12. NOISE

12.1 Introduction

The Proposed Development is for a Wind Farm consisting of 22 no. wind turbines and associated infrastructure. The Proposed Development has the potential to create noise during it's construction, operation and decommissioning phases. This chapter assesses the potential noise impacts at the nearest Noise Sensitive Receptors (NSRs), which are residential properties within c. 3km of the Proposed Development. NSRs are also referred to as Houses (H) in other parts of the EIAR.

The specific objectives of this Noise chapter are to:

- describe the existing noise baseline and NSRs;
- describe the assessment methodology and significance criteria used in completing the noise assessment;
- assess the potential noise effects (including cumulative effects);
- describe the mitigation measures proposed to address any likely significant effects of the Proposed Development, if required; and
- assess the residual noise effects of the Proposed Development remaining following the implementation of mitigation.

This Noise chapter or impact assessment? is supported by the following figures and appendices:

- Figures
  - Figure 12.1: Construction Noise Assessment Locations;
  - Figure 12.2: Operational Noise Monitoring and Assessment Locations; and
  - Figure 12.3: Cumulative Turbine Locations.
- Appendices
  - Appendix 12-1: Construction Noise Report; and
  - Appendix 12-2: Operational Noise Report.

Figures and appendices are referenced in the text where relevant. Appendices 12-1 and 12-2 contain the detailed assessment information and this Noise chapter presents a summary of the main findings.

The full description of the Proposed Development, as assessed in this chapter is detailed in Chapter 4 of the EIAR.

12.1.1.1 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 Ewan Watson (BEng, Dip, AMIOA). Ewan Is a Senior Consultant with over seven years experience of undertaking construction noise assessments. Ewan holds the Diploma in Acoustics and Noise Control and is an associate member of the Institute of Acoustics. The construction noise assessment was reviewed and approved by Jim Singleton (BSc, Dip, MIOA). Jim is a Principal Consultant who has over 16 years experience in undertaking a wide variety of noise assessments. Jim holds the Diploma in Acoustics and Noise Control and is a full member of the institute of Acoustics.

The operational noise assessment was undertaken by Gemma Clark (BSc, MSc, AMIOA). Gemma is a Principal Consultant with over sixteen years experience of undertaking wind farm noise assessments. Gemma is an associate member of the Institute of Acoustics. The operational noise assessment was

reviewed and approved by Jason Baldwin (BSc, Dip, AMIOA). Jason is a Principal Consultant with over ten years experience of undertaking wind farm noise assessments. Jason holds the Diploma in Acoustics and Noise Control and is an associate member of the Institute of Acoustics.

12.2 Legislation, Policy and Guidelines

This assessment adheres to the following 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,' 2006[2];
- The Working Group on Noise from Wind Turbines (NWG) (1996). ETSU-R-97 'The Assessment and Rating of Noise from Wind Farms'[3];
- 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)[4];
- ISO 9613-2: 1996 'Acoustics - Attenuation of sound during propagation outdoors Part 2: General method of calculation'[5];
- Association of Acoustic Consultants of Ireland (AACI) 'Environmental Noise Guidance for Local Authority Planning & Enforcement Departments'[6]; and
- Environmental Protection Agency 'Guidelines on the information to be contained in Environmental Impact Assessment Reports'[7].

The above documents are discussed in detail within Section 2 of Appendix 12-1 and Appendix 12-2, where relevant.

In regards to national planning policy and guidance, it is noted that the Irish Government Wind Energy Development Guidelines for Planning Authorities (2006) WEDG are currently under review and a set of draft updated guidelines were issued for consultation in December 2019 ('draft 2019 WEDG'). The draft 2019 WEDG included reference to, and reliance upon, some elements of ETSU-R-97 and the IOA GPG. Significant concerns were raised during the consultation process regarding the noise section of the draft 2019 WEDGs relating to how the authors had misinterpreted existing guidance and the technical approaches proposed. A summary of the concerns raised by a group of Acousticians[8], was submitted as part of the consultation process and at the time of writing this report, no further updates have been issued. Given the limitations of the draft 2019 WEDGs and the likelihood that significant changes would need to be made to them before they could be adopted, an assessment using those draft guidelines has not been undertaken. On the 22 February 2023, a request for tender (RFT) was published for the review and redraft of the WEDGs by the Department of Environment. The timescales of the review indicated completion of the works by Q4 2023, in line with the Climate Action Plan 2023. At time of writing the WEDG 2006 are still the relevant guidelines so have been used for this assessment. The WEDG 2006 have been supplemented by the guidance in ETSU-R-97 and the IOA GPG where appropriate, these documents are considered by TNEI to represent current best practice.

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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] *ETSU for the DTI (Department of Trade and Industry), 1996 . The Working Group on Noise from Wind Turbines ETSU-R-97 The Assessment and Rating of Noise from Wind Farms'.*
[4] *Institute of Acoustics, 2013. Good Practice Guidance on the application of ETSU-R-97 for wind turbine noise assessment.*
[5] *(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*
[6] *Association of Acoustic Consultants of Ireland, 2021. 'Environmental Noise Guidance for Local Authority Planning & Enforcement Departments.*
[7] *The Environmental Protection Agency. 'Guidelines on the information to be contained in Environmental Impact Assessment Reports'*
[8] *Mackay, J, Singleton, J, Reid, M, Cand, M, Mahon, J, McKenzie, A, Keaney, D, Hayes, M, Bowdler, D, Kelly, D, Jiggins, M, Irvine, G & Lester, M, 2020. Public consultation on the revised wind energy development guidelines: Joint consultation response. Available at: https://www.tneigroup.com/news_event/tnei-submit-joint-consultation-response-and-meet-with-government-regarding-proposed-updates-to-the-irish-wind-farm-noise-guidelines-wedg/*

In 2018, the World Health Organisation (WHO) issued noise guidelines *'Environmental Noise Guidelines for the European Region'*[9] that provide recommendations for protecting human health from exposure to environmental noise. The guidelines consider noise originating from various sources including wind turbine noise. The guidelines make a series of 'strong' and 'conditional' recommendations with two conditional recommendations 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 WHO guidance also 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:

> *'Based on all these factors, it may be concluded that the acoustical description of wind turbine noise by means of Lden or Lnight may be a poor characterization of wind turbine noise and may limit the ability to observe associations between wind turbine noise and health outcomes.'*

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

Notwithstanding the limitations associated with the derivation of the L_{den} threshold levels, serious concerns have 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 using the WHO guidance.

The AACI published noise guidance *'Environmental Noise Guidance for Local Authority Planning & Enforcement Departments'* in May 2021. The guidance document provides advice to local authority officers involved in the assessment of noise reports, the drafting of noise conditions for planning purposes and permitting and also enforcement activities. In relation to wind farm noise guidance is provided in Section 17 and construction noise guidance is included within Section 27. Both sections of the report are considered further in Section 12.4 below.

12.3 Consultation

An EIA Scoping Response for the Proposed Development was issued on 3rd August 2021 by Mayo County Council. The Scoping Response stated the following in relation to noise:

'4. Establish baseline noise conditions at noise sensitive receptors prior to works commencing on site. Submit a noise impact assessment for the proposed development.'

This Noise chapter addresses the requirements of the Scoping Response and provides a detailed noise impact assessment based on a robust background noise survey (baseline noise conditions) and noise predictions.

[9] *World Health organisation, 2018. Environmental Noise Guidelines for the European Region'*

12.4 Assessment Methodology and Significance Criteria

12.4.1.1 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'[10], 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, using source noise level data for appropriate construction plant from Annex C of the current version of BS 5228.

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

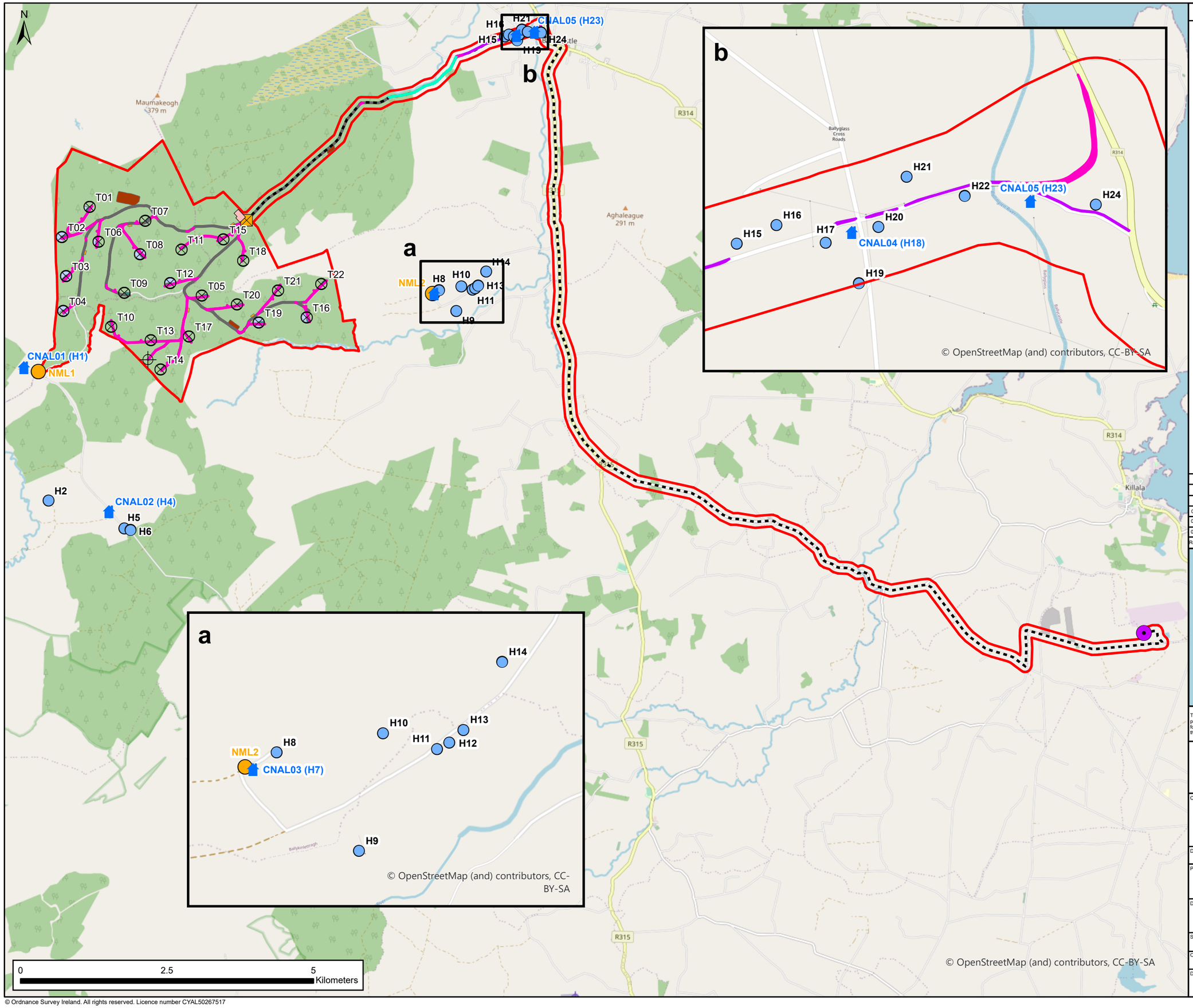
- identify NSRs and select representative Construction Noise Assessment Locations (CNALs);
- identify applicable threshold of significant effects;
- predict noise levels for various construction noise activities;
- compare predicted noise levels against the applicable thresholds;
- where necessary, develop 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.

Of the NSRs identified in the surroundings, a total of five have been chosen as CNALs. All five are residential properties. The CNALs represent the closest NSRs or clusters of NSRs to the proposed construction activities. The CNALs are summarised in Table 12-1 below and are shown on Figure 12-1.

Table 12-1: Summary of Construction Noise Assessment Locations

Receptor	ITM Easting	ITM Northing	Approximate Distance to Nearest Construction Activity (m)
CNAL01 – H01	501398	832178	1,132
CNAL02 – H04	502850	829722	2,550
CNAL03 – H07	508401	833437	1,825
CNAL04 – H18	509806	837855	16

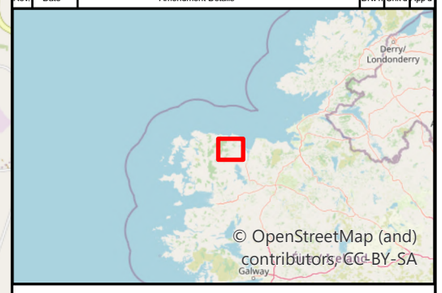
[10] *Association of Acoustic Consultants of Ireland, 2021. Environmental Noise Guidance for Local Authority Planning & Enforcement Departments*



NOTES

- EIAR Site Boundary
- Construction Noise Assessment Locations (CNALs)
- Noise Sensitive Receptors (NSRs)
- Noise Monitoring Locations (NMLs)
- Proposed Met Mast Location
- Proposed Turbine Layout
- Security Cabin Location
- Tawnaghmore Substation
- Alternative Assessed Access Road (Upgrade Proposed)
- Proposed New Roads
- Temporary Road Widending Works
- Proposed Grid Connection Route
- Existing Roads - Upgrade Proposed
- Peat Placement Areas
- Proposed Borrow Pit Locations
- Proposed Construction Compounds
- Proposed Substation Compound
- Proposed Hardstand Footprints

Rev.	Date	Amendment Details	Drw'n	Chk'd	App'd
02	13/10/23	Added Turbine Labels	MT	JB	JB
01	10/10/23	Updated Inset Map	JCM	GC	GC
00	20/07/23	First Issue	JCM	JB	JB



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Client: sse

Drawing Status: FOR INFORMATION

Project Title: Glenora Wind Farm

Drawing Title: EIAR Figure 12.1: Construction Noise Assessment Locations

Scale	Designed	Drawn	Checked	Approved
1:60,000	JCM	MT	JB	JB
Original Size	**Date**	**Date**	**Date**	**Date**
A3	10/10/2023	13/10/2023	13/10/2023	13/10/2023

Drawing Number: 14203-012

Revision: 2

Receptor	ITM Easting	ITM Northing	Approximate Distance to Nearest Construction Activity (m)
CNAL05 – H23	510111	837909	15

Construction of the Proposed Development will be undertaken in several successive phases. During each phase the plant, equipment, and the associated traffic, will influence the noise generated. The selection of plant and equipment to be used would 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 project of this size and the indicative construction schedule (Chapter 4 Figure 4-28). 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, as a worst case scenario (as it would generate the highest noise levels), whereas in reality only certain plant and equipment will be working at the closest point for short periods of time.

The core hours for the proposed works will be normal construction hours, 07:00 to 19:00 Monday to Friday and 07:00 to 13:00 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 the erection of turbine blades and the erection and dismantling of cranes.

Chapter 4 of this EIAR describes the Proposed Development and Project in detail and outlines the tasks that will be undertaken during the construction phase, which is estimated to last between 12 and 18 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 phase. The scenarios assess the following:

- construction of underground cabling routes;
- earthworks at turbine delivery route accommodation works areas;
- earthworks for track upgrade or new tracks;
- construction of hardstanding areas;
- Construction of the substation; and
- erection of the wind turbines.

More detailed information on each of the construction scenarios and modelling assumptions can be found within Appendix 12-1 of this EIAR. The noise levels for all Scenarios have been calculated at the CNALs and compared to the appropriate BS 5228 threshold levels (detailed in Table E.1, Annex E of BS 5228). 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.

12.4.1.2 Operational Noise Methodology

The assessment has been undertaken in accordance with the Wind Energy Development Guidelines, 2006 (WEDG 2006). The AACI Environmental Noise Guidance states the following in relation to the WEDG 2006:

'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 WEDG 2006, information contained in ETSU-R-97 and the IOA GPG has been used to supplement the WEDG 2006.

The WEDG 2006 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 NSRs will be below the noise limits derived in accordance with the WEDG 2006.

Of the NSRs identified, three Noise Assessment Locations (NALs) have been selected for a detailed assessment. All are residential properties. Predictions of operational wind turbine noise have been made at each of the NALs as detailed in Table 12-2 and shown on Figure 12-2. This approach ensures that the assessment considers the worst case (loudest) noise immission level expected at the NSR. All NSRs have also been assessed separately in Appendix 12-2.

Table 12-2: Summary of Operational Noise Assessment Locations

Receptor	Easting	Northing	Elevation (m AOD)	Approximate Distance to Nearest Glenora Turbine	Background Noise Data Used
NAL1 (H1)	501398	832178	119	1,185 (T4)	NML1
NAL2 (H4)	502850	829722	136	2,590 (T14)	NML1
NAL3 (H7)	508401	833437	143	1,940 (T22)	NML2

** Please note the distances to nearest turbines quoted above may differ from those reported elsewhere in the EIAR. Distances for the noise assessment are taken from the nearest turbine to the closest edge of the amenity area (usually the garden).*

The daytime and night time periods are not defined within the WEDG 2006, therefore the assessment has considered these periods as detailed within ETSU-R-97. The quiet daytime criteria are based upon background noise levels measured during 'quiet periods of the day' comprising:

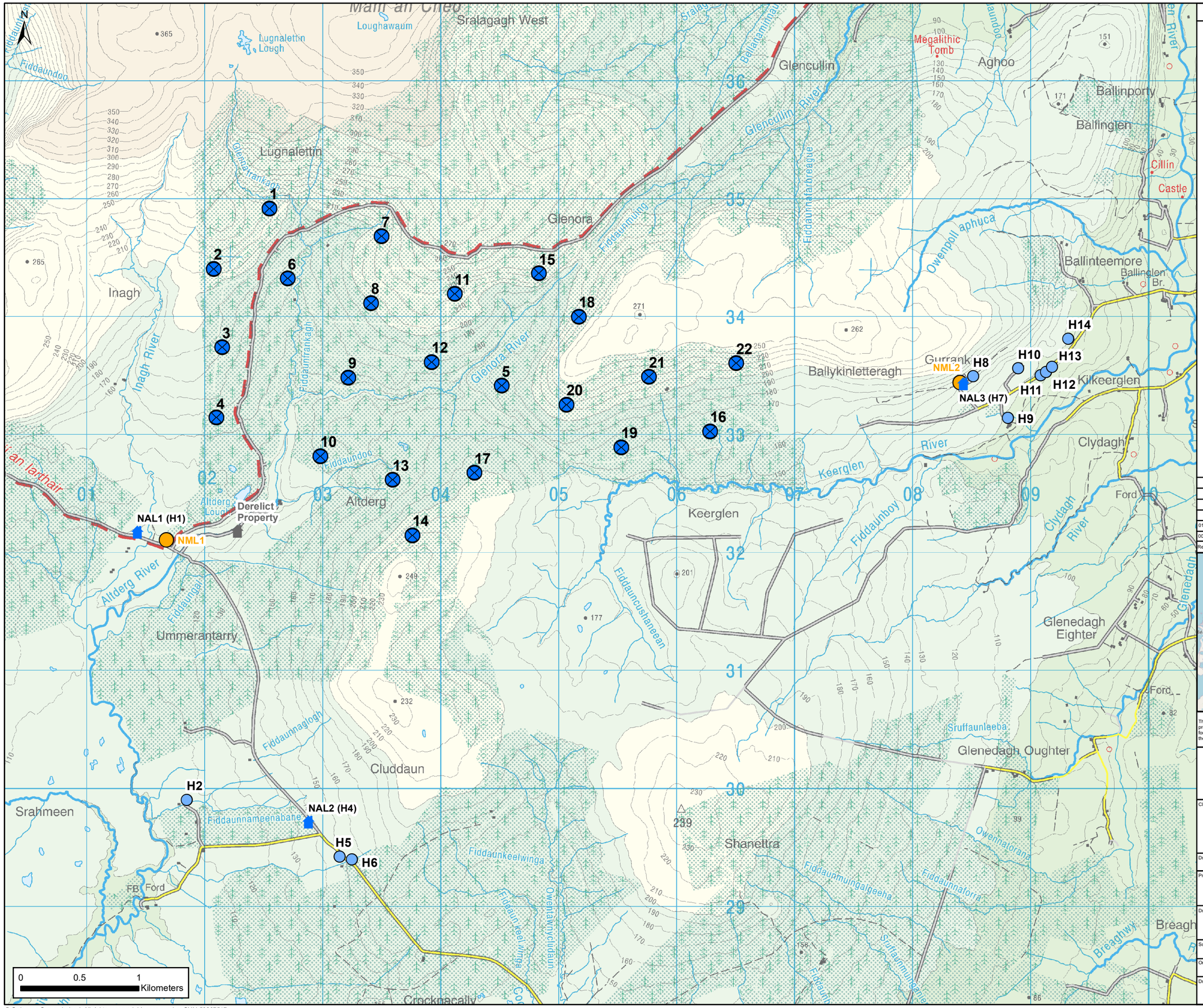
- All weekday evenings from 18:00 to 23:00;
- Saturday afternoons and evenings from 13:00 to 23:00; and
- All day Sunday 07:00 to 23:00.

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 WEDG 2006 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
- 40 dB $L_{A90,\ 10\ min}$ where background noise is less than 30 dB L_{A90}.

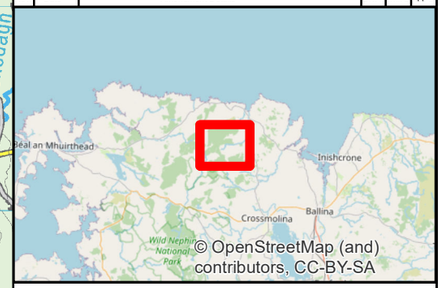
The 40 dB $L_{A90,\ 10\ min}$ fixed minimum limit has been chosen for the daytime period with due consideration given to the limits already adopted for existing/ consented wind farm developments in the area.



NOTES

- Proposed Turbine Locations
- Noise Assessment Locations (NALs)
- Noise Monitoring Locations (NMLs)
- Noise Sensitive Receptors (NSRs)
- Derelict Property

Rev.	Date	Amendment Details	Drw'n	Chk'd	App'd
01	08/09/23	Added Derelict Property	JCM	JB	JB
00	19/07/23	First Issue	JCM	JB	JB



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Client: sse

Drawing Status: FOR PLANNING

Project Title: Glenora Wind Farm

Drawing Title: EIAR Figure 12.2: Noise Assessment, Noise Monitoring, and Proposed Turbine Locations

Scale	Designed	Drawn	Checked	Approved
1:30,000	JCM	JCM	JB	JB
Original Size	**Date**	**Date**	**Date**	**Date**
A3	08/09/2023	08/09/2023	08/09/2023	08/09/2023

Drawing Number: 14203-008

Revision: 1

The WEDG 2006 states that a "fixed limit of 43dB(A) will protect sleep inside properties during the night", however, whilst it is not explicit within the WEDG 2006 guidance, 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. 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.

Two sets of noise limits have been derived; the Total WEDG Noise limits apply to the cumulative noise level of all relevant wind turbine developments operating in the area including the Proposed Development, whilst the Site Specific Noise limits apply to operational noise from the Proposed Development only. The 'Site Specific Noise Limits' are derived to take account of the proportion of the noise limit that has been allocated to, or could theoretically be used by, other wind farm developments.

The aim of the operational noise assessment is to establish the Total WEDG Noise Limits, determine whether a cumulative assessment is required at the nearest NSRs, derive Site Specific Noise Limits and to establish whether the Proposed Development can operate within those limits.

The exact model of turbine to be installed on the site will be the result of a future tendering process and within the dimensions prescribed in this planning application should planning permission be granted. Achievement of the Site Specific Noise Limits determined by this assessment will be a key determining requirement in the final choice of turbine for the Proposed Development. Predictions of wind turbine noise for the Proposed Development were made for the purpose of this noise assessment based upon the sound power level data for a candidate wind turbine with a rotor diameter of 162m, serrated trailing edge blades and a hub height of 99m. The candidate turbine modelled is representative of the type of turbine that will be installed at the 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, where properties are located in between groups of turbines they cannot be downwind of all turbines simultaneously, so it is appropriate to consider the effect of wind direction on predicted noise levels and the impact of directivity has been considered in the assessment (see Section 6.3 of Appendix 12-2).

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 NSRs. 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 found to be required for a number of turbines at a number of receptors as detailed in Annex 7 of Appendix 12-2.

Information relating to other operational noise topics such as Amplitude Modulation (AM), a potential characteristic of wind turbine noise, and Low Frequency Noise (LFN), has been provided in Appendix 12-2. There is no evidence that LFN has adverse impacts on the health of wind farm neighbours and at time of writing 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.

12.4.1.3 Cumulative Operational Noise Methodology

Due to the presence of nearby wind farm developments, a cumulative noise assessment was undertaken in accordance with the guidance contained within the IOA GPG. A cumulative wind farm/ turbine list was provided by MKO. Following a review of the list, preliminary predictions were undertaken to determine which schemes needed to be considered in the cumulative noise assessment. More detail can be found in Section 4 of Appendix 12-2. The following operational, consented and proposed (application submitted) wind farms have been assessed;

- Oweninny 1 (29 x 3.2 MW operational wind turbines);
- Oweninny 2 (23 x 3.6 MW wind turbines under construction);
- ABO Sheskin (8 x 3.6 MW wind turbines under construction);
- Oweninny 3 (18 x >4.6 MW wind turbines in planning); and,
- Sheskin South (21 x 6.2 MW wind turbines in planning).

The operational Bellacorrick Wind Farm has not been considered in the cumulative assessment as it is understood that it will be decommissioned as part of the construction of Oweninny 2 (as detailed in Section 1.2.3 of An Bord Pleanala Report PA00029, dated 29th July 2014). Corvoderry Wind Farm has not been considered in the assessment as the planning permission expired mid October 2022 without construction commencing and we are not aware of any application to extend its duration.

The locations of the turbines modelled, inclusive of those considered in the cumulative noise assessment are shown in Figure 12.3. The operational noise assessment has been undertaken in three separate stages to ensure that cumulative wind farm noise is considered, the stages are :

- Stage 1 – Establish the 'Total WEDG Noise Limits' which are applicable for all wind farm schemes in the area;
- Stage 2 – undertake a cumulative assessment, comparing Total WEDG Noise Limits with cumulative noise predictions. At this stage, the predicted 'likely' cumulative wind turbine noise levels are the actual levels expected at a noise assessment location.
- Stage 3 – establish the 'Site Specific Noise Limits' for the Proposed Development (through apportioning the 'Total WEDG Noise Limits', where required) and compare the noise predictions from the Proposed Development on its own against the 'Site Specific Noise Limits'. In order to the derive the Site Specific Noise Limit an additional buffer of +2dB has been added to the 'likely' predicted levels summarised in Stage 2 which results in 'cautious' Site Specific Noise Limits.

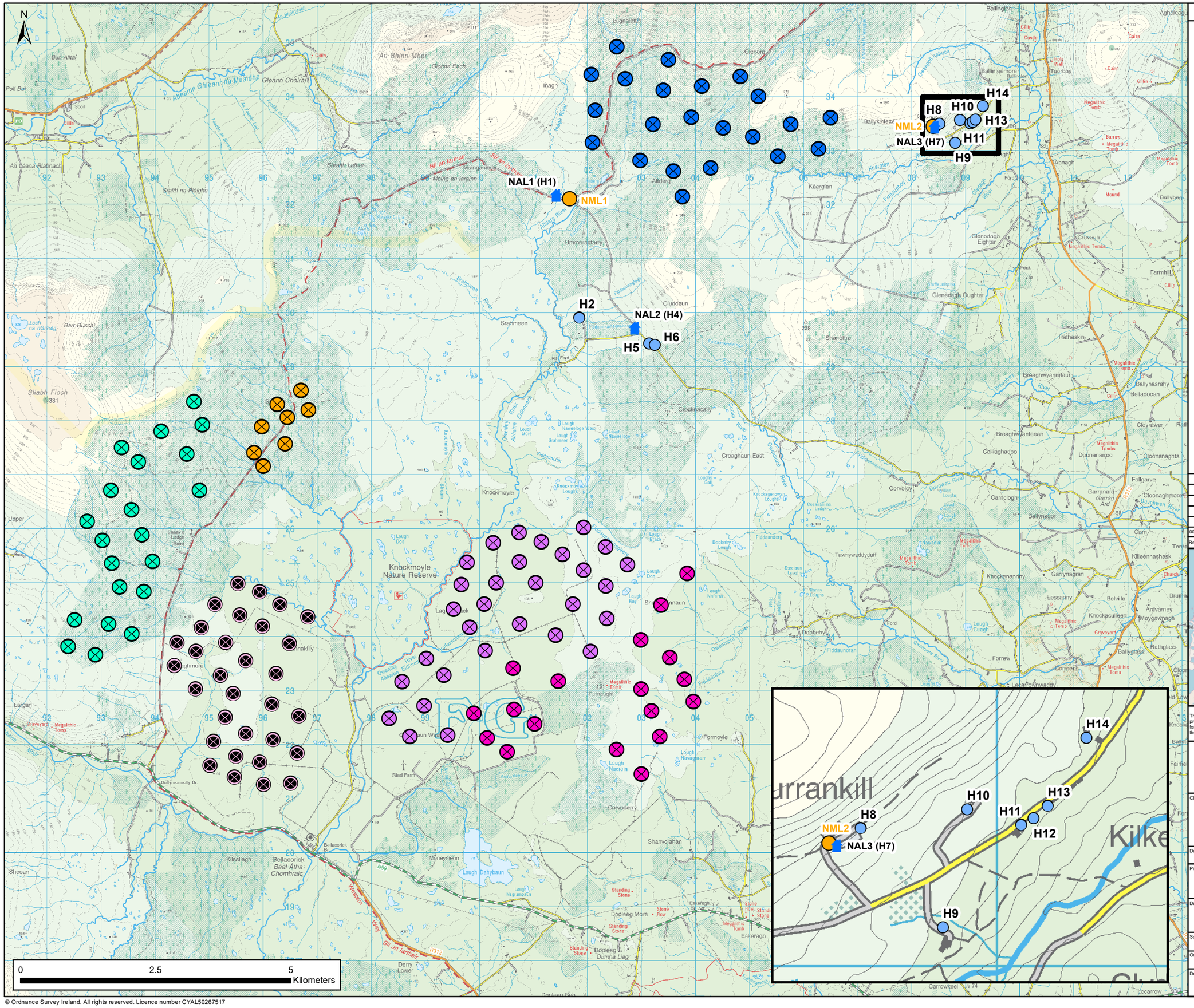
12.4.2 Potential Effects Scoped Out

12.4.2.1 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.

12.4.2.2 Blasting

The extent of any blasting requirement cannot be determined until intrusive site investigation tests are completed. Nevertheless, should blasting be required, a series of tests would be undertaken by the



NOTES

- Noise Assessment Locations (NALs)
- Noise Sensitive Receptors (NSRs)

Turbines

- Proposed Glenora Turbines
- Sheskin
- Sheskin South
- Oweninny 1
- Oweninny 2
- Oweninny 3
- Noise Monitoring Locations (NMLs)

Rev.	Date	Amendment Details	Drw'n	Chk'd	App'd
00	19/07/23	First Issue	JCM	JB	JB

Client

Drawing Status	FIRST ISSUE
Project Title	Glenora Wind Farm
Drawing Title	EIAR Figure 12.3 : Cumulative Wind Turbine Locations

Scale	Designed	Drawn	Checked	Approved
1:65,000	JCM	JCM	JB	JB
Original Size	Date	Date	Date	Date
A3	19/07/2023	19/07/2023	19/07/2023	19/07/2023

Drawing Number	Revision
14203-009	0

appointed contractor in accordance with guidance outlined in BS 5228-2:2009+A1:2014[11]. Following on from these tests, blasts will be designed through appropriate specification of Maximum Instantaneous Charge (MIC) to ensure that vibration levels at the nearest NSR's would not exceed the guideline limits presented in BS 5228 and related standards such as BS 7385-2: 1993 'The Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration'[12][13]. A condition could be attached to the consent to require compliance with these limits.

Given the relative distances between the potential locations of blasting and the closest sensitive receptors, a blast engineer will be able to calculate appropriate Maximum Instantaneous Charge (MIC) values that will ensure that vibration levels will be within the guideline limits detailed in BS 7385-2: 1993 and BS 6472-2: 2008. Therefore this issue can be scoped out of further detailed consideration.

12.4.3 Method of Baseline Characterisation

12.4.3.1 Extent of the Study Area

Prior to the commencement of the noise assessment, an initial desktop review was undertaken in order to identify all NSRs and to select potential Noise Monitoring Locations (NMLs). Fourteen NSRs were identified within a ~3 km search area, these are all residential properties surrounding the Proposed Development. Two NMLs were selected to represent all of the NSRs, which are located to the east, south and west of the Proposed Development. There are no NSRs to the north of the site. The NSRs and NMLs are shown on Figure 12-2 and coordinates of the NMLs are also included below in Table 12-3. More information can be found in the Appendix 12-2.

12.4.3.2 Field Survey

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

Background noise monitoring was undertaken at two NMLs. 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 December 2020 to March 2021 at the NMLs detailed in Table 12-3 and Figure 12.2. Further details on the NMLs can be found within Appendix 12-2.

Table 12-3 Summary of Noise Monitoring Locations

Receptor	Easting	Northing
NML1	501645	832111
NML2	508373	833446

Simultaneous wind speed/direction data were recorded within the site at various heights using a LIDAR Unit (located at Irish Transverse Mercator reference 502370, 833948). The wind speed data collected at the two nearest heights to the proposed hub height, 41 m and 110 m, were used to derive hub height wind speeds (99 m), which were then standardised to 10 m height in accordance with good practice.

[11] *British Standard BS5228-2: 2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites' – Part 2: Vibration*
[12] *British Standard BS7385-2: 1993 'The Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration'*
[13] *British Standard BS6472: 2008 'Guide to evaluation of human exposure to vibration in buildings. Blast-induced vibration'*

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 ETSU-R-97 and the IOA GPG. There were no data limitations.

12.4.4 Criteria for the Assessment of Effects

The Environmental Protection Agency document 'Guidelines on the information to be contained in Environmental Impact Assessment Reports' [14] has been adhered to for the assessment of potential effects as summarised below.

12.4.4.1.1 *Criteria for Assessing Significance – Construction Noise*

The significance criteria adopted for this assessment are based on Appendix E part E.3.2 of BS 5228-1:2009+A1:2014 and detailed in Table 12-4 below.

Table 12-4 Construction Noise Significance Criteria

Significance of Effect	Significance Level	
	Not Significant	Potentially Significant
Category A 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)	<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".*

12.4.4.1.2 *Criteria for Assessing Significance – Operational Noise*

WEDG 2006 and ETSU-R-97 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 WEDG 2006 derived noise limits ensures that wind turbine noise will comply with current Government guidance.

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

[14] *The Environmental Protection Agency, 2022. Guidelines on the information to be contained in Environmental Impact Assessment Reports*

12.4.4.1.3 Limitations and Assumptions

The noise data collected during the background noise survey are representative of the typical background noise levels at the nearest NSRs. The guidance in the WEDG 2006 supplemented by ETSU-R-97 and the IOA GPG has been followed by suitably experienced Acoustic Consultants to ensure that the data collected is as representative as possible.

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.

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 would have to comply with the noise limits imposed by An Bord Pleanála, derived in this noise assessment.

No other assumptions or data gaps have been identified.

12.5 Baseline Conditions

12.5.1 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 at low wind speeds as defined in the WEDG 2006[15]). The predominant sound 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.

Table 12-5 and Table 12-6 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 have been excluded from the dataset, as well as data following periods of heavy rainfall in accordance with best practice. Further information of the data recorded during the noise survey can be found in Section 5 of Appendix 12-2.

Table 12-5 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	24.8*	24.8	25.5	26.7	28.5	30.7	33.3	36.2	39.5	42.9	46.5	50.1
NML2	24.3	24.3	24.8	26.2	28.3	30.9	33.7	36.6	39.5	42.1	44.2	45.6

Table 12-6 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	24.9	25.2	26.0	27.1	28.7	30.7	33.0	35.7	38.6	41.9	45.4	49.2

[15] *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
NML2	23.7	23.7	24.6	25.9	27.8	30.0	32.6	35.3	38.0	40.8	43.5	45.9

12.5.2 Future Baseline

It is possible that noise propagation and resulting noise immission levels could change over the life of the project due to climate change (as noise attenuation is influenced by air temperature, relative humidity and ground conditions). However, noise limits are set based on current background noise levels in the absence of wind farm noise and would be set for the lifetime of the project. The operator would be required to meet them for the duration of the consent. .

12.5.3 Summary of Sensitive Receptors

12.5.3.1 Scoped Out Receptors

During the initial search to identify the closest receptors, a dwelling immediately to the south of the site was identified (H3). The building has been confirmed as derelict and has not been considered as a NSR.

12.5.3.2 Scoped In Receptors

There are 14 NSRs which were identified in proximity (~3 km search area) to the Proposed Development. These are also labelled with the letter 'H', within the rest of the EIAR and all are residential properties. Of the 14 identified NSRs a total of three were chosen as Noise Assessment Locations (NALs) for the operational noise assessment, and a total of 5 were chosen as CNALs. All CNALs and NALs are listed in Table 12-1 and Table 12-2 above, and all NSRs, NALs and CNALs are shown in Figure 12-1 and Figure 12-2. The noise assessment results for the CNALs / NALs has been presented within the main body of this noise assessment, whilst an assessment for all NSRs has also been included within Annex 3 of Appendix 12-1 and Annex 6 of Appendix 12-2.

12.6 Assessment of Likely Effects

12.6.1 Potential Construction Noise Effects

Table 12-7 presents the calculated noise immission levels at each CNAL for all modelled scenarios for different construction activities. The scenarios and full details of the modelling are described in Appendix 12.1.

The results show that the predicted construction noise levels are below the Category A Threshold Levels for all CNALs except CNAL05 in daytime Scenario 1, where the 65 dB(A) threshold is exceeded by 3 dB. The noise at CNAL for Scenario 01 is associated with the construction, upgrading, and widening of the access road, when some construction activity will be close to the properties at the road junction and site entrance. Once the road junction upgrades are completed, however, construction noise levels at these receptors will be much lower.

The predicted noise level of 68dB at CNAL05 indicates the potential for a significant noise impact during the day, however, the calculated level assumes that construction noise will occur continuously at the same location throughout the 12 hour daytime period. In reality, this is unlikely to happen as

construction plant and activities will move location and will not be active continuously throughout the day.

The proposed construction phases are temporary, short term and will not give rise to any long term effects. In practice for much of the working day the noise associated with construction activities will be less than predicted so the impact will therefore be less than indicated. Therefore, **no significant effects** are anticipated during construction.

Table 12-7 Predicted Construction Noise Immission Levels

Noise Assessment Location	Category A Threshold dB $L_{Aeq, t}$			Immission Level, dB $L_{Aeq, t}$ for each Scenario (S)					
	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)	S01	S02	S03	S04	S05	Night
CNAL01 – H01	65	55	45	34	33	36	36	37	16
CNAL02 – H04	65	55	45	30	28	28	30	27	10
CNAL03 – H07	65	55	45	28	27	28	31	28	10
CNAL04 – H18	65	55	45	62	26	26	50	51	2
CNAL05 – H23	65	55	45	68	25	25	46	46	1

12.6.2 Potential Operational Noise Effects

12.6.2.1 Setting the Total WEDG Noise Limits (Stage 1)

Based on the prevailing background noise levels, the Total WEDG Noise Limits have been established for each of the NALs as detailed in

Table 12-8 and Table 12-9 below.

Table 12-8 Total WEDG 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 (H1)	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	47.9	51.5	55.1
NAL2 (H4)	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	47.9	51.5	55.1
NAL3 (H7)	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	47.1	49.2	50.6

Table 12-9 Total WEDG 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 (H1)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.6	46.9	50.4	54.2
NAL2 (H4)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.6	46.9	50.4	54.2
NAL3 (H7)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.8	48.5	50.9

12.6.2.2 Predicting the Likely Effects and the Requirement for a Cumulative Noise Assessment (Stage 2)

A likely cumulative noise assessment was undertaken at the NALs and the results of the cumulative assessment are shown in Table 12-10 and Table 12-11 below. The Tables detail the Total WEDG Noise Limits and predicted likely cumulative wind turbine noise levels for daytime and night time. These results are also presented in graphical form on Figures A1.3a – 3c included in Appendix 12-2.

The result of the likely cumulative noise assessment show that the Proposed Development can operate concurrently with the nearby operational and permitted wind farms, whilst still meeting the Total WEDG Noise limits at all NALs. Therefore, it is predicted that there will be **no significant effects.**

Table 12-10 Compliance Table – Comparison of predicted likely cumulative noise levels (all schemes) against the Total WEDG 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 (H1)	Total WEDG Noise Limit	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	47.9	51.5	55.1
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	26.6	30.8	35.0	36.5	36.6	36.7	36.7	36.7	36.7
	Exceedance Level	-	-	-	-13.4	-9.2	-10.0	-8.5	-8.4	-8.3	-11.2	-14.8	-18.4
NAL2 (H4)	Total WEDG Noise Limit	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	47.9	51.5	55.1
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	21.9	26.4	30.5	31.6	31.7	31.8	31.8	31.8	31.8
	Exceedance Level	-	-	-	-18.1	-13.6	-14.5	-13.4	-13.3	-13.2	-16.1	-19.7	-23.3
NAL3 (H7)	Total WEDG Noise Limit	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	47.1	49.2	50.6
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	20.9	25.1	29.3	30.7	30.9	30.9	30.9	31.0	31
	Exceedance Level	-	-	-	-19.1	-14.9	-15.7	-14.3	-14.1	-14.1	-16.2	-18.2	-19.6
Note: For the cumulative noise predictions the noise model considers the range of noise data available for each turbine type modelled. For some turbines noise data was not available for wind speeds less than 4 ms^{-1} therefore no cumulative predictions are included for wind speeds less than 4 ms^{-1}.													

Table 12-11 Compliance Table – Comparison of predicted likely cumulative noise levels (all schemes) against the Total WEDG 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 (H1)	Total WEDG Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.6	46.9	50.4	54.2
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	26.6	30.8	35.0	36.5	36.6	36.7	36.7	36.7	36.7
	Exceedance Level	-	-	-	-16.4	-12.2	-8.0	-6.5	-6.4	-6.9	-10.2	-13.7	-17.5
NAL2 (H4)	Total WEDG Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.6	46.9	50.4	54.2
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	21.9	26.4	30.5	31.6	31.7	31.8	31.8	31.8	31.8
	Exceedance Level	-	-	-	-21.1	-16.6	-12.5	-11.4	-11.3	-11.8	-15.1	-18.6	-22.4

NAL		Wind Speed (ms^{-1}) as standardised to 10m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL3 (H7)	Total WEDG Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.8	48.5	50.9
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	20.9	25.1	29.3	30.7	30.9	30.9	30.9	31.0	31.0
	Exceedance Level	-	-	-	-22.1	-17.9	-13.7	-12.3	-12.1	-12.1	-14.9	-17.5	-19.9
Note: For the cumulative noise predictions the noise model considers the range of noise data available for each turbine type modelled. For some turbines noise data was not available for wind speeds less than 4 ms^{-1} therefore no cumulative predictions are included for wind speeds less than 4 ms^{-1}.													

12.6.2.3 Operational Phase - Derivation of Site Specific Noise Limits for the Development (Stage 3)

In order to protect residential amenity, good practice guidance requires that cumulatively, all wind farms (including the Proposed Development) operate within the Total WEDG Noise Limits, as demonstrated in Stage 2 above. Depending on the noise immissions from other consented schemes there may be a requirement to apportion the Total WEDG Noise Limits between wind farm schemes to ensure that the total cumulative noise does not exceed the Total WEDG Noise Limits. To allow this to occur, a set of Site Specific Noise Limits for the Proposed Development are required and these have been derived for each NAL.

The Site Specific Noise Limits have been derived to take account of the proportion of the noise limit that has been allocated to, or could theoretically be used by, other wind farm developments in proximity to the Proposed Development. As summarised in Table 6.7 of Appendix 12-2; operational noise from the other wind farm developments would be at least 10 dB below the Total WEDG Noise Limits for all NALs. Therefore, it is appropriate to allocate the entire noise limit to the Proposed Development, as the other wind farms would use a negligible proportion of the Total WEDG Noise Limit.

The Site Specific Noise Limits were compared to the predictions of the Proposed Development operating on its own and the results are summarised below in Table 12-12 for the daytime and Table 12-13 for the night time. The tables also show the exceedance level, which is the difference between the predicted noise level and the Site Specific Noise Limit at a given wind speed. A negative exceedance level indicates satisfaction of the noise limit. These results are also presented in graphical form on Figures A1.4a – 4c included in Appendix 12-2.

The assessment shows that the predicted wind turbine noise levels from the Proposed Development on its own, with a 162 m rotor diameter candidate wind turbine, meet the Site Specific Noise Limits under all conditions at all NALs for both daytime and night time periods, as such there are **no significant effects** predicted to occur.

Table 12-12 Compliance Table –Comparison of predicted noise levels from the Proposed Development against the Site Specific 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 (H1)	Site Specific Noise Limit	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	47.9	51.5	55.1
	Predicted Wind Turbine Noise L_{A90}	-	-	25.6	26.4	30.5	34.7	36.2	36.4	36.5	36.5	36.5	36.5
	Exceedance Level	-	-	-14.4	-13.6	-9.5	-10.3	-8.8	-8.6	-8.5	-11.4	-15.0	-18.6
NAL2 (H4)	Site Specific Noise Limit	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	47.9	51.5	55.1
	Predicted Wind Turbine Noise L_{A90}	-	-	19.4	20.1	24.2	28.5	30.0	30.2	30.2	30.3	30.3	30.3
	Exceedance Level	-	-	-20.6	-19.9	-15.8	-16.5	-15.0	-14.8	-14.8	-17.6	-21.2	-24.8
NAL3 (H7)	Site Specific Noise Limit	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	47.1	49.2	50.6
	Predicted Wind Turbine Noise L_{A90}	-	-	19.5	20.3	24.4	28.6	30.2	30.3	30.4	30.4	30.4	30.4
	Exceedance Level	-	-	-20.5	-19.7	-15.6	-16.4	-14.8	-14.7	-14.6	-16.7	-18.8	-20.2

Table 12-13 Compliance Table – Comparison of predicted noise levels from the Proposed Development against the Site Specific 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 (H1)	Site Specific Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.6	46.9	50.4	54.2
	Predicted Wind Turbine Noise L_{A90}	-	-	25.6	26.4	30.5	34.7	36.2	36.4	36.5	36.5	36.5	36.5
	Exceedance Level	-	-	-17.4	-16.6	-12.5	-8.3	-6.8	-6.6	-7.1	-10.4	-13.9	-17.7
NAL2 (H4)	Site Specific Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.6	46.9	50.4	54.2
	Predicted Wind Turbine Noise L_{A90}	-	-	19.4	20.1	24.2	28.5	30.0	30.2	30.2	30.3	30.3	30.3
	Exceedance Level	-	-	-23.6	-22.9	-18.8	-14.5	-13.0	-12.8	-13.4	-16.6	-20.1	-23.9
NAL3 (H7)	Site Specific Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.8	48.5	50.9
	Predicted Wind Turbine Noise L_{A90}	-	-	19.5	20.3	24.4	28.6	30.2	30.3	30.4	30.4	30.4	30.4
	Exceedance Level	-	-	-23.5	-22.7	-18.6	-14.4	-12.8	-12.7	-12.6	-15.4	-18.1	-20.5

12.6.3 Potential Cumulative Effects

There are no other anticipated nearby large scale construction projects that will be constructed at the same time as the construction of the Proposed Development in close proximity to the NALs, therefore there will be **no significant cumulative construction noise effects.**

The operational noise assessment has taken cumulative impacts with other operational, consented and proposed (planning application submitted) nearby wind farms into consideration, as described in the above assessment. The likely cumulative operational noise assessment shows that the Proposed Development can operate concurrently with the operational, consented and proposed (planning application submitted) wind farms near to the NALs and there will therefore be **no significant cumulative operational noise effects**.

12.7 Mitigation

12.7.1 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) and these will be employed to minimise noise impacts.

During the initial phase of construction when road and junction upgrades are being undertaken, the use of barriers should be considered to reduce noise levels at the nearest receptors.

The use of a barrier can typically achieve up to 10 dB when in optimum locations. However, given the restrictions with space limitation and access, the actual amount of barrier attenuation likely to be achieved in this situation might be as low as 3 dB. Nonetheless, this could still be a useful means of noise control and would be sufficient to reduce noise levels to below the BS5228 noise levels.

The use of barriers could include the erection of temporary boarding in the vicinity of construction activities related to the road junction and road upgrades or the use of 'acoustic blanket panels' to hang from heras fencing or similar. This should be installed as close to the activities as is practicable and fitted to interrupt any direct line of site between the construction plant and the closest residential receptors.

Good practice during all construction phases will be implemented to minimise noise effects. Section 8 of BS 5228-1:2009+A1:2014 recommends a number of simple control measures as summarised below that will be employed onsite:

- Local residents will be kept informed of the proposed working schedule, where appropriate, including the times and duration of any abnormally noisy activity that may cause concern;
- Any extraordinary site work occurring outside of the core working hours (for example, crane operations lifting components onto the tower) will be programmed, if required, so that haulage vehicles will not arrive at or leave the site between 19:00 and 07:00, with the exception of abnormal loads that would be scheduled to avoid anticipated periods of high traffic flows;
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and be subject to programmed maintenance;
- Inherently quiet plant will be selected where appropriate and available - 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 or throttled down to a minimum between work periods (or when not in use). Machinery will be not be left idling unnecessarily;
- All equipment used on site will be regularly maintained, including maintenance related to noise emissions;
- Vehicles will be loaded carefully to ensure minimal drop heights so as to minimise noise during this operation;
- All ancillary plant such as generators and pumps will be positioned so as to cause minimum noise disturbance and temporary acoustic screens or enclosures will be provided where practicable; and
- Use of a temporary acoustic barrier during construction activities in proximity to CNAL5.

12.7.2 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. Achievement of the noise limits determined by this assessment would be a key determining factor in the final choice of wind turbines for the site. No mitigation is required when considering the 162 m rotor diameter candidate wind turbine modelled as part of the noise assessment and based on the margins between the predictions from the Proposed Development and the Site Specific Noise Limits it is unlikely that mitigation would be required even if an alternative candidate model is selected for the Proposed Development.

12.8 Assessment of Residual Effects

12.8.1 Residual Construction Effects

No significant effects resulting from construction noise are predicted, and therefore no mitigation is required. A range of good practice measures will be employed during construction to minimise noise impacts, as detailed in Section 12.7.1 above.

Due to the low background noise levels at some locations, elements of construction noise could be audible at the closest NSRs for certain periods during the construction phases. However, **no significant residual effects** are anticipated.

12.8.2 Residual Operational Effects

The likely cumulative noise predictions (Proposed Development and other operational, consented and proposed (planning application submitted) wind farms) lie below the Total WEDG Noise Limits without additional mitigation. It has also been demonstrated that Site Specific Limits will be met without mitigation. At some locations, under some wind conditions and for a certain proportion of the time operational wind farm noise would be audible; however, it will be at an acceptable level in relation to the WEDG 2006 guidelines and there will be **no significant residual effects**.

12.8.3 Residual Cumulative Effects

It was found that without mitigation there will be no significant cumulative construction noise effects. As such there will be no residual cumulative effects during the construction phase.

It was found that without mitigation there will be no significant cumulative operational noise effects. As such there will be no residual cumulative effects during the operational phase.

12.9 Summary

Predicted construction noise levels have been compared with the Category A criteria outlined in Section E.3 of BS 5228: Part 1 2009+A1:2014. The result of the construction noise assessment show that for all construction phases there are **no significant effects** anticipated at the nearby NSRs (ie. residential properties), and, although there is no requirement for any mitigation measures, good practice measures will be implemented.

The guidance contained within the WEDG 2006 was used to assess the likely operational noise impact of the Proposed Development. Predicted wind turbine noise levels and measured background noise levels show that for the nearby NSRs (ie. residential properties) wind turbine noise would meet the noise criteria established in accordance with the WEDG 2006. Therefore, the operational noise effect is **not significant.**

Predicted noise levels from the Proposed Development meet the Site Specific Noise Limits and there is no requirement for mitigation measures based on the 162 m rotor diameter candidate wind turbine assumed. The use of Site Specific Noise Limits for the operational phase ensures that the Proposed Development can operate concurrently with other operational wind farm developments in the area and that the Proposed Development's individual contribution could be measured and enforced if required. Should the Proposed Development receive consent, the noise immission from the final choice of wind turbine would have to meet the Site Specific Noise Limits presented in this noise assessment.