11. NOISE & VIBRATION

11.1 Introduction

Wind farms have the potential to create noise during their construction, operational and decommissioning phases. This chapter assesses the potential noise & vibration impacts at the nearest Noise Sensitive Receptors (NSRs), within c. 3 km of the Proposed Development, during the construction, operation and decommissioning phases. The full description of the Proposed Development is detailed in Chapter 4.

This chapter considers the likely significant effects with respect to the noise associated with the construction, operation and decommissioning of the Proposed Development. The specific objectives of the chapter are to:

- describe the existing noise baseline;
- describe the assessment methodology and significance criteria used in completing the impact assessment;
- describe the potential effects;
- describe the mitigation measures proposed to address any likely significant effects; and
- assess the residual effects remaining, following the implementation of mitigation.

As detailed in Section 1.1.1 in Chapter 1, for the purposes of this EIAR, the various project components are described and assessed using the following references: 'Proposed Development', 'the Site', 'Wind Farm Site' and 'Grid Connection'.

There are no operational, consented, or proposed (planning application submitted or in the public domain) wind farms within 10 km of the Wind Farm Site, therefore, a cumulative noise impact assessment was not required.

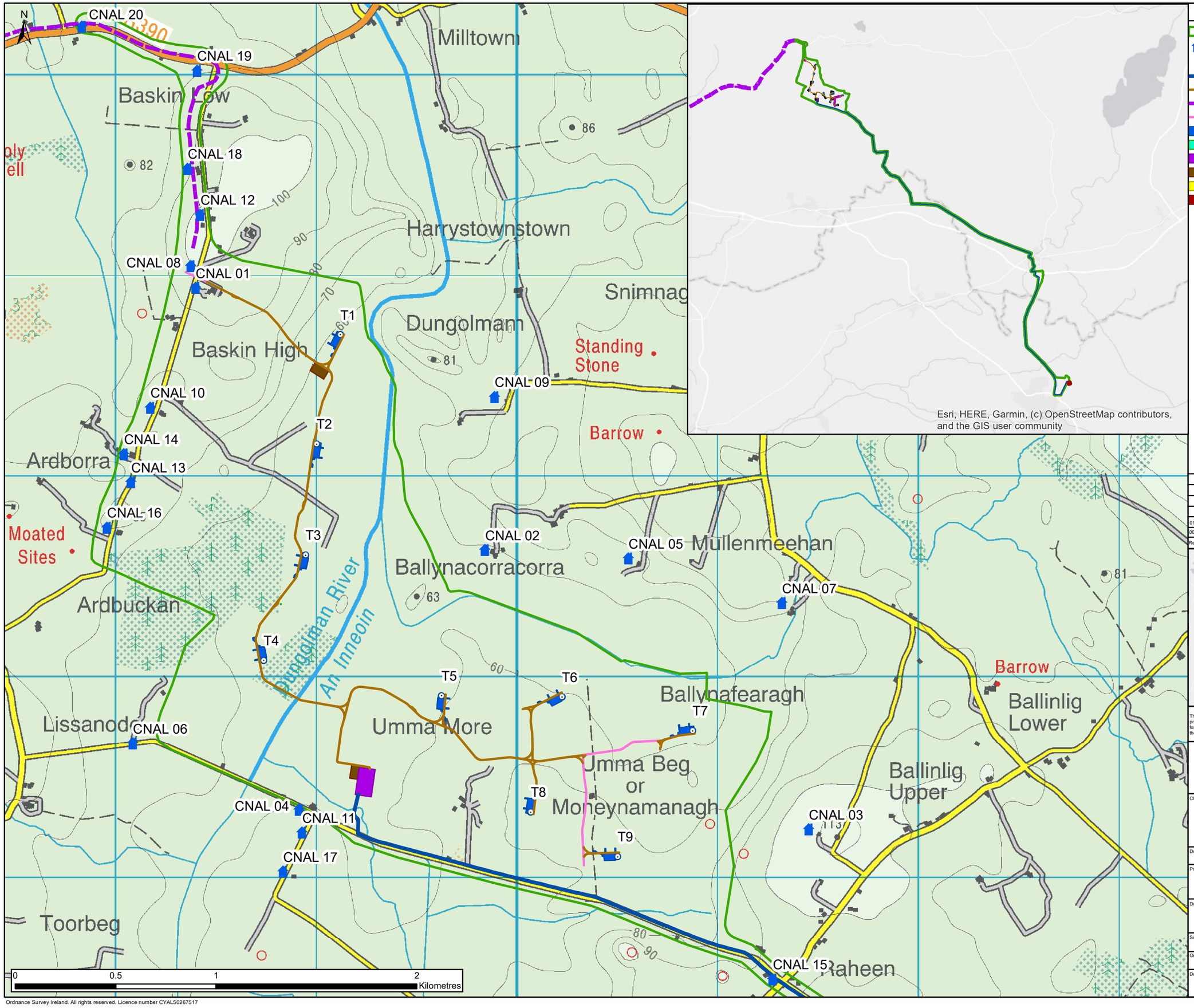
11.1.1.1 Statement of Authority

The noise assessments were carried out by TNEI Services Ltd. TNEI is a specialist energy consultancy with an Acoustics team that has undertaken noise assessments for over 4.5 GW of onshore wind farm developments. The construction noise assessment was undertaken by Alex Dell (MEng), who is an Associate Member of the Institute of Acoustics. The operational noise assessment was undertaken by Jason Baldwin (BSc, Dip) and Gemma Clark (BSc, MSc) who are both Associate Members of the Institute of Acoustics. The construction noise assessment was reviewed and approved by Jim Singleton (BSc, Dip). The operational noise assessment was reviewed by James Mackay (BSc, Dip). Jim and James are full members of the Institute of Acoustics and hold the Diploma in Acoustics and Noise Control.

This chapter is supported by the following figures and technical appendices:

- Figures
  - Figure 11-1: Construction Noise Assessment Locations; and
  - Figure 11-2: Operational Noise Monitoring and Assessment Locations.
- Technical Appendices
  - Appendix 11-1: Construction Noise Report; and
  - Appendix 11-2: Operational Noise Report.

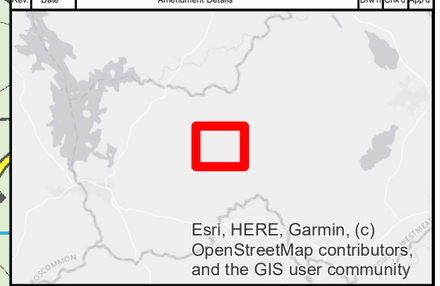
Figures and technical appendices are referenced in the text where relevant.



LEGEND

- EIAR Site Boundary
- Construction Noise Assessment Locations - CNALs
- Proposed Turbine Layout
- Proposed Underground Electrical Cabling Route
- Proposed New Roads
- Proposed Turbine Delivery Route
- Proposed Upgrades to Existing Roads
- Proposed Turbine Hardstands
- Proposed Met Mast Location
- Proposed 110KW Onsite Substation
- Proposed Temporary Construction Compounds
- Proposed Turbine Foundation
- Existing Thornsberry 110kV Substation

Rev.	Date	Amendment Details	Drw'n	Chk'd	App'd
01	31/01/23	Minor Updates	GC	JB	JB
00	02/12/22	For Planning	AD	JB	JB



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Client: Umma More Ltd

Drawing Status: FOR PLANNING

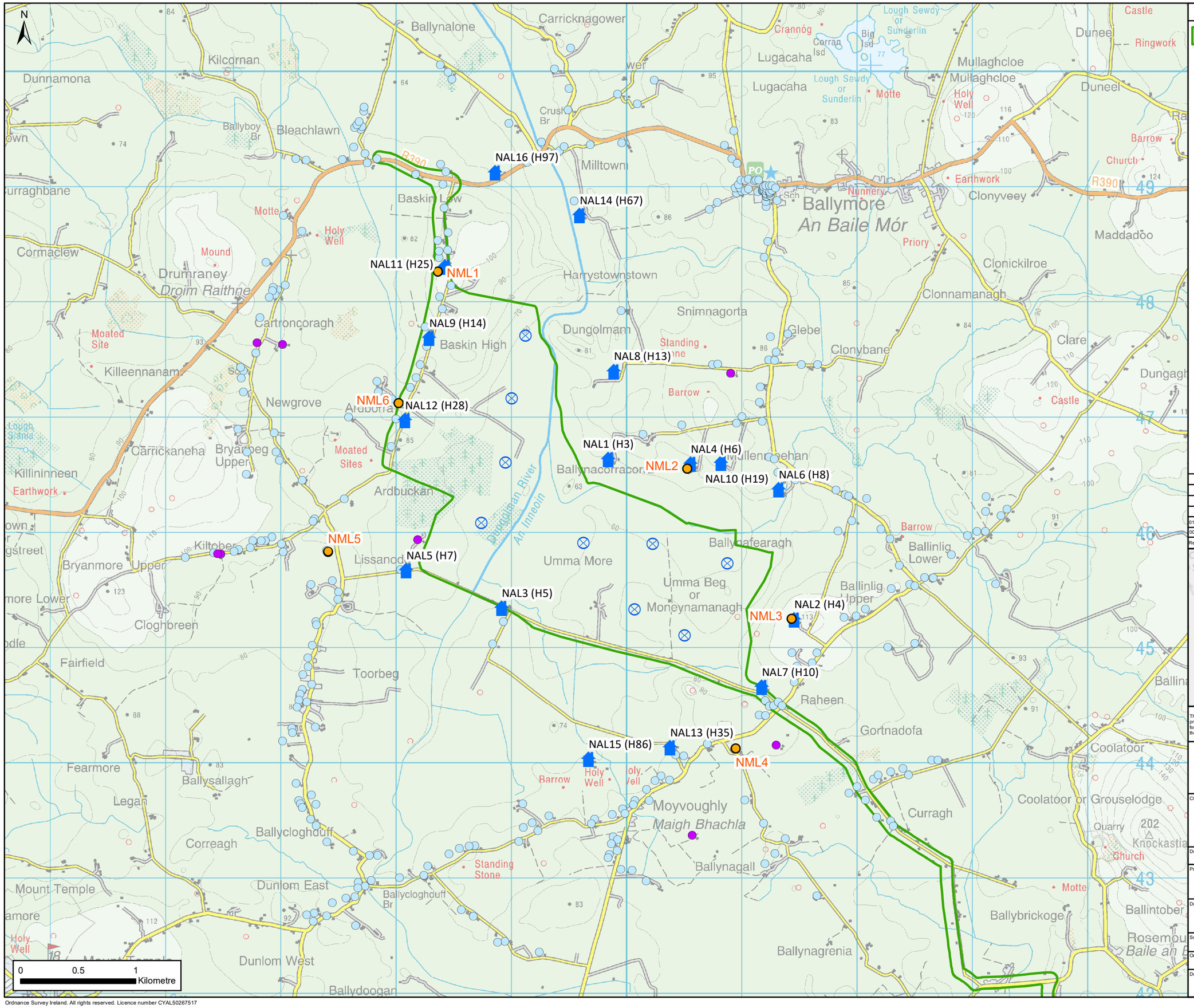
Project Title: Umma More Renewable Energy Development

Drawing Title: EIAR Figure 11-1 Construction Noise Assessment Locations

Scale	Designed	Drawn	Checked	Approved
1:17,500	AD	AD	JB	JB
Original Size	Date	Date	Date	Date
A3	02/12/2022	02/12/2022	02/12/2022	02/12/2022

Drawing Number: 14373 - 012

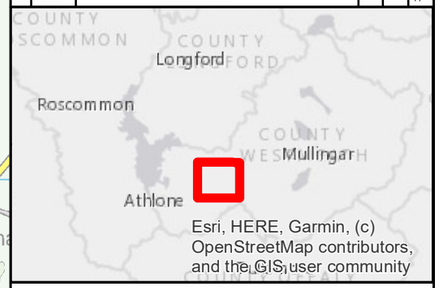
Revision: 1



NOTES

- EIAR Site Boundary
- Proposed Turbine Location
- Noise Monitoring Location (NML)
- Noise Assessment Location (NAL)
- Noise Sensitive Receptor (NSR)
- Derelict Property

Rev.	Date	Amendment Details	Drw'n	Chk'd	App'd
01	30/01/23	Minor Updates	GC	JB	JB
00	06/12/22	First Issue	JCM	GC	GC



tnei

Client: Umma More Ltd

Drawing Status: FOR PLANNING

Project Title: Umma More Renewable Energy Development

Drawing Title: EIAR Figure 11.2 – Operatioal Noise Monitoring and Assessment Locations

Scale	Designed	Drawn	Checked	Approved
1:30,482	JCM	JCM	GC	GC
Original Size	**Date**	**Date**	**Date**	**Date**
A3	06/12/2022	06/12/2022	06/12/2022	06/12/2022

Drawing Number: 14373-011

Revision: 1

11.2 Legislation, Policy and Guidelines

As well as the guidance listed in Section 1.7.2 of Chapter 1 of this EIAR, this assessment adhered to the following combination of guidance and assessment methodologies:

- British Standard BS 5228-1: 2009+A1:2014 'Code of practice for noise and vibration control on construction and open developments - Noise'[1];
- Department of Environment Heritage and Local Government (DoEHLG) 'Wind Energy Development Guidelines (the Guidelines),' 2006[2];
- Institute of Acoustics 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise' (2013) (IOA GPG)[3]; and
- ISO 9613-2: 1996 'Acoustics – Attenuation of sound during propagation outdoors Part 2: General method of calculation'[4].

The above documents are discussed in detail within Section 2 of Appendix 11-1 and Appendix 11-2, where relevant.

It is noted that the WEDG are currently under review and a set of draft updated guidelines were issued for consultation in December 2019 ('the Draft Guidelines'). The Draft Guidlelines included reference to, and reliance upon, some elements of ETSU-R-97 and the IOA GPG, however, significant concerns were raised during the consultation process regarding the noise section of the Draft Guidelines and at the time of writing this report, no further updates have been issued.

The guidance in the Guidelines has been used to assess operational noise from the Proposed Development. In the absence of detailed guidance being included in the Guidelines, the assessment methodology has been supplemented by the guidance in ETSU-R-97 and the IOA GPG where appropriate.

In 2018 the World Health Organisation issued noise guidelines *'Environmental Noise Guidelines for the European Region'*[5] that provide recommendations for protecting human health for exposure to environmental noise. The guidelines consider noise originating from various sources including from transportation noise (road traffic, railway and aircraft), leisure noise and wind turbine noise. The guidelines make a series of 'strong' and 'conditional' recommendations. Strong recommendations are made in relation to road, rail and aircraft noise whilst two conditional recommendations were made in relation to wind turbine noise. In relation to conditional recommendations the guidance notes that:

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

The guidance makes recommendations based on noise exposure levels characterised using the L_{den} parameter. L_{den} is a weighted annual average sound pressure level over all days, evenings and nights in a year which is commonly used for transportation noise but rarely used for wind turbine noise.

In relation to wind turbine noise the guidelines state:

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[1] *British Standards Institute, 2014. Code of practice for noise and vibration control on construction and open sites. Noise. UK : BSI, 2014. BS 5228-1:2009+A1:2014*
[2] *Department of Environment Heritage and Local Government (DoEHLG) 'Wind Energy Development Guidelines,' 2006.*
[3] *Institute of Acoustics, 2013. Good Practice Guidance on the application of ETSU-R-97 for wind turbine noise assessment.*
[4] *(ISO), International Organisation for Standardisation. 1996. Acoustics – Attenuation of Sound During Propagation Outdoors: Part 2 – General Method of Calculation. Geneva: ISO, 1996. ISO 9613-2:1996*
[5] *World Health organisation, 2018. Environmental Noise Guidelines for the European Region'*

'Based on all these factors, it may be concluded that the acoustical description of wind turbine noise by means of L_{den} or L_{night} may be a poor characterization of wind turbine noise and may limit the ability to observe associations between wind turbine noise and health outcomes.'

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

Notwithstanding the limitations associated with the derivation of the L_{den} threshold levels, serious concerns have also been raised about the practicality of using a threshold which is based on a weighed annual average which cannot actually be measured. Given the strength of recommendation and limitations associated with the use of L_{den} it is not considered appropriate to undertake an assessment against L_{den} levels.

11.3 Consultation

An EIA Scoping Response for the Proposed Development was issued on 6th September 2021 by the Environmental Health Service. The Scoping Response stated the following in relation to noise:

> *'A full and thorough noise survey must be carried out to assess the impact of noise from the proposed turbines on the residents living in the vicinity.*
>
> *It is essential that up to date baseline monitoring is carried out to establish the existing noise environment. All noise sensitive receptors in the vicinity of the turbines shall be identified. The selection of noise monitoring locations for background noise is of critical importance in the noise survey, therefore the rationale for choosing the number and the positioning of these should be provided by the applicant.*
>
> *Once the existing noise environment has been established, the predicted increase in noise from the proposed turbines should then be quantified and assessed. It is this departments opinion that adherence to specified noise limit values does not always protect sensitive receptors from noise nuisance therefore the significance of the predicted change in the noise environment should be fully assessed. It is requested that this information is outlined and displayed clearly in the EIS.*
>
> *The potential cumulative effects of other windfarms, industry, quarrying etc in the vicinity of the development should be assessed as part of the noise survey. All mitigation measures for the control of noise shall be described.'*

This Chapter addresses the requirements of the Scoping Response. A summary of the baseline noise survey undertaken for the Proposed Development is detailed below with further information being included within Section 5 of Appendix 11-2.

Predicted noise levels and average background noise levels are presented in detail in Sections 5 and 6 of Appendix 11-2. Both background noise levels and wind turbine noise levels vary with wind speed and direction making the calculation of a change in noise level difficult to define, significance criteria are discussed in Section 11.4.4.

In relation to the background noise survey, the data collected has been split into quiet daytime and night time periods as detailed in Section 11.4.1.3. The background noise data collected during the remaining period (07:00-18:00 weekdays and 07:00-13:00 on a Saturday), when the nearby quarry would most likely have been operational was filtered out as part of the splitting of the data. In addition, the times series graphs were reviewed to consider any other potential atypical periods measured during the noise survey as discussed in Section 5.3 of Appendix 11-2. There are no operational wind farms within 10 km of the Wind Farm Site.

11.4 Assessment Methodology and Significance Criteria

11.4.1.1 Construction Noise Methodology

There is no published statutory Irish guidance that contains suggested noise limits for construction activities, other than for road construction works, however, the Association of Acoustic Consultants of Ireland (AACI) have published 'Environmental Noise Guidance for Local Authority Planning & Enforcement Departments'[6], which states;

> *"The chief guidance document applied in the assessment of construction phase noise impacts is British Standard BS 5228:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites Part 1: Noise (2014)".*

The construction noise assessment has therefore been undertaken using the BS 5228 guidance. The prediction of construction noise levels was undertaken using the calculation methodology presented in ISO 9613:1996, together with published noise data for appropriate construction plant.

To undertake an assessment of the construction noise impact in accordance with the BS 5228 criteria, the following steps have been undertaken:

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

Construction of the Proposed Development will be undertaken in several successive phases. During each phase the plant and equipment, and the associated traffic, would influence the noise generated. The selection of plant and equipment to be used will be determined by the main contractor when they are commissioned, therefore the assessment has been based upon a typical selection of plant for a wind farm development of this size and an indicative construction timetable which is provided in Section 4.6.9 in Chapter 4 of this EIAR. In view of this, the plant has been modelled operating at the closest points to each receptor for a given activity in each construction phase, whereas in reality only certain plant will be working at the closest point for short periods of time.

The core hours for construction activity will be 07:00 to 19:00 Monday to Saturday. There will be no working on Sundays and Public Holidays, however, it should be noted that out of necessity some activity outside of the core hours could arise, from delivery and unloading of abnormal loads or health and safety requirements, or to ensure optimal use is made of fair weather windows for concrete deliveries, the erection of turbine blades and the erection and dismantling of cranes.

Chapter 4: Description outlines the tasks that will be undertaken during the construction period, which is estimated to last 18-24 months. For the purposes of this assessment, noise modelling has been undertaken for a number of construction scenarios, which simulate the likely overlap of several tasks that could occur throughout the construction period:

[6] *Association of Acoustic Consultants of Ireland, 2021. Environmental Noise Guidance for Local Authority Planning & Enforcement Departments*

- Scenario 01 (Q1): Construction of the Grid Connection underground electrical cabling route has begun along with the construction and upgrading of roads and track leading into the Wind Farm Site from the north west and down to the southern proposed construction compound.
- Scenario 02 (Q2): Track upgrade and installation is on-going towards the southern construction compound. Both construction compounds are now in operation. Construction of the turbine hardstandings and foundations at T1 and T2 is underway. Construction of the Grid Connection underground electrical cabling route is on-going and construction of the onsite 110kV substation has begun.
- Scenario 03 (Q3): Track upgrade and installation has begun from the southern construction compound towards T8. Both construction compounds are in operation. Construction of the turbine hardstandings and foundations at T3 and T4 is underway. Construction of the Grid Connection underground electrical cabling and onsite 110kV substation is on-going.
- Scenario 04 (Q4): Track upgrade and installation is on-going from the southern construction compound towards T8. Both construction compounds are in operation. Construction of the turbine hardstandings and foundations at T5 is underway. Construction of the Grid Connection underground electrical cabling route and onsite 110 kV substation is on-going.
- Scenario 05 (Q5): Track upgrade and installation has begun on the remaining Wind Farm Site roads. Both construction compounds are in operation. Construction of the turbine hardstandings and foundations at T6 and T8 are underway. Construction of the Grid Connection underground electrical cabling route and onsite 110 kV substation is on-going. Delivery of turbines has begun and landscaping and backfilling is occurring at all the proposed spoil management locations. Erection of T1 and T2 is underway.
- Scenario 06 (Q6): Both construction compounds are in operation. Construction of the turbine hardstandings and foundations at T7 and T9 are underway. Construction of the Grid Connection underground electrical cabling route and onsite 110 kV substation is on-going. Erection of T3 and T4 is underway and landscaping and backfilling is occurring at all the proposed spoil management locations. Delivery of turbines is still on-going.
- Scenario 07 (Q7): Both construction compounds are in operation. Construction of the Grid Connection underground electrical cabling route and onsite 110 kV substation is on-going. Erection of T6, T7 and T9 is underway and landscaping and backfilling is occurring at all the proposed spoil management locations. Delivery of turbines is still on-going.
- Scenario 08 (Q8): Both construction compounds are in operation. Landscaping and backfilling is occurring at all the proposed spoil management locations.
- Night-time: Diesel generators for the cabin and lighting at both construction compounds are operational.

In addition to the above, forestry activities have been modelled including felling of trees in the vicinity of T4 and forwarding for transportation off site, which will take place prior to the construction of site road to T4, turbine hardstandings and foundations at T4. Some tree felling is anticipated, however, it has not detailed within the indicative timetable, therefore, using the precautionary principle, tree felling activities have been included or all scenarios.

More detailed information on each of the construction Scenarios can be found within Appendix 11-1 of this EIAR. The noise-generating equipment assessed for each construction phase is detailed in Appendix 11-1, which shows actual noise data measured at 10 m from the noise source as detailed in BS5228. Using the data contained in these tables the noise levels for all Scenarios have been calculated. It is worth noting that for much of the working day the noise associated with construction activities will be less than predicted, as the assessment has assumed all equipment is constantly operating at full power and is located at the closest point to each receptor, whereas in practice equipment load and precise location will vary.

The assessment has assumed that gravity based foundations will be used onsite as is typical for most wind farm developments. Should piling be required then best practice mitigation measures will be used to limit noise output, as detailed in BS 7385-2:1993. The exact nature of the mitigation measures will vary depending on the pile type, strata to be penetrated and duration of the works required.

11.4.1.2 Construction Vibration

If it is deemed pertinent to set limits for vibration then two sets of vibration limits should be considered, one in regard to potential for damage to buildings and one in regard to the vibration effects on people within buildings.

Threshold values to determine the potential for damage to buildings are detailed in BS 7385-2:1993 (which is also referred to in BS 5228). The unit of measurement used for this assessment method is the Peak Particle Velocity (PPV), which is measured in mm/s or $mm.s^{-1}$. For dwellings, the standard provides the guideline threshold levels, as set out in Table 11-1 below.

Table 11-1: Transient vibration guide values for building damage

Peak Component Particle Velocity (mm/s)	Damage Levels for residential buildings
15 mm/s PPV for a frequency of 4 Hz, rising to 50 mm/s PPV for a frequency of 40Hz and above.	Cosmetic
30 mm/s PPV for a frequency of 4 Hz, rising to 100 mm/s PPV for a frequency of 40Hz and above.	Minor Damage
60 mm/s PPV for a frequency of 4 Hz, rising to 200 mm/s PPV for a frequency of 40Hz and above.	Major Damage

Table B.1 of BS 5228-2, reproduced here as Table 11-2 provides guideline PPV levels that can be used in a construction setting. It is important to note that the levels refer to internal vibration within a building, and not external levels.

Table 11-2: BS5228-2 Guidance on Effects of Vibration Levels

Vibration Level (A) (B) (C)	Effect
0.14 $mm.s^{-1}$	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3 $mm.s^{-1}$	Vibration might be just perceptible in residential environments.
1.0 $mm.s^{-1}$	It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior warning and explanation has been given to residents.
10 $mm.s^{-1}$	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments.
(A) The magnitudes of the values presented apply to a measurement position that is representative of the point of entry into the recipient. (B) A transfer function (which relates an external level to an internal level) needs to be applied if only external measurements are available. (C) Single or infrequent occurrences of these levels do not necessarily correspond to the stated effect in every case. The values are provided to give an initial indication of potential effects, and where these values are routinely measured or expected then an assessment in accordance with BS 6472-1 or -2, and/or other available guidance, might be appropriate to determine whether the time varying exposure is likely to give rise to any degree of adverse comment.	

With due regard to the above, external vibration level limits can be set at 15 mm/s PPV for frequencies between 4 Hz and 40 Hz and 50mm/s for frequencies above 40Hz.

Internal PPV limits can be set at somewhere between 1 mm/s^{-1} and 10.0 mm/s^{-1}, however, it should be noted that the measurement of vibration levels indoors is invasive and can be problematic. It should also be noted that the limits in Table 11-2 are generally considered guideline levels that should not be exceeded regularly or for long periods of time (see note c of Table 11-2).

11.4.1.3 Operational Noise Methodology

The assessment has been undertaken in accordance with the Wind Energy Development Guidelines (the Guidelines) 2006.

The AACI Environmental Noise Guidance states the following in relation to the Guidelines:

'The document includes daytime and night-time noise criteria. As criteria included in the document are evidently derived from ETSU-R-97, it is considered more robust to base noise assessments on the ETSU and IOA documents, particularly as the DOEHLG document is somewhat vague. The document has been undergoing a protracted review process for several years.'

In 2013 the ETSU-R-97 guidance was supplemented by a document produced by the Institute of Acoustics titled 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise' (IOA GPG). Given the lack of detail in parts of the Guidelines, information contained in ETSU-R-97 and the IOA GPG has been used to supplement the Guidelines.

The Guidelines include limits for daytime and night time periods. Consequently, the test applied to operational noise is whether or not the calculated wind farm noise levels at nearby noise sensitive properties will be below the noise limits derived in accordance with the Guidelines.

The daytime and night time periods are not defined within the Guidelines, therefore the assessment has considered these periods as detailed within IOA GPG. The quiet daytime criteria are based upon background noise levels measured during 'quiet periods of the day' comprising:

- All weekday evenings from 18:00 to 23:00;
- Saturday afternoons and evenings from 13:00 to 23:00; and
- All day Sunday 07:00 to 23:00.

For the avoidance of doubt it should be noted that although the daytime limits are set based upon background data collected only during the quiet daytime period, they apply to the entire daytime period (07:00 – 23:00).

Night time periods are defined as 23:00 to 07:00, with no differentiation made between weekdays and weekends.

The Guidelines include guidance on how to derive limits for daytime and night time periods.

The daytime limits take account of existing background noise levels and include a fixed limit of 45 dB or background + 5 dB, whichever is the greater, except in low background noise environments where a fixed minimum limit in the range 35-40 dB should be considered. TNEIs interpretation of these limits is that turbine noise should not exceed:

- 45 dB $L_{A90,\ 10\ min}$ or background noise + 5 dB, whichever is the greater, for daytime hours (applicable where background noise levels are greater than 30 dB L_{A90}); or
- 35 - 40 dB $L_{A90,\ 10\ min}$ where background noise is less than 30 dB L_{A90}.

The 40 dB $L_{A90,\ 10\ min}$ fixed minimum limit has been chosen for the daytime period based on the noise limits included within some recent planning decisions issued by An Bord Pleanála.

The Guidelines states that a *"fixed limit of 43dB(A) will protect sleep inside properties during the night"*, however, whilst it is not explicit within the Guidelines , the addition of a night time 'background noise +5 dB' parameter is commonly applied in wind turbine noise assessments. This is detailed in numerous examples of planning conditions issued by local authorities and An Bord Pleanála. On that basis, the night time noise limits used in this assessment have been based on 43 dB or background noise + 5 dB, whichever is the greater.

The aim of the operational noise assessment is to establish the Guidelines Noise Limits, and determine whether the Proposed Development can meet those limits.

The exact model of turbine to be installed on the Wind Farm Site will be the result of a future tendering process should planning permission be granted. Achievement of the Guidelines Noise Limits determined by this assessment will be a key determining factor in the final choice of turbine for the Proposed Development. Predictions of wind turbine noise for the Proposed Development were made, based upon the sound power level data for a candidate wind turbine with a rotor diameter of 162 m, output capacity of 6.2 MW with serrated trailing edge blades and a hub height of 104 m. The candidate turbine modelled is considered to be representative of the type of turbine that will be installed at the Wind Farm Site based on the proposed turbine dimensions.

Calculations of operational noise have been undertaken in accordance with International Standard ISO 9613-2, 'Acoustics – Attenuation of sound during propagation outdoors' (ISO 1996). The model calculates, on an octave band basis, attenuation due to geometric spreading, atmospheric absorption and ground effects. The noise model was set up to provide realistic noise predictions, including mixed ground attenuation (G=0.5) and atmospheric attenuation relating to 70 % relative humidity and 10 °C (Section 4.3 of the IOA GPG). The receiver height modelled was 4 m.

Typically wind farm noise assessments assume all properties are downwind of all turbines at all times (as this would result in the highest wind turbine noise levels). However, in reality turbine noise will vary with wind direction.

In line with the IOA GPG, an assessment has been undertaken to determine whether a concave ground profile correction (+3 dB) or barrier correction (-2 dB), is required due to the topography between the turbines and the noise sensitive receptors. Propagation across a valley (concave ground) increases the number of reflection paths, and in turn, has the potential to increase sound levels at a given receptor. Terrain screening effects (barrier corrections) act as blocking points, subsequently reductions in sound levels at a given receptor can potentially be observed. A concave ground and barrier correction was not required for any turbines at any of the receptors as detailed in Sections 4.3.23 - 4.3.24 and Annex 6 of Appendix 11-2.

Information relating to operational noise such as Amplitude Modulation (AM), a potential characteristic of wind turbine noise, and Low Frequency Noise (LFN), has been provided in Appendix 11-2. There is no evidence that LFN has adverse impacts on the health of wind farm neighbours and currently there is no agreed methodology which can be used to predict the occurrence of AM or an agreed methodology that can be used to determine whether the effects of AM, should it occur, are likely to be significant and as such they have not been considered further in the assessment.

11.4.2 Potential Effects Scoped Out

11.4.2.1 Cumulative Wind Farm Noise Assessment

As detailed in Section 2.7 in Chapter 2 of this EIAR, the nearest proposed, permitted or existing wind farm is 16.3km from the Proposed Development turbines. Any turbines located at this distance or beyond this would have no impact at any receptors around the Proposed Development.

11.4.2.2 Decommissioning

Activities that occur during the decommissioning of the Proposed Development are unlikely to produce higher noise levels than those produced during construction and many of the activities will be similar in nature. As such it is considered that if construction noise levels are predicted to be below the threshold levels, then decommissioning noise will also be within the threshold levels.

11.4.3 Method of Baseline Characterisation

11.4.3.1 Extent of the Study Area

Prior to the commencement of the operational noise assessment, an initial desktop review was undertaken in order to identify all NSRs and potential Noise Monitoring Locations (NMLs). Six NMLs were selected to represent all of the NSRs, which are located around the Wind Farm Site. The actual NMLs and NSRs are shown on Figure 11-2. More information on the NMLs can be found in Section 5 of Appendix 11-2: Operational Noise Report.

11.4.3.2 Field Survey

The noise survey to determine the existing background noise environment at noise sensitive receptors neighbouring the Wind Farm Site was undertaken in accordance with the guidance contained within ETSU-R-97 and current good practice (IOA GPG).

Background noise monitoring was undertaken at six noise sensitive receptors. The NMLs were chosen by TNEI to be representative of all other receptors located around the Wind Farm Site. The selection of the NMLs considered local noise sources such as boiler flues, watercourses and vegetation.

Background noise monitoring was undertaken over the period of 1st March 2022 to 3rd May 2022 at the NMLs detailed in Table 11-3 and Figure 11-2. Further details of the NMLs can be found within Appendix 11-2.

Table 11-3 Summary of Noise Monitoring Locations

Receptor	X (ITM)	Y (ITM)
NML1	618362	748260
NML2	620525	746549
NML3	621430	745247
NML4	620944	744124
NML5	617409	745830
NML6	618020	747119

Simultaneous wind speed/direction data were recorded within the site at various heights using a LIDAR Unit (located at Irish Transverse Mercartor reference 620297, 745443). The wind speed data collected directly at hub height (104 m) were standardised to 10 m height in accordance with good practice.

Wind speed/direction and rainfall data were collected over the same time scale and averaged over the same ten-minute periods as the noise data to allow analysis of the measured background noise as a

function of wind speed and wind direction. All data analysis was undertaken in accordance with the IOA GPG.

11.4.4 Criteria for the Assessment of Effects

The Environmental Protection Agency document '*Guidelines on the information to be contained in Environmental Impact Assessment Reports*' [7] has informed the criteria for the assessment of potential effects as summarised below. The descriptors used in this environmental impact assessment are those set out in the EPA (2022) Glossary of effects as shown in Chapter 1, Section 1.7.2 of this EIAR.

11.4.4.1.1 *Criteria for Assessing Significance – Construction Noise*

The significance criteria adopted for this assessment are based on Appendix E part E.3.2 of BS5228-1:2009+A1:2014, as detailed in Section 2.3 of the Construction Noise Report (Appendix 11-1).

The criteria for indicating a potential significance use a noise metric of $L_{Aeq,T}$,, as detailed in Table 11-4. The L_{Aeq} is the A-weighted, equivalent continuous sound level in decibels measured over a stated period of time, ($L_{Aeq,T}$) where T is the length of the assessment period (Time).

Table 11-4 Construction Noise Significance Criteria

Significance of Effect	Significance Level	
	Not Significant	Significant
Category A[8] Daytime (07:00 – 19:00) and Saturdays (07:00 to 13:00)	≤65dB $L_{Aeq, T}$	>65dB $L_{Aeq, T}$
Category A Evenings and Weekends (19:00 – 23:00), Saturdays 13:00-23:00 and Sundays 07:00-23:00.	<55dB $L_{Aeq, T}$	>55dB $L_{Aeq, T}$
Category A Night time (23:00 – 07:00)	<45dB $L_{Aeq, T}$	>45dB $L_{Aeq, T}$

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

11.4.4.1.2 *Criteria for Assessing Significance – Operational Noise*

The Guidelines do not define significance criteria but describe a framework for the measurement of wind farm noise and give indicative noise levels considered to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable restrictions on wind farm development. Achievement of the Guidelines derived noise limits ensures that wind turbine noise will comply with current Government guidance.

[7] *The Environmental Protection Agency, 2022. Guidelines on the information to be contained in Environmental Impact Assessment Reports*
[8] *Category A, B and C thresholds are provided within BS558. Category A thresholds have been used in this assessment as they are the most stringent. Further information on all Category Thresholds can be found in Appendix 11-1.*

In terms of the EIA Regulations, in this Chapter of the EIAR the use of the term "significance" in this EIAR refers to compliance or non-compliance with the Guidelines derived noise limits. For situations where predicted wind turbine noise meets or is less than the noise limits defined in the Guidelines, then the noise effects are deemed not significant. Any exceedance of the Guidelines derived noise limits due to the Proposed Development has the potential to result in a significant effect.

11.4.4.1.3 *Limitations and Assumptions*

It has been assumed that the noise data collected during the background noise survey are representative of the typical baseline noise levels at the nearest noise sensitive receptors; the guidance in the Guidelines supplemented by the IOA GPG has been followed by suitably experienced Acoustic Consultants to ensure that the data collected is as representative as possible.

A candidate wind turbine has been used for predictions of operational noise from the Proposed Development, whilst the final model of wind turbine to be used may differ from that presented in this assessment, operational noise levels will comply with the noise limits imposed by any An Bord Pleanála decision to grant permission.

No other assumptions or data gaps have been identified.

11.5 Baseline Conditions

11.5.1 Current Baseline

The Proposed Development is located within a rural location where existing background noise levels at the NSRs are generally considered to be low (<30 dB as defined in the Guidelines [9]) at low windspeeds. The predominant noise sources in the area are wind induced noise (wind passing through vegetation and around buildings), local watercourses and birdsong. At some receptors the soundscape is affected by some distant road traffic noise.

Tables 11-5 and 11-6 provide a summary of the background noise levels measured during the monitoring period during the quiet daytime and night time periods. Background noise data recorded during periods of rainfall (including the preceding 10 minute period in line with IOA GPG) have been excluded from the dataset, as well as data following periods of heavy rainfall. Further information of the data recorded during the noise survey can be found in Section 5 of Appendix 11-2). The prevailing background noise levels are also shown on Figures A1.2a-A1.2f included in Annex 1 of Appendix 11-2.

Table 11-5 Summary of Prevailing Background Noise Levels during Quiet Daytime Periods (dB(A))

Noise Monitoring Location	Wind Speed (ms^{-1}) as standardised to 10m height											
	1	2	3	4	5	6	7	8	9	10	11	12
NML1	27.6 *	27.6 *	27.6	28.0	29.3	31.4	34.2	37.6	41.4	45.6	50.1	54.7
NML2	28.4 *	28.4 *	28.4	28.6	29.5	31.1	33.4	36.4	40.2	44.7	44.7 *	44.7 *
NML3	28.6 *	28.6 *	28.6 *	28.6	29.3	30.6	32.7	35.6	39.4	44.2	50.1	50.1 *

[9] *Section 5.4 of WEDG 2006 refers to ' low noise environments where background noise is less than 30 dB(A)'*

Noise Monitoring Location	Wind Speed (ms^{-1}) as standardised to 10m height											
	1	2	3	4	5	6	7	8	9	10	11	12
NML4	29.1 *	29.1 *	29.1	29.2	30.0	31.6	33.7	36.5	39.8	43.6	47.8	52.4
NML5	26.4 *	26.4 *	26.4	26.7	27.7	29.4	31.8	34.8	38.3	42.4	46.9	51.8
NML6	27.9 *	27.9 *	27.9 *	27.9	28.7	30.3	32.7	35.7	39.2	43.2	47.6	52.3

** restricted where derived minimum occurs at lower wind speeds and maximum level recorded at higher wind speeds, see Section 5.6.5 of the Operational Noise Report (Appendix 11-2: Operational Noise Report)*

Table 11-6 Summary of Prevailing Background Noise Levels during Night time Periods (dB(A))

Noise Monitoring Location	Wind Speed (ms^{-1}) as standardised to 10m height											
	1	2	3	4	5	6	7	8	9	10	11	12
NML1	16.9 *	16.9	17.0	18.7	21.5	25.3	29.8	34.7	39.8	44.8	49.5	53.5
NML2	15.8 *	15.8 *	15.8	17.0	19.5	22.9	27.0	31.6	36.5	41.3	45.9	50.0
NML3	22.1 *	22.1 *	22.1	22.2	23.4	25.7	28.9	32.7	37.1	41.7	46.6	51.3
NML4	18.0 *	18.0 *	18.0	19.1	21.2	24.3	28.1	32.4	37.0	41.6	46.1	50.1
NML5	18.6 *	18.6 *	18.6	19.4	21.2	23.6	26.8	30.5	34.6	39.1	43.9	48.9
NML6	17.5 *	17.5 *	17.5	18.5	20.6	23.6	27.3	31.7	36.4	41.4	46.4	51.4

**restricted where derived minimum occurs at lower wind speeds, see Section 5.6.5 of the Operational Noise Report (Appendix 11-2).*

11.5.2 Summary of Sensitive Receptors

11.5.2.1 Scoped Out Receptors

All buildings within ~3 km of the proposed turbines within the Wind Farm Site were identified. Of the 341 buildings identified, a number were subsequently classified as derelict (H1, H77, H116, H131, H177, H224, H228 and H237. These locations are not considered to be NSRs for the purposes of this assessment and have not been considered further.

All NSRs are shown on EIAR Figure 11-2. For clarity a series of inset maps showing the individual numbering of the NSRs are also included as Figures A1.1a-c within Annex 1 of Technical Appendix 11-1.

11.5.2.2 Scoped In Receptors

Of the identified NSRs, a total of 16 were chosen as Noise Assessment Locations (NALs) for the operational noise assessment and 20 CNALs where selected for the Wind Farm Site construction noise assessment. The CNALs/ NALs were chosen to represent the noise sensitive receptors located closest to the Wind Farm Site and also some additional receptors were included to consider larger groups of NSRs. The modelling results for the CNALs/ NALs has been presented within the main body of this chapter and Appendices 11-1 and 11-2, whilst an assessment for all NSRs has been included within Annex 3 of Appendix 11-1 and Annex 5 of Appendix 11-2.

For the Grid Connection, the onsite 110kV substation and associated construction compound are located within the Wind Farm Site and as such are addressed above. Rather than identifying individual NSRs on the Grid Connection underground electrical cabling route, the construction noise assessment considers the typical noise levels that are likely to occur at each works segment along the length of the underground electrical cabling route, which has been applied to the assessment of all nearby sensitive receptors.

For the assessment locations where no background noise measurements were undertaken, noise data collected at proxy locations deemed representative of the background noise environment was used to assess the noise impacts at those receptors. For clarity, all NSRs are labelled with the letter 'H' and numbered to ensure consistency with the labelling within the rest of the EIAR.

The receptors considered as NALs within the noise assessment are summarised in Tables 11-5 and 11-6 below. A list of all NSRs is included within Annex C of Appendix 11-1 and Annex 5 of Appendix 11-2. All CNALs and NSRs are shown on Figure 11-1 and NALs and NSRs on Figure 11-2.

11.6 Assessment of Likely Effects

11.6.1 Construction Noise Assessment Locations

The Construction Noise Assessment Locations (CNAL) are summarised in Table 11-7: Summary of Construction Noise Assessment Locations below and are shown on Figure 11-1.

Table 11-7 Summary of Construction Noise Assessment Locations

Receptor	X (ITM)	Y (ITM)
CNAL 01 - H2	618399	747936
CNAL 02 - H3	619841	746630
CNAL 03 - H4	621453	745239
CNAL 04 - H5	618915	745338
CNAL 05 - H6	620556	746589
CNAL 06 - H7	618087	745667
CNAL 07 - H8	621320	746366
CNAL 08 - H12	618376	748045
CNAL 09 - H13	619889	747394
CNAL 10 - H15	618174	747340
CNAL 11 - H21	618929	745223

Receptor	X (ITM)	Y (ITM)
CNAL 12 - H25	618422	748301
CNAL 13 - H28	618077	746968
CNAL 14 - H33	618042	747109
CNAL 15 - H36	621274	744492
CNAL 16 - H41	617957	746743
CNAL 17 - H55	618835	745029
CNAL 18 - H63	618359	748530
CNAL 19 - H103	618406	749020
CNAL 20 - H169	617833	749239

11.6.2 Operational Noise Assessment Locations

Predictions of wind turbine noise have been made at each of the NALs as detailed in Table 11-8 and shown on Figure 11-2. Table 11-8 also details which NML has been used to set noise limits for each NAL. Predictions for all other NSRs are included within Annex 5 of Appendix 11-2.

Table 11-8 Summary of Operational Noise Assessment Locations

Receptor	X (ITM)	Y (ITM)	Elevation (m AOD)	Background Noise Data Used
NAL1 (H3)	619841	746630	60	NML2
NAL2 (H4)	621453	745239	109	NML3
NAL3 (H5)	618915	745338	60	NML5
NAL4 (H6)	620556	746589	70	NML2
NAL5 (H7)	618087	745667	65	NML5
NAL6 (H8)	621320	746366	71	NML2
NAL7 (H10)	621172	744654	90	NML4
NAL8 (H13)	619889	747394	69	NML2
NAL9 (H14)	618287	747683	85	NML6
NAL10 (H19)	620818	746596	83	NML2
NAL11 (H25)	618422	748301	100	NML1
NAL12 (H28)	618077	746968	78	NML6
NAL13 (H35)	620376	744130	81	NML4
NAL14 (H67)	619592	748749	60	NML1
NAL15 (H86)	619669	744029	70	NML4
NAL16 (H97)	618860	749119	69	NML1

11.6.3 Potential Construction Noise Effects

Table 11-9: Predicted Construction Noise Immission Levels presents the calculated noise immission levels at each CNAL for all modelled scenarios. The construction noise assessment results show that the predicted construction noise levels are below the Category A Threshold Levels for all threshold value periods. For all of the CNALs and for all assessment scenarios, therefore, there will be **no significant effects**. Full details of the modelling and assessment can be found in Appendix 11-1 along with the results for all other NSRs.

Although noise levels from the laying of the underground electrical cabling route has the potential to exceed the BS 5228 threshold levels during the daytime, due to the transient nature of the underground electrical cabling works, this will only occur for a short period of time at any one location. Accordingly, the impact is not deemed significant.

Table 11-9 Predicted Construction Noise Immission Levels

CNAL	Category A Threshold dB $L_{Aeq, t}$			Immission Level, dB $L_{Aeq, t}$ for each Scenario								
	Daytime (07:00 – 19:00) and Saturdays (07:00 - 13:00)	Evenings (19:00-23:00 weekdays) Weekends (13:00-23:00 Saturdays and 07:00-23:00 Sundays)	Night-Time (23:00 – 07:00)	1	2	3	4	5	6	7	8	Night
CNAL 01 - H2	65	55	45	35	40	35	32	40	37	36	34	26
CNAL 02 - H3	65	55	45	31	38	40	41	44	43	42	38	25
CNAL 03 - H4	65	55	45	22	29	30	31	38	41	40	34	16
CNAL 04 - H5	65	55	45	40	47	48	48	49	50	45	45	38
CNAL 05 - H6	65	55	45	26	32	32	33	40	40	40	34	19
CNAL 06 - H7	65	55	45	37	39	42	39	41	43	39	39	24
CNAL 07 - H8	65	55	45	21	27	27	28	35	38	37	31	14
CNAL 08 - H12	65	55	45	35	39	34	31	39	36	35	33	25
CNAL 09 - H13	65	55	45	29	38	33	31	39	36	35	34	24
CNAL 10 - H15	65	55	45	31	38	37	33	39	37	35	34	25
CNAL 11 - H21	65	55	45	38	46	47	46	48	48	44	43	36
CNAL 12 - H25	65	55	45	28	36	30	28	39	37	37	31	23

CNAL	Category A Threshold dB $L_{Aeq,\ t}$			Immission Level, dB $L_{Aeq,\ t}$ for each Scenario								
	Daytime (07:00 – 19:00) and Saturdays (07:00 - 13:00)	Evenings (19:00-23:00 weekdays) Weekends (13:00-23:00 Saturdays and 07:00-23:00 Sundays)	Night-Time (23:00 – 07:00)	1	2	3	4	5	6	7	8	Night
CNAL 13 - H28	65	55	45	33	40	39	35	42	39	37	36	23
CNAL 14 - H33	65	55	45	32	39	39	34	41	39	36	35	23
CNAL 15 - H36	65	55	45	20	31	32	32	35	38	35	29	13
CNAL 16 - H41	65	55	45	34	37	40	36	41	40	37	37	22
CNAL 17 - H55	65	55	45	35	42	43	43	44	45	40	40	31
CNAL 18 - H63	65	55	45	26	33	28	26	40	40	40	28	20
CNAL 19 - H103	65	55	45	38	39	25	23	32	31	31	25	16
CNAL 20 - H169	65	55	45	23	28	24	22	43	43	43	23	14

11.6.4 Potential Construction Vibration Effects

Due to the large separation distances between the construction activity areas on the Wind Farm Site and the nearest receptors, no significant effects are anticipated. Where construction activities on the underground electrical cabling route are close to residential receptors, some local vibration effects may be present, however, levels are expected to be low and of limited duration.

11.6.5 Potential Operational Noise Effects

11.6.5.1 Wind Farm Site

11.6.5.1.1 *Setting the Guidelines Noise Limits*

Based on the prevailing background noise levels, the Guidelines Noise Limits have been established for each of the NALs detailed in Table 11-8 above. The Guidelines Noise Limits for the other NSRs are detailed in Annex 5 of Appendix 11-2.

The Guidelines Noise Limits are as detailed in Table 11-10 and Table 11-11 below.

Table 11-10 The Guidelines Noise Limit - Daytime

Noise Assessment Location	Wind Speed (ms^{-1}) as standardised to 10m height											
	1	2	3	4	5	6	7	8	9	10	11	12
NAL1 (H3)	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.2	49.7	49.7	49.7
NAL2 (H4)	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	49.2	55.1	55.1
NAL3 (H5)	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	47.4	51.9	56.8
NAL4 (H6)	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.2	49.7	49.7	49.7
NAL5 (H7)	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	47.4	51.9	56.8
NAL6 (H8)	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.2	49.7	49.7	49.7
NAL7 (H10)	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	48.6	52.8	57.4
NAL8 (H13)	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.2	49.7	49.7	49.7
NAL9 (H14)	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	48.2	52.6	57.3
NAL10 (H19)	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.2	49.7	49.7	49.7
NAL11 (H25)	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.4	50.6	55.1	59.7
NAL12 (H28)	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	48.2	52.6	57.3
NAL13 (H35)	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	48.6	52.8	57.4
NAL14 (H67)	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.4	50.6	55.1	59.7
NAL15 (H86)	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	48.6	52.8	57.4
NAL16 (H97)	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.4	50.6	55.1	59.7

Table 11-11 The Guidelines Noise Limit – Night time

Noise Assessment Location	Wind Speed (ms^{-1}) as standardised to 10m height											
	1	2	3	4	5	6	7	8	9	10	11	12
NAL1 (H3)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.3	50.9	55.0
NAL2 (H4)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.7	51.6	56.3
NAL3 (H5)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.1	48.9	53.9
NAL4 (H6)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.3	50.9	55.0
NAL5 (H7)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.1	48.9	53.9
NAL6 (H8)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.3	50.9	55.0
NAL7 (H10)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.6	51.1	55.1
NAL8 (H13)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.3	50.9	55.0
NAL9 (H14)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.4	51.4	56.4
NAL10 (H19)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.3	50.9	55.0
NAL11 (H25)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.8	49.8	54.5	58.5
NAL12 (H28)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.4	51.4	56.4
NAL13 (H35)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.6	51.1	55.1
NAL14 (H67)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.8	49.8	54.5	58.5
NAL15 (H86)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.6	51.1	55.1
NAL16 (H97)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.8	49.8	54.5	58.5

11.6.5.1.2 Predictions

The Guidelines Noise Limits were compared to the predictions of the Proposed Development operating on its own and the results are summarised below in Table 11-12 for the daytime and Table 11-13 for the night time. The tables also show the exceedance level, which is the difference between the predicted noise level and the Guidelines Noise Limit at a given wind speed. A negative exceedance level indicates satisfaction of the noise limit. The Guidelines Noise Limits and predictions are also shown on Figures A1.3a – 3p in Appendix 11-2: Operational Noise Report.

The assessment shows that the predicted wind turbine noise immission levels meet the Guidelines Noise Limits under all conditions for both daytime and night time periods at all receptors and as such there will be **no significant effects** at those receptors

Table 11-12 Compliance Table –Comparison of predicted noise levels from the Proposed Development against the Guidelines Noise Limit at each receptor – Daytime

NAL		Wind Speed (ms^{-1}) as standardised to 10m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL1 – H3	Guidelines Noise Limit, L_{A90}	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.2	49.7	49.7	49.7
	Predicted Wind Turbine Noise L_{A90}	-	-	30.8	32.4	36.4	40.1	41.4	41.4	41.4	41.4	41.4	41.4
	Exceedance Level	-	-	-9.2	-7.6	-3.6	-4.9	-3.6	-3.6	-3.8	-8.3	-8.3	-8.3
NAL2 – H4	Guidelines Noise Limit, L_{A90}	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	49.2	55.1	55.1
	Predicted Wind Turbine Noise L_{A90}	-	-	28.2	29.8	33.8	37.5	38.8	38.8	38.8	38.8	38.8	38.8
	Exceedance Level	-	-	-11.8	-10.2	-6.2	-7.5	-6.2	-6.2	-6.2	-10.4	-16.3	-16.3
NAL3 – H5	Guidelines Noise Limit, L_{A90}	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	47.4	51.9	56.8
	Predicted Wind Turbine Noise L_{A90}	-	-	29.3	30.9	35.0	38.7	40.0	40.0	40.0	40.0	40.0	40.0
	Exceedance Level	-	-	-10.7	-9.1	-5.0	-1.3	-5.0	-5.0	-5.0	-7.4	-11.9	-16.8
NAL4 – H6	Guidelines Noise Limit, L_{A90}	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.2	49.7	49.7	49.7
	Predicted Wind Turbine Noise L_{A90}	-	-	29.2	30.8	34.9	38.6	39.9	39.9	39.9	39.9	39.9	39.9
	Exceedance Level	-	-	-10.8	-9.2	-5.1	-6.4	-5.1	-5.1	-5.3	-9.8	-9.8	-9.8
NAL5 – H7	Guidelines Noise Limit, L_{A90}	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	47.4	51.9	56.8
	Predicted Wind Turbine Noise L_{A90}	-	-	27.4	29.0	33.0	36.7	38.0	38.0	38.0	38.0	38.0	38.0
	Exceedance Level	-	-	-12.6	-11.0	-7.0	-3.3	-7.0	-7.0	-7.0	-9.4	-13.9	-18.8
NAL6 – H8	Guidelines Noise Limit, L_{A90}	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.2	49.7	49.7	49.7
	Predicted Wind Turbine Noise L_{A90}	-	-	27.6	29.1	33.2	36.9	38.2	38.2	38.2	38.2	38.2	38.2
	Exceedance Level	-	-	-12.4	-10.9	-6.8	-8.1	-6.8	-6.8	-7.0	-11.5	-11.5	-11.5
NAL7 – H10	Guidelines Noise Limit, L_{A90}	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	48.6	52.8	57.4
	Predicted Wind Turbine Noise L_{A90}	-	-	27.5	29.1	33.1	36.8	38.1	38.1	38.1	38.1	38.1	38.1
	Exceedance Level	-	-	-12.5	-10.9	-6.9	-8.2	-6.9	-6.9	-6.9	-10.5	-14.7	-19.3
NAL8 – H13	Guidelines Noise Limit, L_{A90}	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.2	49.7	49.7	49.7
	Predicted Wind Turbine Noise L_{A90}	-	-	28.6	30.2	34.2	37.9	39.2	39.2	39.2	39.2	39.2	39.2
	Exceedance Level	-	-	-11.4	-9.8	-5.8	-7.1	-5.8	-5.8	-6.0	-10.5	-10.5	-10.5
NAL9 – H14	Guidelines Noise Limit, L_{A90}	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	48.2	52.6	57.3
	Predicted Wind Turbine Noise L_{A90}	-	-	27.9	29.5	33.6	37.3	38.6	38.6	38.6	38.6	38.6	38.6
	Exceedance Level	-	-	-12.1	-10.5	-6.4	-7.7	-6.4	-6.4	-6.4	-9.6	-14.0	-18.7
NAL10 – H19	Guidelines Noise Limit, L_{A90}	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.2	49.7	49.7	49.7
	Predicted Wind Turbine Noise L_{A90}	-	-	28.4	30.0	34.0	37.7	39.0	39.0	39.0	39.0	39.0	39.0
	Exceedance Level	-	-	-11.6	-10.0	-6.0	-7.3	-6.0	-6.0	-6.2	-10.7	-10.7	-10.7

NAL		Wind Speed (ms^{-1}) as standardised to 10m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL11 – H25	Guidelines Noise Limit, L_{A90}	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.4	50.6	55.1	59.7
	Predicted Wind Turbine Noise L_{A90}	-	-	25.5	27.1	31.1	34.9	36.2	36.2	36.2	36.2	36.2	36.2
	Exceedance Level	-	-	-14.5	-12.9	-8.9	-10.1	-8.8	-8.8	-10.2	-14.4	-18.9	-23.5
NAL12 – H28	Guidelines Noise Limit, L_{A90}	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	48.2	52.6	57.3
	Predicted Wind Turbine Noise L_{A90}	-	-	28.0	29.6	33.6	37.3	38.6	38.6	38.6	38.6	38.6	38.6
	Exceedance Level	-	-	-12.0	-10.4	-6.4	-7.7	-6.4	-6.4	-6.4	-9.6	-14.0	-18.7
NAL13 – H35	Guidelines Noise Limit, L_{A90}	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	48.6	52.8	57.4
	Predicted Wind Turbine Noise L_{A90}	-	-	25.9	27.5	31.5	35.2	36.5	36.5	36.5	36.5	36.5	36.5
	Exceedance Level	-	-	-14.1	-12.5	-8.5	-9.8	-8.5	-8.5	-8.5	-12.1	-16.3	-20.9
NAL14 – H67	Guidelines Noise Limit, L_{A90}	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.4	50.6	55.1	59.7
	Predicted Wind Turbine Noise L_{A90}	-	-	23.2	24.8	28.9	32.6	33.9	33.9	33.9	33.9	33.9	33.9
	Exceedance Level	-	-	-16.8	-15.2	-11.1	-12.4	-11.1	-11.1	-12.5	-16.7	-21.2	-25.8
NAL15 – H86	Guidelines Noise Limit, L_{A90}	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	48.6	52.8	57.4
	Predicted Wind Turbine Noise L_{A90}	-	-	24.2	25.8	29.8	33.5	34.8	34.8	34.8	34.8	34.8	34.8
	Exceedance Level	-	-	-15.8	-14.2	-10.2	-11.5	-10.2	-10.2	-10.2	-13.8	-18.0	-22.6
NAL16 – H97	Guidelines Noise Limit, L_{A90}	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.4	50.6	55.1	59.7
	Predicted Wind Turbine Noise L_{A90}	-	-	21.2	22.8	26.8	30.5	31.8	31.8	31.8	31.8	31.8	31.8
	Exceedance Level	-	-	-18.8	-17.2	-13.2	-14.5	-13.2	-13.2	-14.6	-18.8	-23.3	-27.9

Table 11-13 Compliance Table – Comparison of predicted noise levels from the Proposed Development against the Guidelines Noise Limit at each receptor – Night time

NAL		Wind Speed (ms^{-1}) as standardised to 10m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL1 – H3	Guidelines Noise Limit, L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.3	50.9	55.0
	Predicted Wind Turbine Noise L_{A90}	-	-	30.8	32.4	36.4	40.1	41.4	41.4	41.4	41.4	41.4	41.4
	Exceedance Level	-	-	-12.2	-10.6	-6.6	-2.9	-1.6	-1.6	-1.6	-4.9	-9.5	-13.6
NAL2 – H4	Guidelines Noise Limit, L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.7	51.6	56.3
	Predicted Wind Turbine Noise L_{A90}	-	-	28.2	29.8	33.8	37.5	38.8	38.8	38.8	38.8	38.8	38.8
	Exceedance Level	-	-	-14.8	-13.2	-9.2	-5.5	-4.2	-4.2	-4.2	-7.9	-12.8	-17.5
NAL3 – H5	Guidelines Noise Limit, L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.1	48.9	53.9
	Predicted Wind Turbine Noise L_{A90}	-	-	29.3	30.9	35.0	38.7	40.0	40.0	40.0	40.0	40.0	40.0
	Exceedance Level	-	-	-13.7	-12.1	-8.0	-4.3	-3.0	-3.0	-3.0	-4.1	-8.9	-13.9
NAL4 – H6	Guidelines Noise Limit, L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.3	50.9	55.0
	Predicted Wind Turbine Noise L_{A90}	-	-	29.2	30.8	34.9	38.6	39.9	39.9	39.9	39.9	39.9	39.9
	Exceedance Level	-	-	-13.8	-12.2	-8.1	-4.4	-3.1	-3.1	-3.1	-6.4	-11.0	-15.1
NAL5 – H7	Guidelines Noise Limit, L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.1	48.9	53.9
	Predicted Wind Turbine Noise L_{A90}	-	-	27.4	29.0	33.0	36.7	38.0	38.0	38.0	38.0	38.0	38.0
	Exceedance Level	-	-	-15.6	-14.0	-10.0	-6.3	-5.0	-5.0	-5.0	-6.1	-10.9	-15.9
NAL6 – H8	Guidelines Noise Limit, L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.3	50.9	55.0
	Predicted Wind Turbine Noise L_{A90}	-	-	27.6	29.1	33.2	36.9	38.2	38.2	38.2	38.2	38.2	38.2
	Exceedance Level	-	-	-15.4	-13.9	-9.8	-6.1	-4.8	-4.8	-4.8	-8.1	-12.7	-16.8
NAL7 – H10	Guidelines Noise Limit, L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.6	51.1	55.1
	Predicted Wind Turbine Noise L_{A90}	-	-	27.5	29.1	33.1	36.8	38.1	38.1	38.1	38.1	38.1	38.1
	Exceedance Level	-	-	-15.5	-13.9	-9.9	-6.2	-4.9	-4.9	-4.9	-8.5	-13.0	-17.0
NAL8 – H13	Guidelines Noise Limit, L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.3	50.9	55.0
	Predicted Wind Turbine Noise L_{A90}	-	-	28.6	30.2	34.2	37.9	39.2	39.2	39.2	39.2	39.2	39.2
	Exceedance Level	-	-	-14.4	-12.8	-8.8	-5.1	-3.8	-3.8	-3.8	-7.1	-11.7	-15.8
NAL9 – H14	Guidelines Noise Limit, L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.4	51.4	56.4
	Predicted Wind Turbine Noise L_{A90}	-	-	27.9	29.5	33.6	37.3	38.6	38.6	38.6	38.6	38.6	38.6
	Exceedance Level	-	-	-15.1	-13.5	-9.4	-5.7	-4.4	-4.4	-4.4	-7.8	-12.8	-17.8
NAL10 – H19	Guidelines Noise Limit, L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.3	50.9	55.0
	Predicted Wind Turbine Noise L_{A90}	-	-	28.4	30.0	34.0	37.7	39.0	39.0	39.0	39.0	39.0	39.0
	Exceedance Level	-	-	-14.6	-13.0	-9.0	-5.3	-4.0	-4.0	-4.0	-7.3	-11.9	-16.0

NAL		Wind Speed (ms^{-1}) as standardised to 10m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL11 – H25	Guidelines Noise Limit, L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.8	49.8	54.5	58.5
	Predicted Wind Turbine Noise L_{A90}	-	-	25.5	27.1	31.1	34.9	36.2	36.2	36.2	36.2	36.2	36.2
	Exceedance Level	-	-	-17.5	-15.9	-11.9	-8.1	-6.8	-6.8	-8.6	-13.6	-18.3	-22.3
NAL12 – H28	Guidelines Noise Limit, L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.4	51.4	56.4
	Predicted Wind Turbine Noise L_{A90}	-	-	28.0	29.6	33.6	37.3	38.6	38.6	38.6	38.6	38.6	38.6
	Exceedance Level	-	-	-15.0	-13.4	-9.4	-5.7	-4.4	-4.4	-4.4	-7.8	-12.8	-17.8
NAL13 – H35	Guidelines Noise Limit, L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.6	51.1	55.1
	Predicted Wind Turbine Noise L_{A90}	-	-	25.9	27.5	31.5	35.2	36.5	36.5	36.5	36.5	36.5	36.5
	Exceedance Level	-	-	-17.1	-15.5	-11.5	-7.8	-6.5	-6.5	-6.5	-10.1	-14.6	-18.6
NAL14 – H67	Guidelines Noise Limit, L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.8	49.8	54.5	58.5
	Predicted Wind Turbine Noise L_{A90}	-	-	23.2	24.8	28.9	32.6	33.9	33.9	33.9	33.9	33.9	33.9
	Exceedance Level	-	-	-19.8	-18.2	-14.1	-10.4	-9.1	-9.1	-10.9	-15.9	-20.6	-24.6
NAL15 – H86	Guidelines Noise Limit, L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.6	51.1	55.1
	Predicted Wind Turbine Noise L_{A90}	-	-	24.2	25.8	29.8	33.5	34.8	34.8	34.8	34.8	34.8	34.8
	Exceedance Level	-	-	-18.8	-17.2	-13.2	-9.5	-8.2	-8.2	-8.2	-11.8	-16.3	-20.3
NAL16 – H97	Guidelines Noise Limit, L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.8	49.8	54.5	58.5
	Predicted Wind Turbine Noise L_{A90}	-	-	21.2	22.8	26.8	30.5	31.8	31.8	31.8	31.8	31.8	31.8
	Exceedance Level	-	-	-21.8	-20.2	-16.2	-12.5	-11.2	-11.2	-13.0	-18.0	-22.7	-26.7

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11.6.5.2 Grid Connection

The Grid Connection onsite 110 kV substation will be installed in the southern half of the Wind Farm Site. The closest receptor to the substation is H5, which is at a distance of approximately 290 m.

'*EirGrid Evidence Based Environmental Studies Study 8: Noise'* presents measured noise levels for a similar 110 kV substation (Dunfirth Substation). Sound pressure level measurements are provided at four different locations around the substation at distances of 5 m and 10 m, which vary between 37 dB $L_{Aeq(t)}$ and 39 dB $L_{Aeq(t)}$. The document provides commentary on the measurements, stating, *"The measured noise levels at the boundary of this substation are below the daytime WHO threshold limits for serious annoyance (55 dB LAeq) and moderate annoyance (50 dB LAeq) for outdoor living areas. They are also below the night-time free-field threshold limit of 42 dB (LAeq) for preventing negative effects on sleep."*

With a separation distance of 290 m to the closest receptor, the level of distance attenuation will be approximately 50 dB. Accordingly, at distances of 290 m and greater the predicted noise level from the substation at the receptor is 0 dB and there is no potential for significant effects.

There will be no operational noise from the Grid Connection underground electrical cabling route.

11.6.6 Potential Cumulative Effects

Potential cumulative effects on noise and vibration between the Proposed Development and other permitted or proposed projects and plans in the area, (wind energy or otherwise), as set out in Section 2.7 in Chapter 2 of this EIAR, were also considered as part of this assessment. The developments considered as part of the cumulative effect assessment are described in Section 2.7 of this EIAR.

As detailed in Section 2.7 in Chapter 2 of this EIAR, the nearest proposed, permitted or existing wind farm is 16.3km from the Proposed Development turbines, therefore, there is no potential for operational cumulative noise effects.

In respect to the quarry that is located adjacent to the Wind Farm Site at its north-eastern boundary, there is the potential for cumulative effects to occur due to the concurrent operation of Proposed Development and the nearby quarry. It is not appropriate to consider the cumulative impacts in relation to the limits set in accordance with the Guidelines as they are specific to wind turbine noise. Conversely it is not appropriate to consider wind turbine noise in the context of any noise and vibration limits set for the quarry. The Proposed Development turbine noise will have a different characteristic than existing nearby sources such as the quarry, and will vary significantly with wind speed, just as quarry activities vary day by day. Once each development, (i.e. the Proposed Development and the quarry) is within its respective noise criteria, the potential for cumulative noise effects is unlikely.

No cumulative noise effects are anticipated in relation to construction of the underground electrical cabling route and other permitted or proposed projects and plans in the area, as set out in Section 2.7 in Chapter 2 of this EIAR, as construction activities will be transient in nature along the route and will not be in any one location long enough for a significant impact to occur.

No cumulative noise effects are anticipated in relation to the construction of the Proposed Development, and other permitted or proposed projects and plans in the area, as set out in Section 2.7 in Chapter 2 of this EIAR. At the vast majority of CNALs, the maximum predicted noise levels as presented in Table 11-9 are >10 dB below the stricter threshold value of 55 dB presented in the table. This means that even if other construction noise activities were taking place concurrently the levels will be such that the addition of the construction noise associated with the Wind Farm Site will not result in an exceedance of the threshold values. For example, if a third parties construction activities were emitting noise up to the threshold value of 55 dB the addition of noise from the Wind Farm Site of up

to 45 dB would not result in a negligible increase overall[10]. There are two CNALs where predicted noise levels from the Wind Farm Site are within 10 dB of the threshold value (CNAL4 and CNAL11) and this would only occur on a Saturday afternoons where the more stringent threshold of 55 dB would apply. No other construction activities have been identified in close proximity to those two receptors and as such no significant cumulative impacts are predicted.

11.7 Mitigation

11.7.1 Mitigation during Construction

No significant effects resulting from construction noise are predicted. Nevertheless, a range of good practice measures are presented in the Construction Environmental Management Plan (CEMP), included as Appendix 4-2 of this EIAR, and these will be employed to minimise noise impacts. At this stage of the development process, the assessment is based on a precautionary approach, as a detailed construction programme is not available.

Good site practices, both on the Wind Farm Site and along the Grid Connection underground electrical cabling route will be implemented to minimise the likely effects. Particular care will be taken at watercourse, culvert and drain crossings along the underground electrical cabling route, as detailed in Section 4.7.7 in Chapter 4 of this EIAR, where directional drilling activities are required to be undertaken. Section 8 of BS5228-1:2009+A1:2014 recommends a number of simple control measures as summarised below that will be employed onsite:

- Keep local residents informed of the proposed working schedule, where appropriate, including the times and duration of any abnormally noisy activity that may cause concern;
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and be subject to programmed maintenance;
- Select inherently quiet plant where appropriate - all major compressors will be 'sound reduced' models fitted with properly lined and sealed acoustic covers, which will be kept closed whenever the machines are in use;
- All ancillary pneumatic percussive tools will be fitted with mufflers or silencers of the type recommended by the manufacturers;
- Machines will be shut down between work periods (or when not in use) or throttled down to a minimum;
- Regularly maintain all equipment used on site, including maintenance related to noise emissions;
- Vehicles will be loaded carefully to ensure minimal drop heights so as to minimise noise during this operation; and
- All ancillary plant such as generators and pumps will be positioned so as to cause minimum noise disturbance and if necessary, temporary acoustic screens or enclosures will be provided.

Where the BS5228 threshold levels are anticipated to be exceeded due to directional drilling activities along the underground electrical cabling route, the following are examples of measures that will be considered, where necessary, to mitigate noise emissions from these activities are as follows:

- Temporary boarding alongside the drilling rig or use of 'acoustic blanket panels' to hang from heras fencing or similar. Installation will be as close to the drilling rig as is practicable and fitted so as to interrupt any direct line of site between the drilling rig and the closest residential receptors.

[10] *For example - 40 dB + 30 dB = 40.4 dB and this is considered to be a negligible change.*

- Examples of appropriate products include Echo Noise Defender and Soundex DeciBloc. It is anticipated that this will be required should directional drilling be used for water crossings 3, 7 and 11, which are in close proximity to sensitive receptors.

While it was concluded in above that there will be no significant vibration impacts associated with the construction of the Proposed Development and that no specific mitigation measures were required, it is recommended that vibration from construction activities will be limited to the values set out in Section 11.4.1.2. Given that construction activities are only likely to occur for a short duration, the use of internal vibration limits is likely to be unnecessary. Therefore, no mitigation measures are proposed.

11.7.2 Mitigation during Operation

The exact model of wind turbine to be used for the Proposed Development will be the result of a future tendering process. The final choice of turbine will, however, have to meet the derived Guidelines noise limits and/or noise limits determined and contained within any planning permission condition imposed.

As detailed above, the predicted noise levels from the Proposed Development are within the Guidelines noise limits, and therefore no mitigation measures are required in respect of noise. Notwithstanding the above, this section discusses the principle of noise curtailment to demonstrate that all modern wind turbines have the capability of operating in reduced noise modes, should it be necessary to reduce the noise immissions from any installed turbine.

Wind turbines can be programmed to run in reduced modes of operation (or low noise modes) in order to achieve noise criteria during certain periods (i.e. day or night) and under specific wind conditions (i.e. wind speed and direction). The turbine technology that has been assumed for this assessment offers various noise modes of operation which typically will have an associated energy output reduction. Operating the turbines in reduced modes is generally referred to as curtailment and is a proven effective mitigation to ensure noise limits are complied with. Low noise modes are available for all modern turbines likely to be considered for this Site.

As an example, Table 11-14 shows the sound power level data for a candidate turbine operating in standard mode (Mode 0) and other operational modes (Modes 1-5) that can be applied to the turbine. As can be seen at mid to higher range wind speeds a reduction in the noise level in the order of 6 dB can be achieved depending on the operational mode set on the specific turbines.

Table 11-14 Sound power levels for normal operation and for various modes for a candidate turbine[11]

Operating Mode	Predicted Noise Level dB L_{A90} at Standardised Wind Speed at 10m AGL									
	3 ms^{-1}	4 ms^{-1}	5 ms^{-1}	6 ms^{-1}	7 ms^{-1}	8 ms^{-1}	9 ms^{-1}	10 ms^{-1}	11 ms^{-1}	12 ms^{-1}
Mode 0	96.2	97.8	101.8	105.4	106.3	106.3	106.3	106.3	106.3	106.3
Mode 1	95.9	98.6	102.6	104.0	104.0	104.0	104.0	104.0	104.0	104.0
Mode 2	95.9	98.6	102.4	103.0	103.0	103.0	103.0	103.0	103.0	103.0
Mode 3	95.9	98.6	101.8	102.0	102.0	102.0	102.0	102.0	102.0	102.0
Mode 4	95.9	98.5	101.0	101.0	101.0	101.0	101.0	101.0	101.0	101.0

[11] *Data supplied by Enerco Energy Ltd.*

Mode 5	95.9	98.5	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

11.8 Assessment of Residual Effects

11.8.1 Residual Construction Effects

Predicted construction noise levels are below the assessment criteria at all receptors, for all phases of construction of the Wind Farm. Good practice mitigation measures are outlined above, however, with or without the good practice construction mitigation measures there will be **no significant residual effects**.

Although noise levels from the laying of the underground electrical cabling route has the potential to exceed the BS 5228 threshold levels during the daytime, due to the transient nature of the underground electrical cabling works, this will only occur for a short period of time at any one location. There will be short periods where threshold levels may be exceeded for the closest noise sensitive receptors. For trenching and backfill activities this will likely occur for less than one day at any given receptor. If directional drilling activities at watercourse, drain and culvert crossing locations are required close to noise sensitive receptors, the mitigation measures detailed above will be put into place and there will be **no significant residual effects**.

11.8.2 Residual Operational Effects

Predicted Proposed Development turbine operational noise levels at all the NALs and NSRs lie below the WEDG daytime and night time Noise Limits, there will be **no significant residual effects**.

11.9 Summary

Predicted construction noise levels compared with the Category A criteria outlined in Section E.3 of BS5228: Part 1 2009+A1:2014 indicate that construction noise levels for the Wind Farm Site are below the guidelines considered acceptable at all receptors for all construction phases of the Proposed Development and therefore **no significant effects** are anticipated.

Noise levels has the potential to exceed the BS 5228 threshold levels for short periods of time during the laying of the underground electrical cabling route, however, the short duration of these activities means that **no significant effects** are anticipated.

The guidance contained within the Guidelines was used to assess the likely operational noise impact of the Proposed Development. Predicted levels and measured background noise levels indicate that for dwellings neighbouring the Wind Farm Site, wind turbine noise will meet the noise criteria established in accordance with the WEDG 2006 therefore **no significant effects** are anticipated.

There are a range of wind turbine models that may be appropriate for the Proposed Development. If the Proposed Development receives planning permission, further data will be obtained from the supplier for the final choice of wind turbine model to demonstrate compliance with the derived Guidelines noise limits and/or noise limits determined and contained within any planning permission condition imposed. In the event that mitigation is required, turbine control systems allow for turbines to operate in a reduced noise mode.