4.1.1 Construction and Decommissioning Study Area

This section defines the study area for the assessment of construction and decommissioning noise and vibration, based on the potential for effects at nearby NSLs.

Based on a review of typical construction plant noise levels derived from BS 5228-1, including high noise-generating activities such as rock breaking, which at 300 m is more than 10 dB below the lowest noise threshold, a study area of 300 m has been defined as the **Construction Study Area** and applied for general construction activities and decommissioning occurring within the Project Site. Taking account of the '10 dB rule' described in Section 12.3.6.7, it is unlikely that a cumulative impact can occur beyond 300 m.

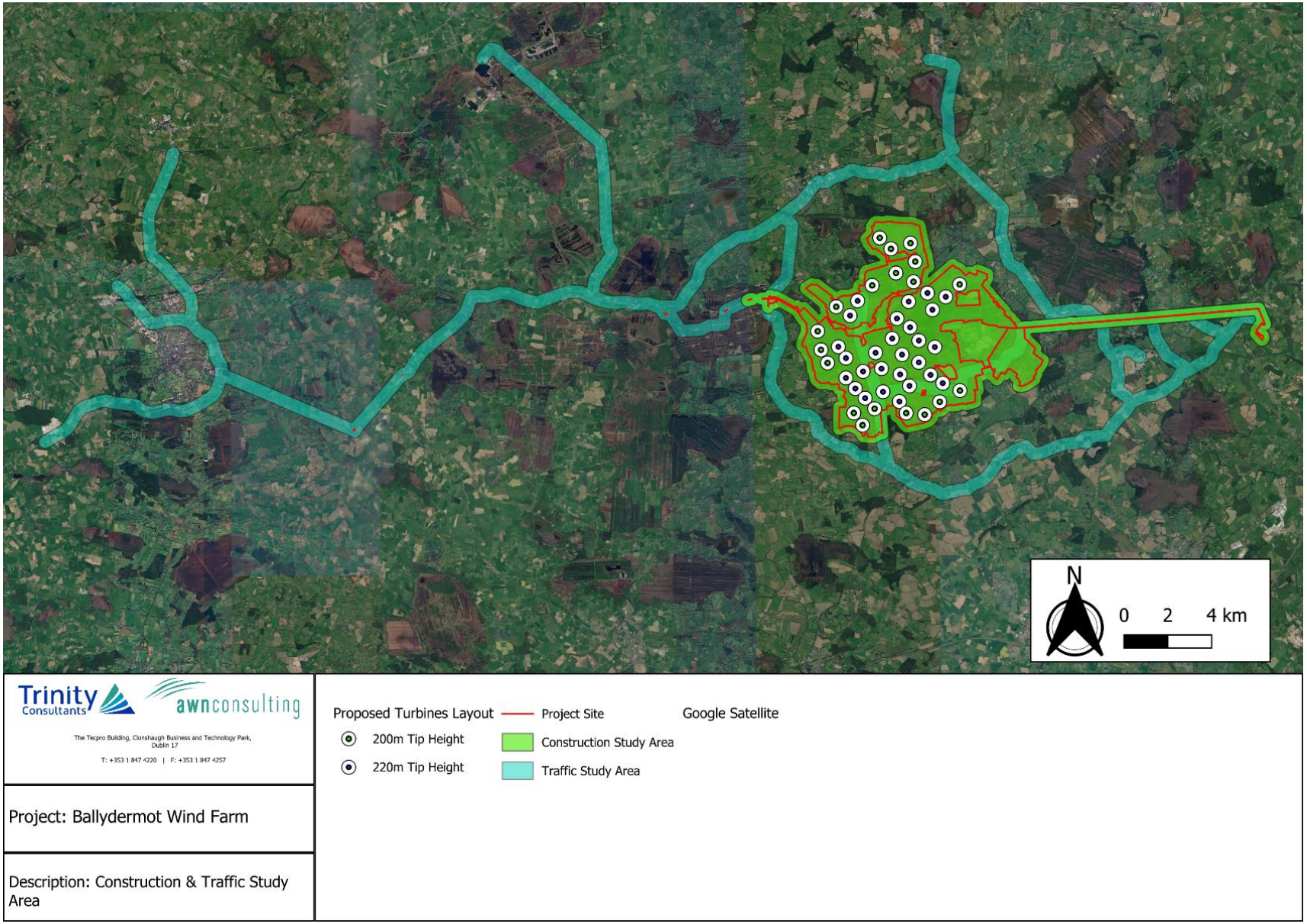
The Construction Study Area presented represents the combined spatial extent of all construction activities. However, in practice, each discrete construction activity is assessed based on a 300 m buffer from the location of the works, reflecting the distance over which significant effects may arise.

For linear and short-duration activities associated with the Proposed Turbine Delivery Route and Proposed Construction Haul Routes, a reduced study area of 200 m has been adopted and is defined as the **Traffic Study Area**. This reflects the transient nature of these works, whereby noise levels are only elevated for short periods at any given NSL.

Construction activities where the nearest NSLs are located beyond these defined distances are unlikely to result in significant noise effects, having regard to BS 5228 threshold criteria and the attenuation of noise with distance, and are therefore scoped out of detailed assessment.

Figure 12-2 shows the extent of the construction study area for the construction activities and the Proposed Construction Haul Routes and Proposed Turbine Delivery Route.

Figure 12-2 Construction and Traffic Study Area



12.4.1.2 Operational Phase Study Area

As described in Section 12.3.6.7, in the first instance the study area must be defined, the IOA GPG states that the 'study area' for background noise surveys (and noise assessment) should, as a minimum, be the area within which noise levels from the proposed, permitted and existing wind turbines is greater than 35 dB L_{A90}.

In some circumstances the cumulative 35 dB L_{A90} area may extend beyond the area where the proposed turbines will have any significant effect. This initial study area can be refined by applying the '10 dB rule' such that the following criterion applies:

- The study area for operational turbine noise can be defined as the area within which predicted turbine noise levels from the proposed, permitted, and existing wind turbines is greater than 35 dB L_{A90}, and the predicted noise from the proposed turbines in isolation is 10 dB below the fixed lower threshold for turbine noise proposed for the Proposed Project.

By way of example, where a fixed lower threshold of 40 dB applies, the maximum extent of the study area for the proposed project will correspond to the 30 dB L_{A90} noise contour of the proposed turbines in isolation. At a minimum, all noise-sensitive receptors within this area will need to be identified and considered in the turbine noise prediction model.

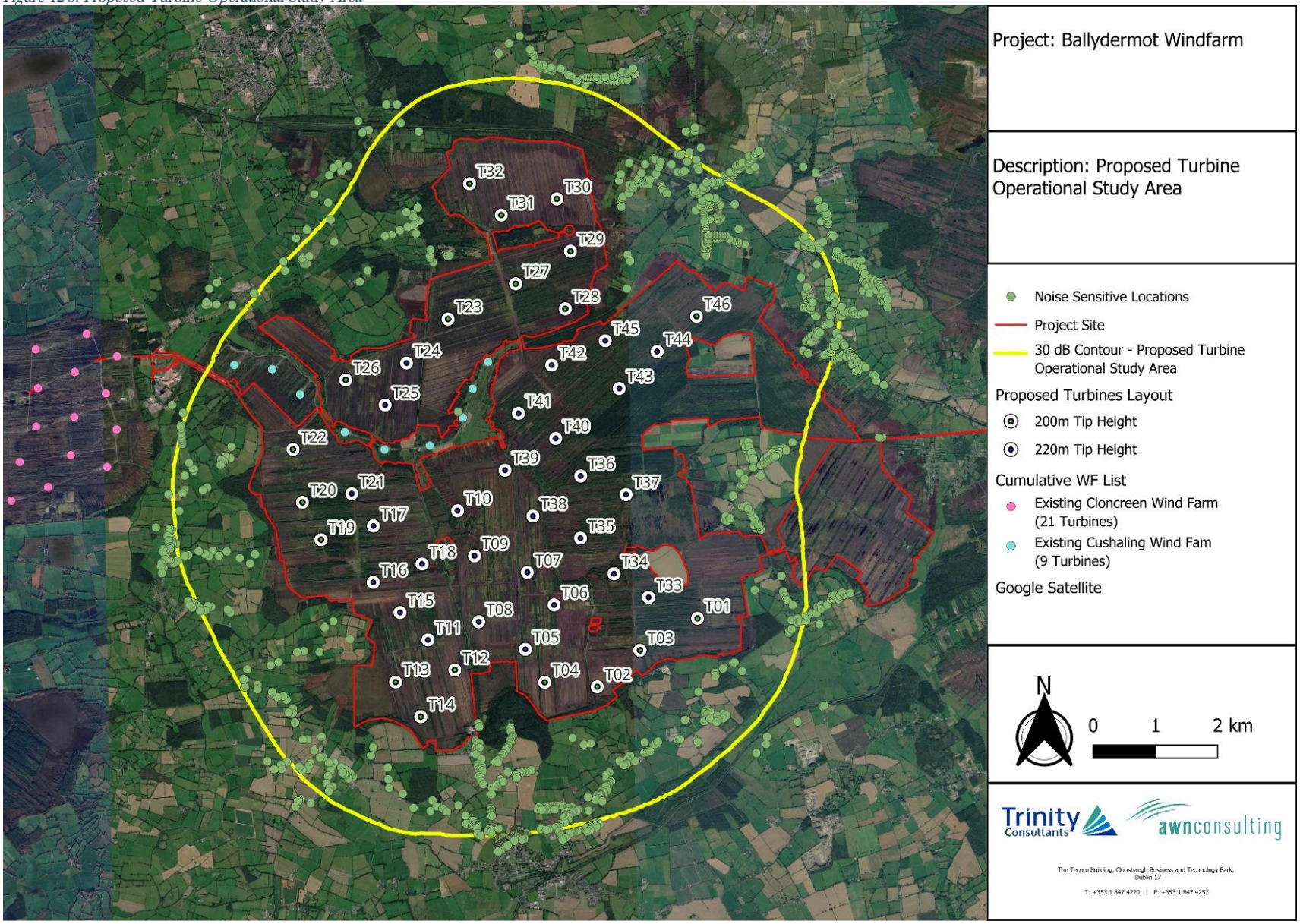
The Proposed Turbine Operational Study Area covers the equivalent to 10 dB below the lower threshold level, in this case 40 dB(A) (See Section 12.5.3). Therefore, the **Proposed Turbine Operational Study Area** is the 30 dB contour of the Proposed Turbines only.

Figure 12-3 displays the relevant noise contours map which identify this area.

In relation to fixed plant, i.e. the Proposed Onsite Substation and Proposed Offsite Substation, the study area has been defined as the **Fixed Plant Operational Study Area** and represents a 300 m buffer from the Proposed Onsite Substation and Proposed Offsite Substation. The Proposed Grid Connection is scoped out of this as there is no sources as part of the operation phase. Above this distance, the noise level would be below the threshold that could result in a significant effect. For the Proposed Onsite Substation and Proposed Offsite Substation, the nearest NSLs (H1675 and H1968, respectively) are at the boundary or outside of the Fixed Plant Operational Study Area, therefore, the noise levels have been assessed at these NSLs at distances of approximately 396 and 295 m respectively.

During the operational phase, traffic movements associated with the Proposed Project will be minimal and are not expected to result in significant effects at nearby sensitive receptors. Therefore, an operational traffic study area has not been defined as part of this assessment.

Figure 12-3. Proposed Turbine Operational Study Area



12.4.2 Background Noise Survey

A noise survey was undertaken to determine typical background noise levels at representative NSL's within the Proposed Turbines Operational Study Area. The baseline noise survey was undertaken prior to the installation of the existing Cloncreen Wind Farm and existing Cushaling Wind Farm. As these wind farms were not yet operational at the time of the baseline noise survey, there is no contribution from the existing Cloncreen Wind Farm and existing Cushaling Wind Farm included in the background noise survey. The background noise survey was conducted through installing unattended sound level meters at 10 no. representative locations in the surrounding area.

All measurement data collected during the background noise surveys has been carried out in accordance with the IOA GPG, 2013 and accompanying, Supplementary Guidance Note 1: Data Collection (2014) discussed in the following section. Appendix 12-2 provides further details.

12.4.2.1 Choice of Measurement Locations

The Noise Monitoring Locations (NMLs) were identified by preparing a preliminary cumulative turbine noise model contour at an early stage of the assessment. Any locations that fell inside the predicted 35 dB L_{A90} noise contour were considered for noise monitoring in accordance with the threshold level defined in the IOA GPG. The selection of the NMLs was informed by site visits and supplemented by reviewing aerial images of the study area and other online sources of information (e.g. Google Earth, Bing Maps, etc.). Appendix 12.2 presents the locations of the background noise surveys.

The locations selected for the noise monitoring are outlined below. Coordinates for the NMLs are detailed in Table 12-8 and illustrated in Figure 12-4.

Table 12-8 Measurement Location Coordinates

Location	NSL ID Ref	Coordinates – Irish Transverse Mercator (ITM)	
		ITM X	ITM Y
NML 1	H076	665011	729857
NML 2	H278	664276	729002
NML 3	H234	662013	724491
NML 4	H012	666561	721602
NML 5	H365	670035	725059
NML 6	H682	670350	726180
NML 7	H165	669752	729532
NML 8	H214	668639	730470
NML 9	H1734	672879	726183
NML 10	N/A	661397	728233
* Met Mast	Blackriver 100m	667181	723944

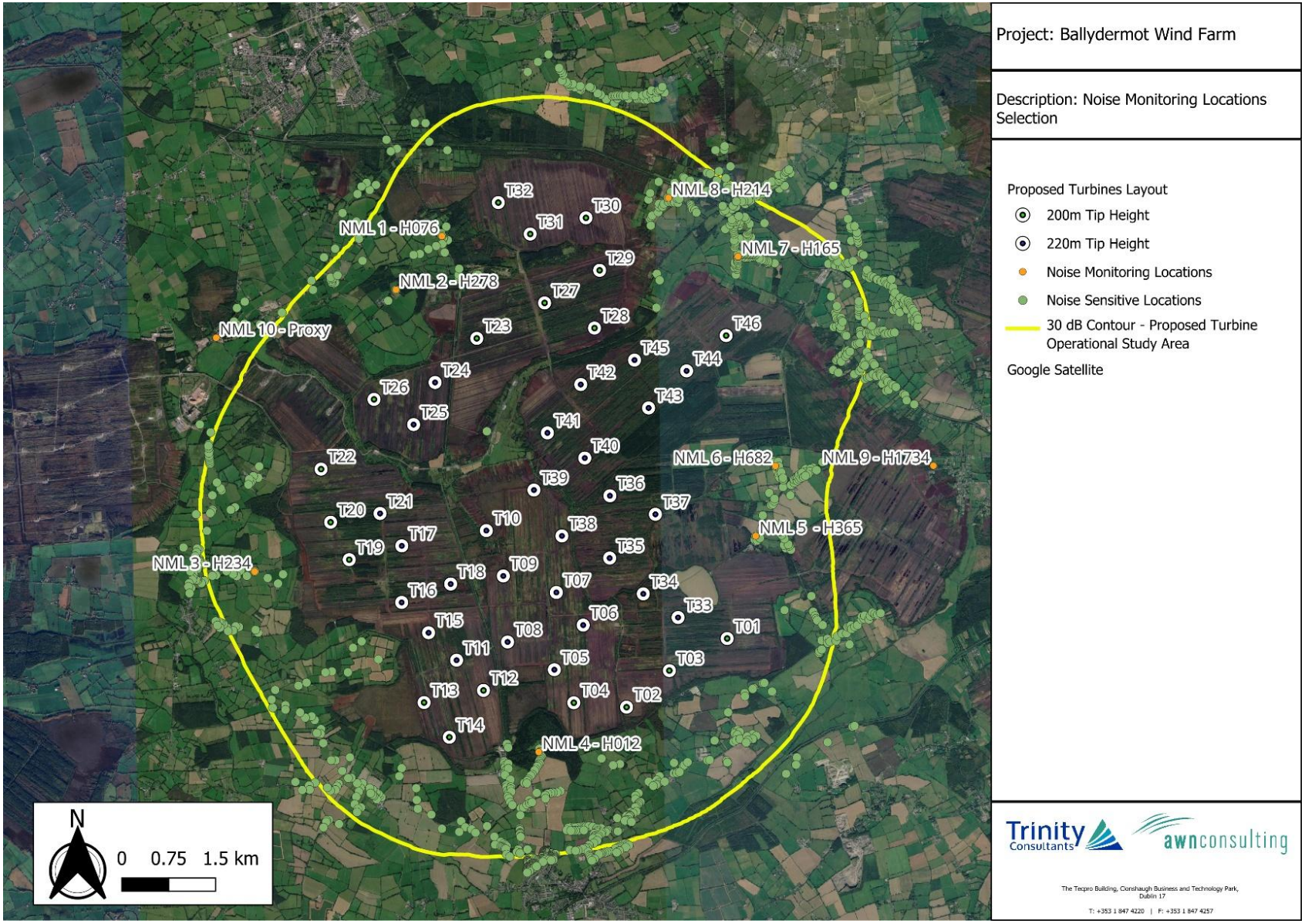
**At the time of writing the meteorological mast has been removed, however as it was onsite during background noise monitoring surveys it has been included as part of the background noise survey.*

The NMLs were selected to obtain background noise levels representative of the noise environments at noise sensitive locations surrounding the Proposed Wind Farm in line with best practice guidance contained in the IOA GPG.

The background noise environments were typically noted to comprise distant traffic movements, activity in and around the residences and wind generated noise from nearby foliage and other typical anthropogenic sources typically found in such rural settings. Additional descriptions of the noise environments from observations made on site during installation, interim visits and collection are presented below for each monitoring location where relevant.

Site visits were carried out during the morning and afternoon time; therefore, no observations were made during night-time periods. There was no perceptible source of vibration noted at any of the survey locations.

Figure 12-4 Noise Monitoring Locations



12.4.2.2 Analysis of Background Noise Data

The data sets have been filtered to remove issues such as the dawn chorus and the influence of other atypical noise sources. An example of atypical sources would be short, isolated periods of raised noise levels attributable to local sources, agricultural activity, boiler flues, operation of gardening equipment etc. 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 assessment methods outlined above are in line with the guidance contained in the IOA GPG.

Further details are discussed in Appendix 12.2 along with the results of the assessment.

The results presented in the following sections refer to the noise data collated during 'quiet periods' of the day and night as defined in the IOA GPG. These periods are defined as follows:

Daytime Amenity hours are:

- all evenings from 18:00 to 23:00hrs;
- Saturday afternoons from 13:00 to 18:00hrs, and;
- all day Sunday from 07:00 to 18:00hrs.

Night-time hours are 23:00 to 07:00hrs.

The background noise levels are derived for each location with reference to the standardised 10m height wind speed relative to the precautionary conditions which have informed the assessment, i.e., the greatest hub height of 135m which would result in the lowest derived noise levels. There are 19 no. Proposed Turbines with a tip height of 200m with a hub height of 115m and 27 no. Proposed Turbines with a tip height of 220m, with a hub height of 135m. For the assessment, the background noise levels have been derived for a hub height of 135m associated with the 27 no. Proposed Turbines at 220m tip height, which yields in the lowest derived background noise levels. This represents a precautionary approach and is in line with best practice guidance.

12.4.3 Construction Noise Calculations

Based on the construction guidance outlined in Section 12.3.3, the following method applies:

For each period (e.g., daytime) the ambient noise level is determined and rounded to the nearest 5 dB. At some sensitive properties, especially those situated near busy roads, ambient noise levels are anticipated to be relatively high. However, given the rural nature of the Project Site and surrounding area, reference has been made to the quietest properties near the Project Site which have daytime ambient noise levels typically in the range of 28 to 45 dB $L_{Aeq,1hr}$. Therefore, for the purposes of this assessment, under a theoretical precautionary approach, all properties within the Construction Study Area will be afforded a 'Category A' designation for initial assessing of construction noise impacts.

A variety of items of plant will be used for the purposes of site preparation, construction, and site works. There will be vehicular movements to and from the Project Site that will make use of existing roads. There is the potential for generation of significant levels of noise from these activities.

In the absence of specific details on the plant items and construction methods to be employed, a set of assumptions must be made to predict and assess the likely noise emissions from these activities within the Construction Study Area during the construction phase. The standard best practice approach is to predict typical noise levels at the NSLs using the guidance set out in BS5228-1.

The methodology adopted for the assessment of construction noise within the Construction Study Area involves analysing the various elements of the construction phase in isolation. For each element, the

typical construction noise sources are assessed along with typical sound pressure levels from BS5228-1 at various distances from these works.

12.4.4 Operational Noise Calculations

A series of computer-based prediction models have been prepared to quantify the potential turbine noise level associated with the operational phase of the Proposed Project on the receiving environment within the Proposed Turbines Operational Study Area and Fixed Plant Operational Study Area. This section discusses the methodology behind the noise modelling process and presents the results of the modelling exercise.

Prediction calculations for turbine noise have been conducted in accordance with ISO 9613-2 (1996) in accordance with IOA GPG.

Appendix 12-3 provides details of noise prediction calculation settings, as well as the Proposed Turbine and receptor locations.

12.4.4.1 Noise Prediction Software

The selected software, DGMR 'iNoise Enterprise (Version 2024.3)' calculates noise levels in accordance with ISO 9613-2 (1996).

iNoise is a proprietary noise calculation package for computing noise levels and propagation of noise sources. iNoise calculates noise levels in different ways depending on the selected prediction standard. The resultant noise level is calculated considering a range of factors affecting the propagation of sound, including:

- The magnitude of the noise source in terms of A weighted sound power levels (L_{WA});
- The distance between the source and receiver;
- The presence of obstacles such as screens or barriers in the propagation path;
- The presence of reflecting surfaces;
- The hardness of the ground between the source and receiver;
- Attenuation due to atmospheric absorption; and
- Meteorological effects such as wind gradient, temperature gradient and humidity (these have significant impacts at distances greater than approximately 400 m).

12.4.4.2 Noise Prediction Model – Input Data and Assumptions

Information available for the Project Wind Farm was input into the iNoise noise modelling software using the ISO 9613, 1996. The input data and assumptions made are described in the following sections.

12.4.4.3 Proposed Turbine Details

There are 46 no. turbines proposed in the Proposed Project, 19 of which will have a Tip Height of 200 m and a Hub Height of 115 m, and 27 no. turbines will have a Tip Height of 220 m and Hub Height of 135 m. Schedule and coordinates of Proposed Turbine dimensions are outlined in Appendix 12-3.

The candidate turbine used in the noise assessment are Siemens Gamesa SG170-7.0 MW with the dimensions defined in Appendix 12-3. These turbines are considered representative of the type of turbine that would be installed on the Proposed Wind Farm taking into consideration the proposed dimensions and the nominal generation capacity.

While the noise profiles of the SG170 wind turbine have been used for the purposes of this assessment, the exact make and model of the turbine installed on the Proposed Wind Farm will be dictated by a

competitive procurement process but will adhere to the specifications and parameters set out above. For the purposes of the assessment, only the predicted noise levels for the SG170 are presented in this chapter.

In terms of predicting noise levels at noise-sensitive locations the turbine noise emission levels can be defined by three parameters:

- The Hub Height (HH);
- Rotor Diameter (RD); and
- The sound power noise emissions at various wind speeds.

Sound power levels for the candidate turbine referenced to wind speeds at standardised 10 m height (calculated in accordance with the IOA GPG), are presented in Table 12-9.

Table 12-9 Sound Power Level for each turbine type

Wind Speed (m/s)	Sound Power Level of SG170 at 115 m HH, dB L_{WA}	Sound Power Level of SG170 at 135 m HH, dB L_{WA}
3	Under NDA[a]	Under NDA[a]
4		
5		
6		
7	106.5	106.5
8		
9		

Note a: The octave-band WTG noise data used in the operational noise assessment was provided by the manufacturer and is subject to the terms of a non-disclosure agreement (NDA).

The manufacturer's turbine sound power levels outlined in Table 12-9 are presented in terms of the L_{Aeq} parameter. As per best practice guidance contained within the IOA GPG, an allowance for uncertainty in the measurement of turbine source levels of +2 dB is applied in modelling to all turbine sound power levels presented in Table 12-9.

As explained in Section 12.3.6, the criteria are couched in terms of a L_{A90} criterion. Best practice guidance in the IOA GPG states that "*L_{A90} levels should be determined from calculated L_{Aeq} levels by subtraction of 2 dB".* A 2 dB reduction has therefore been applied in the noise model calculation. All predicted noise levels in this chapter are presented in terms of L_{A90} parameter, i.e., this reduction of 2 dB is applied in the noise prediction modelling.

Best practice states that should any audible tonal component be present at an NSL from the operation of wind turbines, a penalty shall be added to the measured noise levels. The level of this penalty is described in ETSU-R-97 and relates to the extent by which tonal components exceed the threshold of audibility.

Current good practice recommends that tonal issues at wind farms are best addressed through appropriate planning conditions. A tonal penalty has not been included in the predicted noise levels for this assessment. A warranty will be provided by the manufacturer of the selected turbine to ensure that the noise output, including tonality, is controlled.

12.4.4.4 Cumulative Turbine Details

Cumulative turbine details regarding wind turbine make, sound power and hub height have been obtained through EIAR chapters available to the public, supported by information provided by BnM.

Table 12-10 below shows the noise emissions values used for noise modelling of the existing Cloncreen Wind Farm and the existing Cushaling Wind Farm turbines. Further details on turbine coordinates, turbine make and hub height are presented in Appendix 12-3.

Table 12-10 Sound Power Level L_{wa} Used for Prediction Model

Wind Farm	Turbine Type	Sound Power Level per standardised wind speed, L_W dB (A)						
		3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s
Cloncreen	V136	Under NDA[a]				105.5		
Cushaling	V162	Under NDA[a]				104.8		

Note a: The octave-band WTG noise data used in the operational noise assessment was provided by the manufacturer and is subject to the terms of a non-disclosure agreement (NDA).

An uncertainty factor of +2 dB has been applied to the calculation to the noise emissions presented.

12.4.4.5 Effects of Propagation from Wind Directions

As discussed in Section 12.3.6.6, when considering noise impacts of wind turbines, the effects of propagation in different wind directions can be considered. The day-to-day operations of the optimised development will not result in a theoretical precautionary condition of all noise locations being downwind of all turbines at the same time i.e. omni-directional predictions. Therefore, to address this issue, a review of expected noise levels downwind of the turbines has been prepared for various wind directions in accordance with the IOA GPG.

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

- Downwind (i.e. 0° ±80°): no reduction in noise levels;
- Crosswind (i.e. 90° ±10° and 270° ±10°): reduction of 2 dB, and;
- Upwind (i.e. 180° ±80°): typically, up to 10 dB reduction depending on distance from turbine

Table 12-11 presents the directivity attenuation factor that has been applied to turbines when considering noise propagation in downwind conditions (full downwind is represented by 0° and full upwind is 180°).

Table 12-11 Turbine Directivity Attenuation with Consideration of Wind Direction Applied to this Assessment

Wind Direction Sector	Degrees (°)	Attenuation (dB)
Downwind	280 – 360 & 0 - 80	0
Crosswind	260 – 280 & 80 - 100	2
Upwind	230 - 250	5
	220	5.5

Wind Direction Sector	Degrees (°)	Attenuation (dB)
	210	6
	200	6.5
	190	7
	180	7.5

12.5 Receiving Environment

12.5.1 Summary of Background Noise Levels

Table 12-12 presents the derived $L_{A90,10min}$ noise levels for each of the NMLs for daytime quiet periods and night-time periods. These levels have been derived using regression analysis carried out on the data sets in line with guidance contained the IOA GPG and the *Supplementary Guidance Note (SGN) No. 2 Data Processing & Derivation of ETSU-R-97 Background Curves.* Details of background noise levels are presented in Appendix 12.2.

Table 12-12 Derived Background Noise Levels based on a Hub Height of 135m

Location	Period	Derived $L_{A90,\ 10\ min}$ Levels (dB) at various Standardised 10m Height Wind Speed (m/s)							
		3	4	5	6	7	8	9	10
NML 1	Day	33	33	33.1	33.7	34.8	36.3	38.2	40.5
	Night	18.6	19.1	20.1	21.8	24.1	27.2	31.2	36.2
NML 2	Day	34.7	34.7	34.7	35.1	35.8	37.1	38.8	41.2
	Night	21.7	22.3	23.3	24.9	27.2	30.3	34.3	39.2
NML 3	Day	32.2	32.2	32.7	33.9	35.6	38	41	44.6
	Night	18.1	18.9	20.5	22.9	26.1	30.1	34.8	40.5
NML 4	Day	32.1	32.4	33.2	34.4	36	37.8	39.7	41.8
	Night	18.8	19	20.4	23	26.6	31.1	36.4	42.4
NML 5	Day	28.7	29	30	31.5	33.5	35.9	38.9	42.2
	Night	17.2	17.9	19.4	21.7	24.8	28.5	32.8	37.6
NML 6	Day	31.1	31.6	32.8	34.7	37.2	40.1	43.3	46.7
	Night	17.3	18.7	21.2	24.6	28.8	33.6	38.9	44.4
NML 7	Day	30.9	31.1	31.6	32.5	33.7	35.4	37.6	40.3

Location	Period	Derived $L_{A90,\ 10\ min}$ Levels (dB) at various Standardised 10m Height Wind Speed (m/s)							
		3	4	5	6	7	8	9	10
	Night	18.5	19	20.1	21.9	24.5	27.9	32.3	37.6
NML 8	Day	30.1	30.1	31.1	32.9	35.4	38.1	41.1	44
	Night	18.3	18.7	20	22.1	25	28.6	32.8	37.6
NML 9	Day	31.6	31.8	32.5	33.7	35.3	37.4	39.9	42.7
	Night	19	19.4	20.5	22.2	24.6	27.6	31.3	35.6
NML 10	Day	36.1	36.2	36.6	37.5	38.7	40.1	41.9	43.8
	Night	31.2	31.4	31.7	32.1	33	34.5	36.6	39.6
Minimum	Day	28.7	29	30	31.5	33.5	35.9	37.6	40.5
	Night	17.2	17.9	19.4	21.7	24.1	27.2	31.2	35.6

12.5.2 Likely Future Receiving Environment

This section considers the future receiving environment relating to noise and vibration likely to exist at the Proposed Wind Farm site at the commencement of the construction phase. In accordance with the approach set out in Section 1.8.4 in Chapter 1, the assessment utilises the information presented in the baseline environment, i.e., Section 12.5.1 above, and uses any observed change over the survey period (2020 to 2026) to inform the likely future receiving environment.

The Project Site is located predominantly on former industrial peat extraction lands within the Allen Bog Group. Industrial peat extraction ceased in June 2020. Since then, environmental conditions across these lands have continued to develop through natural revegetation, alongside ongoing site management, decommissioning works and environmental monitoring undertaken in accordance with IPC Licence P0503-01.

At the commencement of the construction phase the likely future receiving environment will reflect the continued establishment and maturation of natural revegetation in suitable areas, in combination with the continuation of site management, decommissioning works, and environmental monitoring under IPC Licence P0503-01. These changes relate primarily to ground-level conditions and would not introduce sources of noise or vibration capable of affecting the noise environment.

The sensitive receptors database for the Proposed Project includes for all inhabitable and uninhabitable properties. In addition, a planning history search to identify properties that may have been granted planning permission, but not yet been constructed, has been carried out with any property with a valid planning permission for a dwelling house included within the sensitive receptors' dataset. This dataset has been updated over the survey period (2020 to 2026). Further applications for residential development may be submitted or permitted between submission of the planning application and commencement of the construction phase; however, as the number and location of any such future dwellings cannot be predicted with certainty, they cannot be incorporated into the sensitive receptors database. By including existing properties and planning applications, the sensitive receptor database represents the most up-to-date and reasonably foreseeable receptor environment available at the time of

preparation of the EIAR and provides an appropriately precautionary basis for the noise and vibration assessment.

Accordingly, the likely future receiving environment at commencement of the construction phase will remain materially comparable to the existing baseline environment with respect to noise and vibration, with the noise limits identified within Section 12.5.3 being applied to all sensitive receptors present at the commencement of the construction phase.

The assessment of likely significant effects presented in Section 12.6 has therefore been undertaken against this likely future receiving environment. As the noise and vibration conditions predicted at commencement of construction are materially comparable to those described in Section 12.5.1, the baseline remains representative of the receiving environment against which the Proposed Project is assessed.

12.5.2.1 Future Environmental Trends

This section identifies the future environment trends relating to noise and vibration likely to exist at the Proposed Wind Farm site following implementation of targeted rehabilitation within the Draft Rehabilitation Plans throughout the operational phase.

Continued natural revegetation, ongoing site management, decommissioning works, and environmental monitoring, and implementation of targeted rehabilitation measures within the Draft Rehabilitation Plans (once approved by EPA) are not anticipated to introduce new noise or vibration generating activities capable of materially altering the existing noise and vibration environment within or surrounding the Proposed Wind Farm site. It is acknowledged that future growth of nearby residential, commercial and community developments may occur in the wider area; however, as outlined in Section 5.3.12.1 of Chapter 5 future trends of the receiving environment for population will remain materially comparable to the baseline conditions described in Section 5.3. Furthermore, it is not anticipated that new developments would materially alter future noise or vibration trends at the Proposed Wind Farm site.

Accordingly, notwithstanding the continued natural revegetation, and implementation of the targeted rehabilitation measures outlined in the Draft Rehabilitation Plans, future trends of the receiving environment for noise and vibration will remain materially comparable to the conditions described above and do not require separate consideration elsewhere in the noise and vibration impact assessment.

The continuation of the aforementioned activities in the absence of the Proposed Project is considered in the Do-Nothing Scenario in Section 12.6.1 and in the cumulative assessment in Section 12.9.

12.5.3 Wind Turbine Noise Criteria

With respect to the relevant guidance documents outlined in Section 12.3.2, noise criteria curves have been established for the Proposed Wind Farm. The criteria curves have been derived following a detailed review of the background noise data conducted at representative NSLs described in Section 12.4.2.

The turbine noise limits proposed are in line with the applicable WEDG 2006 and noise conditions applied to similar sites previously granted planning permission by ACP.

For the Proposed Wind Farm, it is considered that a lower daytime threshold of 40 dB L_{A90} is appropriate for low noise environments where the background noise is less than 30 dB(A), based on the following considerations:

- The EPA NG4 Guidance proposes a daytime noise criterion of 45 dB(A) in 'areas of low background noise'. Turbine noise limits are stated in terms of the L_{A90} parameter while the NG4 daytime limit an L_{Aeq}. The accepted difference between L_{Aeq} and L_{A90} in wind turbine noise assessments is 2 dB; for example, 45 dB L_{Aeq} corresponds to 43 dB L_{A90}. This approach implies a 3 dB difference when comparing the parameter definitions used in NG4 and DOEHLG, 2006. Accordingly, the proposed lower daytime threshold of 40 dB L_{A90} is 3 dB more stringent than the equivalent daytime noise limit for low background noise areas as outlined in NG4.
- A lower threshold of 40 dB is commonly adopted in planning conditions for similar developments that have been granted planning permission by ACP in recent years for example, Derrinlough Wind Farm (ACP Ref: 306706-20), Coole Wind Farm (ACP Ref: PL25M.300686) Cloncreen (ACP Ref: PA0047), Borrisbeg (ACP ref: 318704-23), Castlebanny Wind Farm (Planning Ref: 309306-21), Ballivor (ACP-316212-23), Carrig Renewables Wind Farm (ACP Ref: 318689-23) (and which we understand is subject to a judicial review at the time of writing of this chapter), and Cushaling Wind Farm (ABP Ref: PL.19.306924).

Best practice for setting wind turbine noise limits at NSLs is that the limits should relate to the cumulative turbine noise level from all turbines. Therefore, the proposed noise limits shall be cumulative, accounting for all operational wind turbines within the Proposed Turbines Operational Study Area. When setting appropriate turbine noise limits in accordance with the criteria from WEDG 2006 and best practice guidance, it is important to note that where an existing wind energy development is the dominant source of turbine noise at a given NSL, this must be considered in the context of the planning condition for noise under which other developments operate.

The Proposed Turbine noise criteria should apply to the nearest NSLs where it can be reasonably determined that the noise contribution from the operation of the Proposed Wind Farm is the dominant wind turbine source or has a significant contribution to the cumulative turbine noise level at a given NSL. The operational noise limits proposed for the Proposed Wind Farm are outlined below.

Noise levels generated by the Proposed Wind Farm following commissioning by itself or in combination with other existing or permitted wind energy development in the vicinity when measured externally at noise sensitive locations, shall not exceed:

- 40 dB $L_{A90,10min}$ for daytime in quiet environments with typical background noise of less than 30 dB $L_{A90,10min}$.
- 45 dB $L_{A90,10min}$ for daytime in environments with typical background noise greater than or equal to 30 dB $L_{A90,10min}$ or a maximum increase of 5 dB(A) above background noise (whichever is the higher); and
- 43 dB $L_{A90,10min}$ for night-time periods or a maximum increase of 5 dB(A) above background noise (whichever is the greater).

Prior to the commissioning of the Proposed Wind Farm, the Applicant shall submit a Noise Compliance Monitoring Programme (NCMP) to the planning authority for written agreement. The NCMP shall include a detailed methodology for all noise measurements, the frequency of monitoring and procedures for recording results. The approved NCMP shall be fully implemented throughout the operational phase of the proposed wind farm.

With respect to the methodology in relevant guidance documents outlined in Section 12.3.6 the noise criteria curves in Table 12-13 have been derived for the NSL's surrounding the Proposed Wind Farm. These limit values are determined through applying the criteria to the derived background noise levels in Table 12-12.

Table 12-13 Noise Criteria Curves

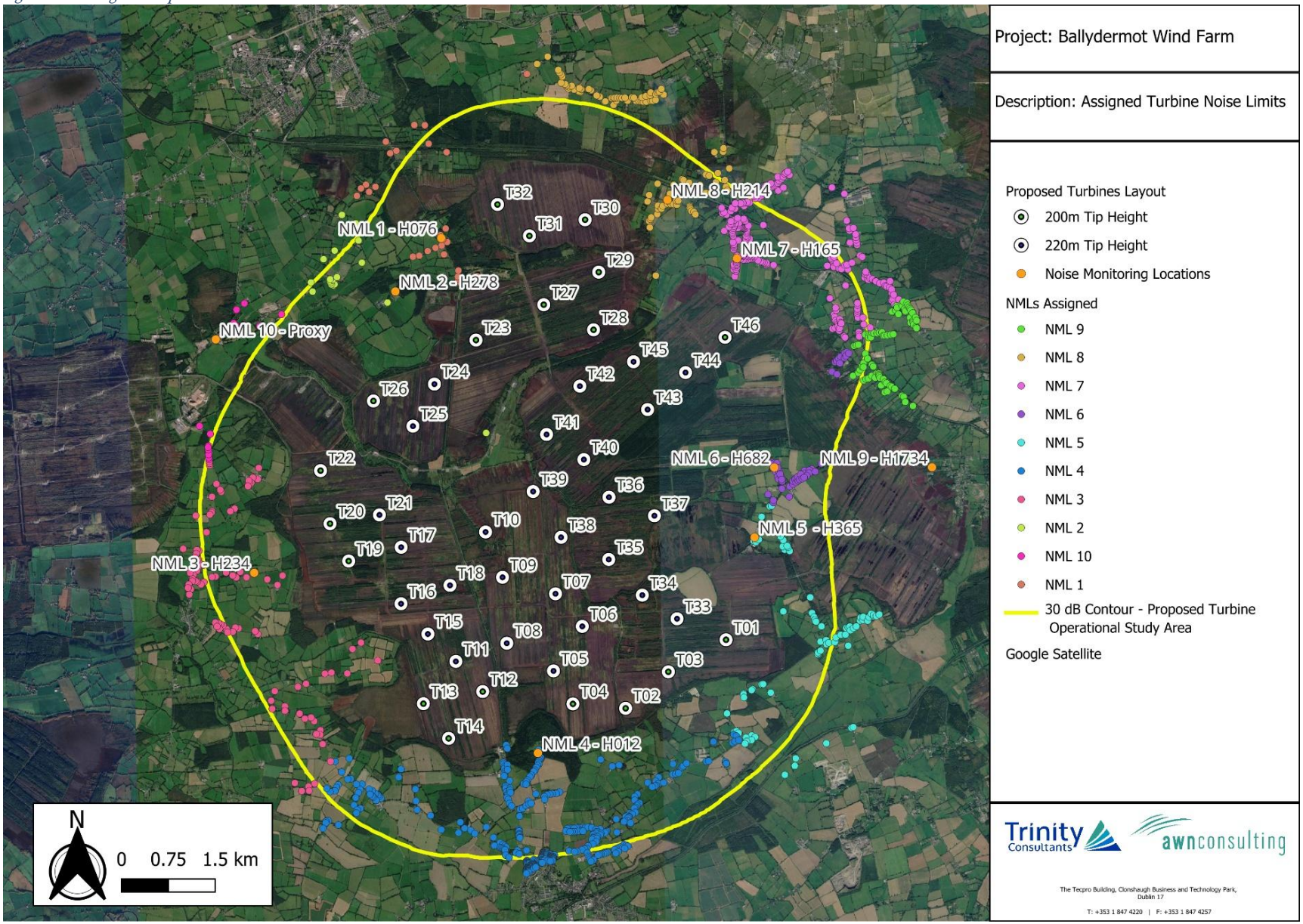
Location	Period	Derived $L_{A90,\ 10\ min}$ Levels (dB) at various Standardised 10m Height Wind Speed (m/s)							
		3	4	5	6	7	8	9	10
NML 1	Day	45	45	45	45	45	45	45	45.5
	Night	43	43	43	43	43	43	43	43
NML 2	Day	45	45	45	45	45	45	45	46.2
	Night	43	43	43	43	43	43	43	44.2
NML 3	Day	45	45	45	45	45	45	46	49.6
	Night	43	43	43	43	43	43	43	45.5
NML 4	Day	45	45	45	45	45	45	45	46.8
	Night	43	43	43	43	43	43	43	47.4
NML 5	Day	40	40	40	45	45	45	45	47.2
	Night	43	43	43	43	43	43	43	43
NML 6	Day	45	45	45	45	45	45.1	48.3	51.7
	Night	43	43	43	43	43	43	43.9	49.4
NML 7	Day	45	45	45	45	45	45	45	45.3
	Night	43	43	43	43	43	43	43	43
NML 8	Day	45	45	45	45	45	45	46.1	49
	Night	43	43	43	43	43	43	43	43
NML 9	Day	45	45	45	45	45	45	45	47.7
	Night	43	43	43	43	43	43	43	43
NML 10	Day	45	45	45	45	45	45.1	46.9	48.8
	Night	43	43	43	43	43	43	43	44.6
Minimum	Day	40	40	40	45	45	45	45	45.3
	Night	43	43	43	43	43	43	43	43

12.5.3.1 Assigning Turbine Noise Limits

The derived background noise levels have been assigned to other NSL's which are deemed to be representative of the measurement locations. Where background noise measurements have been conducted in the vicinity and/or are judged to be typical/indicative of the background noise levels of the area at the measurement location, the background noise levels can be used for deriving turbine noise thresholds at other locations.

Figure 12-5 shows where representative background noise levels have been assigned to each of the relevant NSL's for the purpose of setting noise limits for the assessment of turbine noise. The representative NMLs have been assigned based on professional judgement in line with best practice guidance of representative background noise levels measured as part of the survey. Derelict receptors are not included in the figure below. NMLs assigned in a table format is found in Appendix 12-3.

Figure 12-5. Assigned Proposed Turbine noise limits



12.5.4 Noise Limits for Fixed Plant

Based on a review of the measured noise from the background noise survey described in Section 12.5.1, in scenarios where the wind speeds are very low, the NSLs within the Fixed Plant Operational Phase Study Area can be defined as areas of low background noise. As the Proposed Onsite Substation and Proposed Offsite Substation will operate at a consistent noise output on a 24-hour basis, the potential impact during night-time periods is the primary consideration in this assessment. The criteria proposed at all NSLs within the Fixed Plant Operational Study Area for noise relating to fixed plant is outlined below.

An absolute threshold of 35 dB L_{Aeq} is applied for fixed plant. As the design is progressed, tonality, impulsivity and intermittency will be considered in the context of the character assessment framework contained in BS 4142 to ensure the noise levels at NSL are within the proposed criterion. Where these acoustic features are present, the Rating Level should be controlled to avoid adverse impacts at NSLs in accordance with BS 4142. Where background noise levels are elevated at specific NSLs, i.e. greater than 30 dB L_{A90}, a higher absolute threshold, of up to 5 dB above the background level, may be acceptable.

With respect to the guidance from the BS4142 standard, as discussed in Section 12.3.7, it is considered that the proposed criteria are robust and are expected to prevent adverse impacts at NSLs.

12.6 Likely Significant Effects

12.6.1 Do-Nothing Scenario

If the Proposed Project is not progressed, the existing noise environment is expected to remain unchanged. Any increases in traffic volumes on the local road network would not be expected to result in a significant change to the overall ambient and background noise levels within the study area.

If the Proposed Project were not to proceed, the Proposed Wind Farm site would continue to be managed under the requirements of the relevant IPC licence (Ref. P0-503-01), and therefore, ongoing site management, decommissioning works, and environmental monitoring would continue. The lands required for the Proposed Project not located within lands under IPC License or under PCAS, would continue to function as it does at present, with no changes to the current land-use.

Therefore, under a 'Do-Nothing' scenario, the Proposed Wind Farm site would continue to be managed as per the requirements of the IPC licence as detailed in Chapter 4 Section 4.6.7 with a negligible noise level contribution, as indicated in Section 12.9.5 below. These rehabilitation works are mandatory and will proceed irrespective of whether the Proposed Project is permitted, in order to ensure compliance with the IPC Licence.

If the Proposed Project were not to proceed, the opportunity to capture a significant part of County Offaly's, County Kildare's and Ireland's valuable renewable energy resource would be lost, as would the opportunity to contribute to meeting Government and EU targets for the production and consumption of electricity from renewable resources and the reduction of greenhouse gas emissions if the Proposed Project was not to proceed. The opportunity to generate local employment and investment and to diversify the local economy would also be lost.

12.6.2 Construction Phase

Construction noise prediction calculations have been conducted using the assessment methodology outlined and discussed in Sections 12.3.3 and Section 12.4.3. The source noise levels referred to in this section are indicative of the type of plant items and activities associated with the construction of the Proposed Project.

The highest predicted noise levels are expected to occur for short periods of time at a limited number of NSLs. Construction noise levels will be lower than these levels for most of the time at most properties within the Construction Study Area and Traffic Study Area.

There are several stages and elements associated with the construction phase of the Proposed Project which will include but are not limited to the following:

- Construction of new entrance(s) and hardcore existing entrance, construction of internal site roads;
- Construction of turbines and hardstand areas;
- Construction of Proposed Onsite Substation and Proposed Offsite Substation;
- Construction of Proposed Grid Connection including underground cabling and overhead line connection;
- Construction of 2 no. Meteorological Masts;
- Construction of 1 no. Relay Mast;
- Peat and Spoil Management;
- Construction of temporary construction compounds;
- Tree felling, vegetation removal and Biodiversity Management measures; and
- Construction Traffic.

Chapter 4: Description of the Proposed Project provides detailed information on each of the above elements.

In general, the distances between the construction activities associated with the Proposed Project and the nearest NSLs are such that there will be no significant noise, and vibration impacts at the NSLs. Figure 12-6 shows the construction layout in relation to the NSLs. The following sections present an assessment of the main stages of the construction phase that have the potential for associated noise and vibration effects. All other stages and elements are considered unlikely to have any significant noise and vibration effects namely, relay telecom. Mast, onsite clear-span bridges, parking, security fencing, onsite internal cabling, site drainage works, overhead line connection and accommodation works along the Proposed Turbine Delivery Route, and therefore have not been progressed for assessment.

The inset map in Figure 12-6 below shows the Proposed Offsite Substation in relation to the nearest receivers.

650000

750000

N

Mullingar

Ballinagar

Lough Ennell

Kinnegad

Tullaghlaght

Kilbeggan

Muiniagh

Tullamore

Townparks (Philipstown Lower By)

Geashill

Clonaslee

Bracklone

Cowpasture

Edenderry

Dreenan

Curryhills

Robertstown East

Prosperous

Downings North

R390 R391 R400 R402 R420 R446 R441 R403 R401 R414 R409 R421 R419 R423 R445

N52 N80 M4 M7

0 4 8 16 24 32 Kilometers

650000

Legend

- Project Site
- Turbine Layout
  - 220
  - 200
- Turbine Hardstands
- Met Mast
- Internal 33kV Cable Trench
- Internal 33kV Cabling
- Proposed OHL
- Underground 220KV Cabling
- Haul Routes
- Turbine Delivery Route
- Temporary Construction Compounds
- Proposed Peat and Spoil Management Areas
- Onsite 110kV GIS Substation
- Onsite 220kV GIS Substation
- Offsite 220kV GIS Substation
- New Road
- Upgrades to Existing Roads
- Turning Bay
- Amenity Walkway
- Amenity Board Walk
- Equestrian Amenity
- Woodland
- Peatland Resotration
- Golden Plover Mitigation
- Marsh Fritillary Enhancement
- Golden Plover Offsetting Area
- Lodge Bog Enhancement
- Pollinator Connectivity
- Scrub Planting Areas
- Bat Buffers
- Noise Sensitive Locations

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Earthstar Geographics, Microsoft, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

SITE LOCATION - NOT TO SCALE

Drawing Title

Construction Site Layout

Project Title

Ballydermot Wind Farm
Co. Offaly & Co. Kildare

Project No.	Drawing No.	Scale
250708	12-6	1:280,000
Drawn By	Checked By	Date
LPM	CJ	30/07/2026

MKO
Email: info@mkoireland.ie/ Website: www.mkoireland.ie

Construction activities will be carried out during normal daytime working hours (i.e., weekdays 07:00hrs – 19:00hrs and Saturdays 08:00hrs – 13:00hrs). However, to ensure that optimal use is made of good weather periods or at critical periods within the programme (e.g., concrete pours) or to accommodate delivery of large turbine components along public routes it could be necessary on occasion to work outside of these hours. Any such out of hours working will be notified and agreed in advance with the relevant Local Authority.

Calculations have assumed an on-time of 66% for each item of plant i.e., that the item is operational for 8 hours over a 12-hour assessment period.

12.6.2.1 General Construction of Turbines, Hardstand Areas and Met Mast

12.6.2.1.1 *Noise*

Foundation and hardstanding construction is required at all Proposed Turbine locations. Several noise sources that would be expected on a construction site of this nature have been identified and predictions of the potential noise emissions have been calculated at the nearest NSL within the Construction Study Area. In this instance the closest noise sensitive receptor is Location H005 at approximately 894 m from Proposed Turbine T16. The distance from the Met Masts are approximately 544 m and 2026 m from the nearest NSLs (H011 and H1120, respectively).

The proposed onsite relay mast is 1.5km from the nearest NSL, therefore it has been scoped out of the following assessment.

Table 12-14 outlines the typical construction noise levels associated with the proposed works for this element of the construction. Calculations have assumed an on-time of 66% for each item of plant machinery i.e., that the item is operational for 8 hours over a 12-hour assessment period.

Table 12-14 Typical Wind Farm Turbine Construction Noise Emission Levels

Item (BS 5228 Ref.)	Activity/Notes	Plant Noise level at 10m Distance (dB $L_{Aeq,T}$)[3]	Predicted Noise Level (dB $L_{Aeq,T}$) at distance (544 m)
HGV Movement (C.2.30)	Removing peat and spoil and transporting fill and other materials within the Proposed Wind Farm	79	32
Tracked Excavator (C.4.64)	Removing soil and rubble in preparation for turbine foundations	75	28
Excavator Mounted Rock Breaker (C9.12)	Rock Breaking	85	38
General Construction (Various)	All general activities plus deliveries of materials and plant to the Project Site	84	37

[3] *All plant noise levels are derived from BS5228: Part 1*

Item (BS 5228 Ref.)	Activity/Notes	Plant Noise level at 10m Distance (dB $L_{Aeq,T}$)[3]	Predicted Noise Level (dB $L_{Aeq,T}$) at distance (544 m)
Concrete Mixer Truck and Concrete Pump (C.4.27)	Foundations	79	32
Dumper Truck (C.4.4)	Removing peat and spoil and transporting fill and other materials.	76	29
Mobile Telescopic Crane (C.4.39)	Installation of nacelles	77	30
JCB (D.8.13)	Road surfacing.	82	35
Vibrating Rollers (D.8.29)	For services, drainage and landscaping.	77	30
Piling Operations (C.12.14, if required)	For foundations	41	41
Dewatering pumps (D.7.70)	Extract water	33	33
Total Construction Noise Level			46

At 544 m from the works the predicted noise levels from construction activities are in the range of 22 to 32 dB $L_{Aeq,T}$ with a total conservative cumulative construction level of the order of 46 dB $L_{Aeq,T}$. In all instances the predicted noise levels at the nearest NSLs are below the adopted significance threshold outlined in Table 12-1 (Category A – 65 dB $L_{Aeq,T}$ during daytime periods). This assessment is considered representative of theoretical precautionary conditions for construction noise levels at NSLs.

There is no item of plant that would be expected to give rise to noise levels that would be considered out of the ordinary or in exceedance of the thresholds outlined in Table 12-1 and this finding is valid should all items of plant operate simultaneously. No specific mitigation measures are required.

12.6.2.1.2 *Vibration*

Rock breaking activity will likely generate the highest levels of vibrations through the ground. Empirical data for this activity is not provided in BS 5228-2, however the likely level of vibration from this activity is expected to be substantially below the vibration criteria for building damage based on experience from other sites. AWN Consulting Ltd (the author of this chapter) has previously conducted vibration measurements under controlled conditions, during trial construction works on a sample site where rock breaking was carried out. The trial construction works consisted of the use of the following plant and equipment when measured at various distances:

- Three tonne hydraulic breaker on small CAT tracked excavator
- Six tonne hydraulic breaker on large Liebherr tracked excavator.

Vibration measurements were conducted during various staged activities and at various distances. Peak vibration levels during staged activities using the three-tonne breaker ranged from 0.48 PPV (mm/s) to 0.25 PPV (mm/s) at distances of 10 m to 50 m respectively from the breaking activities. Using a six-

tonne breaker, measured vibration levels ranged between 1.49 PPV (mm/s) to 0.24 PPV (mm/s) at distances of 10 m to 50 m respectively. While these measurements relate to breaking of concrete, the range of values recorded provides some context in relation to typical ranges of vibration generated by construction-breaking activity. The levels measured at up to 50 m from the activity are significantly below the assessment threshold set out in Table 12-5.

Accounting for the distance from proposed works to the nearest NSLs, vibration effects are not likely at any NSL within the Construction Study Area.

12.6.2.1.3 *Description of Effects*

The likely predicted noise and vibration effects are below the limits and/or thresholds identified. With respect to the EPA's criteria for description of effects, the likely potential effects at the nearest NSL, under a theoretical precautionary scenario, associated with construction of Proposed Turbines, associated foundations and hardstanding areas, and the 2 no. proposed met masts are described as in Table 12-15:

Table 12-15 Description of effects for the construction of Proposed Turbines, hardstanding areas, and met masts

Quality	Significance	Duration
Negative	Not Significant	Short Term

The above effect should be considered in terms that the effect is variable, and that this assessment considers the locations of the greatest potential impact. There are no likely significant effects from this element during the construction phase.

12.6.2.2 Construction of Internal Site Roads and Amenity Access Tracks

As part of the Proposed Project, it is proposed to construct new internal roads that will be a mixture of permanent (construction/operational and amenity) roads and amenity tracks. Review of the internal access road and amenity access track layout has identified that within the Construction Study Area the nearest NSL to any point of the Proposed Project is the access road to the existing R414 road to the east of the Proposed Wind Farm and approximately 51 m to receptor H1127. All other locations are at greater distances with the majority at significantly greater distances. The full description of the roads is outlined in Section 4.4.1.2 of Chapter 4: Description of the Proposed Project.

12.6.2.2.1 *Noise*

Table 12-16 shows the predicted levels from the construction of internal site roads and amenity tracks at several distances.

Table 12-16 Indicative Noise Levels from Construction Plant at different distances from Site Roads and Amenity Access Tracks

Item (BS 5228 Ref.)	Plant Noise level at 10m Distance (dB $L_{Aeq,T}$)[4]	Predicted Noise Level at Stated Distance from Edge of Works (dB $L_{Aeq,T}$) at 25 m	Predicted Noise Level at Stated Distance from Edge of Works (dB $L_{Aeq,T}$) at 50 m	Predicted Noise Level at Stated Distance from Edge of Works (dB $L_{Aeq,T}$) at 75 m	Predicted Noise Level at Stated Distance from Edge of Works (dB $L_{Aeq,T}$) at 100 m
Tracked Excavator (C.4.64)	75	61	54	49	46
HGV Movement (C.2.30)	79	65	58	53	50
Vibrating Rollers (D.8.29)	76	62	55	50	47
Dumper Truck (C.4.4)	77	63	56	51	48
Total Construction Level	–	69	62	57	54

For road construction activities, any NSL set back at 25 m or more from the proposed works is predicted to experience noise levels within the linear construction noise limit of 70 dB $L_{Aeq,1hr}$ as set out in Section 12.3.3.2 above.

Table 12-16 above shows that at 50 m, noise levels do not exceed the construction adopted significance threshold outlined in Table 12-1 (Category A – 65 dB $L_{Aeq,T}$ during daytime periods). All receivers within the Construction Study Area are located outside 50 m from the proposed works.

12.6.2.2.2 Vibration

With reference to the discussion on vibration presented in Section 12.6.2.1.2 there will be no significant vibration impacts within the Construction Study Area associated with the construction of internal site roads and therefore no specific mitigation measures are required.

12.6.2.2.3 Description of Effects

The likely predicted noise and vibration effects are below the limits and/or thresholds identified. With respect to the EPA's criteria for description of effects, the likely potential effects, under a conservative scenario, at the nearest NSL associated with construction of internal roads are described in Table 12-17.

[4] *All plant noise levels are taken from BS5228: Part 1*

Table 12-17 Description of effects for the construction of Site Roads and Amenity Access Tracks

Quality	Significance	Duration
Negative	Not Significant	Temporary

The above effect should be considered in terms that the effect is variable, and that this assessment considers the locations of the greatest potential impact. There are no likely significant effects from this element during the construction phase.

12.6.2.3 Construction of Temporary Construction Compounds

It is proposed to construct 10 no. temporary construction compounds, to provide site offices, staff welfare facilities, storage areas and car parking areas for construction staff.

Review of the proposed temporary construction compounds layout has identified that the nearest NSL to the temporary construction compounds is H021 located 628m west of TCC1 see Table 4-2 in Chapter 4. All other locations are at greater distances with the majority at significantly greater distances. The full description of the compounds is in Chapter 4: Description of the Proposed Project.

12.6.2.3.1 *Noise*

Table 12-18 Indicative Noise Levels from Construction Plant at different distances from Temporary Construction Compounds

Item (BS 5228 Ref.)	Plant Noise level at 10m Distance (dB $L_{Aeq,T}$)[5]	Predicted Noise Level at Stated Distance from Edge of Works (dB $L_{Aeq,T}$) at 628 m
HGV Movement (C.2.30)	79	30
Tracked Excavator (C.4.64)	75	26
Concrete Mixer Truck and Concrete Pump (C.4.27)	79	30
Dumper Truck (C.4.4)	76	27
Mobile Telescopic Crane (C.4.39)	77	28
Vibrating Rollers (D.8.29)	77	28
Total Construction Level	85	36

Table above shows that at 628 m, noise levels do not exceed the construction adopted significance threshold outlined in Table 12-1 (Category A – 65 dB $L_{Aeq,T}$ during daytime periods). All other receivers are at further distances from the proposed works.

[5] *All plant noise levels are taken from BS5228: Part 1*

12.6.2.3.2 Vibration

With reference to the discussion on vibration presented in Section 12.6.2.1.2 there will be no significant vibration impacts associated with the construction of internal site roads and therefore no specific mitigation measures are required.

12.6.2.3.3 Description of Effects

The likely predicted noise and vibration effects are below the limits and/or thresholds identified. With respect to the EPA's criteria for description of effects, the likely potential effects, under a conservative scenario, at the nearest NSL associated with construction of internal roads are described below.

Table 12-19 Description of effects for the construction of Temporary Construction Compounds

Quality	Significance	Duration
Negative	Not Significant	Short Term

The above effect should be considered in terms that the effect is variable, and that this assessment considers the locations of the greatest potential impact. There are no likely significant effects from this activity during the construction phase.

12.6.2.4 Proposed Enhancement Areas

12.6.2.4.1 Noise

Areas of forestry will be clear-felled to accommodate the Proposed Enhancement Areas in Killina Bog (refer to Appendix 6-5 BMP). The nearest NSL within the Construction Study Area to any of the Proposed Enhancement Areas is H1127 at a distance of approximately 102 m (Lodge Bog Enhancement Area). However, it is considered that forestry felling activity is linear in nature and therefore the applicable criteria is defined in Section 12.3.3.2. The construction machinery to be used in these areas presented in Table 12-20.

Table 12-20 Typical Construction Noise Emission Levels – Proposed Enhancement Areas

Item (BS 5228 Ref.)	Plant Noise Level at 10m Distance (dB $L_{Aeq,T}$) [6]	Predicted Noise Level at 80 m	Predicted Noise Level at 100 m	Predicted Noise Level at 150 m
Handheld Electrical Saw (D.7. 76)	81	54	52	48
Harvester (C.10.18)	83	56	54	50
Tracked Excavator (C.4.64)	75	48	46	42
Total Construction Noise		59	57	53

[6] *All plant noise levels are derived from BS 5228: Part 1*

The predicted noise levels shown in Table 12-20 indicate that all NSLs are below the criteria outlined in Table 12-1 (Category A – 65 dB $L_{Aeq,T}$ during daytime periods) and therefore, the predicted noise levels are considered Not Significant.

12.6.2.4.2 Vibration

No vibration is expected within the Construction Study Area due to the equipment used and the distance from NSLs during the construction phase.

12.6.2.4.3 Description of Effects

The likely predicted noise and vibration impacts are below the limits and/or thresholds identified. With respect to the EPA's criteria for description of effects, the likely potential associated effects at the nearest NSLs associated within the Proposed Enhancement Areas, are as described below:

Table 12-21 Description of effects for the construction of Proposed Enhancement Areas

Quality	Significance	Duration
Negative	Not Significant	Short Term

There are no likely significant effects from this element during the construction phase.

12.6.2.5 Peat and Spoil Areas

12.6.2.5.1 Noise

Peat and spoil areas are proposed as part of the Proposed Wind Farm. The nearest NSL within the Construction Study Area to any proposed peat and spoil area is H022 at a distance of approximately 578m. The construction machinery to be used in these areas is similar to the ones used for the construction of roads and amenity tracks as in Section 12.6.2.2. Therefore, the predicted noise levels from the construction of peat and spoil areas will be in the order of 35 dB $L_{Aeq,T}$ at the nearest NSL. This level of noise is well below the significance threshold of 65 dB $L_{Aeq,T}$, therefore no specific mitigation measures are required.

12.6.2.5.2 Vibration

No vibration is expected due to the equipment used and distance from NSLs.

12.6.2.5.3 Description of Effects

The likely predicted noise and vibration impacts are below the limits and/or thresholds identified. With respect to the EPA's criteria for description of effects, the likely potential associated effects at the nearest NSLs associated with the proposed peat and spoil areas are as described below:

Table 12-22 Description of effects for the construction of peat and spoil areas

Quality	Significance	Duration
Negative	Not Significant	Short Term

There are no likely significant effects from the proposed peat and spoil areas.

12.6.2.6 Construction Traffic

This section has been prepared to review potential noise impacts associated with the Proposed Construction Haul Routes and Proposed Turbine Delivery Route within the Traffic Study Area. The information presented in Chapter 15 (Material Assets) has been used to inform the assessment presented in this chapter. Table 12-23 to Table 12-28 present the change of noise level at the different links the DMRB impact and the significance of impacts for each traffic activity.

Table 12-23 Predicted change in noise levels, DMRB Impact and Effects - General Construction and Proposed Offsite Substation Construction

Link	Background Units		Total Units		Change in Noise Level	DMRB Impact	Significance of Impact
	Car	HGV	Car	HGV			
1 – R401 (Access Junction 1)	2,234	331	2,379	1,023	4.6	Moderate	Significant
2 – L1001 (Access Junction 4)	2,105	15	2,250	708	11.9	Major	Significant
3 – L3001 (Access Junction 3)	2,102	21	2,247	714	11.4	Major	Significant
4 – L3001 (Access Junction 2)	2,142	22	2,287	714	11.3	Major	Significant
5 – L1005 (Delivery route)	1,732	257	1,877	949	5.4	Major	Significant
6 – R403 (Delivery route)	5,733	418	5,878	1,111	3.7	Moderate	Significant
7 – R414 (Access Junction 6)	1,166	40	1,311	732	11.1	Major	Significant
8 – R414 (Access Junction 5)	1,072	53	1,217	745	10.4	Major	Significant
9 – L1020 (Potential grid diversion)	953	23	1,098	716	12.8	Major	Significant
10 – R415 (Potential grid diversion)	4,920	194	5,065	887	5.5	Major	Significant
11 – L7073 (Potential grid diversion)	1,744	76	1,889	769	8.9	Major	Significant
12 – L7081 (Potential grid diversion)	3,418	180	3,563	873	6.0	Major	Significant
13 – R409 (Potential grid diversion)	4,573	392	4,718	1,085	4.0	Moderate	Significant

Link	Background Units		Total Units		Change in Noise Level	DMRB Impact	Significance of Impact
	Car	HGV	Car	HGV			
14 – N52 (TDR)	17,940	1,371	18,085	2,064	1.5	Minor	Not Significant
15 – R420 (TDR)	9,806	473	9,951	1,165	3.2	Moderate	Significant
16 – R402 (TDR)	6,762	333	6,907	1,026	4.1	Moderate	Significant
17 – R402 (TDR)	5,226	328	5,371	1,020	4.3	Moderate	Significant
18 – L1003 (Delivery route)	1,286	62	1,431	755	9.7	Major	Significant
19 – R400 (Delivery route)	2,088	89	2,233	782	8.2	Major	Significant
20 – R401 (Delivery route)	2,494	159	2,639	852	6.5	Major	Significant
21 – R148 (Delivery route)	12,006	1,002	12,151	1,694	2.0	Minor	Not Significant
22 – R403 (Delivery route)	12,333	872	12,478	1,564	2.2	Minor	Not Significant
23 – L6002 (Access Junction 7)	2,742	56	2,887	748	9.0	Major	Significant
24 – R403 (Delivery route)	7,209	610	7,354	1,303	2.9	Minor	Not Significant
25 – R402 (Delivery route)	10,221	629	10,366	1,322	2.7	Minor	Not Significant
26 – R403 (Delivery route)	7,208	601	7,353	1,294	2.9	Minor	Not Significant
27 – R402 (Delivery route)	5,082	460	5,227	1,153	3.6	Moderate	Significant
28 – R402 (Delivery route)	6,852	653	6,997	1,345	2.8	Minor	Not Significant
29 – R402 (Delivery route)	4,170	463	4,315	1,156	3.6	Moderate	Significant
30 – R401 (Delivery route)	2,204	181	2,349	874	6.2	Major	Significant
31 – R401 (Delivery route)	7,950	340	8,095	1,033	4.0	Moderate	Significant

Link	Background Units		Total Units		Change in Noise Level	DMRB Impact	Significance of Impact
	Car	HGV	Car	HGV			
32 – R414 (Delivery route)	4,751	117	4,896	809	6.6	Major	Significant
33 – R401 (Delivery route)	8,619	340	8,764	1,033	3.9	Moderate	Significant
34 – R415 (Delivery route)	6,481	525	6,626	1,218	3.2	Moderate	Significant
35 – R415 (Delivery route)	5,689	376	5,834	1,069	4.0	Moderate	Significant
36 – L7081 (Potential grid diversion)	2,784	235	2,929	928	5.4	Major	Significant

Table 12-24 Predicted change in noise levels, DMRB Impact and Effects - General Construction and Proposed Grid Connection Construction

Link	Background Units		Total Units		Change in Noise Level	DMRB Impact	Significance of Impact
	Car	HGV	Car	HGV			
1 – R401 (Access Junction 1)	2,234	331	2,379	911	4.1	Moderate	Significant
2 – L1001 (Access Junction 4)	2,105	15	2,250	595	11.2	Major	Significant
3 – L3001 (Access Junction 3)	2,102	21	2,247	601	10.7	Major	Significant
4 – L3001 (Access Junction 2)	2,142	22	2,287	602	10.6	Major	Significant
5 – L1005 (Delivery route)	1,732	257	1,877	837	4.8	Moderate	Significant
6 – R403 (Delivery route)	5,733	418	5,878	998	3.3	Moderate	Significant
7 – R414 (Access Junction 6)	1,166	40	1,311	620	10.4	Major	Significant
8 – R414 (Access Junction 5)	1,072	53	1,217	633	9.7	Major	Significant
9 – L1020 (Potential grid diversion)	953	23	1,098	603	12.1	Major	Significant

Link	Background Units		Total Units		Change in Noise Level	DMRB Impact	Significance of Impact
	Car	HGV	Car	HGV			
10 – R415 (Potential grid diversion)	4,920	194	5,065	774	5.0	Moderate	Significant
11 – L7073 (Potential grid diversion)	1,744	76	1,889	656	8.2	Major	Significant
12 – L7081 (Potential grid diversion)	3,418	180	3,563	760	5.4	Major	Significant
13 – R409 (Potential grid diversion)	4,573	392	4,718	972	3.5	Moderate	Significant
14 – N52 (TDR)	17,940	1,371	18,085	1,951	1.3	Minor	Not Significant
15 – R420 (TDR)	9,806	473	9,951	1,053	2.8	Minor	Not Significant
16 – R402 (TDR)	6,762	333	6,907	913	3.7	Moderate	Significant
17 – R402 (TDR)	5,226	328	5,371	908	3.8	Moderate	Significant
18 – L1003 (Delivery route)	1,286	62	1,431	642	9.1	Major	Significant
19 – R400 (Delivery route)	2,088	89	2,233	669	7.6	Major	Significant
20 – R401 (Delivery route)	2,494	159	2,639	739	5.9	Major	Significant
21 – R148 (Delivery route)	12,006	1,002	12,151	1,582	1.7	Minor	Not Significant
22 – R403 (Delivery route)	12,333	872	12,478	1,452	1.9	Minor	Not Significant
23 – L6002 (Access Junction 7)	2,742	56	2,887	636	8.4	Major	Significant
24 – R403 (Delivery route)	7,209	610	7,354	1,190	2.6	Minor	Not Significant
25 – R402 (Delivery route)	10,221	629	10,366	1,209	2.4	Minor	Not Significant
26 – R403 (Delivery route)	7,208	601	7,353	1,181	2.6	Minor	Not Significant

Link	Background Units		Total Units		Change in Noise Level	DMRB Impact	Significance of Impact
	Car	HGV	Car	HGV			
27 – R402 (Delivery route)	5,082	460	5,227	1,040	3.2	Moderate	Significant
28 – R402 (Delivery route)	6,852	653	6,997	1,233	2.5	Minor	Not Significant
29 – R402 (Delivery route)	4,170	463	4,315	1,043	3.2	Moderate	Significant
30 – R401 (Delivery route)	2,204	181	2,349	761	5.7	Major	Significant
31 – R401 (Delivery route)	7,950	340	8,095	920	3.5	Moderate	Significant
32 – R414 (Delivery route)	4,751	117	4,896	697	6.1	Major	Significant
33 – R401 (Delivery route)	8,619	340	8,764	920	3.5	Moderate	Significant
34 – R415 (Delivery route)	6,481	525	6,626	1,105	2.8	Minor	Not Significant
35 – R415 (Delivery route)	5,689	376	5,834	956	3.5	Moderate	Significant
36 – L7081 (Potential grid diversion)	2,784	235	2,929	815	4.9	Moderate	Significant

Table 12-25 Predicted change in noise levels, DMRB Impact and Effects - Concrete Foundation Deliveries

Link	Background Units		Total Units		Change in Noise Level	DMRB Impact	Significance of Impact
	Car	HGV	Car	HGV			
1 – R401 (Access Junction 1)	2,234	331	2,379	491	1.6	Minor	Not Significant
2 – L1001 (Access Junction 4)	2,105	15	2,250	175	6.4	Major	Significant
3 – L3001 (Access Junction 3)	2,102	21	2,247	181	6.0	Major	Significant
4 – L3001 (Access Junction 2)	2,142	22	2,287	182	5.9	Major	Significant

Link	Background Units		Total Units		Change in Noise Level	DMRB Impact	Significance of Impact
	Car	HGV	Car	HGV			
5 – L1005 (Delivery route)	1,732	257	1,877	417	2.0	Minor	Not Significant
6 – R403 (Delivery route)	5,733	418	5,878	578	1.2	Minor	Not Significant
7 – R414 (Access Junction 6)	1,166	40	1,311	200	5.8	Major	Significant
8 – R414 (Access Junction 5)	1,072	53	1,217	213	5.2	Major	Significant
9 – L1020 (Potential grid diversion)	953	23	1,098	183	7.2	Major	Significant
10 – R415 (Potential grid diversion)	4,920	194	5,065	354	2.0	Minor	Not Significant
11 – L7073 (Potential grid diversion)	1,744	76	1,889	236	4.1	Moderate	Significant
12 – L7081 (Potential grid diversion)	3,418	180	3,563	340	2.3	Minor	Not Significant
13 – R409 (Potential grid diversion)	4,573	392	4,718	552	1.3	Minor	Not Significant
14 – N52 (TDR)	17,940	1,371	18,085	1,531	0.4	Negligible	Not Significant
15 – R420 (TDR)	9,806	473	9,951	633	1.0	Negligible	Not Significant
16 – R402 (TDR)	6,762	333	6,907	493	1.4	Minor	Not Significant
17 – R402 (TDR)	5,226	328	5,371	488	1.4	Minor	Not Significant
18 – L1003 (Delivery route)	1,286	62	1,431	222	4.7	Moderate	Significant
19 – R400 (Delivery route)	2,088	89	2,233	249	3.7	Moderate	Significant
20 – R401 (Delivery route)	2,494	159	2,639	319	2.6	Minor	Not Significant
21 – R148 (Delivery route)	12,006	1,002	12,151	1,162	0.6	Negligible	Not Significant

Link	Background Units		Total Units		Change in Noise Level	DMRB Impact	Significance of Impact
	Car	HGV	Car	HGV			
22 – R403 (Delivery route)	12,333	872	12,478	1,032	0.6	Negligible	Not Significant
23 – L6002 (Access Junction 7)	2,742	56	2,887	216	4.2	Moderate	Significant
24 – R403 (Delivery route)	7,209	610	7,354	770	0.9	Negligible	Not Significant
25 – R402 (Delivery route)	10,221	629	10,366	789	0.8	Negligible	Not Significant
26 – R403 (Delivery route)	7,208	601	7,353	761	0.9	Negligible	Not Significant
27 – R402 (Delivery route)	5,082	460	5,227	620	1.1	Minor	Not Significant
28 – R402 (Delivery route)	6,852	653	6,997	813	0.8	Negligible	Not Significant
29 – R402 (Delivery route)	4,170	463	4,315	623	1.2	Minor	Not Significant
30 – R401 (Delivery route)	2,204	181	2,349	341	2.4	Minor	Not Significant
31 – R401 (Delivery route)	7,950	340	8,095	500	1.3	Minor	Not Significant
32 – R414 (Delivery route)	4,751	117	4,896	277	2.7	Minor	Not Significant
33 – R401 (Delivery route)	8,619	340	8,764	500	1.3	Minor	Not Significant
34 – R415 (Delivery route)	6,481	525	6,626	685	1.0	Negligible	Not Significant
35 – R415 (Delivery route)	5,689	376	5,834	536	1.3	Minor	Not Significant
36 – L7081 (Potential grid diversion)	2,784	235	2,929	395	2.0	Minor	Not Significant

Table 12-26 Predicted change in noise levels, DMRB Impact and Effects - General Construction and Turbine Deliveries (Abnormally Sized Loads)

Link	Background Units		Total Units		Change in Noise Level	DMRB Impact	Significance of Impact
	Car	HGV	Car	HGV			
1 – R401 (Access Junction 1)	2,234	79	2,379	217	3.5	Moderate	Significant
2 – L1001 (Access Junction 4)	2,105	4	2,250	142	6.8	Major	Significant
3 – L3001 (Access Junction 3)	2,102	5	2,247	143	6.7	Major	Significant
4 – L3001 (Access Junction 2)	2,142	5	2,287	143	6.6	Major	Significant
5 – L1005 (Delivery route)	1,732	62	1,877	200	4.1	Moderate	Significant
6 – R403 (Delivery route)	5,733	100	5,878	238	2.4	Minor	Not Significant
7 – R414 (Access Junction 6)	1,166	10	1,311	148	7.8	Major	Significant
8 – R414 (Access Junction 5)	1,072	13	1,217	151	7.6	Major	Significant
9 – L1020 (Potential grid diversion)	953	6	1,098	144	8.9	Major	Significant
10 – R415 (Potential grid diversion)	4,920	47	5,065	185	3.3	Moderate	Significant
11 – L7073 (Potential grid diversion)	1,744	18	1,889	156	6.1	Major	Significant
12 – L7081 (Potential grid diversion)	3,418	43	3,563	181	3.9	Moderate	Significant
13 – R409 (Potential grid diversion)	4,573	94	4,718	232	2.7	Minor	Not Significant
14 – N52 (TDR)	17,940	329	18,085	467	0.9	Negligible	Not Significant
15 – R420 (TDR)	9,806	114	9,951	252	1.8	Minor	Not Significant
16 – R402 (TDR)	6,762	80	6,907	218	2.4	Minor	Not Significant

Link	Background Units		Total Units		Change in Noise Level	DMRB Impact	Significance of Impact
	Car	HGV	Car	HGV			
17 – R402 (TDR)	5,226	79	5,371	217	2.7	Minor	Not Significant
18 – L1003 (Delivery route)	1,286	15	1,431	153	7.0	Major	Significant
19 – R400 (Delivery route)	2,088	21	2,233	159	5.5	Major	Significant
20 – R401 (Delivery route)	2,494	38	2,639	176	4.5	Moderate	Significant
21 – R148 (Delivery route)	12,006	240	12,151	378	1.2	Minor	Not Significant
22 – R403 (Delivery route)	12,333	209	12,478	347	1.3	Minor	Not Significant
23 – L6002 (Access Junction 7)	2,742	13	2,887	151	5.4	Major	Significant
24 – R403 (Delivery route)	7,209	146	7,354	284	1.9	Minor	Not Significant
25 – R402 (Delivery route)	10,221	151	10,366	289	1.6	Minor	Not Significant
26 – R403 (Delivery route)	7,208	144	7,353	282	1.9	Minor	Not Significant
27 – R402 (Delivery route)	5,082	110	5,227	248	2.4	Minor	Not Significant
28 – R402 (Delivery route)	6,852	157	6,997	295	1.8	Minor	Not Significant
29 – R402 (Delivery route)	4,170	111	4,315	249	2.5	Minor	Not Significant
30 – R401 (Delivery route)	2,204	44	2,349	182	4.5	Moderate	Significant
31 – R401 (Delivery route)	7,950	82	8,095	220	2.2	Minor	Not Significant
32 – R414 (Delivery route)	4,751	28	4,896	166	3.7	Moderate	Significant
33 – R401 (Delivery route)	8,619	82	8,764	220	2.2	Minor	Not Significant

Link	Background Units		Total Units		Change in Noise Level	DMRB Impact	Significance of Impact
	Car	HGV	Car	HGV			
34 – R415 (Delivery route)	6,481	126	6,626	264	2.1	Minor	Not Significant
35 – R415 (Delivery route)	5,689	90	5,834	228	2.5	Minor	Not Significant
36 – L7081 (Potential grid diversion)	2,784	57	2,929	195	3.8	Moderate	Significant

Table 12-27 Predicted change in noise levels, DMRB Impact and Effects - General Construction and Turbine Deliveries (Standard HGVs)

Link	Background Units		Total Units		Change in Noise Level	DMRB Impact	Significance of Impact
	Car	HGV	Car	HGV			
1 – R401 (Access Junction 1)	2,234	331	2,379	889	4.0	Moderate	Significant
2 – L1001 (Access Junction 4)	2,105	15	2,250	573	11.0	Major	Significant
3 – L3001 (Access Junction 3)	2,102	21	2,247	579	10.5	Major	Significant
4 – L3001 (Access Junction 2)	2,142	22	2,287	580	10.4	Major	Significant
5 – L1005 (Delivery route)	1,732	257	1,877	815	4.7	Moderate	Significant
6 – R403 (Delivery route)	5,733	418	5,878	976	3.2	Moderate	Significant
7 – R414 (Access Junction 6)	1,166	40	1,311	598	10.3	Major	Significant
8 – R414 (Access Junction 5)	1,072	53	1,217	611	9.5	Major	Significant
9 – L1020 (Potential grid diversion)	953	23	1,098	581	11.9	Major	Significant
10 – R415 (Potential grid diversion)	4,920	194	5,065	752	4.9	Moderate	Significant
11 – L7073 (Potential grid diversion)	1,744	76	1,889	634	8.1	Major	Significant

Link	Background Units		Total Units		Change in Noise Level	DMRB Impact	Significance of Impact
	Car	HGV	Car	HGV			
12 – L7081 (Potential grid diversion)	3,418	180	3,563	738	5.3	Major	Significant
13 – R409 (Potential grid diversion)	4,573	392	4,718	950	3.4	Moderate	Significant
14 – N52 (TDR)	17,940	1,371	18,085	1,929	1.3	Minor	Not Significant
15 – R420 (TDR)	9,806	473	9,951	1,031	2.8	Minor	Not Significant
16 – R402 (TDR)	6,762	333	6,907	891	3.6	Moderate	Significant
17 – R402 (TDR)	5,226	328	5,371	885	3.7	Moderate	Significant
18 – L1003 (Delivery route)	1,286	62	1,431	620	8.9	Major	Significant
19 – R400 (Delivery route)	2,088	89	2,233	647	7.5	Major	Significant
20 – R401 (Delivery route)	2,494	159	2,639	717	5.8	Major	Significant
21 – R148 (Delivery route)	12,006	1,002	12,151	1,560	1.7	Minor	Not Significant
22 – R403 (Delivery route)	12,333	872	12,478	1,430	1.8	Minor	Not Significant
23 – L6002 (Access Junction 7)	2,742	56	2,887	614	8.2	Major	Significant
24 – R403 (Delivery route)	7,209	610	7,354	1,168	2.5	Minor	Not Significant
25 – R402 (Delivery route)	10,221	629	10,366	1,187	2.3	Minor	Not Significant
26 – R403 (Delivery route)	7,208	601	7,353	1,159	2.5	Minor	Not Significant
27 – R402 (Delivery route)	5,082	460	5,227	1,018	3.1	Moderate	Significant
28 – R402 (Delivery route)	6,852	653	6,997	1,211	2.4	Minor	Not Significant

Link	Background Units		Total Units		Change in Noise Level	DMRB Impact	Significance of Impact
	Car	HGV	Car	HGV			
29 – R402 (Delivery route)	4,170	463	4,315	1,021	3.1	Moderate	Significant
30 – R401 (Delivery route)	2,204	181	2,349	739	5.6	Major	Significant
31 – R401 (Delivery route)	7,950	340	8,095	898	3.4	Moderate	Significant
32 – R414 (Delivery route)	4,751	117	4,896	675	5.9	Major	Significant
33 – R401 (Delivery route)	8,619	340	8,764	898	3.4	Moderate	Significant
34 – R415 (Delivery route)	6,481	525	6,626	1,083	2.8	Minor	Not Significant
35 – R415 (Delivery route)	5,689	376	5,834	934	3.4	Moderate	Significant
36 – L7081 (Potential grid diversion)	2,784	235	2,929	793	4.8	Moderate	Significant

Table 12-28 Predicted change in noise levels, DMRB Impact and Effects - General Construction Only

Link	Background Units		Total Units		Change in Noise Level	DMRB Impact	Significance of Impact
	Car	HGV	Car	HGV			
1 – R401 (Access Junction 1)	2,234	331	2,379	881	4.0	Moderate	Significant
2 – L1001 (Access Junction 4)	2,105	15	2,250	565	10.9	Major	Significant
3 – L3001 (Access Junction 3)	2,102	21	2,247	571	10.5	Major	Significant
4 – L3001 (Access Junction 2)	2,142	22	2,287	572	10.4	Major	Significant
5 – L1005 (Delivery route)	1,732	257	1,877	807	4.7	Moderate	Significant
6 – R403 (Delivery route)	5,733	418	5,878	968	3.2	Moderate	Significant

Link	Background Units		Total Units		Change in Noise Level	DMRB Impact	Significance of Impact
	Car	HGV	Car	HGV			
7 – R414 (Access Junction 6)	1,166	40	1,311	590	10.2	Major	Significant
8 – R414 (Access Junction 5)	1,072	53	1,217	603	9.5	Major	Significant
9 – L1020 (Potential grid diversion)	953	23	1,098	573	11.9	Major	Significant
10 – R415 (Potential grid diversion)	4,920	194	5,065	744	4.8	Moderate	Significant
11 – L7073 (Potential grid diversion)	1,744	76	1,889	626	8.0	Major	Significant
12 – L7081 (Potential grid diversion)	3,418	180	3,563	730	5.3	Major	Significant
13 – R409 (Potential grid diversion)	4,573	392	4,718	942	3.4	Moderate	Significant
14 – N52 (TDR)	17,940	1,371	18,085	1,921	1.3	Minor	Not Significant
15 – R420 (TDR)	9,806	473	9,951	1,023	2.7	Minor	Not Significant
16 – R402 (TDR)	6,762	333	6,907	883	3.5	Moderate	Significant
17 – R402 (TDR)	5,226	328	5,371	878	3.7	Moderate	Significant
18 – L1003 (Delivery route)	1,286	62	1,431	612	8.9	Major	Significant
19 – R400 (Delivery route)	2,088	89	2,233	639	7.4	Major	Significant
20 – R401 (Delivery route)	2,494	159	2,639	709	5.8	Major	Significant
21 – R148 (Delivery route)	12,006	1,002	12,151	1,552	1.7	Minor	Not Significant
22 – R403 (Delivery route)	12,333	872	12,478	1,422	1.8	Minor	Not Significant
23 – L6002 (Access Junction 7)	2,742	56	2,887	606	8.2	Major	Significant

Link	Background Units		Total Units		Change in Noise Level	DMRB Impact	Significance of Impact
	Car	HGV	Car	HGV			
24 – R403 (Delivery route)	7,209	610	7,354	1,160	2.5	Minor	Not Significant
25 – R402 (Delivery route)	10,221	629	10,366	1,179	2.3	Minor	Not Significant
26 – R403 (Delivery route)	7,208	601	7,353	1,151	2.5	Minor	Not Significant
27 – R402 (Delivery route)	5,082	460	5,227	1,010	3.1	Moderate	Significant
28 – R402 (Delivery route)	6,852	653	6,997	1,203	2.4	Minor	Not Significant
29 – R402 (Delivery route)	4,170	463	4,315	1,013	3.1	Moderate	Significant
30 – R401 (Delivery route)	2,204	181	2,349	731	5.5	Major	Significant
31 – R401 (Delivery route)	7,950	340	8,095	890	3.4	Moderate	Significant
32 – R414 (Delivery route)	4,751	117	4,896	667	5.9	Major	Significant
33 – R401 (Delivery route)	8,619	340	8,764	890	3.3	Moderate	Significant
34 – R415 (Delivery route)	6,481	525	6,626	1,075	2.7	Minor	Not Significant
35 – R415 (Delivery route)	5,689	376	5,834	926	3.4	Moderate	Significant
36 – L7081 (Potential grid diversion)	2,784	235	2,929	785	4.7	Moderate	Significant

As shown in the tables above, several route links will have a Moderate or Major impact according to the DMRB (with the corresponding 'Significant' EPA rating) based on the magnitude of change in traffic noise.

As such, a Moderate or Major DMRB impact reflects a noticeable increase in traffic noise relative to baseline traffic conditions. However, this DMRB impact does not indicate that unacceptable noise levels will occur at nearby noise-sensitive locations. To determine the significance of effects, the predicted traffic noise levels have also been assessed against the adopted CNT of 65 dB $L_{Aeq,T}$ (see Section 12.3.4 above). The predicted noise levels at a reference distance of 20 m from the road edge are presented in Table 12-29 below. While several road links present Moderate or Major increases in noise level under

the DMRB methodology, the majority of predicted traffic noise levels remain below the CNT, with the remaining links not exceeding the CNT by more than 5 dB.

Accordingly, although the changes in traffic noise are considered 'Significant' under the DMRB impact descriptions for magnitude of change criteria, the resulting absolute noise environment is expected to remain within a range corresponding to Minor to Moderate effects, with no substantial exceedances of the adopted construction traffic noise threshold anticipated.

Table 12-29 Predicted noise levels at 20 m for different construction phases

Link	General Construction and Proposed Offsite Substation		General Construction and Proposed Grid Connection Construction		Concrete Foundation Deliveries		General Construction and Turbine Deliveries (Abnormally Sized Loads)		General Construction and Turbine Deliveries (Standard HGVs)		General Construction Only	
	DMRB Impact	Total SPL @20m	DMRB Impact	Total SPL @20m	DMRB Impact	Total SPL @20m	DMRB Impact	Total SPL @20m	DMRB Impact	Total SPL @20m	DMRB Impact	Total SPL @20m
1 – R401	Moderate	65	Moderate	64	Minor	62	Moderate	59	Moderate	64	Moderate	64
2 – L1001	Major	63	Major	63	Major	58	Major	57	Major	62	Major	62
3 – L3001	Major	63	Major	63	Major	58	Major	57	Major	62	Major	62
4 – L3001	Major	63	Major	63	Major	58	Major	57	Major	62	Major	62
5 – L1005	Major	64	Moderate	64	Minor	61	Moderate	58	Moderate	64	Moderate	64
6 – R403	Moderate	65	Moderate	65	Minor	63	Minor	60	Moderate	65	Moderate	65
7 – R414	Major	63	Major	63	Major	58	Major	57	Major	62	Major	62
8 – R414	Major	63	Major	63	Major	58	Major	57	Major	63	Major	62
9 – L1020	Major	63	Major	62	Major	57	Major	57	Major	62	Major	62
10 – R415	Major	64	Major	64	Minor	61	Moderate	59	Moderate	64	Moderate	64

Link	General Construction and Proposed Offsite Substation		General Construction and Proposed Grid Connection Construction		Concrete Foundation Deliveries		General Construction and Turbine Deliveries (Abnormally Sized Loads)		General Construction and Turbine Deliveries (Standard HGVs)		General Construction Only	
	DMRB Impact	Total SPL @20m	DMRB Impact	Total SPL @20m	DMRB Impact	Total SPL @20m	DMRB Impact	Total SPL @20m	DMRB Impact	Total SPL @20m	DMRB Impact	Total SPL @20m
11 – L7073	Major	63	Major	63	Moderate	59	Major	57	Major	63	Major	63
12 – L7081	Major	64	Major	64	Minor	60	Moderate	58	Major	64	Major	63
13 – R409	Moderate	65	Moderate	65	Minor	62	Minor	59	Moderate	65	Moderate	65
14 – N52	Minor	68	Minor	68	Negligible	67	Negligible	63	Minor	68	Minor	68
15 – R420	Moderate	66	Minor	65	Negligible	63	Minor	61	Minor	65	Minor	65
16 – R402	Moderate	65	Moderate	65	Minor	62	Minor	60	Moderate	64	Moderate	64
17 – R402	Moderate	65	Moderate	64	Minor	62	Minor	59	Moderate	64	Moderate	64
18 – L1003	Major	63	Major	63	Moderate	58	Major	57	Major	63	Major	63
19 – R400	Major	64	Major	63	Moderate	59	Major	57	Major	63	Major	63
20 – R401	Major	64	Major	63	Minor	60	Moderate	58	Major	63	Major	63

Link	General Construction and Proposed Offsite Substation		General Construction and Proposed Grid Connection Construction		Concrete Foundation Deliveries		General Construction and Turbine Deliveries (Abnormally Sized Loads)		General Construction and Turbine Deliveries (Standard HGVs)		General Construction Only	
	DMRB Impact	Total SPL @20m	DMRB Impact	Total SPL @20m	DMRB Impact	Total SPL @20m	DMRB Impact	Total SPL @20m	DMRB Impact	Total SPL @20m	DMRB Impact	Total SPL @20m
21 – R148	Minor	67	Minor	67	Negligible	66	Minor	62	Minor	67	Minor	67
22 – R403	Minor	67	Minor	67	Negligible	65	Minor	62	Minor	67	Minor	67
23 – L6002	Major	63	Major	63	Moderate	59	Major	57	Major	63	Major	63
24 – R403	Minor	66	Minor	66	Negligible	64	Minor	60	Minor	66	Minor	66
25 – R402	Minor	66	Minor	66	Negligible	64	Minor	61	Minor	66	Minor	66
26 – R403	Minor	66	Minor	66	Negligible	64	Minor	60	Minor	66	Minor	65
27 – R402	Moderate	65	Moderate	65	Minor	63	Minor	60	Moderate	65	Moderate	65
28 – R402	Minor	66	Minor	66	Negligible	64	Minor	61	Minor	66	Minor	66
29 – R402	Moderate	65	Moderate	65	Minor	63	Minor	59	Moderate	65	Moderate	65
30 – R401	Major	64	Major	64	Minor	60	Moderate	58	Major	63	Major	63

Link	General Construction and Proposed Offsite Substation		General Construction and Proposed Grid Connection Construction		Concrete Foundation Deliveries		General Construction and Turbine Deliveries (Abnormally Sized Loads)		General Construction and Turbine Deliveries (Standard HGVs)		General Construction Only	
	DMRB Impact	Total SPL @20m	DMRB Impact	Total SPL @20m	DMRB Impact	Total SPL @20m	DMRB Impact	Total SPL @20m	DMRB Impact	Total SPL @20m	DMRB Impact	Total SPL @20m
31 – R401	Moderate	65	Moderate	65	Minor	62	Minor	60	Moderate	65	Moderate	65
32 – R414	Major	64	Major	63	Minor	60	Moderate	58	Major	63	Major	63
33 – R401	Moderate	65	Moderate	65	Minor	62	Minor	60	Moderate	65	Moderate	65
34 – R415	Moderate	66	Minor	65	Negligible	63	Minor	60	Minor	65	Minor	65
35 – R415	Moderate	65	Moderate	65	Minor	62	Minor	60	Moderate	65	Moderate	65
36 – L7081	Major	64	Major	64	Minor	61	Moderate	58	Moderate	64	Moderate	64

12.6.2.6.1 Description of Effects

The likely predicted effects are below the limits and/or thresholds identified for a significant effect to occur. With respect to the EPA's criteria for description of effects, the potential associated effects at the nearest NSLs associated with additional traffic generated during the construction phase are described below.

Table 12-30 Description of effects for the construction of construction traffic

Quality	Significance	Duration
Negative	Not Significant to Moderate	Short-Term

12.6.2.7 Substation Construction

12.6.2.7.1 Noise

The Proposed Project includes a Proposed Onsite Substation and a Proposed Offsite Substation, full details are provided in Chapter 4. The Proposed Onsite Substation is located approximately 394 m from the nearest NSL H1675, in the townland of Lullymore, Co. Kildare. The Proposed Offsite Substation is 296 m to the nearest NSL H2009, in the townland of Killybegs, Co. Kildare.

As a reference, and under theoretical precautionary conditions, and assuming the same construction activities as outlined in Table 12-14, the predicted noise levels from construction activities associated with the Proposed Onsite Substation and Proposed Offsite Substation within the Construction Study Area have been indicated in Table 12-31 below.

Based on the same typical construction activities as outlined in Table 12-14 it is predicted that the likely theoretical precautionary potential noise level due to construction activities associated with the Proposed Onsite Substation and Proposed Offsite Substation will be in the order of 49 dB $L_{Aeq,T}$ at a distance of 296 m which is well below the significance threshold of 65 dB $L_{Aeq,T}$. outlined in Section 12.3.3; there are no NSL's located within this distance range from either the Proposed Onsite Substation or the Proposed Offsite Substation.

Table 12-31 Construction Noise Levels for the Proposed Onsite Substation and Proposed Offsite Substation

Item (BS 5228 Ref.)	Plant Noise level at 10m Distance (dB $L_{Aeq,T}$)[7]	Predicted Noise Level (dB $L_{Aeq,T}$) at distance (296 m)	Predicted Noise Level (dB $L_{Aeq,T}$) at distance (394m)
HGV Movement (C.2.30)	79	38	35
Tracked Excavator (C.4.64)	75	34	31
Excavator Mounted Rock Breaker (C9.12)	85	44	41
General Construction (Various)	84	43	40

[7] *All plant noise levels are derived from BS5228: Part 1*

Concrete Mixer Truck and Concrete Pump (C.4.27)	79	38	35
Dumper Truck (C.4.4)	76	35	32
Mobile Telescopic Crane (C.4.39)	77	36	33
JCB (D.8.13)	82	41	38
Vibrating Rollers (D.8.29)	77	36	33
Total Construction Noise Level		49	46

Table 12-31 shows that for both the Proposed Onsite Substation and Proposed Offsite Substation, the predicted noise levels at the nearest NSL H2009 will be between 35 and 45 dB $L_{Aeq,T}$. This level of noise is below the significance threshold of 65 dB $L_{Aeq,T}$, therefore no specific mitigation measures are required.

It is concluded that there will be no significant noise impacts associated with the construction of the Proposed Onsite Substation and Proposed Offsite Substation within the Construction Study Area and therefore no specific mitigation measures will be required.

12.6.2.7.2 *Vibration*

Due to the distance of the proposed works from sensitive locations vibration effects are not likely at any NSL within the Construction Study Area. With reference to the discussion on vibration presented in Section 12.6.2.1.2 there will be no significant vibration impacts associated with the construction of the Proposed Onsite Substation and Proposed Offsite Substation and therefore no specific mitigation measures are required.

12.6.2.7.3 *Description of Effects*

The likely predicted vibration effects are below the limits and/or thresholds identified. With respect to the EPA's criteria for description of effects, the potential effects under a precautionary scenario at the nearest noise sensitive locations associated with construction of the Proposed Onsite Substation and Proposed Offsite Substation are described below.

Table 12-32 Description of effects for the construction of the Proposed Onsite Substation and Proposed Offsite Substation

Quality	Significance	Duration
Negative	Not Significant	Short Term

The above effect should be considered in terms that the effect is variable, and that this assessment considers the locations of the greatest potential effect. There are no likely significant effects from this element of the construction phase.

12.6.2.8 Proposed Grid Connection Underground Electrical Cabling and OHL

The Proposed Grid Connection comprises approximately 13.1 km of 220kV underground electrical cables linking the Proposed Onsite Substation with the Proposed Offsite Substation. It is also proposed to connect the Proposed Offsite Substation to the existing Maynooth-Dunstown 220kV OHL via a

0.12km OHL connection. The expected noise levels generated by the OHL connection are at distances such that they are considered not significant and scoped out from the assessment as indicated in Section 12.6.2. The Proposed Grid Connection underground electrical cabling route will utilise Horizontal Directional Drilling (HDD) to cross the Grand Canal at 1 no. location. Further detail is provided in Section 4.4.2.3 of Chapter 4.

12.6.2.8.1 Noise

The associated construction works will occur for short durations (rolling construction method, approximately 100 – 150 m per day for approximately 1 year) at varying distances from NSLs. As the Proposed Grid Connection underground electrical cabling route is approximately 13.1km in length, it will take an estimated 100 days to construct the full length of the underground electrical cabling route. Review of the Proposed Grid Connection underground electrical cabling has identified that the nearest NSLs within the Construction Study Area, are at distances ranging from 10m to 30m.

Table 12-33 presents noise calculations, considering the typical anticipated methods of construction, at varying distances from the construction works. The calculations assume that there is no acoustic screening (i.e. barriers) in place between the Proposed Grid Connection underground electrical cabling works and the NSLs, and that plant items are operating at nominal on-times noted. Note the plant items and activities are indicative and based on assumption to be representative of a reasonable conservative assessment.

The nearest NSL to the Proposed Grid Connection underground electrical cabling is H1470 and is located approximately 10 m from proposed works.

Table 12-33 Indicative Noise Levels for Typical Construction Plant at nearest distance from the Proposed Grid Connection underground electrical cabling route

Plant Item (BS 5228 Ref.)	Plant Noise Level at 10m Distance (dB L_{Aeq})	Calculated Construction Noise Levels dB $L_{Aeq,12hr}$ at given distance from works				
		10 m	20 m	22 m	30 m	50 m
Tracked Excavator (C.2.7)	70	68	62	61	54	49
Vibrating Rollers (C.2.40)	73	71	65	64	57	52
Wheeled Loader (C.2.8)	68	66	60	59	52	47
Dumper Truck (C.4.4)	76	74	68	67	60	55
Total Predicted Construction Noise Level (No Rock Breaking)		77	71	70	63	58
HDD[a]	77	74	68	67	60	55
Total Predicted Construction Noise Level (HDD and No Rock Breaking)		79	73	72	65	60
Excavator Mounted Rock Breaker (C9.12)[b]	85	78	72	71	64	59
Total Predicted Construction Noise Level (No HDD with Rock Breaking)[c]		81	75	74	67	62

A – Assumed 50% on time for HDD
B - Assumed 20% on time for rock breaking

C - Only one tracked excavator considered in cumulative calculations. Rock breaking and Vibration rolling will occur simultaneously.

For standard grid connection works, any NSL set back at 22 m or more from the proposed works is predicted to experience noise levels within the linear construction noise limit of 70 dB $L_{Aeq,1hr}$ as set out in Section 12.3.3.2. 58 no. NSLs are located within 22 m of the Proposed Grid Connection underground electrical cabling route.

NSLs located closer than 22 m, i.e., within the Construction Study Area, to the works may experience construction noise levels slightly above 70 dB $L_{Aeq,1hr.}$ However, due to the progressive nature of the construction methodology, it is anticipated that works will remain in close proximity to the nearest NSLs only for a limited duration. The predicted noise levels shown in Table 12-33 are expected to occur for less than one day at each location under a theoretical precautionary scenario, with works typically progressing at a rate of 100 to 150 metres per day along the Proposed Grid Connection underground electrical cabling route.

Based on the guidance in Section 12.3.3.3, the likely noise impacts are considered not significant, and no specific mitigation measures are required.

For the HDD works required to cross the Grand Canal, any NSL set back 30 metres or more from the proposed works is predicted to remain within the construction noise limit of 65 dB $L_{Aeq,1hr}$ as set out in Section 12.3.3. 3 no. NSLs were found along the Grand Canal works within 30 m distance if the plant is installed on the southwest bank of the Grand Canal. However, if the HDD plant is installed on the northeastern bank of the Grand Canal, the distance to the nearest receiver (H1262) is approximately 57 m from the works. Therefore, if the HDD is installed on the eastern bank of the Grand Canal, the predicted noise level at the nearest receiver is below the noise limit outlined in Section 12.3.3, and therefore the effect is considered not significant.

Where rock breaking is required along the route, any NSL set back 25 metres or more from the proposed works is predicted to remain within the linear construction noise limit of 70 dB $L_{Aeq,1hr}$ as set out in Section 12.3.3. There are 98 no. NSLs found within 25m of the Proposed Grid Connection underground electrical cabling route, i.e., within the Construction Study Area. The assessment is assuming that rock breaking activities will be required along the Proposed Grid Connection underground electrical cabling route at the point closest to these NSLs. This assumption is considered very conservative.

In line with the guidance in Section 12.3.4.1 the likely noise impacts are considered not significant, and no specific mitigation measures are required.

12.6.2.8.2 Vibration

Due to the distance of the proposed works from sensitive locations vibration effects are not likely at any NSL within the Construction Study Area. With reference to the discussion on vibration presented in Section 12.6.2.1.2 there will be no significant vibration impacts associated with the construction of the Proposed Grid Connection underground electrical cabling route and therefore no specific mitigation measures are required.

12.6.2.8.3 Description of Effects

The likely predicted noise and vibration effects are below the limits and/or thresholds identified. With respect to the EPA's criteria for description of effects, the potential worst-case associated effects at the nearest noise sensitive locations associated with construction of the Proposed Grid Connection underground electrical cabling route are described in Table 12-34.

Table 12-34 Description of effects for the construction of the Proposed Grid Connection underground electrical cabling route

Quality	Significance	Duration
Negative	Not Significant	Temporary

The above effect should be considered in terms that the effect is variable, and that this assessment considers the locations of the greatest potential effect. There are no likely significant effects from this element of the proposed construction phase.

12.6.3 Operational Phase

12.6.3.1 Assessment of Proposed Turbine Noise

Using the assessment methodology described in Section 12.4.4 the predicted turbine noise levels have been calculated at all NSLs within the Proposed Turbine Operational Study Area. A conservative omni-directional turbine noise prediction assessment has been carried out using the ISO 9613-2 calculation standard and best practice guidance for turbine noise prediction contained in the IOA GPG. These calculations are based on conservative conditions favourable to noise propagation, i.e., downwind propagation from source to receiver and downward refraction under temperature inversions. On that basis the omnidirectional turbine noise predictions can be considered precautionary.

The results of the noise prediction models have been compared against the assigned turbine noise limits that have been presented in Section 12.5.3.1, which have been derived in accordance with the criteria set out in Section 12.3.6. Table 12-35 presents the predicted noise levels at different wind speeds for the SG170 turbine.

At the majority of the NSLs the theoretical precautionary omni-directional cumulative turbine noise levels are below the noise criteria. However, 1 no. NSL (H1120) presents potential exceedances for the theoretical precautionary omni-directional scenario, primarily from the Cushaling Wind Farm (see comments in Section 12.6.3.1.1 below). Therefore, it is necessary to consider wind direction for the noise prediction at these NSLs, the results of which demonstrate turbine noise levels below the noise criteria.

Appendix 12-5 presents the predicted omni-directional turbine results for the SG170 at all NSLs in tabulated form.

Noise contours for the omni-directional rated power wind speed for the candidate turbine assessed (i.e., highest noise emission) are presented in Appendix 12-4.

Table 12-35 Predicted Noise Levels at 15 receivers with the highest predicted levels for candidate turbine SG170

House	NML Representative Location for Criterion	Parameter	Standardised Wind Speed, m/s						
			3	4	5	6	7	8	9
H005	NML 3	Predicted	29	31.6	36.1	39	39.2	39.2	39.2
		Daytime Criterion	45	45	45	45	45	45	46
		Daytime Excess	–	–	–	–	–	–	–

House	NML Representative Location for Criterion	Parameter	Standardised Wind Speed, m/s						
			3	4	5	6	7	8	9
		Night-time Criterion	43	43	43	43	43	43	43
		Night-time Excess	–	–	–	–	–	–	–
H011	NML 3	Predicted	29.5	32.1	36.7	39.6	39.8	39.8	39.8
		Daytime Criterion	45	45	45	45	45	45	46
		Daytime Excess	–	–	–	–	–	–	–
		Night-time Criterion	43	43	43	43	43	43	43
		Night-time Excess	–	–	–	–	–	–	–
H1120	NML 4	Predicted	42.5	44.1	47.4	50.2	51.2	51.2	51.2
		Daytime Criterion	45	45	45	45	45	45	45
		Daytime Excess	–	–	2.4	5.2	6.2	6.2	6.2
		Night-time Criterion	43	43	43	43	43	43	43
		Night-time Excess	–	1.1	4.4	7.2	8.2	8.2	8.2
H2890	NML 5	Predicted	29.4	31.9	36.6	39.4	39.7	39.7	39.7
		Daytime Criterion	40	40	45	45	45	45	45
		Daytime Excess	–	–	–	–	–	–	–

House	NML Representative Location for Criterion	Parameter	Standardised Wind Speed, m/s						
			3	4	5	6	7	8	9
		Night-time Criterion	43	43	43	43	43	43	43
		Night-time Excess	–	–	–	–	–	–	–
H428	NML 9	Predicted	28.7	31.4	35.3	38.4	39.2	39.2	39.2
		Daytime Criterion	45	45	45	45	45	45	45
		Daytime Excess	–	–	–	–	–	–	–
		Night-time Criterion	43	43	43	43	43	43	43
		Night-time Excess	–	–	–	–	–	–	–
H431	NML 4	Predicted	28.8	31.5	35.4	38.5	39.3	39.3	39.3
		Daytime Criterion	45	45	45	45	45	45	45
		Daytime Excess	–	–	–	–	–	–	–
		Night-time Criterion	43	43	43	43	43	43	43
		Night-time Excess	–	–	–	–	–	–	–
H436	NML 7	Predicted	28.8	31.5	35.4	38.5	39.3	39.3	39.3
		Daytime Criterion	45	45	45	45	45	45	45
		Daytime Excess	–	–	–	–	–	–	–

House	NML Representative Location for Criterion	Parameter	Standardised Wind Speed, m/s						
			3	4	5	6	7	8	9
		Night-time Criterion	43	43	43	43	43	43	43
		Night-time Excess	–	–	–	–	–	–	–
H443	NML 7	Predicted	28.9	31.6	35.5	38.6	39.4	39.4	39.4
		Daytime Criterion	45	45	45	45	45	45	45
		Daytime Excess	–	–	–	–	–	–	–
		Night-time Criterion	43	43	43	43	43	43	43
		Night-time Excess	–	–	–	–	–	–	–
H444	NML 8	Predicted	29	31.7	35.5	38.6	39.4	39.4	39.4
		Daytime Criterion	45	45	45	45	45	45	46.1
		Daytime Excess	–	–	–	–	–	–	–
		Night-time Criterion	43	43	43	43	43	43	43
		Night-time Excess	–	–	–	–	–	–	–
H448	NML 4	Predicted	29	31.7	35.5	38.6	39.4	39.4	39.4
		Daytime Criterion	45	45	45	45	45	45	45
		Daytime Excess	–	–	–	–	–	–	–

House	NML Representative Location for Criterion	Parameter	Standardised Wind Speed, m/s						
			3	4	5	6	7	8	9
		Night-time Criterion	43	43	43	43	43	43	43
		Night-time Excess	–	–	–	–	–	–	–
H469	NML 4	Predicted	29.1	31.8	35.6	38.7	39.5	39.5	39.5
		Daytime Criterion	45	45	45	45	45	45	45
		Daytime Excess	–	–	–	–	–	–	–
		Night-time Criterion	43	43	43	43	43	43	43
		Night-time Excess	–	–	–	–	–	–	–
H471	NML 4	Predicted	29.2	31.8	35.7	38.8	39.6	39.6	39.6
		Daytime Criterion	45	45	45	45	45	45	45
		Daytime Excess	–	–	–	–	–	–	–
		Night-time Criterion	43	43	43	43	43	43	43
		Night-time Excess	–	–	–	–	–	–	–
H473	NML 9	Predicted	29.2	31.8	35.7	38.8	39.6	39.6	39.6
		Daytime Criterion	45	45	45	45	45	45	45
		Daytime Excess	–	–	–	–	–	–	–

House	NML Representative Location for Criterion	Parameter	Standardised Wind Speed, m/s						
			3	4	5	6	7	8	9
		Night-time Criterion	43	43	43	43	43	43	43
		Night-time Excess	–	–	–	–	–	–	–
H484	NML 3	Predicted	29.5	32	35.8	38.8	39.7	39.7	39.7
		Daytime Criterion	45	45	45	45	45	45	46
		Daytime Excess	–	–	–	–	–	–	–
		Night-time Criterion	43	43	43	43	43	43	43
		Night-time Excess	–	–	–	–	–	–	–
H621	NML 4	Predicted	29.8	32.5	36.4	39.5	40.4	40.4	40.4
		Daytime Criterion	45	45	45	45	45	45	45
		Daytime Excess	–	–	–	–	–	–	–
		Night-time Criterion	43	43	43	43	43	43	43
		Night-time Excess	–	–	–	–	–	–	–

It is clear from the above, that all receivers with the exception of H1120 are within the noise limits at all wind speeds, and therefore no mitigation is required.

12.6.3.1.1 *Discussion on H1120*

A review of the theoretical precautionary omni-directional cumulative predicted levels at H1120 is presented with discussion in Table 12-36 below. Contours are presented in Appendix 12-5.

Table 12-36 Review of predicted noise levels at NSL H1120 for different wind speeds

Wind Speed, m/s	Predicted Cumulative Turbine Noise Level	Predicted Turbine Noise Level from Proposed Turbines Only	Review and Comment
4	44.1	32.0	At location H1120, the predicted cumulative turbine noise level is dominated by the existing Cushaling Wind Farm. The predicted contribution from the Proposed Turbines is more than 10 dB below that from the existing wind farm and is therefore negligible, in accordance with the guidance discussed in Section 12.3.6.7. Furthermore, the predicted noise level from the Proposed Turbines in isolation is well below the applicable turbine noise limit. Consequently, the cumulative noise level at H1120 is effectively determined by the existing Cushaling Wind Farm, with no significant contribution from the Proposed Development.
5	47.4	36.8	
6	50.2	39.6	
7	51.2	39.8	
8	51.2	39.8	

As outlined in Table 12-36, the proximity of the existing Cushaling Wind Farm (Approximately 125 m) to this receiver means that the noise level is dominated by Cushaling Wind Farm, rather than by the Proposed Turbines. For all wind speeds, the Proposed Turbine contribution at H1120 is over 10 dB below the cumulative noise level and its contribution is not significant.

It is therefore determined that there are no significant effects associated with the operation of the Proposed Project, as the predicted cumulative turbine noise levels are within the turbine noise criteria, or the contribution from the Proposed Project is negligible.

12.6.3.1.2 Description of Effects

The predicted turbine noise levels associated with the Proposed Turbines within the Proposed Turbine Operational Study Area are within the applicable noise criteria described in Section 12.5.2, therefore it is not considered that a significant effect is associated with turbine noise from the Proposed Turbines.

While noise levels at low wind speeds will increase due to the Proposed Project and specifically the operation of the Proposed Turbines, the predicted levels will remain low, albeit new sources of noise will be introduced to the soundscape.

With respect to the EPAs criteria for description of effects, the potential effects at the most impacted NSLs associated with noise from the operation of the Proposed Turbines are described as follows:

Table 12-37 Description of effects of the operation of wind turbines

Quality	Significance	Duration
Negative	Not Significant	Long Term

The above effect should be considered in terms that the effect is variable, and that this assessment considers the locations of the greatest potential impact.

12.6.3.2 Fixed Plant Noise

12.6.3.2.1 *Proposed Onsite Substation*

Details of the Proposed Onsite Substation are described in Section 4.4.2.1.1 in Chapter 4.

As previously stated, the location of the Proposed Onsite Substation is shown in the site layout drawings in Figure 4-1 of Chapter 4 of the EIAR. The Proposed Onsite Substation will be operational 24/7 and the noise impact at the nearest NSL, i.e., H1675 has been assessed to identify the potential greatest impact associated with the operation of the Proposed Onsite Substation within the Fixed Plant Operational Study Area.

The Proposed Onsite Substation installation will have comparable noise emissions to the 220kV unit discussed above. The nearest NSL H1675 to the Proposed Onsite Substation is approximately 394 m. The noise emission level associated with a Proposed Onsite Substation that would support a renewable energy development of this nature is the order of 95 dB(A) L_w.

Noise prediction model calculations for the operation of the Proposed Onsite Substation have been undertaken in accordance with ISO 9613-2 (2024). The predicted noise level from the operation of the Proposed Onsite Substation at the nearest NSL (H1675) at approximately 394 m northeast is 29 dB $L_{Aeq,T}$.

This level of noise is below the criterion for fixed mechanical plant outlined in Section 12.3.7 and will not result in an adverse impact at NSLs within the Fixed Plant Operational Study Area. As the Proposed Project design progresses, consideration will be given to the selection of mechanical and electrical plant to ensure that noise emissions comply with the proposed criteria and that any character corrections are appropriately addressed in accordance with the requirements outlined in Section 12.3.7.

It is therefore concluded that noise emissions from the operation of the Proposed Onsite Substation will be Not Significant.

12.6.3.2.2 *Proposed Offsite Substation*

Location and layout of the Proposed Offsite Substation are described in Section 4.4.2.1.2 in Chapter 4. The Proposed Offsite Substation will have similar characteristics to the Proposed Onsite Substation, detailed above.

The predicted noise level from the operation of the Proposed Offsite Substation, with one transformer, at the nearest NSL, i.e., H2009 at approximately 298 m east is 31 dB $L_{Aeq,T}$.

This level of noise is below the criterion for fixed mechanical plant outlined in Section 12.3.7 and will not result in an adverse impact at nearby NSLs. As the Proposed Project design progresses, consideration will be given to the selection of mechanical and electrical plant to ensure that noise emissions comply with the proposed criteria and that any character corrections are appropriately addressed in accordance with the requirements outlined in Section 12.3.7.

It is therefore concluded that noise emissions from the operation of the Proposed Offsite Substation will be Not Significant.

12.6.3.2.3 *Description of Effects*

With respect to the EPA's criteria for description of effects, the potential effects, at the nearest NSLs associated with noise from the operation of the fixed mechanical and electrical plant within the Fixed Plant Operational Study Area is described below.

Table 12-38 Description of effects of the operation of fixed plant at the Proposed Onsite Substation and Proposed Offsite Substation

Quality	Significance	Duration
Negative	Not Significant	Long Term

12.6.3.3 Operational Phase Vibration

No significant vibration effects are associated with the operation of the site at any of the receivers as indicated in Section 12.3.8.

12.6.4 Decommissioning Phase

In relation to the decommissioning phase, similar overall noise levels as those calculated for the construction phase would be expected, as similar tools and equipment will be used. The noise and vibration impacts associated with the decommissioning of the Proposed Wind Farm can be considered comparable to those outlined in relation to the construction phase (as per Section 12.6.2) albeit less works will be required as only above ground structures (i.e., Proposed Turbines, 2 no. met masts, and 1 no. relay mast) will be removed. Proposed Turbine and met mast foundations will remain underground, and the Proposed Onsite Substation and Proposed Offsite Substation and associated infrastructure will remain in situ. Refer to Section 4.12 of Chapter 4 for full details on decommissioning.

The predicted noise levels are expected to be below the appropriate Category A value (i.e. 65 dB $L_{Aeq,T}$) at all NSLs for the decommissioning phase, the impact is not significant.

12.6.4.1.1 *Description of Effects*

The likely predicted noise and vibration impacts are below the limits and/or thresholds identified. With respect to the EPA's criteria for description of effects, the likely potential associated effects at the nearest noise sensitive locations associated with construction of turbines and hardstanding areas are described below.

Table 12-39 Description of effects of the decommissioning phase

Quality	Significance	Duration
Negative	Not Significant	Short Term

12.7 Mitigation Measures

The assessment of potential effects has demonstrated that the Proposed Project is expected to comply with the identified criteria for the construction, operational and decommissioning phases of the Proposed Project and therefore no specific mitigation measures are required.

12.7.1 Construction Phase

The contract documents will specify that the Contractor undertaking the construction works will be obliged to adopt best practice noise abatement measures contained in British Standard BS 5228-1:2009+A1:2014 '*Code of practice for noise and vibration control on construction and open sites – Noise*' and BS 5228-2:2009+A1:2014 '*Code of practice for noise and vibration control on construction and open sites – Vibration*'.

The assessment of potential impacts presented in Section 12.6.2 has demonstrated that the Proposed Project is expected to comply with the noise and vibration criteria during the construction phase and therefore no specific mitigation measures are required.

The contract documents will specify that the Contractor undertaking the construction works will be obliged to adopt best practice noise abatement measures contained in British Standard BS 5228-1:2009+A1:2014 and BS 5228-2:2009+A1:2014.

To ameliorate any potential noise impacts that may present during the construction phase, a schedule of noise control measures has been formulated in accordance with best practice guidance, and the contract documents will require the Contractor to implement these measures. These are outlined in the Construction and Environmental Management Plan (CEMP) that has been prepared for the Proposed Project included in Appendix 4-4.

12.7.1.1 Construction and Decommissioning Phases – Vibration

The assessment presented in Section 12.6.2 has demonstrated that there will be no significant vibration impacts associated with the construction of the Proposed Project and that no specific mitigation measures are required. However, it is recommended that vibration from construction activities will be limited to the values set out in Section 12.3.5.

It should be noted that these limits are not absolute but provide guidance as to magnitudes of vibration that are very unlikely to cause cosmetic damage. Magnitudes of vibration slightly greater than those in the table are normally unlikely to cause cosmetic damage, but construction work creating such magnitudes should proceed with caution. Where there is existing damage, these limits may need to be reduced subject to structural engineer inspection on a case-to-case basis.

12.7.2 Operational Phase

12.7.2.1 Proposed Turbine Noise

An assessment of operational wind turbine noise has been undertaken in accordance with the best-practice guidance and procedures set out in WEDG 2006, as described in Section 12.6.3. Having regard to the specific circumstances at H1120 discussed in Section 12.6.3.1.1, the findings presented in Section 12.6.3.1 confirm that the predicted operational noise levels associated with the Proposed Wind Farm will comply with the applicable turbine noise criteria at all locations and will not result in significant adverse effects. Therefore, no specific mitigation measures are required.

If alternative turbine models are considered for the Proposed Wind Farm, an updated noise assessment will be prepared to confirm that the noise emissions will comply with the noise criteria outlined in Section 12.5.2 and/or the relevant operational criteria associated with the grant of planning for the Proposed Project.

12.7.2.1.1 *Amplitude Modulation and Tonality*

In the event that a complaint which indicates potential excessive amplitude modulation (AM) associated with the proposed project, the operator will fully investigate the complaint in collaboration with the turbine manufacturer, through review of the meteorological periods and conditions during which the reported AM occurs. If an ongoing issue with excessive AM is identified, a mitigation strategy to reduce the level of AM will be implemented through engineering methods and/or curtailment of specific turbines. The operator may appoint a qualified acoustic consultant to objectively assess the level of AM in accordance with the methods outlined in the IOA AMWG or subsequent revisions.

The measurement method outlined in the IOA AMWG document, known as the ‘Reference Method’, will provide a robust and reliable indicator of AM and yield important objective information on the

frequency and duration of occurrence, which can be used to evaluate different operational conditions including methods to mitigate any excessive AM. These mitigation measures, if required, will consist of the implementation of operational controls for the relevant turbine type, which will include turbine curtailment under specific operational conditions and may in very unlikely circumstance require turning specific turbines off under certain conditions. To minimise adverse impacts from excessive AM associated with the proposed project.

If the complaints suggest the potential occurrence of clearly audible tonality in the wind turbine noise, the audibility of the tones will be investigated from measured data with a robust, objective method such as that included in ISO 1996-2:2017 with modifications in IEC 61400-11-2. If the rated level of the wind farm is above the limit, then the operator would liaise with the turbine manufacturer to investigate and identify appropriate corrective measures. This may involve engineering methods, operational changes and/or (in very unlikely circumstance) curtailment of specific turbines.

The commitment outlined to control AM from wind turbines are considered best practice. The proposed approach will ensure that any adverse impacts from excessive amplitude modulation (AM) associated with the operation of the proposed project are effectively managed by the operator.

12.7.2.2 Fixed Plant

The assessment of noise from the operation of fixed plant within the Fixed Plant Operational Study Area is predicted to comply with the proposed criteria in Section 12.3.7 and that no adverse impacts or likely significant effects are expected. The Applicant confirms its commitment to selecting and specifying electrical plant such that operational noise emissions remain within the proposed criteria. On this basis, no additional specific noise mitigation measures are required to achieve the proposed noise criteria.

12.7.3 Decommissioning Phase

The contract documents will specify that the Contractor undertaking the decommissioning works will be obliged to adopt best practice noise abatement measures contained in British Standard BS 5228-1:2009+A1:2014 '*Code of practice for noise and vibration control on construction and open sites – Noise*' and BS 5228-2:2009+A1:2014 '*Code of practice for noise and vibration control on construction and open sites – Vibration'*.

To ameliorate any potential noise impacts that may present during the decommissioning phase, a schedule of noise control measures has been formulated in accordance with best practice guidance. These are outlined in the Decommissioning Plan (Appendix 4-7) that has been prepared for the Proposed Project.

12.7.4 Monitoring

12.7.4.1 Noise Compliance Monitoring Plan

Noise Compliance Monitoring refers to testing the wind turbine noise levels due to the Proposed Project against the planning conditions, in terms of overall noise levels.

Prior to the commissioning of the Proposed Project, the Applicant will submit a Noise Compliance Monitoring Programme (NCMP) (see Section 12.3.6.12.2) to the planning authority for written agreement and approval. The NCMP will include detailed methodologies for noise measurements, procedures for recording results, and a protocol for managing complaints in accordance with the most up to date guidance, standards, and industry best practice. It is a standard procedure for this to be agreed under the planning condition compliance framework.

Compliance noise surveys will be undertaken to verify compliance with any noise conditions applied to the Proposed Project. It is common practice to commence surveys within six months of a wind farm being commissioned. The guidance outlined in the IOA GPG and Supplementary Guidance Note 5: Post Completion Measurements (July 2014) will be implemented.

In the unlikely event that an exceedance of the noise criteria is identified as part of the commissioning assessment, relevant corrective actions will be undertaken. For example, implementation of noise reduced operational modes resulting in curtailment of turbine operation can be implemented for specific turbines in specific wind conditions to ensure turbine noise levels are within the relevant noise criterion or conditions turbine noise limits. Such curtailment can be applied using the wind farm SCADA system with a marginal reduction of the wind turbine performance. After the implementation of the mitigation measures, the noise survey will be repeated to confirm compliance with the planning conditions.

In the event of a complaint associated with noise, for example tonality or amplitude modulation from the Proposed Wind Farm, as discussed in Section 12.7.2.1.1 and in line with the NCMP documents to be submitted and agreed with the local authority, the operator will fully investigate the complaint in collaboration with the turbine manufacturer, through review of the meteorological periods and conditions.

If an ongoing issue with excessive AM is established, a mitigation strategy to reduce the level of AM will be implemented through engineering methods, operational changes and/or curtailment of specific turbines. The operator would first appoint a qualified acoustic consultant to objectively assess the level of AM in accordance with the methods outlined in the Institute of Acoustics IOA Noise Working Group (Wind Turbine Noise) Amplitude Modulation Working Group Final Report: A Method for Rating Amplitude Modulation in Wind Turbine Noise (9 August 2016) or subsequent revisions.

12.7.4.2 Complaints Procedure

In the event of a complaint associated with noise, tonality or amplitude modulation from the proposed project, the operator will fully investigate the complaint in collaboration with the turbine manufacturer (in accordance with the NCMP documents to be submitted and agreed with the local authority).

A Draft Protocol for Managing Noise Complaints is presented in Appendix 12-6. A final version of this protocol will be contained within the NCMP to be agreed the relevant Local Authority and/or Authorities.

12.8 Residual Effects

This section summarises the likely residual noise and vibration effects associated with the Proposed Project following the implementation of mitigation/best practice measures. The effects described consider the locations of the greatest potential impact unless otherwise stated.

12.8.1 Construction Phase

During the construction phase of the Proposed Project, there will be some impacts on nearby NSLs due to noise and vibration emissions from site traffic and other construction activities. However, given the distances between the main construction works and the NSLs, the short-term duration of the construction phase, and the assessment's findings that the expected noise and vibration emissions will be below the identified noise or temporal threshold and limit values, the effects are deemed Not Significant.

With respect to the EPA, 2022 criteria for description of effects, in terms of these construction activities, the potential effects at the nearest NSLs associated with the various elements of the construction phase are described below.

Table 12-40 Construction Residual Effects

Construction Phase	Quality	Significance	Duration
Proposed Turbines, Hardstands, and 2 no. Met Masts	Negative	Not Significant	Short Term
Internal Roads and Amenity Access Tracks	Negative	Not Significant	Temporary
Temporary Construction Compounds	Negative	Not Significant	Short Term
Proposed Enhancement Areas, including Clear-felled Forestry and Replanting	Negative	Not Significant	Short Term
Peat and Spoil Areas	Negative	Not Significant	Short Term
Construction Traffic	Negative	Not Significant to Moderate	Short-Term
Proposed Onsite Substation and Proposed Offsite Substation Construction	Negative	Not Significant	Short Term
Proposed Grid Connection Underground Electrical Cabling	Negative	Slight	Temporary

The likely predicted noise and vibration effects are below the limits and/or thresholds identified. The described effects should be considered in terms that the effect is variable, and that this assessment considers the locations of the greatest potential impact.

12.8.2 Operational Phase

12.8.2.1 Proposed Turbine Noise

The predicted turbine noise levels within the Proposed Turbine Operational Study Area will be within best practice noise criteria curves recommended in line with WEDG 2006. It is therefore not considered that a significant effect is associated with the Proposed Project.

While noise levels at low wind speeds will increase due to the Proposed Project and specifically the operation of the Proposed Turbines, the predicted levels will remain low.

The predicted residual operational turbine noise effects with respect to EPA, 2022 description of effects are summarised as follows at the nearest NSLs.

Table 12-41 Description of effects of the residual operation of Proposed Turbines

Quality	Significance	Duration
Negative	Not Significant	Long Term

The above effects should be considered in terms that the effect is variable, and that this assessment considers the locations of the greatest potential impact.

12.8.2.2 Fixed Plant Operation

The residual effects at the nearest NSLs within the Fixed Plant Operational Study Area are described as follows with respect to EPA, 2022:

Table 12-42 Description of effects of the residual operation of fixed plant

Quality	Significance	Duration
Negative	Not Significant	Long Term

12.8.3 Decommissioning Phase

During the decommissioning phase of the Proposed Project, there will be some effect on nearby NSLs due to noise emissions from 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 will be used. The noise and vibration impacts associated with any decommissioning of the Proposed Wind Farm are considered to be comparable to those outlined in relation to the construction of the Proposed Project.

With respect to the EPA, 2022 criteria for description of effects, the anticipated associated effects at the nearest noise sensitive locations associated with the decommissioning phase is not significant and are described below.

Table 12-43 Description of effects of the residual decommissioning phase

Quality	Significance	Duration
Negative	Not Significant	Short-term

12.9 Cumulative Effects

This section considers operational noise from the wind turbines and fixed plant associated with the Proposed Project. These sources are assessed separately in the EIAR in accordance with the applicable guidance and assessment criteria. The operational noise criteria for fixed plant are set out in Section 12.5.4, while the criteria for operational wind turbine noise are set out in Section 12.5.3.

Wind turbine noise and fixed plant noise are fundamentally different source types and are subject to distinct guidance, assessment methodologies, prediction models, noise parameters and compliance criteria. Wind turbine noise is assessed using wind-speed-dependent criteria, while fixed plant noise is

assessed against criteria intended to protect receptors during periods of low background sound. Consistent with the approach generally applied to other distinct source types, such as road traffic and construction noise, it is not standard practice to combine wind turbine and fixed plant noise within a single cumulative assessment. Furthermore, there is no applicable combined criterion against which the total noise from these sources could be meaningfully assessed. Combining the predicted levels and comparing the result against either set of source-specific criteria would therefore not represent the assessment methodology applicable to either source.

The potential effects of each source have been assessed against the relevant criteria, and the resulting residual effects are Negative, Not Significant and Long-term, as detailed in Sections 12.8.2. On this basis, the separate assessments provide the appropriate means of determining the potential operational noise effects of the Proposed Project.

12.9.1 Proposed Turbine Noise

Existing, permitted and proposed wind farm developments with the potential for cumulative impacts have been considered as part of the Proposed Turbine noise impact assessment. The noise impact assessment includes the existing Cloncreen Wind Farm and the existing Cushaling Wind Farm. The results of the operational phase noise assessment within the Proposed Turbines Operational Study Area associated with the Proposed Turbines, existing Cushaling Wind Farm, and existing Cloncreen Wind Farm are detailed in Section 12.6.3.1 and determined to be Not Significant.

In relation to location H1120, and as indicated in Section 12.6.3.1.1, the effects from the Proposed Wind Farm compared to the Cushaling Wind Farm are negligible, and therefore, the cumulative impact at location H1120 and any other within the Proposed Turbine Operational Study Area is not significant.

12.9.2 Noise from Fixed Plant Operation

A review of submitted planning applications surrounding the Fixed Plant Operational Study Area (as detailed in Chapter 2) showed that the onsite substations associated with the existing Cloncreen Wind Farm and existing Cushaling Wind Farm, i.e., the Edenderry Power Plant, located approximately 11.7 km west of the Proposed Onsite Substation (approximately 2.3 km west of T22), and the local Blake 110kV Substation, located approximately 2.4km east of the Proposed Onsite Substation and approximately 8.7km west of the Proposed Offsite Substation need to be considered cumulatively. Other fixed plant facilities are the Statkraft Cushaling BESS, the Philipstown 110kV Substation, and the Kilcumber 110kV Substation located at proximity of the Edenderry Power Plant (2.3 km west of T22). There are no other industrial noise sources of fixed mechanical and electrical plant in the vicinity of the nearest NSLs.

All other fixed plant are located at great distance from the Fixed Plant Operational Study Area (minimum of 2.4km) and therefore the potential for any cumulative noise effects is not significant between the above referenced fixed plant and the Proposed Onsite Substation and Proposed Offsite Substation. There is no known industrial plant in the area that would contribute cumulatively to the Proposed Onsite Substation and Proposed Offsite Substation. Therefore, the predicted cumulative noise levels are within the criterion for fixed mechanical plant outlined in Section 12.3.7 and unlikely to result in any adverse impacts at nearby NSLs. Plant will be selected such that no tonal components are evident at any NSLs. At NSLs further from the Proposed Onsite Substation and Proposed Offsite Substation, i.e., outside the Fixed Plant Operational Study Area, the noise levels will be lower.

Due to the distances to other substations, the potential for any cumulative noise effects from the Proposed Onsite Substation and Proposed Offsite Substation is Not Significant.

In conclusion, the predicted noise from the operation of the Proposed Onsite Substation and Proposed Offsite Substation at the nearest NSLs is below the adopted criteria and remains headroom for any other fixed plant operations to operate within the adopted criteria.

12.9.3 Construction and Decommissioning

It is not anticipated that there will be any other activities that would give rise to significant cumulative noise effects during the construction or decommissioning phases, including specialised activities such as HDD, which are typically short term and localised. The predicted noise emissions for the Proposed Project are not of enough magnitude to cause an increase in the cumulative construction noise emissions exceeding the threshold for significant impacts at any NSL within the Construction Study Area.

In order for cumulative noise levels to increase, the contribution of noise from the Proposed Project must be within 10 dB of the other source of noise. The predicted noise levels from construction activity would need to be in excess of 55 dB $L_{Aeq,T}$ at an NSL in order for a potential cumulative construction noise increase to exceed the noise thresholds. The assessment in Section 12.6.2 and Section 12.6.3.3 confirms that the predicted noise levels from activities at static construction sites at any NSL are ≤55 dB $L_{Aeq,T}$, therefore the potential for any cumulative noise effect from all of the proposed activities occurring simultaneously or with construction activities from other developments is unlikely and not significant.

Construction activities that will progress over a defined route are predicted to exceed the construction noise threshold at the closest receptor locations, however, given the duration of the activities outside each individual NSL, the temporal criteria are not likely to be exceeded and hence higher cumulative noise levels for those periods would not result in any significant effect.

12.9.4 Substitute Consent

As identified in Section 2.10.2.3 in Chapter 2 and above in Section 12.4.6, an application for substitute consent was submitted to An Coimisiún Pleanála (Case Ref: SU09.324604) on 20 August 2026, for peat extraction and ancillary works from 1988 to the present day that have been carried out within the Allen Bog Group. A Remedial Natura Impact Statement (rNIS) and rEIAR was submitted with that application.

The limited and localised activities will be substantially lower than any phase of the Proposed Project, and therefore, it is highly unlikely that a cumulative effect will occur.

12.9.5 EPA Licenced Activities

The current activities onsite include site management, decommissioning works and environmental monitoring as required under IPC Licence P0503-01. As part of the above referenced ongoing site activities and site managers will visit the part of the Project Site under IPC Licence regularly for monitoring purposes. Noise generating machinery will be limited to occasional tractors or excavators across the Proposed Wind Farm site. In addition, ecologists and site managers will travel to and from the site in LGVs to oversee these activities.

The Draft Rehabilitation Plans will be implemented following completion of the wind farm construction phase and are therefore expected to overlap with the operational phase of the Proposed Project. The implementation of the targeted rehabilitation measures within the Draft Rehabilitation Plans will occur irrespective of the Proposed Project and have therefore been considered within the future environmental trends (Section 12.5.2.1) for the Proposed Wind Farm site.

The overall footprint of the Proposed Project will be ca. 2.7% of the total area of the Project Site and therefore will not change the overall goals and outcomes of the Draft Rehabilitation Plans. Therefore, there are no significant negative cumulative noise and vibration effects when considering the targeted rehabilitation measures within the Draft Rehabilitation Plan and the Proposed Project.

It is not anticipated that the implementation of the targeted rehabilitation measures within the Draft Rehabilitation Plans will give rise to significant cumulative noise effects during the operation or decommissioning phases of the Proposed Project. As it is the intention of BnM to carry out rehabilitation works under the IPC Licence, following agreement with the EPA, after the construction phase of the Proposed Project is completed, there is no potential for cumulative noise effects to occur. The predicted noise emissions for the Proposed Project are not of enough magnitude to cause an increase in the cumulative construction noise emissions exceeding the threshold for significant impacts at any NSL within the identified study areas (see Section 12.4.1 above).

12.9.6 Peatland Climate Action Scheme

PCAS is completed in Lodge Bog, i.e., the bog in which the Proposed Onsite Substation is located. PCAS works include hydrological management, extensive re-wetting and drain blocking, modifying outfalls, creation of berms etc.

It is anticipated that the maintenance and monitoring of PCAS in Lodge Bog will be minor during the operational phase of the Proposed Project. As such, cumulative noise effects are not expected to occur during the construction, operational, or decommissioning phases of the Proposed Project.

When considered cumulatively, the Proposed Wind Farm and completed PCAS within Lodge Bog will not result in any negative cumulative effects on noise and vibration.

12.10 Difficulties Encountered During the Preparation of this Chapter

There were no difficulties or limitations encountered when undertaking this assessment.

12.11 Interactions

The potential interaction between noise and vibration and other specialist chapters in the EIAR is primarily limited to Chapter 5 (Population & Human Health), Chapter 6 (Biodiversity) and Chapter 15 (Material Assets). This chapter has been prepared in consideration of and in conjunction with the relevant elements of these chapters. For example, noise and vibration impacts associated with the Proposed Project have been fully considered within this Chapter of the EIAR. However, commentary on the impact assessment and related noise levels are also summarised specifically with respect to potential human health impacts in Chapter 5 and Chapter 6. The traffic flow projections associated with the Proposed Project provided in Section 15.1 of Chapter 15 has been utilised in the calculations in Section 12.6.2.6 of this Chapter.

12.12 Summary

When considering a renewable energy development of this nature, the potential noise and vibration effects on the surroundings must be considered for three stages: the short-term construction phase and decommissioning phase, and the long-term operational phase.

The assessments of construction and decommissioning noise and vibration have been conducted in accordance with best practice guidance contained in *BS 5228-1* and *BS 5228-2*.

Residual noise associated with the construction and decommissioning phases have been predicted to be below the proposed threshold values. The associated noise and vibration levels are not likely to cause significant effect at any NSL within the Construction Study Area.

Based on the Proposed Wind Farm layout, turbine noise emission levels and turbine hub height, the turbine noise levels have been predicted at NSLs for a range of operational wind speeds. The predicted noise levels associated with the Proposed Project will be within the best practice noise limits recommended in the applicable WEDG 2006.

Predicted operational noise from the Proposed Onsite Substation and Proposed Offsite Substation have been assessed and found to be within the adopted criteria. Therefore, it is not considered that a significant effect is associated with the Proposed Project.

No significant vibration effects are associated with the operation of the Proposed Project.

Therefore, it is not considered that a significant effect is associated with the Proposed Project.