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TECHNICAL APPENDICES (VOLUME 3)

Acronyms and Abbreviations

ACP	An Coimisiún Pleanála
AOB	Above Ordnance Datum
BESS	Battery Energy Storage System
BSc	Bachelor of Science
CAP24	Climate Action Plan 2024
CAP25	Climate Action Plan 2025
CEMP	Construction Environmental Management Plan
CLO	Community Liaison Officer
CLS	Community Liaison Strategy
CO2eq	Carbon Dioxide equivalent
CSO	Central Statistics Office
DECC	Department of Environment, Climate and Communications
DOEHLG	Department of the Environment, Heritage and Local Government
EDs	Electoral Divisions
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
ELF	Extremely Low Frequency
ELF-EMF	Extremely Low Frequency-Electromagnetic Field
EMF	Electromagnetic Field
EPA	Environmental Protection Agency
ESB	Electricity Supply Board
EU	European Union
EWEA	European Wind Energy Association
Grid Connection Route (GCR)	Refers to the proposed Grid Connection Route as defined in Chapter 1 of this EIAR.
GVA	Gross Value Added
GW	Gigawatt
HGVs	Heavy Goods Vehicles
HSA	Health and Safety Authority
HSE	Health Service Executive
IARC	International Agency for Research on Cancer
ICNIRP	International Commission on Non-Ionising Radiation Protection
IEMA	Institute of Environmental Management and Assessment
IWEA	Irish Wind Energy Association
LGVs	Light Goods Vehicles

Main Wind Farm Development Site	The site where the Proposed Development is located. As defined in Chapter 1 of this EIAR.
MCC	Mayo County Council
MCDP	Mayo County Development Plan 2022-2028
MW	Megawatt
MWh	Megawatt-hour
NESC	National Economic and Social Council
NHMRC	National Health and Medical Research Council
NPWS	National Parks and Wildlife Service
PPE	Personal Protective Equipment
Proposed Project	Refers to the Proposed Development including the GCR.
RESS	Renewable Energy Support Scheme
SEAI	Sustainable Energy Authority of Ireland
SEI	Sustainable Energy Ireland
SLR	SLR Consulting Limited
Turbine Delivery Route (TDR)	Refers to the proposed turbine delivery route as defined in Chapter 1 of this EIAR.
UN	United Nations
WAW	Wild Atlantic Way
WEI	Wind Energy Ireland
WHO	World Health Organisation
ZTV	Zone of Theoretical Visibility

9.0 NOISE AND VIBRATION INTRODUCTION

Background

9.1 This chapter assesses the potential noise and vibration effects of all elements of the Proposed Project including the grid connection route, as described in **Chapter 2** of this EIAR. The assessment considers the Proposed Project's construction, operation and decommissioning phases. To assist the reader, a glossary of terminology is included in **Technical Appendix 9-1**.

9.2 Potential construction noise and vibration impacts have been determined with reference to British Standard 5228:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites Part 1 Noise (BS 5228-1), as is current best practice in the absence of any Ireland specific guidance.

9.3 The operational wind turbine noise assessment documented in this chapter complies with guidance in relation to acceptable levels of noise from wind farms as contained in the document Wind Energy Development Guidelines for Planning Authorities published by the then Department of the Environment, Heritage and Local Government (now the Department of Housing, Local Government and Heritage) in 2006 (the '2006 Guidelines'). Potential operational noise impacts associated with the Proposed Project have been determined in accordance with the UK Institute of Acoustics' (IOA), A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise, 2013 (IOA GPG), which is considered in Ireland to be current best practice. Operational noise associated with the Proposed Project includes noise from the proposed wind turbines, substation and battery energy storage system (BESS).

9.4 Although in December 2019, the Draft Revised Wind Energy Development Guidelines were published for consultation, these guidelines have yet to be finalised, have not been adopted and are not considered best practice. The 2006 Guidelines, as supplemented by the ESTU-R-97 and IOA methodologies described below, are considered best practice and have been applied in this assessment.

9.5 Assessment has been carried out of the cumulative developments listed in **Table 2-5** of **Chapter 2** of this EIAR.

9.6 Separate assessment has been carried out of operational noise impacts from the substation and BESS. Noise levels have been calculated from this plant outside nearby noise sensitive receptors (NSRs) and compared against criteria developed from the World Health Organisation guidelines.

9.7 Decommissioning noise and vibration impacts have been assessed in accordance with the same British Standards as the construction noise assessment.

Statement of Authority

9.8 This assessment was prepared by Richard Carter CEng, BEng(Hons), MIOA, a Director at Bow Acoustics Ltd., on behalf of SLR. Richard has worked in the field of acoustics for 20 years, with over 15 years' experience specialising in the assessment of wind farm noise. Richard has a bachelor of Engineering (BEng (Hons)), a post graduate diploma in acoustics and noise control, is a member of the Institute of Acoustics (MIOA) and a Chartered Engineer (CEng). He has extensive experience in all aspects of environmental surveying,

noise modelling and impact assessment for various sectors including wind energy, industrial, commercial and residential.

9.9 The background noise measurements were undertaken by Aldona Binchy MSc. Eng PIEMA, MIAH, AAG Environmental Engineering, a Principal of SLR, with 20 years of experience conducting environmental noise surveys. Aldona completed the Environmental Noise Competency Course with Industrial Noise and Vibration Centre. Aldona has extensive experience of undertaking noise monitoring programmes in accordance with relevant standards and best practice methods.

Scope and Consultation

Consultation

9.10 Mayo County Council (MCC) were consulted via a Scoping Report in April 2024 on the assessment of the Proposed Project. MCC advised that noise is one of the major points of contention in respect of wind farm developments. MCC further advised that noise modelling to most recent best practice may be required as separation distances alone cannot be relied upon to accurately control noise levels from wind farms. MCC noted that the assessment proposed to follow the 2006 Wind Energy Guidelines (discussed in more detail later) and not the Draft 2019 Wind Energy Development Guidelines and that updated Guidelines are anticipated to be released which may change the extent of the assessment required. At the time of writing (May 2026) no updated Guidelines had been published.

Construction Noise & Vibration

9.11 Noise is generated from the construction of the turbine foundations, the erection of the turbines, the excavation of trenches for cables, the construction of associated hard standings and access tracks, the construction of Over-run Areas on the Turbine Delivery Route (TDR) and construction of the substation and BESS.

9.12 All noise, including construction noise, will diminish with distance. Construction noise will reduce to a negligible level typically at a distance of less than 500m, depending on the nature of construction works. Notwithstanding this, construction noise impact from the Proposed Project have been calculated at the nearest NSR, even if the nearest NSR is over 500m away. The nearest cumulative development, as listed in **Table 2-5** of **Chapter 2** of the EIAR, that is not already constructed is Sheskin South Wind Farm at approximately 15.7 km, which is substantially greater than the distance at which construction noise reduces to a negligible impact. As such, cumulative construction noise is not considered further in this chapter.

9.13 Noise from vehicles on local roads and access tracks is also generated from the delivery of the turbine components and construction materials, notably aggregates, concrete and steel reinforcement.

9.14 Vibration is generated by construction activities such as rock breaking and passing heavy goods vehicles. The threshold of human perception of vibration is stated in British Standard 5228-2:2009+A1:2014 (BS5228) (see **paragraph 9.59**) to be in the range of 0.14 mm/s to 0.3 mm/s, described as "*might just be perceptible*". The standard also provides guideline values for damage to buildings from vibration of 15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz and 50 mm/s at 40 Hz and above.

9.15 The nearest vibration sensitive locations are sufficiently distant to any construction activities that have the potential to generate vibration. Such activities are over 600 m from vibration

sensitive locations, at which distance vibration will not be perceivable by residents at their dwellings and building damage will not occur from construction incurred vibration.

9.16 Some construction activities taking place outside the Main Wind Farm Development Site and associated with cable trenching have the potential to generate vibration and will take place closer to vibration sensitive receptors than activities within the Main Wind Farm Development Site. It is expected that vibration levels from trenching activities, such as tracked excavators, disc cutters and pneumatic breakers will be 0.7 mm/s at 10 m distance, as calculated in accordance with BS5228-2; however, this is dependent on ground conditions, with very stiff cohesive soils containing large obstacles resulting in higher vibration levels than loose granular soils. Whilst this may be perceptible for some residents of dwellings situated within this distance, it will be for a brief period of less than a day while the construction work is at this minimum distance, before construction activity progresses along the Grid Connection Route (GCR), increasing the distance between it and the dwelling, thus reducing the vibration impact. The vibration impact, both in magnitude and duration of exposure, will be comparable to that experienced during other highway road works and substantially below the threshold of structural damage. As such, construction vibration will not be considered further in this chapter.

Operational Noise & Vibration

9.17 Once constructed and operating, wind turbines may emit two types of noise: aerodynamic noise from the blades, and mechanical noise from other components, both of which contribute to the overall noise level from the turbine which has been assessed in this chapter. Extraneous noise tends to be perceived when the wind speeds are low as natural noise sources are supressed, although at very low wind speeds wind turbine blades do not rotate or rotate very slowly and so, at these wind speeds, negligible wind turbine noise is generated. In higher winds, wind turbine noise is generally masked by the normal sound of wind blowing through trees and around buildings. The level of this natural ‘masking’ noise relative to the level of wind turbine noise determines the subjective audibility of the Proposed Project. The relationship between wind turbine noise and the naturally occurring masking noise at nearby NSRs will therefore form the basis of the assessment of the levels of noise against accepted standards that form current best practice.

9.18 Ancillary equipment such as transformers at the proposed substation and inverters within the BESS can also generate noise. Operational noise impacts from the proposed substation and BESS have been considered in this chapter.

Blade Swish (Amplitude Modulation of Aerodynamic Noise)

9.19 Amplitude modulation (AM) is the periodic variation in the amplitude of aerodynamic noise generated during the operation of a wind turbine, sometimes referred to as ‘blade swish’. The noise assessment methodology presented in ETSU-R-97, sets out noise limits which already account for likely encountered levels of amplitude modulation from wind turbines.

9.20 A study was carried out on behalf of the UK’s Government Department for Business, Enterprise and Regulatory Reform (BERR) by the University of Salford, which investigated the incidence of noise complaints associated with wind farms and whether these were associated with AM (University of Salford, 2007). This report defined AM as aerodynamic noise fluctuations from wind turbines at blade passing frequency. Its aims were to ascertain the prevalence of AM on UK wind farm sites, to try to gain a better understanding of the likely causes, and to establish whether further research into AM is required.

9.21 The study concluded that AM with a greater degree of fluctuation than normal had occurred at only a small number of wind farms in the UK (4 of 133), and only for between 7% and

15% of the time. It also states that, at the time of writing, the causes of this were not well understood and that prediction of the effect was not currently possible.

9.22 This research was updated in 2013 by an in-depth study undertaken by Renewable UK, which considered 'other AM' (OAM). OAM is a now outdated term which was defined as AM with atypical characteristics which could not be explained by standard causal factors, and is now simply referred to as AM. Such characteristics include a greater depth of modulation, different directivity patterns or a changed noise character. The study identified that many of the previously suggested causes of AM have little or no association to the occurrence of OAM in practice. The generation of OAM was likely based upon the interaction of several factors, the combination and contributions of which are unique to each site. Based on current best engineering knowledge, it is not possible to predict whether any particular site is more or less likely to give rise to OAM.

9.23 In 2016, the IOA proposed a measurement technique to quantify the level of AM present in any particular sample of wind farm noise (Institute of Acoustics, 2016). As part of this study, all previous terms for AM, including OAM and normal AM, are grouped under the new definition: "*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 of the turbine rotor(s)*". This technique is supported by the UK's Government Department of Business, Energy & Industrial Strategy (BEIS, formerly the Department of Energy & Climate Change) who have published guidance which follows on from the conclusions of the IOA study in order to define an appropriate assessment method for AM, including a penalty scheme and an outline planning condition (BEIS, 2016).

9.24 The Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise which was published by the Institute of Acoustics in May 2013 (IOA GPG) discusses AM. Section 7.2.1 of the IOA GPG remains current best practice and states: "*The evidence in relation to 'Excess' or 'Other' Amplitude Modulation (AM) is still developing. At the time of writing, current practice is not to assign a planning condition to deal with AM*".

9.25 Subsequently, a report commissioned by the UK Department for Business, Energy & Industrial Strategy was published in February 2023 (BEIS, 2023) and concludes that the noise limits in ETSU-R-97 should be reviewed and that updated guidance on AM should be included but makes no firm recommendations with regards to any update. Therefore, until the UK or Irish governments conclude such a review, the ETSU-R-97 methodology continues to be applicable. The UK Government has also confirmed that ETSU-R-97 should continue to apply until the review recommendations are considered in further detail.

9.26 In 2024, the International Electrotechnical Commission (IEC) published Technical Specification IEC/TS 61400-11-2 (Edition 1.0), Wind energy generation systems – Part 11-2: Acoustic noise measurement techniques – Measurement of wind turbine sound characteristics at receptor locations. This document introduces a standardised methodology for measuring and rating AM at receptor locations. The method is technically consistent with the AM Working Group (AMWG) approach but includes some minor differences.

9.27 In October 2025 Wind Energy Ireland published their position paper on AM planning conditions (WEI, 2025), included as **Technical Appendix 9-2**. This paper provides a background on AM and the various approaches taken by other countries on the subject. It notes that no other EU country regulates AM and whilst countries such as the UK and New Zealand have examples of planning conditions to control AM, no suitable precedents could be cited. Three Irish wind farms that were consented in early 2025 included a condition that the "*wind farm shall not give rise to amplitude modulation…*", which is noted to be unworkable due to:

- the lack of Irish Government (or relevant expert body) endorsed scientific evidence, research or data to support the necessity of the condition;
- AM cannot be measured or predicted in advance of the operation of the wind farm. Therefore, developers can't know how much AM may be produced or commit to a condition that requires no AM; and
- It is not achievable to have no AM, regardless of any measure implemented. AM may be measured at a property near to a wind farm but may be of low level which would result in a low character correction.

9.28 The WEI paper supports a complaint driven approach to the control of AM and provides a sample planning condition that sets out a requirement for the developer to submit and agree with the planning authority a Noise Complaint Monitoring Programme (NCMP) prior to commissioning.

9.29 The above evidence shows that AM has the potential to occur in any wind farm, however the likelihood is low. There is no available method for predicting the probability of AM occurring, or whether or not it would amount to a likely significant effect on the environment before the wind farm is constructed and operational. This is because AM depends on a number of factors that can only be ascertained through operation of the wind farm. Therefore, it is appropriate to control the risk of AM through a complaint driven planning condition which references an NCMP to be agreed with the local authority prior to commissioning. The NCMP will set out the details of how AM will be measured, quantified and the magnitude of correction applied to the wind turbine noise level due to AM. Further details of the important elements of the NCMP are included later in this chapter.

Infrasound & Low Frequency Noise

9.30 Low frequency noise is noise that occurs within the frequency range of 20 Hz to 200 Hz. Infrasound is noise occurring at frequencies below that at which sound is normally audible, that is, less than about 20 Hz, due to the significantly reduced sensitivity of the ear at such frequencies. For low frequency sound to be perceptible, it must be at very high amplitude, and it is considered that when such sounds are perceptible then they can cause considerable annoyance.

9.31 A study, published in 2006 by acoustic consultants Hayes McKenzie on behalf of the then UK's Government Department of Trade and Industry (DTI) (now the Department for Innovation, Universities and Skills and the Department for Business, Enterprise and Regulatory Reform), investigated low frequency noise from wind farms (Hayes McKenzie, 2006). This study concluded that there is no evidence of health effects arising from infrasound or low frequency noise generated by wind turbines.

9.32 Further, in February 2013, the Environmental Protection Authority of South Australia published the results of a study into infrasound levels near wind farms (Environment Protection Authority, 2013). This study measured infrasound levels at urban locations, rural locations with wind turbines close by, and rural locations with no wind turbines in the vicinity. It found that infrasound levels near wind farms are comparable to levels away from wind farms in both urban and rural locations. Infrasound levels were also measured during organised shutdowns of the wind farms; the results showed that there was no noticeable difference in infrasound levels whether the turbines were active or inactive.

9.33 In an article for the IOA, Bowdler et al. (2009) discusses the relevant factors for noise assessments from wind farms, including a section on vibration and low frequency noise. It concludes that: *"...there is no robust evidence that low frequency noise (including*

'infrasound') or ground-borne vibration from wind farms generally has adverse effects on wind farm neighbours."

9.34 The studies discussed above are current and represent best knowledge. It is best practice to not carry out a specific assessment of infrasound and low-frequency noise and therefore, it will not be considered further in this chapter.

Tonal Noise

9.35 Tonal noise is the concentrations of acoustic energy over relatively small bands of frequency. Tonality found in wind turbine sound is most often of mechanical origin, which over the years has been engineered out of modern wind turbines and is generally caused by structural resonances in the mechanical parts of the turbine. Modern day wind turbines are highly unlikely to generate tonal noise unless there is a fault with a mechanical component such as the gearbox as a result of poor maintenance. Therefore, a correctly operating wind turbine will not produce noise of a tonal nature and this will not be considered further in this chapter.

Vibration

9.36 Research undertaken by D J Snow (1997) found that levels of ground-borne vibration 100 m from the nearest wind turbine were significantly below the criteria for 'critical working areas' given by British Standard BS 6472:1992 Evaluation of human exposure to vibration in buildings (1 Hz to 80 Hz) and were lower than limits specified for residential premises by an even greater margin (Snow, 1997). Subsequently, BS 6472-1:2008 has superseded BS 6472:1992 and no longer applies to critical working areas, where vibration criteria are more stringent than those for human perception. Therefore, the ground-borne vibration measured by Snow 100 m from a wind turbine were also significantly below human perception and the thresholds set out in BS 6472-1:2008 for probability of adverse comment.

9.37 More recently, the Low Frequency Noise Report published in 2016 by the Federal State of Baden-Württemberg simultaneously measured vibration at several locations at increasing distance from an operational Nordex N117 – 2.4 MW wind turbine with a tip height of 140.6 m, which is representative from an operational vibration point of view to the candidate turbines. The report concluded that at less than 300 m from the turbine, the vibration levels had reduced such that they could no longer be differentiated from the background vibration levels.

9.38 The separation distances between the wind turbines and the closest sensitive receptors are at least 740 m. Therefore, it is current best practice to not carry out a specific assessment of vibration arising from the operation of wind turbines and it is not considered further in this chapter. It should be noted that the receptor locations used for the noise and vibration assessment correspond to the amenity space and not necessarily the dwelling; therefore, the quoted minimum distance may differ from other assessments.

9.39 Operational vibration associated with the other aspects of the Proposed Project, comprising the BESS, substation and grid connection, will be minimal and have been scoped out the assessment.

Decommissioning noise and vibration

9.40 The noise and vibration levels generated during the decommissioning of a wind farm are lower than those generated during its construction due to the reduced number of operations required, as discussed in **paragraphs 9.177 to 9.180**. Therefore, as a worst case it is assumed that the noise impacts calculated for the construction phase will equally apply to

the decommissioning phase. As with construction vibration, decommissioning vibration impacts are scoped out.

Legislation, Guidance and Policy

9.41 A summary overview of the relevant guidance documentation adhered to in this assessment is provided below. The following sections provide further details of how they have been applied.

European Communities (Environmental Noise) Regulations, (As Amended) 2018

9.42 The European Communities (Environmental Noise) Regulations 2018 (S.I. No. 549 of 2018) transpose the EU Environmental Noise Directive 2002/49/EC into Irish law. These Regulations provide for the implementation in Ireland of a common approach within the European Union intended to avoid, prevent or reduce on a prioritised basis the harmful effects, including annoyance, due to exposure to environmental noise.

European Communities (Environmental Noise) (Amendment) Regulations, 2021

9.43 The European Communities (Environmental Noise) (Amendment) Regulations 2021 (S.I. No. 663 of 2021) transpose the amendments to EU Environmental Noise Directive 2002/49/EC into Irish law. These amendments comprise Commission Directive (EU) 2020/367 establishing assessment methods for harmful effects of environmental noise and Commission Delegated Directive (EU) 2021/1226 establishing common noise assessment methods and for the purposes of giving full effect to Directive 2002/49/EC as amended by EU Regulation 2019/1010 and the associated Commission Implementing Decision (EU) 2021/1967 establishing alignment of reporting obligations in the field of legislation related to the environment.

Mayo County Development Plan 2022 – 2028

9.44 Volume 4 of Mayo County Development Plan 2022 – 2028 (MCDP), adopted in June 2022, provides details of the Council's renewable energy strategy. Section 6.5.5 addresses noise and sets out a general requirement for noise impacts during the construction and operation of all renewable energy developments, including changes in road traffic noise, to be considered. Further reference is made to the Mayo Noise Action Plan 2024 – 2028. The Draft Renewable Energy Strategy for County Mayo (2026) has also been considered.

9.45 Section 6.5.5 of the MCDP also specifically addresses noise from proposed wind energy developments, where "*due regard shall be taken of noise assessment, mitigation and thresholds outlined in the Planning Guidelines for Wind Energy Developments for Planning Authorities 2006.*"

Mayo County Noise Action Plan 2024 – 2028

9.46 Mayo County Noise Action Plan 2024 – 2028 (MCNAP) was prepared as a requirement of the Environmental Noise Regulations, set out above, and provides details of the Council's strategy for long-term management of environmental noise. The MCNAP states "*For Wind Energy developments due regard shall be taken of noise assessment, mitigation and thresholds outlined in the Planning Guidelines for Wind Energy Developments for Planning Authorities 2006.*". The draft revised 2019 version of the guidelines are noted in the MCNAP;

however, as a final version had not been published at the time of publication of the MCNAP (January 2024), they are not considered further.

Project Ireland 2040 National Planning Framework First Revision, 2025

9.47 The National Planning Framework is a planning framework to guide development and investment by empowering regions to lead in the planning and development of their communities and contains a set of national objectives and key principles.

9.48 National Policy Objective (NPO) 94 promotes the proactive management of noise where it is likely to have significant adverse impacts on health and quality of life and support the aims of the Environmental Noise Regulations through national planning guidance and Noise Action Plans.

9.49 The National Planning Framework recognises the importance of quiet areas, such as green spaces and sea frontages, and seeks to protect them through the preservation of low sound levels or a reduction in undesirably high sound levels.

Wind Energy Development Guidelines, 2006

9.50 Published by the then Department of Environment, Heritage and Local Government (now the Department of Housing, Local Government and Heritage), these Guidelines offer advice for many aspects of wind energy development, including noise, which is covered in Section 5.6. At the time of writing, the 2006 Guidelines remain in force. Best practice for operational noise assessment is to apply the 2006 Guidelines as supplemented by ETSU-R-97 and IOA GPG (see below).

9.51 MCDP and MCNAP both make reference to the 2006 Wind Energy Development Guidelines (WEDG) as the appropriate guidelines when assessing noise impacts of proposed wind energy projects.

Draft Revised Wind Energy Development Guidelines, 2019

9.52 Published by the Department of Housing, Planning and Local Government (DoHPLG). These guidelines are currently under review and are yet to be adopted, with further revisions to the text, including noise guidance, anticipated. Until such a time as these guidelines are re-published for public consultation, the 2006 Guidelines remain in place.

Guidelines on the Information to be Contained in Environmental Impact Assessment Reports, 2022

9.53 Published in May 2022 by the Environmental Protection Agency (EPA), these guidelines supersede the draft 2017 guidelines and provide consistency on the information to be contained in Environmental Impact Assessment Reports (EIAR) with the objective of improving their quality.

ETSU-R-97 The Assessment & Rating of Noise from Wind Farms, 1996

9.54 The Assessment and Rating of Noise from Wind Farms - ETSU-R-97, 1996, provides a framework for the assessment and rating of noise from wind farms. In Ireland, under the 2006 Guidelines, the determination of background noise levels and limits is carried out using the ETSU-R-97 methodology.

Institute of Acoustics Good Practice Guide, 2013

9.55 The IOA GPG is supported by a suite of six Supplementary Guidance Notes, published in 2014. The guide presents current good practice in the application of ETSU-R-97

assessment methodology for wind turbine developments at the various stages of the assessment process.

Best Practice Guidelines for the Irish Wind Energy Industry, 2012

9.56 The Best Practice Guidelines for the Irish Wind Energy Industry, published by the Irish Wind Energy Association (IWEA), sets various guidelines for the industry to encourage responsible and sensitive wind farm development, which takes into consideration the concerns of local communities, planners, and other interested groups. Section 6.3.3. addresses the assessment of noise and confirms that the 2006 Guidelines should be followed, and reference is made to ETSU-R-97 as the appropriate method for the determination of existing background noise levels. Construction noise impacts should be assessed in accordance with British Standard BS 5228-1.

British Standard BS 5228, 2014

9.57 British Standard BS 5228 refers to the need for the protection against noise (in Part 1) and vibration (in Part 2) for people living in the vicinity of construction or open sites.

9.58 Part 1, or BS 5228-1:2009+A1:2014, sets out a methodology for predicting noise levels arising from a wide variety of construction activities and it contains tables of sound power levels generated by mobile and fixed plant. Annex E of BS 5228-1 gives example criteria that may be used to consider the significant effect of any construction noise impact. The criteria are not mandatory and are presented as a set of example approaches that reflect the type of methods commonly applied to construction noise.

9.59 Part 2, or BS 5228-2:2009+A1:2014 (BS 5228-2), gives recommendations for basic methods of vibration control relating to construction and open sites. Annexes E and F of BS 5228-2 includes guidance on the subject of vibration from blasting sites, whereas Annex G discusses air overpressure resulting from blasting.

World Health Organisation, Guidelines for Community Noise, 1999

9.60 The Guidelines for Community Noise provides guideline values for overall desirable internal and external sound levels for a variety of situations, which are intended to minimise health impacts for certain environments.

World Health Organisation, Night Noise Guidelines for Europe, 2009

9.61 The Night Noise Guidelines for Europe provide complimentary guidance to that set out in the Guidelines for Community Noise, with additional consideration of the night time period.

International Standard ISO 9613-2, 2024

9.62 International Standard ISO 9613-2, Acoustics – Attenuation of Sound During Propagation outdoors – Part 2: Engineering Method for the Prediction of Sound Pressure Levels Outdoors, specifies an engineering method for accurately predicting levels of environmental noise at a distance from a variety of sources. It is recognised in current best practice, including the IOA GPG, as the appropriate method when calculating noise immission levels from wind turbines. It should be noted that current best practice documents make reference to the 1996 version of ISO 9613-2, which was recently superseded by the 2024 version.

9.63 Note that in the above, and subsequently in this assessment, the term ‘noise emission’ relates to the sound power level of a wind turbine, whereas the term ‘noise immission’ relates to the sound pressure level experienced at a receptor location.

Calculation of Road Traffic Noise

9.64 The former Department of Transport and Welsh Office memorandum Calculation of Road Traffic Noise (CRTN) published in 1988 sets out standard methods and procedures to predict and measure road traffic noise. These procedures were primarily intended to enable entitlement under the Noise Insulation Regulations to be determined, but they also provide guidance appropriate to the calculation of traffic noise for more general applications. This UK guidance document has been used in this assessment in the absence of any Ireland specific guidance on this topic.

Approach and Methodology

Study Area

9.65 The Main Wind Farm Development Site is situated within a coastal region of County Mayo located approximately 0.5km from the village of Gweesalia with Bangor Erris being located approximately 8km from the Main Wind Farm Development Site. The centre of the Main Wind Farm Development Site is at ITM 476800, 822700. The proposed turbine locations are shown on **Figure 9-1**.

9.66 The study area for the construction and decommissioning noise is limited to the nearest NSR in each general direction during the construction or decommissioning phase under assessment. The calculation for construction and decommissioning noise assumes no reduction for screening and assumes downwind propagation, therefore, other, more distant NSRs will be exposed to lower levels of noise and do not need to be considered also.

9.67 The study area for the operational noise assessment, as defined in the IOA GPG, comprises the area where noise levels from the Proposed Project are predicted to be within 10 dB of those from other relevant wind energy developments, and the predicted cumulative wind farm noise level is greater than 35 dB $L_{A90,10min}$. It should be noted that when two noise sources are present that produce noise levels at the same receptor location more than 10 dB apart, the total noise will equal to the higher of the two noise levels. This is therefore the reason why the IOA GPG specify that developments producing noise levels more than 10 dB than one another need not be considered cumulatively. Where no other wind farms contribute to the cumulative wind farm noise level, the study area is defined by the 35 dB $L_{A90,10min}$ noise level from the Proposed Project alone.

9.68 The $L_{A90,\ 10min}$ parameter is used to describe wind turbine noise and it represents the level of noise exceeded for 90% of the measurement period, 10 minutes. All of the proposed and existing cumulative wind farms nearby are calculated to produce less than 20 dB L_{A90} at the assessment locations; therefore can only cumulatively affect another noise sources that produces a noise level up to 30 dB L_{A90}, which is below the study area threshold of 35 dB L_{A90}. Therefore, these other wind energy developments cannot contribute cumulatively and the study area is limited to the 35 dB L_{A90} noise contour shown in **Figure 9-1**.

9.69 NSRs are properties within the study area which are potentially sensitive to noise and, as such, may require protection from nearby noise sources. The 2006 Guidelines list NSRs as dwellings, hostels, health buildings, places of worship and may also include areas of particular scenic quality or special recreational amenity importance.

9.70 The NSRs identified within this assessment are all residential dwellings. The industrial area in the centre of the Main Wind Farm Development Site does not contain any NSRs. During the operational phase wind turbine noise immission levels are predicted to a location representative of each outdoor amenity area rather the façade of the property. This is in line with the IOA GPG which states (at paragraph 4.3.8) that "*calculations should be made at*

points representative of the relevant outdoor amenity area (as defined in ETSU-R-97) at locations nearest to the proposed wind farm development".

9.71 It is not always appropriate to assess operational wind turbine noise impacts at all nearby NSRs, as a worst-case can be presented with a selection of NSRs. Where multiple NSRs are in the same general direction from the Main Wind Farm Development Site, it may be appropriate to present results for just one of these which represents the highest noise levels that could be experienced at any of them.

9.72 **Table 9-1** details the identified NSRs for the assessment of operational, construction and decommissioning noise and **Figure 9-1** shows the location of each NSR in relation to the Main Wind Farm Development Site.

Table 9-1: Noise Sensitive Receptors

NSR ID	Eircode	Easting (ITM)	Northing (ITM)
NSR01	F26 X3X5	480192	823940
NSR02	F26 V290	478631	823165
NSR03	F26 T8F7	477830	822092
NSR04	F26 K2R6	478213	822165
NSR05	F26 Y4E7	477968	821945
NSR06	F26 WN97	477447	821029
NSR07	F26 X397	477312	820986
NSR08	F26 C838	477006	820866
NSR09	F26 D9Y6	476634	820435
NSR10	F26 TKN3	476365	820223
NSR11	F26 E9W7	475752	820854
NSR12	F26 E1C7	475650	821146
NSR13	F26 F6X8	475628	822350
NSR14	F26 V803	475558	822547
NSR15	F26 V3W7	475547	822636
NSR16	F26 D7D0	475414	822851
NSR17	F26 A9F6	474768	823752
NSR18	F26 R5V6	474769	823926
NSR19	F26 XC91	474676	824286
NSR20	F26 C6H2	474916	824629

Field Survey

9.73 A background noise survey was carried out at seven noise measurement locations (NML) around the site within the study area, as shown on **Figure 9-1** and listed in **Table 9-2**. The locations were chosen to be representative of the NSRs in the Study Area. Monitoring was carried out for 28 days at each of the NMLs from 19 May 2023 to 16 June 2023. This total exceeds the two-weeks recommended in the IWEA Best Practice Guidelines and the IOA GPG.

Table 9-2: Noise Measurement Locations

NML ID	Eircode	Easting (ITM)	Northing (ITM)
NML1	F26 V2N7	479025	823003
NML2	F26 K2R6	478224	822158
NML3	F26 WN97	477458	821023
NML4	F26 E1C7	475628	821141
NML5	F26 H9Y3	475576	822370
NML6	F26 TR74	474501	824174
NML7	F26 YN24	474781	824594

9.74 In line with the IOA GPG, the background survey data has been used as a proxy for some NSRs where monitoring was not carried out. This is considered appropriate due to the comparable distances from local roads or streams. Furthermore, as set out above, it is not necessary to assess every NSR in the area. Details of which survey location has been used as a proxy for the corresponding assessment location are included in **Table 9-3**.

Table 9-3: Proxy Locations for Noise Sensitive Receptors

NSR ID	NSR Eircode	NML ID	NML Eircode
NSR01	F26 X3X5	NML1	F26 V2N7
NSR02	F26 V290	NML1	F26 V2N7
NSR03	F26 T8F7	NML2	F26 K2R6
NSR04	F26 K2R6	NML2	F26 K2R6
NSR05	F26 Y4E7	NML2	F26 K2R6
NSR06	F26 WN97	NML3	F26 WN97
NSR07	F26 X397	NML3	F26 WN97
NSR08	F26 C838	NML3	F26 WN97
NSR09	F26 D9Y6	NML3	F26 WN97
NSR10	F26 TKN3	NML3	F26 WN97

NSR ID	NSR Eircode	NML ID	NML Eircode
NSR11	F26 E9W7	NML4	F26 E1C7
NSR12	F26 E1C7	NML4	F26 E1C7
NSR13	F26 F6X8	NML5	F26 H9Y3
NSR14	F26 V803	NML5	F26 H9Y3
NSR15	F26 V3W7	NML5	F26 H9Y3
NSR16	F26 D7D0	NML5	F26 H9Y3
NSR17	F26 A9F6	NML6	F26 TR74
NSR18	F26 R5V6	NML6	F26 TR74
NSR19	F26 XC91	NML6	F26 TR74
NSR20	F26 C6H2	NML7	F26 YN24

9.75 The equipment used for the background noise survey comprised Class 1 logging sound level meters, each enclosed in environmental cases to protect from the weather. Outdoor enhanced windshields were used to reduce wind induced noise on the microphones and provide protection from rain. These windshields were supplied by the sound level meter manufacturer and maintain the required performance of the whole measurement system when fitted. The installed microphone height was approximately 1.5 m.

9.76 The sound level meters were located at least 3.5 m from the façade of the property and as far away as was practical from obvious atypical localised sources of noise such as running water, tall trees or boiler flues.

9.77 Details and photographs of the measurement locations can be found in **Technical Appendix 9-3**.

9.78 Sound level meters were all field calibrated during their installation and collection, with no acoustically significant (>1 dB(A)) drifts in calibration observed. The equipment used and locations chosen followed the IOA GPG guidelines in all cases.

9.79 The sound level meters logged the $L_{A90,10min}$ and $L_{Aeq,10min}$ noise levels continuously over the survey period, using Coordinated Universal Time (UTC) time reference. Wind data were measured using a Light Detection and Ranging (LiDAR) remote sensing measurement system that also logged data using the same 10-minute periods and UTC time reference.

9.80 The use of a LiDAR to monitor the wind data is endorsed by the IOA GPG as one of three preferred methods of capturing such data. The LiDAR was installed at a central location on site (located ITM 476693, 823432) by experts in wind measurements for such applications.

9.81 NML3 had a rain logger installed to monitor periods of rainfall during the background noise survey. The rain logger comprised a Davis tipping bucket detector, set to record if any rain was detected during the same 10-minute measurement period used by the sound level meters and wind data. The data from the rain logger was also synchronised to the UTC time reference.

Assessment Methodology

Construction Noise

9.82 There is no statutory Irish guidance relating to the calculation and assessment of construction noise. In the absence of specific guidance, BS 5228-1 has been used as the appropriate reference for the method of calculation and assessment of construction noise effects, which aligns with current best practice. At this stage of a development it is not feasible to accurately specify exact construction techniques or locations where construction activity is likely to take place. Therefore, various assumptions have been made based on best practice and the proposed construction activities and methodologies. The calculation follows Annex F of BS 5228-1 and assumes the following:

- there will be no screening effects;
- propagation over mixed ground (50% hard 50% soft); and
- construction activity is assumed to occur at a single point from receiver (closest point to the nearest receiver to represent a worst case).

9.83 **Table 9-4** lists the primary noise generation construction activities, the associated types of plant proposed to be used, and the expected worst-case sound power level over a working day for each activity. With the exception of turbine erection, the sound power levels for all plant used in the tasks listed in **Table 9-4** have been obtained from Annex C of BS5228-1. Sound power levels for the specialist plant associated with the erection of the wind turbines has been provided from an internal database.

Table 9-4: Construction Plant Sound Power Levels

Task	Total Sound Power Level, dB L_{WA}	Details of Plant or Equipment
Construct temporary site compounds	118	Excavator, dump truck, pumping concrete, delivery lorries
Construct site tracks	118	Excavators, dump trucks, tippers, bulldozers, vibrating roller
Pile substation / BESS foundations	121	Piling Rig, excavators, dump trucks, concrete mixing lorries, mobile cranes, diesel water pumps, pneumatic hammers, compressors, vibratory pokers
Construct substation / BESS	112	Excavator, concrete mixing lorry, delivery lorries
Construct crane hard standings	121	Piling Rig, excavators, dump trucks, concrete mixing lorries, mobile cranes, diesel water pumps, pneumatic hammers, compressors, vibratory pokers
Construct turbine foundations	121	Piling Rig, excavators, dump trucks, concrete mixing lorries, mobile cranes, diesel water pumps, pneumatic hammers, compressors, vibratory pokers
Erect turbines	117	Cranes, turbine delivery vehicles, articulated lorries for crane movement, generators, torque guns
Reinstate crane bases	116	Excavator, dump truck

Task	Total Sound Power Level, dB L_{WA}	Details of Plant or Equipment
Forestry felling around tracks and turbines	115	Harvesters and forwarders, characterised by saw noise diesel engine noise emissions commonly associated with tractors and excavation noise

9.84 The calculated construction noise levels are compared with absolute noise limits for temporary construction activities which are commonly regarded as providing an acceptable level of protection from the short-term noise levels associated with construction activities, based on guidance from BS 5228-1.

9.85 Separate consideration is also given to the possible noise effects of construction-related traffic passing to and from the site along local surrounding roads. The potential noise levels associated with construction traffic movement on public roads, has been carried out in accordance with the methodology provided by CRTN and BS 5228-1, as described below.

9.86 Road traffic flow data have been provided as part of the traffic and transportation assessment (for further details see **Chapter 14**) for roads used by construction vehicles which represents the Average Weekday Total (AWT) two-way flows for the worst-case period of construction. These roads are the N59, L1206 and the L5252. CRTN provides an accurate method to determine road traffic noise, or a change in road traffic noise, provided there is a minimum flow of traffic. The change in road traffic noise along the majority of the construction route, the N59, has been determined by calculating the Basic Noise Level (BNL) with corrections for heavy vehicles as described in CRTN, for two scenarios: without construction traffic and with construction traffic. This is considered acceptable to provide a reasonable estimate of the likely change in road traffic noise along this road. The two smaller local roads along the construction traffic route, the L1206 and the L5252, do not have enough traffic flow to enable a reliable calculation using the CRTN method. For these roads construction traffic noise impacts have been calculated using the haul route method set out in BS 5228-1 which provides an absolute noise level.

9.87 The Proposed Project will include a 110kV electricity substation, which will be connected to the national grid via the GCR routed eastward under the L1206 and the N59 at Bangor Erris, where it continues east under the N59 to Bellacorick Substation. The proposed plant to be in operation during the laying of underground cables along the GCR to the grid are provided in **Table 9-5**.

Table 9-5: GCR Route Construction Plant Sound Power Levels

Task	Sound Power Level, dB L_{WA}	Sound Power Reference	Details of Plant or Equipment
Dust suppression	104	BS5228-1 Table C.4 Line 90	Road Sweeper
Breaking road surfaces	111	BS5228-1 Table C.1 Line 17	Mini excavator with hydraulic breaker
Rolling and compacting	105	BS5228-1 Table C.5 Line 26	Vibratory roller
Trenching	98	BS5228-1 Table C.5 Line 34	Wheeled excavator
Cutting concrete	115	BS5228-1 Table C.5 Line 36	Hand held circular saw

Task	Sound Power Level, dB L_{WA}	Sound Power Reference	Details of Plant or Equipment
Tipping fill	107	BS5228-1 Table C.2 Line 30	Dump truck tipping fill
Compaction	108	BS5228-1 Table C.2 Line 41	Petrol vibratory plate
Tunnelling	105	BS5228-1 Table C.2 Line 44	Directional drill (generator)

9.88 The construction associated with the burying of cables will be transient as works moves along the GCR. Construction noise will be greatest when plant passes closest to the NSR. The shortest distance between construction plant and the NSR has been obtained using GIS by obtaining the minimum distance between the GCR and Eircode data. As Eircode datapoints are located centrally to the building they are referencing, 5 m was subtracted from the given distances to provide a more realistic minimum distance between construction works and the building's nearest façade. Furthermore, the method described for the calculation and assessment of construction noise in BS 5228 is based on the daily noise level at the receptor location; therefore, it is important to account for the average distance that plant will be from an NSR during the day. This has been done by assuming over one construction day plant will be located on average 15m from the closest point. The distance used in the calculation was hypotenuse derived from the shortest distance and a point 15m perpendicular. Construction noise associated with the GCR has been calculated using the same method described in **paragraph 9.82**, and assessed in the same way as construction noise generated within the site, as described in **paragraph 9.84**. NSRs within 150m of the GCR have been included and in cases where multiple apartments are located in a single building just one receptor location is used in the assessment.

9.89 In addition to the above construction works, there will be three Over-run Areas along the TDR, as identified in **Figure 2-4b,c,d**. Each of the Over-run Areas will require the construction of a new road or track, with a total sound power of 118 dB L_{WA} assumed for all the required construction plant, as per **Table 9-4**. As each of the Over-run Areas are located outside the Main Wind Farm Development Site, the associated construction noise impact has been calculated at the nearest dwelling in accordance with **paragraph 9.82** and assessed as described in **paragraph 9.84**.

Operational Noise

9.90 The operational noise assessment applies the current 2006 Guidelines and is supplemented by ETSU-R-97 and the IOA GPG as set out below.

9.91 ETSU-R-97 provides a robust basis for assessing impacts of operational noise from wind turbines. Noise limits for wind farm developments are derived from background measurements and fixed values, and wind turbine immission levels are calculated for the NSRs in the assessment. Consequently, the test applied to operational noise is whether or not the calculated wind farm noise immission levels at nearby NSRs lie below the noise limits derived in accordance with ETSU-R-97. The principal method for assessing operational wind turbine noise set out in ETSU-R-97 calculates immission from, and sets noise limits for, all wind turbines in a given area.

9.92 An important component of the calculation of noise immission level is the selection of an appropriate candidate wind turbine. The IOA GPG notes that most sites at the planning stage will not have selected a preferred turbine, therefore a representative candidate turbine should be selected to provide appropriate noise levels. Once noise levels have been

predicted at the potentially affected properties, compliance with noise limits can be assessed and design advice provided if compliance with the limits is considered unlikely.

9.93 Three candidate wind turbine machines have been modelled to determine the likely noise impacts: Vestas V150 6.0 MW, Nordex N163 7.0 MW and Nordex N149 5.7 MW machines. All three turbine models assume their standard configuration, which includes the fitting of trailing edge serrations. All three of these candidate machines have been assessed to provide the likely significant effects from the potential permutations within the turbine parameter range as per the advice received from An Coimisiún Pleanála (ACP) in its response to the Design Flexibility Request (see **Chapter 3** for further details), as discussed further in **paragraph 9.130**. Of these three candidate machines, the worst case, determined by the narrowest margin between the calculated wind farm noise immission levels and the ETSU-R-97 noise limit at nearby NSRs, is the Nordex N163 7.0 MW. This chapter presents the assessment of the Nordex N163 7.0 MW machine, and **Technical Appendix 9-4** provides full details of the assessment of, and the parameters used for the Vestas V150 6.0 MW and the Nordex N149 5.7 MW machines. A hub height of 98.5 m and a machine equipped with trailing edge serrations have been modelled for this assessment. The manufacturer's noise emission data has been provided for standardised wind speeds of 3 m/s to 12 m/s and excludes any margin for uncertainty, and as such an additional 2 dB has been included in the sound power levels in this assessment. **Table 9-6** details the sound power data used, which includes unconstrained (Mode 0) and noise reduced Mode 9 (used in the mitigation section), all values presented include the 2 dB uncertainty.

Table 9-6: Nordex N163 7.0 MW Overall Noise Emission Data

Details	Emission Level, dB L_{WA}, at Standardised Wind Speed									
	3	4	5	6	7	8	9	10	11	12
Mode 0 (unconstrained)	97.8	99.1	103.7	108.1	109.4	109.4	109.4	109.4	109.4	109.4
Mode 9	97.8	99.1	103.4	103.8	103.8	103.8	103.8	103.8	103.8	103.8

9.94 Nordex have also supplied the octave band frequency spectrum equivalent to the maximum sound power level, detailed in **Table 9-7**. The values specified in **Table 9-7** also include 2 dB uncertainty.

Table 9-7: Nordex N163 7.0 MW Octave Band Noise Emission Data

Details	Emission Level, dB L_{WA}, at Octave Band Centre Frequency, Hz								
	63	125	250	500	1000	2000	4000	8000	dB(A)
Mode 0	90.6	98.2	100.3	101.5	103.3	104.0	98.4	84.0	109.4
Mode 9	85.0	92.6	94.7	95.9	97.7	98.4	92.8	78.4	101.8

9.95 The ISO 9613-2:2024 model has been used to calculate the noise immission levels at the NSRs, applying the propagation parameters and assumptions recommended in the IOA GPG. The model accounts for the attenuation owing to geometric spreading, atmospheric absorption, and barrier and ground effects and assumes the following parameters, in accordance with the IOA GPG:

- octave band data which accounts for the sound frequency characteristics of the turbines;
- receiver height of 4 m above local ground;
- mixed ground (G=0.5);

- an air absorption based on a temperature of 10°C and 70 % relative humidity;
- attenuation due to terrain screening has been limited to a maximum of 2 dB(A); and
- in situations of propagation above concave ground, a correction of +3 dB was added.

9.96 The above method is consistent with the recommendations of the IOA GPG. The IOA GPG also allows for directional effects to be taken into account within the noise modelling which can reduce the noise immission level at a receptor. However, predictions have been made assuming downwind propagation from every turbine to every receptor at the same time as a worst case.

9.97 The 2006 Guidelines contain recommended noise limits to control operational noise from wind farms and state:

"In general, a lower fixed limit of 45 dB(A) or a maximum increase of 5 dB(A) above background noise at nearby noise sensitive locations is considered appropriate to provide protection to wind energy development neighbours. However, in very quiet areas, the use of a margin of 5 dB(A) above background noise at nearby noise sensitive properties is not necessary to offer a reasonable degree of protection and may unduly restrict wind energy developments which should be recognised as having wider national and global benefits. Instead, in low noise environments where background noise is less than 30 dB(A), it is recommended that the daytime level of the $L_{A90,10min}$ of the wind energy development noise be limited to an absolute level within the range of 35-40 dB(A).

Separate noise limits should apply for day-time and for night-time. During the night, the protection of external amenity becomes less important and the emphasis should be on preventing sleep disturbance. A fixed limit of 43 dB(A) will protect sleep inside properties during the night."

9.98 Operational noise limits comprise two elements: a lower fixed limit, and a maximum increase above background noise levels, whichever is greater. Separate noise limits apply for the daytime and night-time.

9.99 The daytime background noise level is derived from data measured during the 'quiet periods of the day' defined in ETSU-R-97: these comprise weekday evenings (18:00 to 23:00), Saturday afternoons and evenings (13:00 to 23:00) and all day and evening on Sundays (07:00 to 23:00). The night-time background noise level is derived from data measured during the night time periods (23:00 to 07:00) with no differentiation being made between weekdays and weekends. As noted in **paragraph 9.79** the UTC time reference was used to synchronise all data; therefore, 1 hour was added to all data to present in local, Irish Standard Time, when organising into the above quiet periods of the day and night-time.

9.100 The prevailing background curve is derived from noise data, using the $L_{A90,\ 10min}$ parameter, measured at a representative location of a receptor and wind data measured at a location that is representative of the proposed wind turbines. Data measured during the ETSU-R-97 'quiet periods of the day' inform the daytime prevailing background curve.

9.101 Data displaying evidence of being influenced by extraneous sources such as boiler flues, localised plant or watercourses were excluded. Periods of rainfall, including 30 minutes after the rain was recorded to have stopped were also excluded. This period is representative of the extent of which rainfall was noted to influence background noise levels measured in the area.

9.102 During the daytime and in low noise environments, where the background noise levels are less than 30 dB L_{A90}, the 2006 Guidelines recommend a value of between 35 dB L_{A90} and 40 dB L_{A90} for the lower fixed element of the daytime noise limit. Where the prevailing background noise levels exceed 30 dB L_{A90} during the daytime, it is appropriate to set the fixed portion of the limit to 45 dB L_{A90}.

9.103 It is proposed that a value of 40 dB L_{A90} is set for the fixed element of the daytime noise limit for wind speeds where the background noise is less than 30 dB L_{A90}. This is considered appropriate in light of the 2006 Wind Energy Development Guidelines for Planning Authorities, which states that "*An appropriate balance must be achieved between power generation and noise impact.*" Given the potential energy generation of the Proposed Project, a value for the fixed limit at the upper end of the available range is considered appropriate.

9.104 In summary, the operational noise limits proposed for the Proposed Project are:

- 40 dB L_{A90} for daytime windspeeds where the typical background noise is less than 30 dB L_{A90};
- 45 dB L_{A90} for daytime windspeeds where the typical background noise is greater than 30 dB L_{A90} or a maximum increase of 5 dB(A) above background noise (whichever is the higher); and
- 43 dB L_{A90} for night-time periods or a maximum increase of 5 dB(A) above background noise (whichever is the higher).

9.105 This set of criteria has been chosen as it is in line with the 2006 Guidelines and best practice, and is comparable to noise planning conditions applied to similar sites previously granted planning permission by An Coimisiún Pleanála.

9.106 In addition to operational noise from the turbines, noise from the operation of the substation and BESS has been assessed. The main noise source associated with the substation is likely to be the power transformer and its cooling fan. The transformer noise is generally fairly constant, once energised, whereas the cooling fans operate as needed, depending on load and ambient temperature. The noise from the transformer is usually tonal in nature with most energy contained within discrete frequency components at 100 Hz and harmonics thereof. The cooling fan noise is likely to be broadband in nature but may switch on and off. BESS infrastructure also includes a range of electrical plant, such as inverters and transformers, as well as temperature control equipment but are less likely overall to have a noise which includes tones at low frequencies.

9.107 The proposed substation and BESS (approximate central location at ITM 476516, 823460) is located over 1 km from the nearest NSR, NSR16. Noise will be produced by the transformer located within the substation. Calculations have been carried out for the proposed substation transformer using a sound power level of 85 dB(A).

9.108 The BESS facility is currently designed to include 120 battery containers with cooling elements along with a single inverter, and 15 mid voltage stations containing auxiliary transformers and smart control cabinet. These items of plant typically represent the main sources of noise for such installations. Sungrow has supplied test data[1] for the ST5015UX-4H-LN battery storage unit with cooling and inverter. Measured data for the battery storage unit with a fan speed of 100% and ambient temperature of 25°C results in a sound power

[1] Test report ST5015UX-4H-LN&ST5015UX-4H-US-LN Version 2

level of 79.5 dB(A) L_{WA}. Sungrow has supplied test data[2] for the mid voltage stations with a total sound power level of 79.3 dB(A) L_{WA}. Both of the Sungrow test reports specify an expanded uncertainty of σ = 2.4 dB, which has been added to the specified sound power levels. **Table 9-8** summarises the sound power data for the substation and BESS components, the values include all relevant uncertainties.

Table 9-8: Substation and BESS Plant Octave Band Noise Emission Data

Details	Emission Level, dB L_{WA}, at Octave Band Centre Frequency, Hz								
	63	125	250	500	1000	2000	4000	8000	dB(A)
Substation transformer	79.0	81.3	76.4	76.3	70.6	65.6	60.5	53.2	85.0
Battery storage unit	58.2	68.4	71.7	75.1	77.2	75.5	70.7	60.9	81.9
BESS mid voltage station	61.3	72.4	74.9	75.7	74.8	73.9	67.7	56.3	81.7

9.109 The operational noise from the substation and BESS has been predicted at the NSRs following the methodology set out in ISO 9613-2. The substation and BESS operational noise level predictions have been undertaken assuming source and receiver heights of 1.5 metres above local ground level, hard ground near to the substation and BESS (G=0), mixed soft and hard ground elsewhere (G=0.5) and an air absorption based on a temperature of 10°C and 70 % relative humidity. No allowance has been included for directivity. Barrier effects provided by ground and intervening buildings have been modelled in accordance with ISO 9613-2. New buildings associated with the substation and BESS are assumed to be 4m high and all other buildings (existing dwellings and agricultural or industrial buildings) are all assumed to be 6m high. All buildings have been assumed to be acoustically reflective with 80% of sound reflected back.

9.110 The calculated total noise from the substation and BESS is then compared to the impact magnitude criteria discussed further in **paragraph 9.117**.

Sensitivity of Receptor

9.111 All of the relevant NSRs within the assessment area are dwellings, which are of high sensitivity. This applies to construction, operational and decommissioning noise. It is noted that there are more distant NSRs that include a church and health centre, which have medium sensitivity. In such situations, a worst case scenario has been assessed at the closer, more sensitive, receptors, and not at the more distant and less sensitive receptors.

Magnitude of Impact

9.112 There is no statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. In the absence of specific noise limits, appropriate emission criteria relating to permissible construction noise levels for a development of this scale may be found in the BS 5228-1 Annex E.

9.113 The criteria do not represent mandatory limits but rather a set of example approaches intended to reflect the type of methods commonly applied to construction noise. In broad terms, the example criteria are based on a set of fixed limit values which, if exceeded, may result in a significant effect unless ambient noise levels are sufficiently high to provide a degree of masking of construction noise.

[2] Test report MVS5140-LS&MVS5140-LSUS Version 1

9.114 Based on the range of guidance values set out in BS 5228 Annex E, the following impact assessment scale has been derived. The values have been chosen in recognition of the relatively low ambient noise observed during the baseline survey carried out between 19 May 2023 and 16 June 2023 in the area around the Proposed Project. The presented criteria have been normalised to free-field day time noise levels occurring over a time period, T, equal to the duration of a working day on site. BS 5228 1 Annex E provides varied definitions for the range of day time working hours which can be grouped for equal consideration. The values presented in **Table 9-9** have been chosen to relate to day time hours from 07:00 to 19:00 on weekdays, and 07:00 to 13:00 on Saturdays.

Table 9-9: Magnitude of Impact for Construction Noise

Magnitude	Noise Level, dB $L_{Aeq, T}$		Description
	4 weeks or more	Up to 4 weeks	
High	> 75	> 85	Trigger level for noise insulation works, or costs thereof, as set out in E.4 of BS 5228-1.
Medium	> 65 and ≤ 75	> 75 and ≤ 85	Most stringent threshold values for potential significant effects given in Annex E of BS 5228-1 relevant to Proposed Project is exceeded.
Low	> 55 and ≤ 65	> 65 and ≤ 75	Noise is likely to be audible, but unlikely to change behaviour. BS 5228-1 thresholds not exceeded.
Negligible	≤ 55	≤ 65	At least 10 dB below the most stringent criteria provided in of BS 5228-1.

9.115 It should be noted that the parameter used to describe noise from construction activities is the L_{Aeq}, which is the equivalent continuous sound pressure level of a fluctuating noise over a given period.

9.116 When considering the impact of short-term changes in traffic noise associated with the construction activities on existing roads in the vicinity of the Proposed Project, there are no specific Irish guidelines or limits. In the absence of such Irish guidance, current best practice is to make reference to Highways England (now National Highways) criteria set out in the Design Manual for Roads and Bridges (DMRB) LA111, as summarised in **Table 9-10**. This applies where the change in noise level is calculated using the CRTN methodology to compare Heavy Goods Vehicles (HGV) corrected BNL with and without construction traffic, as described in **paragraph 9.86**. Where insufficient traffic flow is present on local roads to enable a reliable calculation using the CRTN method, the absolute level of traffic noise has been calculated using the haul road calculation method set out in BS 5228-1. The absolute level of traffic noise is then compared to the impact magnitude set out in **Table 9-9**.

Table 9-10: Magnitude of Impact for Construction Traffic Noise

Magnitude	Description
High	Change in HGV corrected BNL of 5 dB or greater
Medium	Change in HGV corrected BNL of at least 3 dB and less than 5 dB
Low	Change in HGV corrected BNL of at least 1 dB and less than 3 dB
Negligible	Change in HGV corrected BNL of less than 1 dB

9.117 Noise from the operation of the substation and BESS has been assessed against criteria which comply with the WHO guidance documents. WHO Community Noise Guidelines provides a value of 45 dB $L_{Aeq, 8hour}$ outside an open bedroom window at night to be a level which should not be exceeded so that people may sleep with windows open. WHO Night Noise Guidelines set out, in its Table 3, a correlation of observed health effect with average night noise level over a year. It is noted that an external noise level of up to 30 dB L_{night} will have no substantial effect and is equivalent to the no observed effect level (NOEL). A level of 40 dB L_{night} outside an open bedroom window is noted to be the lowest observed adverse effect level (LOAEL). Adverse effects are noted to occur when the external noise levels are in the range of 40 dB to 55 dB L_{night} and when the level exceeds 55 dB L_{night} a sizable proportion of the population are said to be highly annoyed, suffer from sleep disturbance and adverse health effects. The L_{night} noise parameter used in the WHO Night Noise Guidelines is an annualised average noise level which differs from the L_{Aeq} parameter used in the WHO Community Noise Guidelines and this assessment, and are generally taken as broadband in nature. The noise generated by the substation and BESS has the potential to include identifiable characteristics, such as tonal elements. For this reason, the WHO noise levels have been reduced by 5 dB to account for any potential acoustic characteristics.

9.118 **Table 9-11** sets out the magnitude of criteria for operational noise impacts from the substation and BESS, based on the above considerations.

Table 9-11: Magnitude of Impact for Substation and BESS Operational Noise

Magnitude	Description
High	Substation and BESS noise exceeds 50 dB L_{Aeq}
Medium	Substation and BESS noise greater than 40 dB L_{Aeq} and not exceeding 50 dB L_{Aeq}
Low	Substation and BESS noise greater than 35 dB L_{Aeq} and not exceeding 40 dB L_{Aeq}
Negligible	Substation and BESS noise does not exceed 35 dB L_{Aeq}

Significance Criteria

9.119 The EIAR guidelines (EPA, 2022) provide criteria for determining the significance of environmental impacts and the effects in broad terms for all assessment topics. The EIAR guidelines (EPA, 2022) recognise that professional judgment, relevant guidance and standards play an important role in the determination of significance, and as such do not quantify the impacts in decibel terms.

9.120 The predicted significance of the effect was determined through a standard method of assessment based on professional judgement, considering both sensitivity and magnitude of change as discussed above. As set out in **paragraph 9.111**, all NSRs have an equal sensitivity of 'high'. **Table 9-12** details the significance of effect an impact of varying magnitude will have upon a receptor with high sensitivity. Major and moderate effects are considered significant in the context of the EIA Regulations.

Table 9-12: Significance Criteria

Magnitude of Impact	Significance of Effect (High Sensitivity)
High	Major
Medium	Moderate
Low	Minor
Negligible	Negligible

9.121 The assessment of the significance of effects from operational wind turbine noise is made as follows, with reference to ETSU-R-97 and 2006 Guidelines:

- not significant if the noise limits derived according to the 2006 Guidelines (and summarised in **paragraph 9.102** to **paragraph 9.105**) are not exceeded; or
- significant if the noise limits derived according to the 2006 Guidelines are exceeded.

Potential Cumulative Effects

9.122 As set out in **paragraph** 9.12, cumulative noise impacts from the construction phase are scoped out due to the large separation distances between the Main Wind Farm Development Site and the nearest cumulative development.

9.123 Operational cumulative effects from wind turbines are limited to other wind energy developments predicted at any given NSR to be within 10 dB of the Main Wind Farm Development Site, and the predicted cumulative wind farm noise level is greater than 35 dB $L_{A90,10min}$, as detailed in **paragraph 9.67**. No other wind energy developments have been identified that satisfy these criteria; therefore, a cumulative operational wind turbine noise assessment is not required.

9.124 Other, non-wind energy developments, that are currently in the planning system and, as such, are to be considered within the cumulative operational noise impact assessment, as listed in **Table 2-5** of **Chapter 2** of the EIAR, are situated over 5 km from the Main Wind Farm Development Site. At such distances these developments will not contribute cumulatively to the noise impacts assessed in this chapter.

9.125 As per noise from the other phases of the Proposed Project, cumulative noise from the decommissioning phase is scoped out due to the large separation distances between the Main Wind Farm Development Site and the nearest cumulative development.

Approach to Mitigation

9.126 If noise limits have been identified to be exceeded either during construction, operation or decommissioning, appropriate mitigation is specified to minimise any potential impacts.

Identification of Residual Significant Effects

9.127 Where mitigation has been applied, the residual impacts are assessed against the significance criteria discussed above to determine any residual significant effects.

Assumptions, Limitations and Confidence

9.128 No significant information gaps were identified, and the assessment was undertaken in line with relevant standards and policy documents, as set out in **paragraph 9.41** to **paragraph 9.62**.

9.129 For construction noise, predicted noise levels are based on assuming standard machinery and equipment are used and that these are operated in the way intended by their manufacturers. It is also assumed, on a precautionary basis, that these items of equipment are all used at the closest point of the proposed works area to each of the receptor locations. These are considered to be precautionary assumptions, with noise levels lower than predicted for much of the construction period.

9.130 For operational noise, the exact model of turbine to be used at the site will be the result of a future tendering process and therefore, an indicative turbine model (Nordex N163 7.0 MW) has been assumed for a worst case operational noise assessment with an additional two turbines (Vestas V150 6.0 MW and Nordex N149 5.7 MW) also fully assessed to provide the likely significant effects from the potential permutations within the turbine parameter range as per the Design Flexibility response received from ACP. The turbine model assumed is considered representative of the range of noise emissions for turbines which may be installed at the site. Noise emission for the wind turbine was considered on a robust basis by the addition of 2 dB uncertainty to the warranted values specified by the manufacturer.

9.131 For the operational substation and BESS, although the equipment selection and installation arrangements are not finalised, the assessment is based upon the number and scale of electrical plant that is required to supply the specified capacity. The assessment includes 120 Sungrow ST5015UX-4H-LN battery storage units operating at 100% capacity, together with 15 Sungrow mid voltage stations. The sound power data was modelled on a robust basis by the addition of 2.4 dB expanded uncertainty to the specified data.

9.132 The road traffic noise model used in this assessment is dependent upon the predicted future traffic data, which will have inherent uncertainties associated with them, details of which are set out in **Chapter 14**.

Baseline Conditions

Current Baseline

9.133 **Technical Appendix 9-3** provides details of the background noise survey locations and the noise climates experienced therein. The noise climate at all survey locations can be described as fairly typical for rural amenity influenced by wind disturbed vegetation, distant road traffic, and natural noises such as birds and livestock.

9.134 The measured background noise data, standardised wind speed data and rain data for identical periods have been collated and reviewed for atypical relationships between noise level and wind speed, periods of rain fall and any extraneous data. Where these traits have been identified these data has been excluded from the analysis. In the case of rainfall, its effects on noise can be detected both during (as it hits vegetation), and immediately after it stops, and in some cases for a short while after it has stopped (as streams and burns swell to carry run-off rainwater). Periods of rain plus the following 30-minute periods have been excluded. Full details of excluded periods can be found in **Technical Appendix 9-3**.

9.135 Best fit lines were generated through the remaining data using a polynomial fit of a maximum of 4th order, so as to best represent the typical values. These lines form the

prevailing background noise level curve for each measurement location, as set out in **Table 9-13** and **Technical Appendix 9-5** provides this information graphically.

9.136 If the prevailing background noise is shown to be higher at lower wind speeds, the lowest derived background noise level has been applied for all wind speeds below the minimum value, in accordance with the IOA GPG. Furthermore, the derived prevailing background noise polynomial curve was not extended beyond the range covered by adequate data points. Where a noise limit is required at higher wind speeds it was restricted to the highest derived point, as indicated by an * in **Table 9-13**.

Table 9-13: Prevailing Background Noise Levels

NML ID	Period	Prevailing Background Noise Level, dB L_{A90}, at Standardised Wind Speed, m/s								
		4	5	6	7	8	9	10	11	12
NML1	Quiet daytime	23.7	26.1	28.9	32.0	35.4	39.1	43.2	43.2*	43.2*
	Night-time	20.4	22.1	24.7	28.0	32.1	37.1	37.1*	37.1*	37.1*
NML2	Quiet daytime	27.1	32.7	38.9	44.5	49.2	52.2	53.5	53.5*	53.5*
	Night-time	21.8	27.3	33.7	40.3	46.5	51.7	51.7*	51.7*	51.7*
NML3	Quiet daytime	28.3	32.1	36.2	40.1	43.3	45.3	45.6	45.6*	45.6*
	Night-time	18.9	21.9	25.8	30.8	36.5	43.0	43.0*	43.0*	43.0*
NML4	Quiet daytime	28.8	29.7	30.6	31.5	32.4	33.3	34.2	34.2*	34.2*
	Night-time	20.7	21.2	21.8	22.7	23.6	24.7	24.7*	24.7*	24.7*
NML5	Quiet daytime	27.1	28.4	29.5	30.6	31.8	33.2	34.9	34.9*	34.9*
	Night-time	19.8	20.5	21.5	23.0	24.9	27.2	27.2*	27.2*	27.2*
NML6	Quiet daytime	27.8	28.8	29.7	30.6	31.5	32.4	33.3	33.3*	33.3*
	Night-time	20.6	21.1	21.5	21.9	22.4	22.8	22.8*	22.8*	22.8*
NML7	Quiet daytime	30.0	31.4	32.3	32.8	33.3	33.8	34.6	34.6*	34.6*
	Night-time	21.4	22.2	23.2	24.3	25.6	27.1	27.1*	27.1*	27.1*

9.137 The prevailing background noise levels have been used to inform the overall noise limits used in the assessment of the Proposed Project at the NSRs, as summarised in **paragraph 9.102** to **paragraph 9.105**. In accordance with **paragraph 9.74**, background noise data is assigned to each assessment location to provide a noise limit for the NSRs, which have been summarised in **Table 9-14**. All windspeeds are standardised values.

Table 9-14: Operational Wind Turbine Noise Limits

NSR ID	Period	Derived Noise Limit, dB L_{A90}, at Standardised Wind Speed, m/s								
		4	5	6	7	8	9	10	11	12
NSR01	Daytime	40.0	40.0	40.0	45.0	45.0	45.0	48.2	48.2	48.2
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
NSR02	Daytime	40.0	40.0	40.0	45.0	45.0	45.0	48.2	48.2	48.2
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
NSR03	Daytime	40.0	45.0	45.0	49.5	54.2	57.2	58.5	58.5	58.5

NSR ID	Period	Derived Noise Limit, dB L_{A90}, at Standardised Wind Speed, m/s								
		4	5	6	7	8	9	10	11	12
	Night-time	43.0	43.0	43.0	45.3	51.5	56.7	56.7	56.7	56.7
NSR04	Daytime	40.0	45.0	45.0	49.5	54.2	57.2	58.5	58.5	58.5
	Night-time	43.0	43.0	43.0	45.3	51.5	56.7	56.7	56.7	56.7
NSR05	Daytime	40.0	45.0	45.0	49.5	54.2	57.2	58.5	58.5	58.5
	Night-time	43.0	43.0	43.0	45.3	51.5	56.7	56.7	56.7	56.7
NSR06	Daytime	40.0	45.0	45.0	45.1	48.3	50.3	50.7	50.7	50.7
	Night-time	43.0	43.0	43.0	43.0	43.0	48.0	48.0	48.0	48.0
NSR07	Daytime	40.0	45.0	45.0	45.1	48.3	50.3	50.7	50.7	50.7
	Night-time	43.0	43.0	43.0	43.0	43.0	48.0	48.0	48.0	48.0
NSR08	Daytime	40.0	45.0	45.0	45.1	48.3	50.3	50.7	50.7	50.7
	Night-time	43.0	43.0	43.0	43.0	43.0	48.0	48.0	48.0	48.0
NSR09	Daytime	40.0	45.0	45.0	45.1	48.3	50.3	50.7	50.7	50.7
	Night-time	43.0	43.0	43.0	43.0	43.0	48.0	48.0	48.0	48.0
NSR10	Daytime	40.0	45.0	45.0	45.1	48.3	50.3	50.7	50.7	50.7
	Night-time	43.0	43.0	43.0	43.0	43.0	48.0	48.0	48.0	48.0
NSR11	Daytime	40.0	40.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
NSR12	Daytime	40.0	40.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
NSR13	Daytime	40.0	40.0	40.0	45.0	45.0	45.0	45.0	45.0	45.0
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
NSR14	Daytime	40.0	40.0	40.0	45.0	45.0	45.0	45.0	45.0	45.0
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
NSR15	Daytime	40.0	40.0	40.0	45.0	45.0	45.0	45.0	45.0	45.0
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
NSR16	Daytime	40.0	40.0	40.0	45.0	45.0	45.0	45.0	45.0	45.0
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
NSR17	Daytime	40.0	40.0	40.0	45.0	45.0	45.0	45.0	45.0	45.0
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
NSR18	Daytime	40.0	40.0	40.0	45.0	45.0	45.0	45.0	45.0	45.0
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
NSR19	Daytime	40.0	40.0	40.0	45.0	45.0	45.0	45.0	45.0	45.0
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
NSR20	Daytime	40.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0

Cumulative Situation

9.138 As per **paragraph 9.122** to **paragraph 9.125**, there are no potential cumulative noise impacts.

Future Baseline

9.139 In the absence of the Proposed Project, the existing baseline noise climate is not expected to perceptibly change in level or nature. The existing noise environment is noted in **paragraph 9.133** to be typical of that for rural locations with no one noise source dominating. Natural changes to the wider environment that occur over time will not affect the baseline noise environment. Changes to the number of vehicles using local roads through normal annual adjustments is not expected to alter the baseline noise environment as the total traffic flow will have to be doubled or halved before the contribution from this source may begin to be perceived.

Assessment of Effects

Assumptions of the Assessment – Proposed Project

9.140 **Paragraph 9.129** to **paragraph 9.132** provides further information regarding the assumptions made for the construction and operational noise impact assessments.

9.141 The potential impacts that could arise from the Proposed Project during the construction, and decommissioning phases relate to increases in noise due to construction and decommissioning activities. Construction noise calculations assume a worst case that all equipment are located at the closest point of the proposed works area to each of the receptor locations. The calculations assume a receiver height of 4 m and due to the relatively flat ground does not account for any screening that may be provided by intervening buildings or topography. This results in a higher calculated construction noise level when compared to a case when the receiver height is closer to the ground and screening is included.

9.142 For wind turbine operational noise calculations, the turbine model assumed is considered representative of the range of noise emissions for turbines which may be installed at the site. Furthermore, a +2 dB correction has been applied to the manufacture supplied wind turbine noise emission data to account for uncertainty. The ISO 9613-2 modelling parameter assumptions are set out in **paragraph 9.95**, which accord to good practice as set out in the IOA GPG. These parameters are the industry standard used to present a precautionary prediction of wind turbine noise under downwind propagation conditions. The IOA GPG permits the consideration of directional effects to be taken into account within the noise modelling: under upwind propagation conditions between a given receiver and the wind farm, the noise immission level at that receiver can be as much as 10 dB(A) to 15 dB(A) lower than the level predicted using the ISO 9613-2 model. However, predictions have been made assuming downwind propagation from every turbine to every receptor at the same time as a worst case.

9.143 There will be no change to the potential construction, operational and decommissioning impacts or predicted effects irrespective of which turbine is selected within the Turbine Range. The potential impacts that could arise from the Proposed Project during the operational phase relate to increases in noise caused by the operational wind turbines. The hub height range is the only element of the turbine dimensions within the Turbine Range that influences the operational noise impact assessment as it will slightly alter the distance between the noise source (wind turbine) and the NSR and potentially alter the level of screening (noise reduction) provided by the interim topography. The noise assessment has

considered predicted noise levels for hub height 98.5 m for the Nordex N163 and 105 m for the Vestas V150. It is important to emphasis in this context that the overall tip height and rotor diameter of the turbine do not influence the noise emissions of any turbine selected. Far beyond a change in hub height, the noise emission produced by different make and models of turbines has a much greater influence on the operational wind turbine noise level at an NSR. This assessment considers three different wind turbine models with unconstrained emission levels ranging from 106.9 dB for the Vestas V150 machine to 109.4 dB for the Nordex N163 machine.

9.144 A proposed mitigation scheme to control the operational modes of the turbines to ensure limits are not exceeded is described later in **Mitigation**. This will ensure the operational wind farm noise levels will meet the daytime and night-time limit set out in **Table 9-14** irrespective of the turbine selected within the Turbine Range.

9.145 For the operational substation and BESS noise, the final equipment selection and installation arrangements are not yet finalised; however they are unlikely to alter the impacts reported given the large separation distances between the substation / BESS and NSRs.

Construction Effects (including Cumulative Effects)

9.146 The level of construction noise that occurs at the NSRs will be highly dependent on a number of factors such as the final site programme, equipment types used for each process, and the operating conditions that prevail during construction. It is not practically feasible to specify each and every element of the factors that may affect noise levels, therefore it is necessary to make reasonable allowance for the level of noise emissions that may be associated with key phases of the construction. Whilst the proposed turbine model installed on site will be subject to a future procurement process, the level of construction noise will not differ with alternative machines as the same construction techniques and plant will be used in the same locations. Therefore, the construction noise assessment remains valid for all turbine types considered.

Embedded Measures

9.147 To reduce the potential impacts of construction noise, the following good practice measures will be implemented and are included in the Construction Environmental Management Plan (CEMP):

- Those activities that may give rise to audible noise at the surrounding properties and heavy goods vehicle deliveries to the site will be limited to the hours 07:00 to 19:00 Monday to Friday and 07:00 to 13:00 on Saturdays. Turbine deliveries will only take place outside these times with the prior consent of the local council and An Garda Síochána.
- All construction activities will adhere to good practice as set out in BS 5228-1.
- All equipment will be maintained in good working order and any associated noise attenuation such as engine casing and exhaust silencers shall remain fitted at all times.
- Where flexibility exists, activities will be separated from residential neighbours by the maximum practicable distances.
- A site management regime will be developed to control the movement of vehicles to and from the Main Wind Farm Development Site.
- Construction plant capable of generating significant noise and vibration levels will be operated in a manner to restrict the duration of the higher magnitude levels.

9.148 A CEMP is provided in **Technical Appendix 2-1**.

Potentially Significant Effects – Proposed Project

9.149 **Table 9-4** lists the key construction activities, the associated types of plant involved and the expected total sound power level over a working day for each activity. The predicted construction noise levels at the NSR which will be closest to that activity for a portion of construction are presented in **Table 9-15**. It must be emphasised that these predictions only relate the noise level occurring during the time when the activity is closest to the referenced NSR. In many cases such as access track construction and turbine erection, the separation distances will be considerably greater for the majority of the construction period and the predictions are therefore the worst-case periods of the construction phase.

Table 9-15: Predicted Construction Noise Levels

Task	Nearest NSR	Minimum distance, m	Predicted noise level at nearest NSR, dB L_{Aeq}
Construct temporary site compound	NSR15	800	49
Construct site tracks	NSR13	650	51
Pile substation / BESS foundations	NSR16	1,050	49
Construct substation / BESS	NSR16	1,050	40
Construct crane hard standings	NSR03	690	53
Construct turbine foundations	NSR03	730	53
Erect turbines	NSR03	730	49
Reinstate crane bases	NSR03	690	48
Forestry felling around tracks and turbines	NSR03	650	48

9.150 Comparing the above predicted construction noise levels to the range of background noise levels measured around the site suggests that the noisier construction activities will be audible at various times throughout the construction phase. However, comparing the levels to the impact magnitudes presented in **Table 9-9** indicates that the construction noise generated will be of negligible magnitude. A negligible magnitude of impact upon a high sensitive receptor equates to a **negligible significant effect**, which is **not significant** in EIA terms.

9.151 In addition to on-site activities, construction traffic passing to and from the site will also represent a potential source of noise to surrounding properties. Traffic flow data, as reported in **Chapter 14**, has been used to confirm the likely type and number of vehicles using the nearby roads for cases with and without construction traffic, as summarised in **Table 9-16**. This table also shows the BNL, where there is sufficient flow on the road to calculate it using CRTN.

Table 9-16: Changes in Road Traffic Noise Due to Construction Vehicles

Link	Without construction traffic			With construction traffic			Change in BNL, dB
	Total Traffic	% HGV	BNL, dB	Total Traffic	% HGV	BNL, dB	
N59	2731	15	68.0	2918	19	68.8	0.9
L1206	939	1	n/a	1206	19	61.0	n/a
L5252	61	16	n/a	328	71	n/a	n/a

9.152 An increase of 0.9 dB in road traffic noise is predicted during the busiest months for the number of construction vehicles along the N59, which represents the majority of the construction traffic route. This will have a negligible impact (**Table 9-10**) upon dwellings situated along this road (high sensitivity receptors), which equates to a **negligible significant effect**, which is **not significant** in EIA terms. For dwellings situated along the L1206 and L5252, an absolute level of construction traffic noise has been calculated to be 60 dB, which equates to a low impact (**Table 9-9**). A low impact upon a high sensitivity receptor results in a **minor significant effect**, which is **not significant** in EIA terms.

9.153 The predicted noise levels for the key construction activities associated with the GCR are presented in **Appendix 9-6**. **Table 9-17** summarises the number of NSRs that will be exposed to daily construction noise levels based on the impact magnitudes set out in **Table 9-9**.

Table 9-17: Predicted GCR Construction Noise Levels

Task	Sound power level, dB L_{WA}	On time % of day	Number of NSRs exposed to daily construction noise level, dB L_{Aeq}			
			≤ 65	> 65 and ≤ 75	> 75 and ≤ 85	> 85
Dust suppression	104	10	215	0	0	0
Breaking road surfaces	111	25	128	87	0	0
Rolling and compacting	105	50	157	58	0	0
Trenching	98	50	215	0	0	0
Cutting concrete	115	10	140	75	0	0
Tipping fill	107	10	208	7	0	0
Compaction	108	10	190	25	0	0
Tunnelling	105	25	215	0	0	0

9.154 The nature of the construction work associated with the burying of cables under the existing roads will be comparable to other roadwork activity and will quickly diminish as work progresses along the road. The highest daily noise levels from the construction of the GCR occur during the breaking of the road surface and a total of 87 NSRs will be exposed to a low magnitude of impact (**Table 9-9**), which upon high sensitivity receptors equates to a **minor significant effect**, which is **not significant** in EIA terms.

9.155 The noise impacts associated with the construction of the Over-run Areas are presented in **Table 9-18**. The table shows the highest level of noise that may only occur for short periods of time at the nearest dwelling to the corresponding area. As work progresses away from the dwelling construction noise will reduce. Also shown in the table are the number of dwellings with the potential to be exposed to construction noise of 65 dB L_{Aeq} and 75 dB L_{Aeq} when work passes closest to their location.

Table 9-18: Over-run Area Construction Noise Impacts

Over-run Area	Nearest Dwelling		№ of dwellings exposed to construction noise 65 - 75 dB L_{Aeq}	№ of dwellings exposed to construction noise > 75 dB L_{Aeq}
	Eircode	Max construction noise, dB L_{Aeq}		
1	F26 H6D6	82	2	1
2	F26 Y409	49	0	0
3	F26 R9C6	66	1	0

9.156 One dwelling is predicted to be exposed to construction noise above 75 dB L_{Aeq}, which is only 25 m from Over-run Area 1, at a maximum level of 82 dB L_{Aeq}. As work progresses to a distance of 52 m away the level of construction noise will reduce to 75 dB L_{Aeq}. As this distance increases to 150 m, construction noise will be below 65 dB L_{Aeq}. This has the potential to result in a medium magnitude of impact at this one dwelling as the duration for high noise levels will be less than four weeks (see **Table 9-9**). Noise impacts at all other dwellings for all three Over-run Areas is calculated to be less than a maximum of 75 dB L_{Aeq}, when works are at their closest and will quickly diminish as works progress further away. These impacts will be of low magnitude as exposure to the higher levels will be less than four weeks. A medium magnitude of impact upon a highly sensitive receptor results in a **moderate significant effect**, which is significant in EIA terms.

Potentially Significant Effects – Cumulative

9.157 As per **paragraph 9.122**, there are no potential cumulative noise impacts.

Operational Effects (including Cumulative Effects)

Embedded Measures

9.158 As set out in **paragraph 9.130**, the exact model of turbine to be used at the site is not known at this stage of the Proposed Project. The model selected will be chosen on a number of factors, including noise. The installed turbine and its operational modes will be selected to ensure that the noise limits are not exceeded during operation. This assessment presents the noise impacts with all wind turbines operating in Mode 0, unconstrained.

Potentially Significant Effects – Proposed Project

9.159 The assessment of operational wind turbine noise for each NSR is shown in **Table 9-19** and **Graph 9-17** to **Graph 9-36** (**Technical Appendix 9-5**). A negative exceedance indicates that the turbine immission level is below the appropriate limit. The predictions assume downwind propagation which represents a worst-case as noise immission levels will be the highest in this scenario. In practice, NSRs will not be downwind of all turbines at any one time and the actual noise levels will be lower than those presented in **Table 9-19**.

9.160 All wind farm noise immission levels in this report are presented in terms of the $L_{A90,T}$ noise indicator in accordance with the recommendations of the IOA GPG, obtained by subtracting 2 dB(A) from the calculated $L_{Aeq,T}$ noise levels based on the turbine sound power levels presented in **Table 9-6**.

Table 9-19: Assessment of Predicted Wind Farm Noise Immission Levels (unconstrained)

NSR ID	Description	Standardised wind speed, m/s. Noise level dB L_{A90}						
		4	5	6	7	8	9	≥10
NSR01	Wind turbine immission	19.6	24.2	28.6	29.9	29.9	29.9	29.9
	Daytime limit	40.0	40.0	40.0	45.0	45.0	45.0	48.2
	Daytime exceedance	**-20.4**	**-15.8**	**-11.4**	**-15.1**	**-15.1**	**-15.1**	**-18.3**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time exceedance	**-23.4**	**-18.8**	**-14.4**	**-13.1**	**-13.1**	**-13.1**	**-13.1**
NSR02	Wind turbine immission	28.2	32.8	37.2	38.5	38.5	38.5	38.5
	Daytime limit	40.0	40.0	40.0	45.0	45.0	45.0	48.2
	Daytime exceedance	**-11.8**	**-7.2**	**-2.8**	**-6.5**	**-6.5**	**-6.5**	**-9.7**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time exceedance	**-14.8**	**-10.2**	**-5.8**	**-4.5**	**-4.5**	**-4.5**	**-4.5**
NSR03	Wind turbine immission	32.2	36.8	41.2	42.5	42.5	42.5	42.5
	Daytime limit	40.0	45.0	45.0	49.5	54.2	57.2	58.5
	Daytime exceedance	**-7.8**	**-8.2**	**-3.8**	**-7.0**	**-11.7**	**-14.7**	**-16.0**
	Night-time limit	43.0	43.0	43.0	45.3	51.5	56.7	56.7
	Night-time exceedance	**-10.8**	**-6.2**	**-1.8**	**-2.8**	**-9.0**	**-14.2**	**-14.2**
NSR04	Wind turbine immission	29.2	33.8	38.2	39.5	39.5	39.5	39.5
	Daytime limit	40.0	45.0	45.0	49.5	54.2	57.2	58.5
	Daytime exceedance	**-10.8**	**-11.2**	**-6.8**	**-10.0**	**-14.7**	**-17.7**	**-19.0**
	Night-time limit	43.0	43.0	43.0	45.3	51.5	56.7	56.7
	Night-time exceedance	**-13.8**	**-9.2**	**-4.8**	**-5.8**	**-12.0**	**-17.2**	**-17.2**
NSR05	Wind turbine immission	30.7	35.3	39.7	41.0	41.0	41.0	41.0
	Daytime limit	40.0	45.0	45.0	49.5	54.2	57.2	58.5
	Daytime exceedance	**-9.3**	**-9.7**	**-5.3**	**-8.5**	**-13.2**	**-16.2**	**-17.5**
	Night-time limit	43.0	43.0	43.0	45.3	51.5	56.7	56.7
	Night-time exceedance	**-12.3**	**-7.7**	**-3.3**	**-4.3**	**-10.5**	**-15.7**	**-15.7**
NSR06	Wind turbine immission	29.7	34.3	38.7	40.0	40.0	40.0	40.0
	Daytime limit	40.0	45.0	45.0	45.1	48.3	50.3	50.7
	Daytime exceedance	**-10.3**	**-10.7**	**-6.3**	**-5.1**	**-8.3**	**-10.3**	**-10.7**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	48.0	48.0
	Night-time exceedance	**-13.3**	**-8.7**	**-4.3**	**-3.0**	**-3.0**	**-8.0**	**-8.0**

NSR ID	Description	Standardised wind speed, m/s. Noise level dB L_{A90}						
		4	5	6	7	8	9	≥10
NSR07	Wind turbine immission	29.9	34.5	38.9	40.2	40.2	40.2	40.2
	Daytime limit	40.0	45.0	45.0	45.1	48.3	50.3	50.7
	Daytime exceedance	**-10.1**	**-10.5**	**-6.1**	**-4.9**	**-8.1**	**-10.1**	**-10.5**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	48.0	48.0
	Night-time exceedance	**-13.1**	**-8.5**	**-4.1**	**-2.8**	**-2.8**	**-7.8**	**-7.8**
NSR08	Wind turbine immission	29.7	34.3	38.7	40.0	40.0	40.0	40.0
	Daytime limit	40.0	45.0	45.0	45.1	48.3	50.3	50.7
	Daytime exceedance	**-10.3**	**-10.7**	**-6.3**	**-5.1**	**-8.3**	**-10.3**	**-10.7**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	48.0	48.0
	Night-time exceedance	**-13.3**	**-8.7**	**-4.3**	**-3.0**	**-3.0**	**-8.0**	**-8.0**
NSR09	Wind turbine immission	26.7	31.3	35.7	37.0	37.0	37.0	37.0
	Daytime limit	40.0	45.0	45.0	45.1	48.3	50.3	50.7
	Daytime exceedance	**-13.3**	**-13.7**	**-9.3**	**-8.1**	**-11.3**	**-13.3**	**-13.7**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	48.0	48.0
	Night-time exceedance	**-16.3**	**-11.7**	**-7.3**	**-6.0**	**-6.0**	**-11.0**	**-11.0**
NSR10	Wind turbine immission	25.3	29.9	34.3	35.6	35.6	35.6	35.6
	Daytime limit	40.0	45.0	45.0	45.1	48.3	50.3	50.7
	Daytime exceedance	**-14.7**	**-15.1**	**-10.7**	**-9.5**	**-12.7**	**-14.7**	**-15.1**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	48.0	48.0
	Night-time exceedance	**-17.7**	**-13.1**	**-8.7**	**-7.4**	**-7.4**	**-12.4**	**-12.4**
NSR11	Wind turbine immission	28.5	33.1	37.5	38.8	38.8	38.8	38.8
	Daytime limit	40.0	40.0	45.0	45.0	45.0	45.0	45.0
	Daytime exceedance	**-11.5**	**-6.9**	**-7.5**	**-6.2**	**-6.2**	**-6.2**	**-6.2**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time exceedance	**-14.5**	**-9.9**	**-5.5**	**-4.2**	**-4.2**	**-4.2**	**-4.2**
NSR12	Wind turbine immission	30.2	34.8	39.2	40.5	40.5	40.5	40.5
	Daytime limit	40.0	40.0	45.0	45.0	45.0	45.0	45.0
	Daytime exceedance	**-9.8**	**-5.2**	**-5.8**	**-4.5**	**-4.5**	**-4.5**	**-4.5**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time exceedance	**-12.8**	**-8.2**	**-3.8**	**-2.5**	**-2.5**	**-2.5**	**-2.5**
NSR13	Wind turbine immission	32.2	36.8	41.2	42.5	42.5	42.5	42.5
	Daytime limit	40.0	40.0	40.0	45.0	45.0	45.0	45.0
	Daytime exceedance	**-7.8**	**-3.2**	**1.2**	**-2.5**	**-2.5**	**-2.5**	**-2.5**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0

NSR ID	Description	Standardised wind speed, m/s. Noise level dB L_{A90}						
		4	5	6	7	8	9	≥10
	Night-time exceedance	**-10.8**	**-6.2**	**-1.8**	**-0.5**	**-0.5**	**-0.5**	**-0.5**
NSR14	Wind turbine immission	31.4	36.0	40.4	41.7	41.7	41.7	41.7
	Daytime limit	40.0	40.0	40.0	45.0	45.0	45.0	45.0
	Daytime exceedance	**-8.6**	**-4.0**	**0.4**	**-3.3**	**-3.3**	**-3.3**	**-3.3**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time exceedance	**-11.6**	**-7.0**	**-2.6**	**-1.3**	**-1.3**	**-1.3**	**-1.3**
NSR15	Wind turbine immission	31.2	35.8	40.2	41.5	41.5	41.5	41.5
	Daytime limit	40.0	40.0	40.0	45.0	45.0	45.0	45.0
	Daytime exceedance	**-8.8**	**-4.2**	**0.2**	**-3.5**	**-3.5**	**-3.5**	**-3.5**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time exceedance	**-11.8**	**-7.2**	**-2.8**	**-1.5**	**-1.5**	**-1.5**	**-1.5**
NSR16	Wind turbine immission	30.2	34.8	39.2	40.5	40.5	40.5	40.5
	Daytime limit	40.0	40.0	40.0	45.0	45.0	45.0	45.0
	Daytime exceedance	**-9.8**	**-5.2**	**-0.8**	**-4.5**	**-4.5**	**-4.5**	**-4.5**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time exceedance	**-12.8**	**-8.2**	**-3.8**	**-2.5**	**-2.5**	**-2.5**	**-2.5**
NSR17	Wind turbine immission	27.1	31.7	36.1	37.4	37.4	37.4	37.4
	Daytime limit	40.0	40.0	40.0	45.0	45.0	45.0	45.0
	Daytime exceedance	**-12.9**	**-8.3**	**-3.9**	**-7.6**	**-7.6**	**-7.6**	**-7.6**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time exceedance	**-15.9**	**-11.3**	**-6.9**	**-5.6**	**-5.6**	**-5.6**	**-5.6**
NSR18	Wind turbine immission	27.0	31.6	36.0	37.3	37.3	37.3	37.3
	Daytime limit	40.0	40.0	40.0	45.0	45.0	45.0	45.0
	Daytime exceedance	**-13.0**	**-8.4**	**-4.0**	**-7.7**	**-7.7**	**-7.7**	**-7.7**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time exceedance	**-16.0**	**-11.4**	**-7.0**	**-5.7**	**-5.7**	**-5.7**	**-5.7**
NSR19	Wind turbine immission	25.7	30.3	34.7	36.0	36.0	36.0	36.0
	Daytime limit	40.0	40.0	40.0	45.0	45.0	45.0	45.0
	Daytime exceedance	**-14.3**	**-9.7**	**-5.3**	**-9.0**	**-9.0**	**-9.0**	**-9.0**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time exceedance	**-17.3**	**-12.7**	**-8.3**	**-7.0**	**-7.0**	**-7.0**	**-7.0**
NSR20	Wind turbine immission	26.2	30.8	35.2	36.5	36.5	36.5	36.5
	Daytime limit	40.0	45.0	45.0	45.0	45.0	45.0	45.0
	Daytime exceedance	**-13.8**	**-14.2**	**-9.8**	**-8.5**	**-8.5**	**-8.5**	**-8.5**

NSR ID	Description	Standardised wind speed, m/s. Noise level dB L_{A90}						
		4	5	6	7	8	9	≥10
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time exceedance	**-16.8**	**-12.2**	**-7.8**	**-6.5**	**-6.5**	**-6.5**	**-6.5**

9.161 The results of the assessment shown in **Table 9-19** indicate that the daytime noise limits derived in accordance with the Wind Energy Guidelines (2006) at 6 m/s for NSR13, NSR14 and NSR15 may be exceeded if all turbines operate in Mode 0, unconstrained (highlighted in yellow). The night-time noise limit derived in accordance with the Wind Energy Guidelines (2006) is not exceeded at any locations under all wind speeds. As the noise limit may be exceeded under certain conditions with the N163 7.0 MW turbine operating unconstrained, a significant effect is predicted during the operation of the wind turbines.

9.162 **Technical Appendix 9-4** provides the assessment for operational noise for two alternative turbines: Vestas V150 6.0 MW and Nordex N149 5.7 MW machines, both fitted with serrated trailing edges as the standard option. In the case of the Vestas V150 turbine operating unconstrained, the wind turbine noise levels do not exceed the daytime or night-time noise limits derived in accordance with the Wind Energy Guidelines (2006) under all wind speeds and at all locations. In the case of the Nordex N149 operating unconstrained, predicted wind turbine noise levels indicate a small exceedance (0.1 dB) at NSR13 during the daytime at 6 m/s only. All other wind speeds, locations and times are shown to be below these noise limits. Accordingly, the Vestas V150 6.0 MW turbine will result in no significant effect, and operating the Proposed Project with Nordex N149 5.7 MW machines unconstrained could result in a significant effect.

9.163 Operational noise from the substation and BESS within the Proposed Project has been predicted at the NSRs, as summarised in **Table 9-20** and illustrated in **Figure 9-2.**

Table 9-20: Substation and BESS Operational Noise

NSR ID	Eircode	Substation and BESS Operational Noise, dB L_{Aeq}
NSR01	F26 X3X5	15
NSR02	F26 V290	23
NSR03	F26 T8F7	26
NSR04	F26 K2R6	22
NSR05	F26 Y4E7	23
NSR06	F26 WN97	20
NSR07	F26 X397	22
NSR08	F26 C838	18
NSR09	F26 D9Y6	18
NSR10	F26 TKN3	17
NSR11	F26 E9W7	21

NSR ID	Eircode	Substation and BESS Operational Noise, dB L_{Aeq}
NSR12	F26 E1C7	21
NSR13	F26 F6X8	29
NSR14	F26 V803	20
NSR15	F26 V3W7	29
NSR16	F26 D7D0	29
NSR17	F26 A9F6	25
NSR18	F26 R5V6	24
NSR19	F26 XC91	23
NSR20	F26 C6H2	25

9.164 The highest substation and BESS noise level is 29 dB L_{Aeq}, this equates to a negligible impact (see **Table 9-11**). A negligible impact upon a highly sensitive receptor results in a **negligible significant effect**, which is **not significant** in EIA terms.

Potentially Significant Effects – Cumulative

9.165 As per **paragraph 9.122**, there are no potential cumulative noise impacts.

Mitigation

Construction

9.166 The predicted noise levels from onsite construction activity from the Proposed Project are below the noise limit for the threshold of significance; therefore, no mitigation is necessary.

9.167 During the construction of Over-run Area 1 there is a risk of a temporary moderate significant effect at one dwelling situated to the north where the over-run track joins the local road opposite this property. A temporary 2.5 m high solid close-boarded wooden fence, or equivalent noise barrier, will be installed on the north section of Over-run Area 1, where it joins the local road, which will reduce noise from construction activity taking place closest to this area by up to 10 dB. The barrier will be installed in between the construction activity and nearby dwellings, and as close to the construction plant as practicable, there is no requirement to install the barrier within the local road.

Operation

9.168 An assessment of the operational noise levels has been undertaken in accordance with current best practice guidelines and procedures as outlined in **paragraphs 9.92 to 9.96** of this chapter. In the case of the N163 7.0 MW turbine, and the N149 5.7 MW turbine, with all turbines operating unconstrained, a potential significant effect has been identified; therefore, mitigation is necessary which is discussed further below. For the case of the V150 6.0 MW turbine operating unconstrained, no significant effects have been determined, so no mitigation will be required if these turbines were installed at the Proposed Project.

9.169 Wind turbine manufacturers offer various noise-reduced modes for their turbines, whereby the turbine can operate normally but will produce a lower level of noise at the expense of a corresponding reduction in energy generation. Nordex offer 17 and 18 different noise-reduced modes for the N163 and N149 turbines respectively. The required noise-reduced modes will be confirmed by the manufacturers for site-suitability. The final mitigation in terms of the requirement of noise-reduced modes will be based on the final candidate turbine selected and the noise modes confirmed to be available. The final turbines will only be selected if they can meet the noise limits in **Table 9-14**, either operating unconstrained or mitigated in noise reduced modes, and the final mitigation strategy (if required) will be confirmed with the local authority.

9.170 To comply with the noise limits, the turbines have been designed to operate in noise-reduced modes. For the N163 layout, turbines T8 and T9 are assumed to operate in modes 9 at 6 m/s only. For the N149 layout, turbine T8 is assumed to operate in mode 5 at 6 m/s only. These noise-reduced modes will need to be confirmed by the turbine manufacturer for site suitability. The final confirmed noise mitigation modes will ensure compliance with the noise limits and will be agreed with the local authority.

9.171 The operational noise from the substation and BESS is of **negligible significant effect**, therefore, additional mitigation is not required.

Residual Significant Effects

Construction

9.172 The residual noise impacts for onsite construction works will be negligible and therefore **negligible significant effect**.

9.173 The residual noise impacts associated with construction vehicles using the existing road network will be low, which equates to a **minor significant effect**, that is **not significant** in EIA terms.

9.174 Following implementation of the mitigation measures, construction noise associated with the GCR works and residual noise impacts associated with the construction of the Over-run Areas will reduce from a moderate significant effect, which is significant in EIA terms, to a **minor significant effect**, which is **not significant** in EIA terms.

Operation

9.175 The residual wind turbine operational noise impact assessment for the N163 7.0 MW machine with the above mitigation is set out in **Table 9-21**. Residual operational noise impacts of the N149 5.7 MW machine with the above mitigation is provided in **Technical Appendix 9-4**.

Table 9-21: Assessment of Predicted Residual Wind Farm Noise Immission Levels

NSR ID	Description	Standardised wind speed, m/s. Noise level dB L_{A90}						
		4	5	6	7	8	9	≥10
NSR01	Wind turbine immission	19.6	24.2	28.3	29.9	29.9	29.9	29.9
	Daytime limit	40.0	40.0	40.0	45.0	45.0	45.0	48.2
	Daytime exceedance	**-20.4**	**-15.8**	**-11.7**	**-15.1**	**-15.1**	**-15.1**	**-18.3**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0

NSR ID	Description	Standardised wind speed, m/s. Noise level dB L_{A90}						
		4	5	6	7	8	9	≥10
	Night-time exceedance	**-23.4**	**-18.8**	**-14.7**	**-13.1**	**-13.1**	**-13.1**	**-13.1**
NSR02	Wind turbine immission	28.2	32.8	37.0	38.5	38.5	38.5	38.5
	Daytime limit	40.0	40.0	40.0	45.0	45.0	45.0	48.2
	Daytime exceedance	**-11.8**	**-7.2**	**-3.0**	**-6.5**	**-6.5**	**-6.5**	**-9.7**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time exceedance	**-14.8**	**-10.2**	**-6.0**	**-4.5**	**-4.5**	**-4.5**	**-4.5**
NSR03	Wind turbine immission	32.2	36.8	40.9	42.5	42.5	42.5	42.5
	Daytime limit	40.0	45.0	45.0	49.5	54.2	57.2	58.5
	Daytime exceedance	**-7.8**	**-8.2**	**-4.1**	**-7.1**	**-11.7**	**-14.7**	**-16.0**
	Night-time limit	43.0	43.0	43.0	45.3	51.5	56.7	56.7
	Night-time exceedance	**-10.8**	**-6.2**	**-2.1**	**-2.9**	**-9.1**	**-14.2**	**-14.2**
NSR04	Wind turbine immission	29.2	33.8	37.9	39.5	39.5	39.5	39.5
	Daytime limit	40.0	45.0	45.0	49.5	54.2	57.2	58.5
	Daytime exceedance	**-10.8**	**-11.2**	**-7.1**	**-10.0**	**-14.6**	**-17.7**	**-18.9**
	Night-time limit	43.0	43.0	43.0	45.3	51.5	56.7	56.7
	Night-time exceedance	**-13.8**	**-9.2**	**-5.1**	**-5.8**	**-12.0**	**-17.2**	**-17.2**
NSR05	Wind turbine immission	30.7	35.3	39.4	41.0	41.0	41.0	41.0
	Daytime limit	40.0	45.0	45.0	49.5	54.2	57.2	58.5
	Daytime exceedance	**-9.3**	**-9.7**	**-5.6**	**-8.6**	**-13.2**	**-16.2**	**-17.5**
	Night-time limit	43.0	43.0	43.0	45.3	51.5	56.7	56.7
	Night-time exceedance	**-12.3**	**-7.7**	**-3.6**	**-4.3**	**-10.6**	**-15.7**	**-15.7**
NSR06	Wind turbine immission	29.7	34.3	38.4	40.0	40.0	40.0	40.0
	Daytime limit	40.0	45.0	45.0	45.1	48.3	50.3	50.7
	Daytime exceedance	**-10.3**	**-10.7**	**-6.6**	**-5.1**	**-8.3**	**-10.3**	**-10.7**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	48.0	48.0
	Night-time exceedance	**-13.3**	**-8.7**	**-4.6**	**-3.0**	**-3.0**	**-7.9**	**-7.9**
NSR07	Wind turbine immission	29.9	34.5	38.5	40.2	40.2	40.2	40.2
	Daytime limit	40.0	45.0	45.0	45.1	48.3	50.3	50.7
	Daytime exceedance	**-10.1**	**-10.5**	**-6.5**	**-4.9**	**-8.1**	**-10.1**	**-10.5**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	48.0	48.0
	Night-time exceedance	**-13.1**	**-8.5**	**-4.5**	**-2.8**	**-2.8**	**-7.8**	**-7.8**
NSR08	Wind turbine immission	29.7	34.3	38.3	40.0	40.0	40.0	40.0
	Daytime limit	40.0	45.0	45.0	45.1	48.3	50.3	50.7
	Daytime exceedance	**-10.3**	**-10.7**	**-6.7**	**-5.1**	**-8.3**	**-10.3**	**-10.7**

NSR ID	Description	Standardised wind speed, m/s. Noise level dB L_{A90}						
		4	5	6	7	8	9	≥10
	Night-time limit	43.0	43.0	43.0	43.0	43.0	48.0	48.0
	Night-time exceedance	**-13.3**	**-8.7**	**-4.7**	**-3.0**	**-3.0**	**-7.9**	**-7.9**
NSR09	Wind turbine immission	26.8	31.4	35.3	37.1	37.1	37.1	37.1
	Daytime limit	40.0	45.0	45.0	45.1	48.3	50.3	50.7
	Daytime exceedance	**-13.2**	**-13.6**	**-9.7**	**-8.1**	**-11.3**	**-13.2**	**-13.6**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	48.0	48.0
	Night-time exceedance	**-16.2**	**-11.6**	**-7.7**	**-5.9**	**-5.9**	**-10.9**	**-10.9**
NSR10	Wind turbine immission	25.3	29.9	33.8	35.6	35.6	35.6	35.6
	Daytime limit	40.0	45.0	45.0	45.1	48.3	50.3	50.7
	Daytime exceedance	**-14.7**	**-15.1**	**-11.2**	**-9.6**	**-12.8**	**-14.7**	**-15.1**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	48.0	48.0
	Night-time exceedance	**-17.7**	**-13.1**	**-9.2**	**-7.4**	**-7.4**	**-12.4**	**-12.4**
NSR11	Wind turbine immission	28.5	33.1	37.0	38.8	38.8	38.8	38.8
	Daytime limit	40.0	40.0	45.0	45.0	45.0	45.0	45.0
	Daytime exceedance	**-11.5**	**-6.9**	**-8.0**	**-6.2**	**-6.2**	**-6.2**	**-6.2**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time exceedance	**-14.5**	**-9.9**	**-6.0**	**-4.2**	**-4.2**	**-4.2**	**-4.2**
NSR12	Wind turbine immission	30.2	34.8	38.7	40.5	40.5	40.5	40.5
	Daytime limit	40.0	40.0	45.0	45.0	45.0	45.0	45.0
	Daytime exceedance	**-9.8**	**-5.2**	**-6.3**	**-4.5**	**-4.5**	**-4.5**	**-4.5**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time exceedance	**-12.8**	**-8.2**	**-4.3**	**-2.5**	**-2.5**	**-2.5**	**-2.5**
NSR13	Wind turbine immission	32.2	36.8	39.7	42.5	42.5	42.5	42.5
	Daytime limit	40.0	40.0	40.0	45.0	45.0	45.0	45.0
	Daytime exceedance	**-7.8**	**-3.2**	**-0.3**	**-2.5**	**-2.5**	**-2.5**	**-2.5**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time exceedance	**-10.8**	**-6.2**	**-3.3**	**-0.5**	**-0.5**	**-0.5**	**-0.5**
NSR14	Wind turbine immission	31.4	36.0	39.0	41.7	41.7	41.7	41.7
	Daytime limit	40.0	40.0	40.0	45.0	45.0	45.0	45.0
	Daytime exceedance	**-8.6**	**-4.0**	**-1.0**	**-3.3**	**-3.3**	**-3.3**	**-3.3**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time exceedance	**-11.6**	**-7.0**	**-4.0**	**-1.3**	**-1.3**	**-1.3**	**-1.3**
NSR15	Wind turbine immission	31.2	35.8	38.9	41.5	41.5	41.5	41.5
	Daytime limit	40.0	40.0	40.0	45.0	45.0	45.0	45.0

NSR ID	Description	Standardised wind speed, m/s. Noise level dB L_{A90}						
		4	5	6	7	8	9	≥10
	Daytime exceedance	**-8.8**	**-4.2**	**-1.1**	**-3.5**	**-3.5**	**-3.5**	**-3.5**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time exceedance	**-11.8**	**-7.2**	**-4.1**	**-1.5**	**-1.5**	**-1.5**	**-1.5**
NSR16	Wind turbine immission	30.2	34.8	38.2	40.5	40.5	40.5	40.5
	Daytime limit	40.0	40.0	40.0	45.0	45.0	45.0	45.0
	Daytime exceedance	**-9.8**	**-5.2**	**-1.8**	**-4.5**	**-4.5**	**-4.5**	**-4.5**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time exceedance	**-12.8**	**-8.2**	**-4.8**	**-2.5**	**-2.5**	**-2.5**	**-2.5**
NSR17	Wind turbine immission	27.1	31.7	35.8	37.4	37.4	37.4	37.4
	Daytime limit	40.0	40.0	40.0	45.0	45.0	45.0	45.0
	Daytime exceedance	**-12.9**	**-8.3**	**-4.2**	**-7.6**	**-7.6**	**-7.6**	**-7.6**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time exceedance	**-15.9**	**-11.3**	**-7.2**	**-5.6**	**-5.6**	**-5.6**	**-5.6**
NSR18	Wind turbine immission	27.0	31.6	35.8	37.3	37.3	37.3	37.3
	Daytime limit	40.0	40.0	40.0	45.0	45.0	45.0	45.0
	Daytime exceedance	**-13.0**	**-8.4**	**-4.2**	**-7.7**	**-7.7**	**-7.7**	**-7.7**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time exceedance	**-16.0**	**-11.4**	**-7.2**	**-5.7**	**-5.7**	**-5.7**	**-5.7**
NSR19	Wind turbine immission	25.7	30.3	34.5	36.0	36.0	36.0	36.0
	Daytime limit	40.0	40.0	40.0	45.0	45.0	45.0	45.0
	Daytime exceedance	**-14.3**	**-9.7**	**-5.5**	**-9.0**	**-9.0**	**-9.0**	**-9.0**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time exceedance	**-17.3**	**-12.7**	**-8.5**	**-7.0**	**-7.0**	**-7.0**	**-7.0**
NSR20	Wind turbine immission	26.2	30.8	35.0	36.5	36.5	36.5	36.5
	Daytime limit	40.0	45.0	45.0	45.0	45.0	45.0	45.0
	Daytime exceedance	**-13.8**	**-14.2**	**-10.0**	**-8.5**	**-8.5**	**-8.5**	**-8.5**
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time exceedance	**-16.8**	**-12.2**	**-8.0**	**-6.5**	**-6.5**	**-6.5**	**-6.5**

9.176 It can be seen from **Table 9-21** and **Technical Appendix 9-4**, that the residual wind turbine noise levels do not exceed the daytime or night-time noise limits derived in accordance with the Wind Energy Guidelines (2006) under all wind speeds and at all locations. Therefore, resulting in **no significant residual effect**.

Decommissioning Effects

9.177 Upon decommissioning of the Proposed Project, the wind turbines will be disassembled and all above ground components will be separated and removed off-site. It is proposed

that turbine foundations will remain in place underground and will be covered with earth and reseeded as appropriate. These activities will be undertaken during daytime hours, and noise will be of a lesser impact than for construction. As construction noise impacts will be negligible, decommissioning noise will also be of negligible impact which is a negligible significant effect and **not significant** in EIA terms.

9.178 Site access tracks will remain in use for purposes other than the operation of the Proposed Project by the time the decommissioning of the Proposed Project is underway, and therefore it will be more appropriate to leave the site access tracks in situ for future use. Therefore, there will be negligible noise impact associated with the decommissioning of the access tracks.

9.179 It is proposed that underground cables will not be dug up and removed, instead they will be cut back and remain in-situ. The works associated with the cutting back of the underground cable will have a negligible impact and no trenching will be required.

9.180 Therefore, decommissioning noise impacts will be of **negligible significant effect**.

Further Survey Requirements and Monitoring

9.181 A Noise Complaint Monitoring Programme will be drafted, agreed with the planning authority, and put in place to protect local residents. The NCMP will confirm how complaints will be investigated and verified that the operational wind turbine noise from the Proposed Project is not in excess of the appropriate noise limit. The NCMP will include:

- The noise limits which cannot be exceeded by the combined effects of the wind turbines within the Proposed Project, including the application of any tonal penalty or amplitude modulation penalty. The noise limits will be in accordance with those specified in **Table 9-14** and set for the integer wind speed range from the cut-in speed of the installed wind turbine up to 12 m/s. The wind speed at turbine hub height shall be 'standardised' to a reference height of 10 metres as described in ETSU-R-97 at page 120 using a reference roughness length of 0.05 metres.
- A commitment by the Applicant to employ a qualified acoustician, at their expense, within 28 days of receipt of a written request of the planning authority, following complaint to it alleging noise disturbance at a dwelling.
- The independent noise consultant will measure noise using the $L_{A90,\ 10\text{-minute}}$ noise index outside the complainant's property, or alternative location agreed with the local authority to be representative of the complainant's property, in accordance with the IOA GPG. Measurements will be undertaken in such a manner to enable a tonal penalty to be calculated and to allow an AM penalty to be calculated for selected periods where a tonal or AM assessment is required.
- Where the noise contains a tonal component, a tonal audibility shall be carried out for each 10-minute period as described in ETSU-R-97. The audibility shall be calculated by comparison with the audibility criterion given in Section 2.1 on pages 104 -109 of ETSU-R-97 and the appropriate penalty applied
- Where the noise contains AM, an AM penalty shall be calculated for each 10-minute period. The value of AM will be quantified in accordance with the IOA metric[3] and converted into a penalty equal to: 0 dB for an AM rating of less than 3 dB; 3 dB for an

[3] 'A Method Rating Amplitude Modulation in Wind Turbine Noise', Institute of Acoustics Noise Working Group (Wind Turbine Noise), 2016

AM rating equal to 3 dB; 5 dB for an AM rating greater than or equal to 10 dB; and a linear interpolation of between 3 dB and 5 dB if the AM rating is between 3 dB and 10 dB.

- The Applicant will provide to the planning authority the independent consultant's assessment of the wind turbine noise immission including any penalty for tonality or AM within an agreed time frame.

Summary of Predicted Effects

9.182 The construction noise assessment has determined that mitigation will be required during the construction of turbine Over-run Area 1, whilst no mitigation will be required for other areas of the construction. The associated residual levels are expected to be audible at various times throughout the construction programme but remain with acceptable limits such that their temporary effects are **not significant**.

9.183 Operational noise from the Proposed Project has been assessed in accordance with current best practice. It has been demonstrated that with mitigation in the form of noise-reduced modes, both the daytime and night-time wind turbine noise limits will not be exceeded at any of the NSRs across all wind speeds. The assumed noise-reduced modes will be confirmed by the manufacturers for site-suitability. The final mitigation in terms of the requirement of noise-reduced modes will be based on the final candidate turbine selected and the noise modes confirmed to be available. The final turbines will only be selected if they can meet the noise limits in **Table 9-14**, either operating unconstrained or mitigated in noise reduced modes, and the final mitigation strategy (if required) will need to be confirmed with the local authority. These operation effects are **not significant**. Operational noise from the substation and BESS will be of negligible effect, which is also **not significant**.

9.184 Decommissioning noise impacts from the Proposed Project has been assessed and confirmed to be of negligible significant effect without the need for mitigation.

9.185 In summary, the noise impact of the Proposed Project is **not significant** based on this assessment which has been carried out in accordance with current best practice.

Table 9-22: Summary of Residual Effects

Likely Significant Effect	Mitigation	Means of Implementation	Residual Effect
Construction noise (site components)	Best practice	CEMP	Negligible (not significant)
Construction noise (turbine Over-run Areas)	Temporary noise barrier to the north of Over-run Area 1	CEMP	Not significant
Operational noise (turbines)	Noise-reduced modes for a limited number of turbines and wind speeds for a limited number of turbines and wind speeds	Planning condition	Not significant
Operational noise (substation / BESS)	n/a	n/a	Negligible (not significant)
Decommissioning noise	n/a	n/a	Negligible (not significant)

Statement of Significance

9.186 No significant effects are expected on noise sensitive receptors during the construction, operation and decommissioning of the Proposed Project, both individually and in combination with other proposed developments.

References

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Figures

Technical Appendices

Technical Appendix 9.1 Glossary of Terms

Technical Appendix 9.2 Copy of 2025 Wind Energy Ireland Position Paper on AM Condition

Technical Appendix 9.3 Baseline Noise Survey Details

Technical Appendix 9.4 Alternative Turbine Calculations

Technical Appendix 9.5 Background Noise Survey Measurement Data

Technical Appendix 9.6 Cable Route Construction Noise Levels

Technical Appendix 9.7 Operational Wind Turbine Noise Assessment Graphs

(Refer to EIAR Volume 3 for Technical Appendices)

NML ID	Eircode	Easting (ITM)	Northing (ITM)
NML1	F26 V2N7	479025	823003
NML2	F26 K2R6	478224	822158
NML3	F26 WN97	477458	821023
NML4	F26 E1C7	475628	821141
NML5	F26 H9Y3	475576	822370
NML6	F26 TR74	474501	824174
NML7	F26 YN24	474781	824594

NSR ID	Eircode	Easting (ITM)	Northing (ITM)
NSR01	F26 X3X5	480192	823940
NSR02	F26 V290	478631	823165
NSR03	F26 T8F7	477830	822092
NSR04	F26 K2R6	478213	822165
NSR05	F26 Y4E7	477968	821945
NSR06	F26 WN97	477447	821029
NSR07	F26 X397	477312	820986
NSR08	F26 C838	477006	820866
NSR09	F26 D9Y6	476634	820435
NSR10	F26 TKN3	476365	820223
NSR11	F26 E9W7	475752	820854
NSR12	F26 E1C7	475650	821146
NSR13	F26 F6X8	475628	822350
NSR14	F26 V803	475558	822547
NSR15	F26 V3W7	475547	822636
NSR16	F26 D7D0	475414	822851
NSR17	F26 A9F6	474768	823752
NSR18	F26 R5V6	474769	823926
NSR19	F26 XC91	474676	824286
NSR20	F26 C6H2	474916	824629

LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Location
- Proposed Site Access Location
- Proposed Met Mast Location
- Proposed New Access Track
- Proposed Upgraded Access Track
- Proposed Grid Connection Route (Subject to Separate Planning Application)
- Proposed Crane Pad
- Proposed Substation
- Proposed Battery Energy Storage System (BESS) Compound
- Proposed Temporary Construction Compound (TCC)
- Proposed Attenuation Basin
- Noise Sensitive Receptor (NSR) Location
- Noise Monitoring Location (NML)
- 35 dB LA90 Study Area Noise Contour

MUINGMORE WIND FARM

NOISE AND VIBRATION

NOISE MONITORING LOCATIONS AND NOISE SENSITIVE RECEPTOR LOCATIONS

FIGURE 9-1

Scale 1:30,000 @ A3

Date MARCH 2026

402.064443.00001.0088.1 NSR and NML

472000 474000 476000 478000 480000

826000 824000 822000

Substation and Battery Energy Storage System (BESS) Noise Level

- High - Substation and BESS noise exceeds 50 dB LAeq
- Medium - Substation and BESS noise greater than 40 dB LAeq and not exceeding 50 dB LAeq
- Low - Substation and BESS noise greater than 35 dB LAeq and not exceeding 40 dB LAeq

Substation and Battery Energy Storage System (BESS) Noise Level

- High - Substation and BESS noise exceeds 50 dB LAeq
- Medium - Substation and BESS noise greater than 40 dB LAeq and not exceeding 50 dB LAeq
- Low - Substation and BESS noise greater than 35 dB LAeq and not exceeding 40 dB LAeq
- Negligible - Substation and BESS noise does not exceed 35 dB LAeq

20 dB LAeq
25 dB LAeq
30 dB LAeq
35 dB LAeq
40 dB LAeq
45 dB LAeq

Lough Nahelly
L1205

NSR20 NSR19 NSR18 NSR17 NSR16 NSR15 NSR14 NSR13 NSR12 NSR11 NSR10 NSR09 NSR08 NSR07 NSR06 NSR05 NSR04 NSR03 NSR02 NSR01

T1 T2 T3 T4 T5 T6 T7 T8 T9 T10 T11 T12 T13

TCC1 TCC2

1 2 3

N

LEGEND

- Proposed Development Site Boundary
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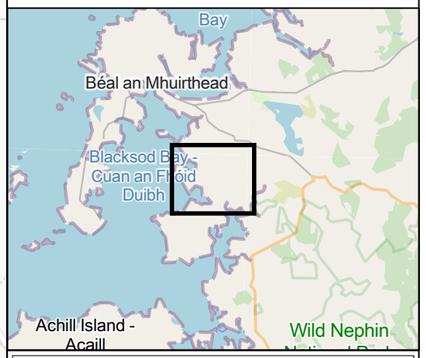
- Proposed Substation
- Proposed Battery Energy Storage System (BESS) Compound
- Proposed Temporary Construction Compound (TCC)
- Proposed Attenuation Basin
- Noise Sensitive Receptor (NSR) Location



0 1 2
Kilometres

RWE

SLR

MUINGMORE WIND FARM

NOISE AND VIBRATION

SUBSTATION AND BESS NOISE LEVELS

FIGURE 9-2

Scale 1:25,000 @ A3

Date MARCH 2026

402.064443.00001.0152.0 Noise Levels