Chapter 10: Noise



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Chapter 10: Noise

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10 Noise

10.1 Executive Summary

- 10.1.1 A noise assessment was undertaken to determine the likely significant noise effects from the construction and operational phases of the proposed Appin Wind Farm (hereafter referred to as the 'Proposed Development'), at nearby noise sensitive receptors (NSRs).
- 10.1.2 Construction noise activities associated with the Proposed Development were assessed in accordance with guidance and acceptable threshold noise values presented within BS 5228. Predicted noise levels from construction activities are below the guidelines considered acceptable at all receptors for all construction phases during the weekday (07:00 19:00) and Saturday daytime (07:00-13:00) periods¹. At some receptors, noise levels have been calculated to be equal to, or above, the evening and weekend threshold level, however, this is unlikely to result in a significant impact, as duration of exposure will be limited.
- 10.1.3 The operational wind farm noise assessment involved setting the Total ETSU-R-97 Noise Limits (which are limits for total cumulative turbine noise levels) relative to background noise levels at the nearest NSRs, predicting the likely effects (undertaking a cumulative noise assessment where required) and setting Site Specific Noise Limits which could be conditioned for the operation of the Proposed Development on its own.
- 10.1.4 Background noise monitoring was undertaken at three residential properties located in proximity to the Proposed Development. The background noise data measured was used to set the Total ETSU-R-97 Noise Limits for the Proposed Development at thirteen noise assessment locations which were selected to be representative of the surrounding NSRs.
- 10.1.5 Predictions of turbine noise from the Proposed Development were made in accordance with good practice using a candidate turbine, the Vestas V162 7.2 MW with serrated trailing edge blades with a hub height of 119 m. Predicted cumulative operational wind farm noise levels indicate that for NSRs neighbouring the Proposed Development, cumulative turbine noise resulting from nearby operational, consented and proposed wind farms (planning application submitted), as well as the Proposed Development, would meet the Total ETSU-R-97 Noise Limits.
- 10.1.6 The Total ETSU-R-97 Noise Limit is applicable to all operational, consented and proposed wind farms (planning application submitted) in the area, so Site Specific Noise Limits have also been derived to inform conditioning of the noise levels from the Proposed Development on its own. Predicted operational noise levels from the Proposed Development on its own indicate that it would meet the Site Specific Noise Limits at all noise assessment locations, except at NAL1 Shinnelhead. To meet the Site Specific Noise Limits at NAL1 Shinnelhead in combination with all operational, consented and proposed wind farms, mitigation in the form of low noise mode management would be required based on current candidate turbine for certain wind speeds and wind directions.
- 10.1.7 The use of Site Specific Noise Limits would ensure that the Proposed Development could operate concurrently with other operational, consented and proposed wind farm developments in the area and would also ensure that the Proposed Development's individual contribution could be measured and enforced if required.
- 10.1.8 The turbine model for the Proposed Development was chosen to allow a representative assessment of the noise impacts. Should the Proposed Development receive consent, the final choice of turbine would be subject to a competitive tendering process. The final choice of turbine would, however, meet the Site Specific Noise Limits presented in the noise assessment and contained within any operational noise condition.

10.2 Introduction

- 10.2.1 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 assessment methodology and significance criteria used in completing the impact assessment;
 - describe the baseline following a noise survey which measured existing background noise levels;

¹ The core hours for construction activity are anticipated to be 07:00 - 19:00 Monday to Friday and 07:00 - 16:00 on Saturdays. No work will be undertaken on public holidays. The requirement for out-of-hours work could arise, for example, from delivery and unloading of abnormal loads, or to ensure optimal use is made of fair weather windows for the erection of turbine blades and the erection and dismantling of cranes



- describe the potential effects (including cumulative effects);
- describe the mitigation measures proposed to address likely significant effects (if required); and
- assess the residual effects remaining following the implementation of mitigation (if required).
- 10.2.2 This chapter is supported by a number of figures which are referenced throughout the text and which can be found at **Volume 2: Figures**.
- 10.2.3 The following technical appendices are also referred to throughout the chapter and can be found in **Volume 4: Appendices**:
 - Technical Appendix 10.1: Construction Noise Report; and
 - Technical Appendix 10.2: Operational Noise Report.

10.3 Legislation, Policy and Guidelines

Legislation

- 10.3.1 Relevant legislation and guidance documents have been reviewed and taken into account as part of this noise assessment. Of particular relevance are:
 - The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017 (Scottish Government, 2017)
 - Control of Pollution Act 1974 (HM Government, 1974).
 - Town and Country Planning (Scotland) Act 1997 (Scottish Government, 1997)
 - Electricity Act 1989 (HM Government, 1989)

Planning Policy

- 10.3.2 The following planning policy of relevance to this chapter have been considered:
 - National Planning Framework 4, (Scottish Government, 2023); and
 - Onshore Wind Policy Statement 2022 (Scottish Government, 2022).

Guidance

- 10.3.3 This assessment was carried out in accordance with the principles contained within the following documents:
 - Planning Advice Note (PAN) 1/2011: 'Planning and Noise' (Scottish Government, 2011);
 - Web Based Renewables Advice: 'Onshore Wind Turbines' (Scottish Government, 2014);
 - BS 5228-1: 2009+A1:2014 'Code of practice for noise and vibration control on construction and open developments - Noise';
 - ETSU-R-97 'The Assessment and Rating of Noise from Wind Farms' (NWG, 1996);
 - Institute of Acoustics (IOA) 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise' (IOA GPG, 2013); and
 - ISO 9613-2:2024 'Acoustics Attenuation of sound during propagation outdoors Part 2: Engineering method for the prediction of sound pressure levels outdoors' (ISO, 2024).

10.4 Consultation

10.4.1 An EIA Scoping Opinion for the Proposed Development was issued in June 2022 by the Energy Consents Unit (ECU) on behalf of the Scottish Government. A summary of consultation responses received as part of the scoping exercise and response/actions taken, is given in **Table 10.1**. Consultation was undertaken directly with the Environmental Health Department at Dumfries and Galloway Council (DGC) and a summary of the consultation is included within **Table 10.1**. A full copy of the consultation letter is included in Annex 2 of **Technical Appendix 10.2**.

Table 10.1 – Consultation

Consultee and Date	Scoping / Other Consultation	Consultation Response	Applicant Response
ECU (June 2022)	Scoping	The scoping opinion issued by the Scottish Government's ECU stated that the noise assessment should be carried out in accordance with the relevant legislation and standards	The operational noise assessment for the Proposed Development was undertaken in accordance with the relevant legislation and standards detailed in Chapter 9 of



Consultee and Date	Scoping / Other Consultation	Consultation Response	Applicant Response
		detailed in Chapter 9 of the scoping report and that the report should be formatted as per Table 6.1 of the IOA GPG.	the scoping report and the report should be formatted as per Table 6.1 of the IOA GPG.
		It also stated that the final list of receptors in respect of noise assessment should be agreed following discussion between the Applicant and DGC.	Post-scoping consultation was undertaken with Environmental health at DGC to seek to agree the noise monitoring and assessment locations (see below).
DGC (June 2022)	Scoping	DGC did not respond to the noise section within the Scoping Report so it is assumed that they had no comment to make in relation to the proposed noise assessment.	n/a
DGC (June – September 2022)	Post-scoping consultation undertaken to detail the noise monitoring, NSRs, and any derelict properties which would not be considered within the noise assessment.	DGC did not respond to the initial letter, any subsequent emails, or the installation report detailing the final noise monitoring locations. It is assumed that they had no comment in relation to the noise assessment.	The background noise levels measured at the noise monitoring locations detailed within post- scoping consultation were used to inform the noise assessment for the Proposed Development.

10.5 Assessment Methodology and Significance Criteria

Construction Noise Methodology

- 10.5.1 The construction noise assessment was undertaken using guidance contained in BS 5228: Part 1 2009+A1:2014 (BS 5228). The prediction of construction noise levels was undertaken using the calculation methodology presented in ISO 9613-2:2024, together with published noise data for appropriate construction plant. To undertake an assessment of the construction noise impact using relevant data from BS 5228, the following steps were undertaken:
 - identify the NSRs near potential construction activities and select representative Construction Noise Assessment Locations;
 - identify the applicable threshold of significant effects from BS 5228;
 - predict the noise levels for various construction noise activities;
 - compare predicted noise levels against the applicable threshold;
 - 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.
- 10.5.2 Construction of the Proposed Development would 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 would be determined by the Contractor and detailed arrangements for on-site management would be decided at that time. This assessment has therefore been based upon a typical selection of plant for a project of this size and assesses a number of construction scenarios which have been chosen to represent the likely noisiest activities that would occur across the construction phases. For each scenario the plant has been modelled operating in the closest activity areas to each receptor for any given activity, whereas in reality plant will move around the Site and for much of the time would be operating at more distant locations.
- 10.5.3 The core hours for construction activity are anticipated to be 07:00 19:00 Monday to Friday and 07:00 16:00 on Saturdays². No work will be undertaken on public holidays. The requirement for out-of-hours work could arise, for example, from delivery and unloading of abnormal loads, or to ensure optimal use is made of fair weather windows for the erection of turbine blades and the erection and dismantling of cranes. No scheduled construction is anticipated during the night-time, although, there may be a requirement for some plant to be operational during night-time, for example, a portable generator to provide lighting. A night-time scenario was therefore also considered within the construction noise assessment. Should any construction activity outwith the core working hours be required then prior agreement with DGC will be sought, unless there was an emergency situation or works were required for health and safety reasons.

² Whilst core hours are until 16:00, no noisy works would take place after 13:00 hours on Saturdays.



- 10.5.4 **Chapter 4** describes the outline tasks that will be undertaken during the construction phase, which is estimated to last 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 would occur throughout the construction phase:
 - Scenario 1 (Month 1): Construction compound activity, including the use of generators for power and unloading and loading of materials. Felling is being undertaken across the Site. Specifically, felling is occurring within borrow pit 1a, along the new access track proximate to Meikle Auchrae, along the new access track within the Auchrae and Manquhill Management Fell area, at the location of T4, at the location of T7, the eastern borrow pit area, and proximate to the construction compounds.
 - Scenario 2 (Month 2): Compound activity modelled as per Scenario 1. Operation of borrow pit 1 for extraction of aggregate is underway. Concrete batching is also occurring within this borrow pit. Upgrades to the primary access track leading is underway. The new track proximate to Meikle Auchrae is also occurring. Widening of the junction leading to the main access track, proximate to Strahanna Farm. Substation civils works is underway.
 - Scenario 3 (Month 3): Compound activity modelled as per Scenario 1. Operation of the borrow pits 2 and 3 for extraction of aggregate is underway. Concrete batching is also occurring within the easternmost borrow pit. Upgrade and construction of the access track leading to T1. Construction of the crane hardstands at T1 T3. Substation civils works is underway.
 - Scenario 4 (Month 4): Compound activity modelled as per Scenario 1. Operation of borrow pits 2 and 3 for extraction of aggregate is underway. Concrete batching is also occurring within the easternmost borrow pit. Upgrade and construction of the access track leading to substation and construction compounds. Construction of the crane hardstands at T4. Substation civils works is underway. Pouring of turbine foundations at T1 – T3. Substation construction is occurring
 - Scenario 5 (Month 5 7): Compound activity modelled as per Scenario 1. Operation of the borrow
 pits 2 and 3 for extraction of aggregate is underway. Concrete batching is also occurring within the
 easternmost borrow pit. Upgrade and construction of the access track leading from the substation
 to T5 and T9. Construction of the crane hardstands at T5 T8. Pouring of turbine foundations at
 T4. Substation construction is occurring
 - Scenario 6 (Month 8 9): Compound activity modelled as per Scenario 1. Operation of borrow pits 2 and 3 for extraction of aggregate is underway. Concrete batching is also occurring within the easternmost borrow pit. Construction of the crane hardstands at T9. Pouring of turbine foundations at T5 T8. Substation construction is occurring. There are turbine deliveries along the main access track.
 - Scenario 7 (Month 10): Compound activity modelled as per Scenario 1. Operation of borrow pits 2 and 3 for extraction of aggregate is underway. Concrete batching is also occurring within the easternmost borrow pit. Pouring of turbine foundations at T9. Substation construction is occurring. There are turbine deliveries along the main access track.
 - Scenario 8 (Month 11 12): Compound activity modelled as per Scenario 1. Substation construction is occurring. There are turbine deliveries along the main access track.
 - Scenario 9 (Month 13): Compound activity modelled as per Scenario 1. Substation construction is occurring. There are turbine deliveries along the main access track. Turbine erection at T1 and T6 – T8.
 - Scenario 10 (Night-time): Generators for the welfare facilities and lighting within one of the construction compounds.
- 10.5.5 The modelled scenarios represent the assumed 'noisiest' activities. Other construction activities not included in the noise models would occur, however, the noise output from these would be less than those considered above.
- 10.5.6 The noise-generating equipment assessed for each construction phase is detailed in **Technical Appendix 10.1**. It is noted that for much of the working day the noise associated with construction activities would 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 would vary.
- 10.5.7 To protect the amenity of local residents, construction noise activities would be controlled under the Control of Pollution Act 1974 (COPA) (HM Government, 1974), which includes provisions on the control of noise pollution. In particular, Part III Section 60 of the COPA refers to the control of noise on construction sites. It provides that a Local Authority can impose restrictions on construction works, including specifying the plant allowed to be used, hours of activity, or the setting of noise levels that may be emitted from a site. BS 5228 is the approved code under COPA.

Cumulative Construction Noise

10.5.8 There is the potential that construction activities could occur at the same time as the construction for the nearby consented Sanquhar II, Lorg and Manquhill Wind Farms and the proposed Euchanhead and Cloud Hill Wind Farms. In this case, it is necessary to consider the impacts that could occur from cumulative construction noise, considering both noise level and duration of exposure.

Operational Noise Methodology

10.5.9 In Scotland, The Onshore Wind Policy Statement 2022 web-based planning advice states:

'The Assessment and Rating of Noise from Wind Farms' (Final Report, Sept 1996, DTI), (ETSU-R-97) provides the framework for the measurement of wind turbine noise, and all applicants are required to follow the framework and use it to assess and rate noise from wind energy developments.'

10.5.10 The web-based document then refers to the Institute of Acoustics 'A Good Practice Guide to the Application of ETSU-R-97' (IOA GPG) stating that it supports:

'the use of ETSU-R-97 when designing potential windfarm schemes, and the monitoring of noise levels from generating sites. The Scottish Government recognises this guide as a useful tool which developers can use in conjunction with ETSU-R-97.'

10.5.11 The web-based document concludes that:

'The Scottish Government is aware that the UK Government has been considering the extent to which ETSU-R-97 may require updating to ensure it is aligned with the potential effects from more modern turbines. The Scottish Government supports this work and we anticipate the results of a short-term review project in due course.'

'Until such time as new guidance is produced, ETSU-R-97 should continue to be followed by applicants and used to assess and rate noise from wind energy developments.'

- 10.5.12 Therefore, the Proposed Development operational noise assessment has been undertaken in accordance with ETSU-R-97 and the IOA GPG. ETSU-R-97 provides a robust basis for determining acceptable noise limits for wind farm developments. Consequently, the test applied to operational noise is whether or not the calculated wind farm noise levels at nearby noise sensitive properties would be below the noise limits derived in accordance with ETSU-R-97.
- 10.5.13 Limits differ between daytime and night-time periods. The daytime criteria are based upon background noise levels measured during the 'quiet periods of the day' comprising:
 - all evenings from 18:00 23:00;
 - Saturday afternoons from 13:00 16:00; and
 - all day Sunday from 07:00 23:00.
- 10.5.14 For the avoidance of doubt the limits set based upon the background data collected during the quiet daytime period apply to the entire daytime period (07:00 23:00).
- 10.5.15 Night-time periods are defined as 23:00 07:00 with no differentiation made between weekdays and weekends.
- 10.5.16 ETSU-R-97 recommends that wind farm noise for the daytime periods should be limited to 5 dB(A) above the prevailing background or a fixed minimum level (FML) within the range 35 40 dB L_{A90,10min}, whichever is the higher. The precise choice of criterion level within the range 35 40 dB(A) depends on a number of factors, including:
 - the number of dwellings in the neighbourhood of the wind farm (relatively few dwellings suggest a figure towards the upper end);
 - the effect of noise limits on the number of kWh generated (larger sites tend to suggest a higher figure); and
 - the duration and level of exposure to any noise.
- 10.5.17 Following a review of the noise limits for other wind farm/turbine developments in the surrounding area, the 'Total ETSU-R-97 Noise Limits' for the Proposed Development operating in conjunction with other cumulative schemes has been set at 40 dB(A) or background plus 5 dB whichever is the greater during the daytime period and at 43 dB(A) or background plus 5 dB whichever is the greater during the night-time period. This 'Total' limit relates to noise from all wind farm developments in the area.
- 10.5.18 The daytime 'Site Specific Noise Limits' have been derived based on the lower FML of 35 dB(A), or background plus 5 dB whichever is the greater whilst taking account of the proportion of the noise limit that has been allocated to, or could theoretically be used by, other schemes. Where turbine immission from the other turbines at a given receptor were found to be at least 10 dB below the Total ETSU-R-97 Noise Limit, it is considered that they will be using a negligible proportion of the limit, as such it was



considered appropriate to allocate the entire noise limit to the Proposed Development, subject to the lower FML of 35 dB(A). For the receptors where turbine predictions were found to be within 10 dB of the Total ETSU-R-97 Noise Limit, apportionment of the Total ETSU-R-97 Noise Limits was undertaken in accordance with current good practice.

- 10.5.19 For night-time periods the recommended limits are 5 dB(A) above prevailing background or a fixed minimum level of 43 dB L_{A90,10min}, whichever is higher whilst taking account of the proportion of the noise limit that has been allocated to, or could theoretically be used by, other schemes.
- 10.5.20 The exception to the setting of both the daytime and night-time fixed minimum on the noise limits occurs where a property occupier has a financial involvement in the wind farm development where the fixed minimum limit can be increased to 45 dB(A) and/or a higher permissible limit above background during the daytime and night-time periods.
- 10.5.21 In addition to ETSU-R-97, the recommendations included in the IOA GPG have been considered in the noise assessment.
- 10.5.22 The exact model of turbine to be installed on the Site will be the result of a future tendering process should consent be granted. Achievement of the Site Specific Noise Limits determined by this assessment will be a key determining factor in the final choice of turbine for the Proposed Development. Predictions of turbine noise for the Proposed Development were made based upon the sound power level data for a single candidate turbine, the Vestas V162 7.2 MW with serrated trailing edge blades, as it is considered representative of the type of turbine that would be installed at the Site.
- 10.5.23 Noise predictions have been undertaken using the propagation model contained within Part 2 of International Standard ISO 9613-2, 'Acoustics Attenuation of sound during propagation outdoors' (ISO, 2024). 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 and a receiver height of 4 m.
- 10.5.24 Typically wind farm noise assessments assume all properties are downwind of all turbines at all times (as this would result in the highest 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; the impact of directivity has been considered in the assessment. Further information on the methodology adopted where this condition comes into effect is provided in Section 6.3 of **Technical Appendix 10.2**.
- 10.5.25 The turbine noise immission levels are based on the LA90,10 minute noise indicator in accordance with the recommendations in ETSU-R-97, which were obtained by subtracting 2 dB(A) from the turbine sound power level data (LAeq indicator).
- 10.5.26 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 6, **Technical Appendix 10.2**.
- 10.5.27 More information relating to all the parameters for operational noise discussed above and on other topics such as Amplitude Modulation (AM) and Low Frequency Noise (LFN) has been provided in **Technical Appendix 10.2**. There is no evidence that LFN has adverse impacts on the health of wind farm neighbours and at the 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.

Cumulative Wind Farm Noise

- 10.5.28 The need for a cumulative noise assessment was considered in accordance with the guidance contained within the IOA GPG. There are a number of operational, consented and proposed turbine developments within the vicinity of the Proposed Development (refer to **Technical Appendix 10.2**); as such, and where required, a cumulative noise assessment was undertaken. The noise assessment was undertaken in three separate stages:
 - Stage 1 establish the Total ETSU-R-97 Noise Limits for each Noise Assessment Location (NAL) using the measured background noise levels to derive new limits;
 - Stage 2 undertake noise modelling to determine whether noise predictions from the Proposed Development on its own are within 10 dB of the noise predictions from other turbines within the area; where turbine predictions are within 10 dB then a cumulative noise assessment is undertaken; and

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- Stage 3 establish the Site Specific Noise Limits for the Proposed Development (through apportioning the Total ETSU-R-97 Noise Limits) and compare the noise predictions from the Proposed Development on its own against the Site Specific Noise Limits.
- 10.5.29 The aim of the operational noise assessment therefore was to establish the Total ETSU-R-97 Noise Limits, determine the likely impacts of the Proposed Development and other schemes at the nearest NSRs, derive Site Specific Noise Limits, and to demonstrate that the Proposed Development could meet those limits.
- 10.5.30 All the turbines modelled in the cumulative noise assessment (Stage 2), are summarised in Annex 6 of **Technical Appendix 10.2**. Uncertainty in sound power data for the Proposed Development has been accounted for using the guidance contained within Section 4.2 of the IOA GPG. The location of the turbines for the Proposed Development and the other schemes are shown on **Figure 10.3**.

Study Area

- 10.5.31 The Proposed Development is located within a rural location, where existing background noise levels at the NSRs are relatively low. The predominant noise sources in the area are watercourses, wind induced noise (wind passing through vegetation and around buildings), and birdsong.
- 10.5.32 Prior to the commencement of the baseline noise survey, initial desktop noise modelling was undertaken in order to identify suitable locations at which to monitor background noise. The proposed noise monitoring locations (NMLs) were included in a consultation letter issued to DGC as part of the consultation process.
- 10.5.33 There are a number of operational, consented and proposed wind farms located in the vicinity of the Proposed Development, referred to as the cumulative developments (as shown on **Figure 10.3**, and summarised in Table 1.1 of **Technical Appendix 10.2**.

Desk Study

10.5.34 The assessment was informed by data sources such as Google Earth Aerial Imagery, OS Terrain 50 height data and was complemented by site visit as part of the noise survey. The noise data used for noise predictions was provided by turbine manufacturers or alternative reliable sources such as BS 5228 for construction plant.

Field Survey

- 10.5.35 The noise survey to determine the existing background noise environment at the NSRs neighbouring the Proposed Development was undertaken in accordance with the guidance contained within ETSU-R-97 and the IOA GPG.
- 10.5.36 Background noise monitoring was undertaken over the period 12 August 20 October 2022 at two noise sensitive receptors and from 23 August 20 October 2022 at a third location. The locations of the NMLs are detailed in Table 10.2 and shown on **Figure 10.2**. The selection of the noise monitoring locations considered local noise sources such as local watercourses, vegetation and the existing operational turbines. More information on the NMLs including noise monitoring equipment used, the maximum calibration drift, dominant noise sources noted, and the approach undertaken to account for any potential measured operational turbine noise at each of the three NMLs can be found in Section 5 of **Technical Appendix 10.2**.

Table 10.2 – Summary of Noise Monitoring Locations

NML/ Receptor Name	Easting	Northing
NML1 – Shinnelhead	272958	599160
NML2 – High Appin	274653	697262
NML3 – Blairoch	270732	596568

Assessment of Potential Effect Significance

Construction Noise

10.5.37 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 10.3 below.

Table 10.3 – Construction Noise Category A Criteria

Significance of Effect	Criteria Thresholds						
	Criteria Met	Criteria Exceeded					
Category A Daytime (07:00 - 19:00) and Saturdays (07:00 - 13:00)	≤65dB L _{Aeq} , _{12 hr}	>65dB L _{Aeq} , 12 hr					
Category A Evenings and Weekends (19:00 - 23:00)	≤55dB L _{Aeq} , _{12 hr}	>55dB L _{Aeq} , _{12 hr}					



Significance of Effect	Criteria Thresholds						
_	Criteria Met	Criteria Exceeded					
Category A							
Night-time	≤45dB L _{Aea} , _{12 hr}	>45dB L _{Aea} , _{12 hr}					
(23:00 - 07:00)							

10.5.38 It should be noted that exceedance of the threshold 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.'

Wind Farm Noise

- 10.5.39 Planning Advice Note PAN 1/2011 'Planning and Noise' provides advice on the role of the planning system in helping to prevent and limit the adverse effects of noise. PAN 1/2011 refers to the webbased planning advice on renewable technologies for Onshore Wind Turbines, which states that ETSU-R-97 should be used to assess and rate noise from wind energy developments. ETSU-R-97 does not define significance criteria but describes a framework for the measurement of wind farm noise and gives 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 ETSU-R-97 derived noise limits ensures that turbine noise will comply with current Government guidance.
- 10.5.40 The use of the term 'significance' in this Chapter in relation to operational wind turbine noise refers to compliance/non-compliance with the ETSU-R-97 derived noise limits. For situations where predicted wind turbine noise meets or is less than the noise limits defined in ETSU-R-97, then the noise effects are deemed to be not significant. Any breach of the ETSU-R-97 derived noise limits due to the Proposed Development is deemed to result in a significant effect in terms of the EIA Regulations.
- 10.5.41 For the purposes of this assessment, residential properties that lawfully exist or have extant planning permission or are deemed habitable are considered to be NSRs.

Assessment Assumptions

10.5.42 A candidate turbine has been used for predictions of operational noise from the Proposed Development. The final model of turbine to be used may differ from that presented here, however the operational noise levels from the Proposed Development would have to comply with the noise limits imposed within the noise condition attached to any consent.

Limitations to Assessment

- 10.5.43 A candidate turbine has been used for predictions of operational wind farm noise from the Proposed Development. The final model of turbine to be used may differ from that presented here, however the operational noise levels from the Proposed Development would have to comply with the noise limits imposed within the noise condition attached to any planning consent. No other assumptions or data gaps have been identified.
- 10.5.44 Whilst some limitations due to the assumptions made have been identified, it is considered that there is sufficient information to enable an informed decision to be taken in relation to the identification and assessment of likely significant noise and vibration effects.

10.6 Baseline Conditions

Table 10.4 and **Table 10.5** provide a summary of the background noise levels measured during the monitoring period for the ETSU-R-97 quiet daytime and night-time periods. Further information of the data recorded during the noise survey can be found in Section 5 of **Technical Appendix 10.2**.

Table 10.4 – Summary of Prevailing Background Noise Levels during Quiet Daytime Periods (L_{A90, 10mins} dB)

Noise Monitoring Location	Wind S	Wind Speed (ms ⁻¹) as standardised to 10 m height										
(NML)	1	2	3	4	5	6	7	8	9	10	11	12
NML1 – Shinnelhead	26.8*	26.8*	26.8	27.3	28.4	29.9	31.7	33.6	35.5	37.3	39.0	40.3
NML2 – High Appin	23.4	23.7	24.2	25.1	26.2	27.4	28.8	30.2	31.6	33.0	34.4	35.5
NML3 – Blairoch	26.1	27.0	28.0	29.0	30.1	31.1	32.3	33.4	34.6	35.8	37.0	38.3
* = 1	-											

* Flatlined where derived minimum occurs at lower wind speeds.

Table 10.5 – Summary of Prevailing	Background Noise Levels during	y Night-time Periods	(LA90, 10mins dB)
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Noise Monitoring Location	Wind S	Wind Speed (ms ⁻¹) as standardised to 10 m height										
(NML)	1	2	3	4	5	6	7	8	9	10	11	12
NML1 – Shinnelhead	25.5*	25.5*	25.5*	25.5	26.0	26.8	28.0	29.6	31.5	33.7	36.1	38.8
NML2 – High Appin	23.0*	23.0*	23.0	23.4	24.4	25.7	27.3	29.1	30.9	32.7	34.3	35.6
NML3 – Blairoch	26.9*	26.9	27.1	27.5	28.2	29.0	30.0	31.2	32.5	33.8	35.2	36.7



Noise Monitoring Location	Wind Speed (ms ⁻¹) as standardised to 10 m height											
(NML)	1	2	3	4	5	6	7	8	9	10	11	12

* Flatlined where derived minimum occurs at lower wind speeds.

10.7 Implications of Climate Change for Existing Conditions

10.7.1 It is possible that noise propagation and resulting noise immission levels could change over the life of the Proposed Development due to climate change (as noise attenuation is influenced by air temperature, relative humidity and ground conditions). However, this is unlikely to be significant and 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 Proposed Development.

10.8 Future Baseline in the Absence of the Proposed Development

10.8.1 There are no other known current or predicted future processes that are likely to change the future baseline conditions in the absence of the Proposed Development.

10.9 Embedded Mitigation

10.9.1 Throughout the design process the layout of the Proposed Development was reviewed to optimise turbine numbers and locations, subject to a wide range of identified constraints inclusive of noise which was fully considered throughout the EIA process. Each layout modification was 'reviewed' by undertaking noise predictions to ensure noise limits could be met. The site design process therefore satisfactorily minimised any increase in ambient noise levels at two levels: firstly, through several iterations of site specific design and secondly, at a higher level, through the use of ETSU-R-97 itself which provides a robust basis for determining appropriate noise limits.

10.10 Good Practice Measures

- 10.10.1 A range of good practice measures would be detailed in a Construction Environmental Management Plan (CEMP) and employed to minimise noise impacts.
- 10.10.2 Good site practices would be implemented to minimise effects. Section 8 of BS5228 recommends a number of simple control measures as summarised below that would be employed on-site during construction:
 - 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;
 - Ensure that any extraordinary site work continuing throughout 24 hours of a day (for example, crane operations lifting components onto the tower) would be programmed, when appropriate, so that haulage vehicles would 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 peak traffic times;
 - Ensure all vehicles and mechanical plant would be fitted with effective exhaust silencers and be subject to programmed maintenance;
 - Select inherently quiet plant where appropriate all major compressors would be 'sound reduced' models fitted with properly lined and sealed acoustic covers, which would be kept closed whenever the machines are in use;
 - Ensure all ancillary pneumatic percussive tools would be fitted with mufflers or silencers of the type recommended by the manufacturers;
 - Instruct that machines would be shut down between work periods or throttled down to a minimum;
 - Regularly maintain all equipment used on site, including maintenance related to noise emissions;
 - Vehicles would be loaded carefully to ensure minimal drop heights so as to minimise noise during this operation; and
 - Ensure all ancillary plant such as generators and pumps would be positioned so as to cause minimum noise disturbance and if necessary, temporary acoustic screens or enclosures should be provided.

10.11 Micrositing

10.11.1 A 100 m micrositing distance is proposed. It should be noted that the need to include a concave ground profile correction and/or barrier correction to the noise modelling may change depending on the final location of the turbines (following micrositing) and the final turbine hub height chosen. Nevertheless,



turbine noise levels will have to meet the noise limits established in this report regardless of any increases and decreases in noise propagation caused by topography. Should consent be granted, the need to apply a concave ground profile/barrier correction will need to be considered by the Applicant prior to the final selection of a turbine model for the Site.

10.12 Scope of the Assessment

Effects Assessed in Full

10.12.1 The assessment considers the potential effects during the construction, operational and decommissioning phases of the Proposed Development.

Construction Noise Assessment Locations

- 10.12.2 A total of nine Construction Noise Assessment Locations (CNALs) were chosen as representative of the nearest NSRs. The CNALs chosen were the closest receptors to the Proposed Development and access tracks and these are presented on **Figure 10.1**.
- 10.12.3 The CNALs refer to the position on the curtilage of a property where the predictions of construction noise levels have been made, as detailed in **Table 10.6** below.

Table 10.6 – Construction Noise Assessment Locations

CNAL/ Receptor Name	Status	Easting	Northing
CNAL1 - Shinnel Head	Inhabited	272939	599143
CNAL2 - High Appin	Inhabited	274653	597276
CNAL3 - Benbuie	Inhabited	271050	596140
CNAL4 - Blairoch	Inhabited	270713	596545
CNAL5 - Meikle Auchrae	Uninhabited	264610	594564
CNAL6 - Strathanna Farm	Inhabited	264554	595860
CNAL7 - Auchrae	Inhabited	265168	596543
CNAL8 - Crigengillan	Inhabited	263693	594821
CNAL9 – Cairnhead (Bothy)	Uninhabited	270144	597209

Operational Noise Assessment Locations

- 10.12.4 A total of thirteen Noise Assessment Locations (NALs) were chosen as being representative of the nearest NSRs to the Proposed Development and they are shown on Figure 10.2 and detailed in Table 10.7 below. They were selected based on them having the loudest predicted noise levels within a group of nearby properties around the Proposed Development.
- 10.12.5 The NALs refer to the position on the curtilage of a property closest to the Proposed Development. Predictions of turbine noise have been made at each of the NALs as detailed in **Table 10.7**. This approach ensures that the assessment considers the worst case (highest) noise immission level expected at the NSR. **Table 10.7** also details which NML has been used to set noise limits for each NAL.

Table 10.7 – Operational Noise Assessment Locations

NAL/ Receptor Name	Status	Easting	Northing
NAL1 - Shinnelhead	Inhabited	272939	599143
NAL2 - High Appin	Inhabited	274653	597276
NAL3 - Appin Lodge	Inhabited	275249	597409
NAL4 - High Auchenbrack	Inhabited	275704	597132
NAL5 - Kilnmark	Inhabited	276068	596512
NAL6 - Auchenbrack	Inhabited	276625	596515
NAL7 - Kirkconnel	Inhabited	276321	594505
NAL8 - Dalwhat Farm	Inhabited	273814	593359
Cottage			
NAL9 - Corriedow	Inhabited	272118	593813
NAL10 - Glenjaan	Inhabited	271669	594245
NAL11 - Benbuie	Inhabited	271065	596125
NAL12 - Blairoch Cairnhead	Inhabited	270713	596545
NAL13 – Cairnhead (Bothy)	Uninhabited	270144	597209

Effects Scoped Out

Decommissioning

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



Vibration

10.12.7 Vibration from turbines is low therefore on that basis it was not considered necessary to carry out a specific assessment of perceptible vibration and it has been scoped out of the EIA. However, further information on vibration can be found in Section 3.2 of **Technical Appendix 10.2**.

Blasting

10.12.8 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 appointed contractor in accordance with guidance outlined in BS 5228-2:2009+A1:2014. In addition, blasts would 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 7385-2: 1993 'The Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration' and BS 6472-2: 2008 'Guide to evaluation of human exposure to vibration in buildings. Blast-induced vibration'. A condition would be attached to the consent to require compliance with these limits, as per the Standard Conditions. Given the relative distances between the potential locations of blasting and the closest noise sensitive receptors, there is no reason to suggest that the guidance within BS 7385 and BS 6472 would not be met, and therefore this issue can be scoped out of further detailed consideration.

10.13 Assessment of Effects

Construction

Predicted Construction Effects

- 10.13.1 The construction noise impact results summarised in **Table 10.8** below show that the predicted construction noise levels are below the weekday and Saturday daytime Category A Threshold Level at all CNALs for all assessment scenarios.
- 10.13.2 At CNAL5 and CNAL6, noise levels have been calculated to be equal to, or above, the evening and weekend 55 dBA threshold levels in during S2 (month 2), however, this is unlikely to result in a significant impact, as duration of exposure will be limited. Nonetheless, activities relating specifically to the construction of access tracks are not to be undertaken in proximity to these properties outwith normal daytime working hours (Mon-Fri 07:00 19:00 and Saturday 07:00 13:00).
- 10.13.3 No construction activities are proposed during the night-time, however, a night-time scenario (Scenario 10) is included in the assessment in case of generator usage at night. The predicted noise levels for this scenario are comfortably below the night-time 45 dB(A) threshold level.
- 10.13.4 Therefore, there would be **no significant effects**. Further details of the modelling and assessment can be found in **Technical Appendix 10.1**.

	Category	A Threshold	dB L _{Aeq, t}	Immi	ssion L	evel, d	B L _{Aeq, t}	for eac	h Scen	ario			
CNAL	Daytime weekdays and Saturday Mornings	Evening weekdays, Saturday afternoon and Sundays**	Night- Time ***	S1	S2	S 3	S4	S5	S6	S7	S8	S9	S10
CNAL1 - Shinnelhead	65	55	45	27	25	35	35	36	36	34	27	34	15
CNAL2 - High Appin	65	55	45	32	33	41	42	41	41	41	34	37	24
CNAL3 - Benbuie	65	55	45	20	20	38	38	38	38	38	22	33	nil
CNAL4 - Blairoch	65	55	45	21	22	42	42	43	43	42	24	33	nil
CNAL5 - Meikle Auchrae	65	55	45	49	62	nil	nil	nil	nil	37	37	37	nil
CNAL6 - Strathanna Farm	65	55	45	37	55	nil	nil	nil	nil	32	32	32	nil
CNAL7 - Auchrae	65	55	45	34	47	nil	nil	nil	nil	24	24	24	nil
CNAL8 - Crigengillan	65	55	45	31	41	nil	nil	nil	nil	25	25	25	nil
CNA9 – Cairnhead (Bothy)	65	55	45	24	28	33	34	36	35	35	29	35	11

Table 10.8 – Predicted Construction and Decommissioning Noise Immission Levels



* 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)

Committed Additional Mitigation

10.13.5 Construction activities will not be undertaken in proximity to CNAL5 and CNAL6 outwith normal daytime working hours (Mon-Fri 07:00 – 19:00 and Saturday 07:00 – 13:00).

Residual Construction Effects

10.13.6 Elements of construction noise may be audible at the closest residential receptors for certain periods during the construction phases. However, with or without the good practice construction mitigation measures outlined in paragraph 10.13.5, there would be **no significant residual effects.**

Operational

Predicted Operational Effects

Setting the Total ETSU-R-97 Noise Limits (Stage 1)

10.13.7 Based on the prevailing background noise levels, the Total ETSU-R-97 Noise Limits have been established for each of the NALs detailed in Table 10.7 above. The Total ETSU-R-97 Noise Limits are as detailed in Table 10.9 and Table 10.10 below and have been based on an upper fixed minimum of 40 dB (Daytime) or background plus 5 dB and 43 dB (Night-time) or background plus 5 dB.

Table 10.9 - Total ETSU-R-97 Noise Limits - Daytime

NAL	Wind	Speed	(ms ⁻¹) a	s stand	lardised	d to 10 i	n heigh	nt				
	1	2	3	4	5	6	7	8	9	10	11	12
NAL1 - Shinnelhead	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.5	42.3	44.0	45.3
NAL2 - High Appin	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.5
NAL3 - Appin Lodge	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.5
NAL4 - High Auchenbrack	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.5
NAL5 - Kilnmark	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.5
NAL6 - Auchenbrack	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.5
NAL7 - Kirkconnel	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.5
NAL8 - Dalwhat Farm Cottage	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.8	42.0	43.3
NAL9 - Corriedow	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.8	42.0	43.3
NAL10 - Glenjaan	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.8	42.0	43.3
NAL11 - Benbuie	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.8	42.0	43.3
NAL12 - Blairoch Cairnhead	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.8	42.0	43.3
NAL13 – Cairnhead (Bothy)	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.8	42.0	43.3

Table 10.10 – Total ETSU-R-97 Noise Limits – Night-time

NAL	Wind	Speed	(ms ⁻¹) a	is stand	lardise	d to 10	m heigł	nt				
	1	2	3	4	5	6	7	8	9	10	11	12
NAL1 - Shinnelhead	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.8
NAL2 - High Appin	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
NAL3 - Appin Lodge	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
NAL4 - High Auchenbrack	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
NAL5 - Kilnmark	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
NAL6 - Auchenbrack	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
NAL7 - Kirkconnel	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
NAL8 - Dalwhat Farm Cottage	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
NAL9 - Corriedow	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
NAL10 - Glenjaan	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
NAL11 - Benbuie	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
NAL12 - Blairoch Cairnhead	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
NAL13 – Cairnhead (Bothy)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0

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

- 10.13.8 Predicted cumulative noise levels were compared to the Total ETSU-R-97 Noise Limits. For some turbine models considered in the cumulative assessment noise data was not available for wind speeds lessthan 5 ms⁻¹ therefore no cumulative predictions are included for wind speeds lessthan 4 ms⁻¹.
- 10.13.9 As shown in Table 10.11 and Table 10.12, the predicted cumulative turbine noise immission levels are below the Total ETSU-R-97 Noise Limits under all conditions and at all NALs during both daytime and night-time periods. As such, there would be **no significant effects**.



NAL		Wind	Speed	d (ms⁻¹)	as star	ndardis	ed to 10)m heig	ht				
		1	2	3	4	5	6	7	8	9	10	11	12
NAL1 - Shinnelhead	Total ETSU-R-97 Noise Limit L _{A90}	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.5	42.3	44.0	45.3
	Cumulative Predictions L _{A90}	-	-	-	30.8	34.9	38.3	39.3	39.3*	39.3*	39.3*	39.3*	39.3*
	Exceedance Level	-	-	-	-9.2	-5.1	-1.7	-0.7	-0.7	-1.2	-3.0	-4.7	-6.0
NAL2 - High Appin	Total ETSU-R-97 Noise Limit L _{A90}	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.5
	Cumulative Predictions L _{A90}	-	-	-	27.4	30.9	34.3	35.6	35.6	35.7	35.7	35.7	35.7
	Exceedance Level	-	-	-	-12.6	-9.1	-5.7	-4.4	-4.4	-4.3	-4.3	-4.3	-4.8
NAL3 – Appin Lodge	Total ETSU-R-97 Noise Limit L _{A90}	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.5
	Cumulative Predictions L _{A90}	-	-	-	25.6	29.2	32.5	33.7	33.8	33.8	33.9	33.9	33.9
	Exceedance Level	-	-	-	-14.4	-10.8	-7.5	-6.3	-6.2	-6.2	-6.1	-6.1	-6.6
NAL4 – High Auchenbrack	Total ETSU-R-97 Noise Limit L _{A90}	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.5
	Cumulative Predictions L _{A90}	-	-	-	24.5	28.1	31.4	32.6	32.7	32.7	32.8	32.8	32.8
	Exceedance Level	-	-	-	-15.5	-11.9	-8.6	-7.4	-7.3	-7.3	-7.2	-7.2	-7.7
NAL5 - Kilnmark	Total ETSU-R-97 Noise Limit L _{A90}	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.5
	Cumulative Predictions L _{A90}	-	-	-	23.0	26.5	29.7	30.9	30.9	31.0	31.1	31.1	31.1
	Exceedance Level	-	-	-	-17.0	-13.5	-10.3	-9.1	-9.1	-9.0	-8.9	-8.9	-9.4
NAL6 - Auchenbrack	Total ETSU-R-97 Noise Limit L _{A90}	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.5
	Cumulative Predictions L _{A90}	-	-	-	22.4	25.8	29.1	30.3	30.3	30.4	30.5	30.5	30.5
	Exceedance Level	-	-	-	-17.6	-14.2	-10.9	-9.7	-9.7	-9.6	-9.5	-9.5	-10.0
NAL7 - Kirkconnel	Total ETSU-R-97 Noise Limit L _{A90}	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.5
	Cumulative Predictions L _{A90}	-	-	-	23.0	25.2	27.6	28.6	28.8	29.2	29.6	29.6	29.6
	Exceedance Level	-	-	-	-17.0	-14.8	-12.4	-11.4	-11.2	-10.8	-10.4	-10.4	-10.9
NAL8 – Dalwhat	Total ETSU-R-97 Noise Limit L _{A90}	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.8	42.0	43.3
Farm Cottage	Cumulative Predictions L _{A90}	-	-	-	25.6	27.6	29.7	30.6	30.8	31.2	31.8	31.8	31.8
	Exceedance Level	-	-	-	-14.4	-12.4	-10.3	-9.4	-9.2	-8.8	-9.0	-10.2	-11.5
NAL9 - Corriedow	Total ETSU-R-97 Noise Limit L _{A90}	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.8	42.0	43.3
	Cumulative Predictions L _{A90}	-	-	-	28.2	30.3	32.4	33.2	33.4	33.8	34.4	34.4	34.4
	Exceedance Level	-	-	-	-11.8	-9.7	-7.6	-6.8	-6.6	-6.2	-6.4	-7.6	-8.9
NAL10 - Glenjaan	Total ETSU-R-97 Noise Limit L _{A90}	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.8	42.0	43.3
	Cumulative Predictions L _{A90}	-	-	-	29.9	31.8	33.7	34.5	34.7	35.2	35.8	35.8	35.8
	Exceedance Level	-	-	-	-10.1	-8.2	-6.3	-5.5	-5.3	-4.8	-5.0	-6.2	-7.5
NAL11 – Benbuie	Total ETSU-R-97 Noise Limit L _{A90}	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.8	42.0	43.3
	Cumulative Predictions L _{A90}	-	-	-	29.1	32.6	35.8	37.2	37.2	37.2	37.3	37.3	37.3

Table 10.10 – ETSU-R-97 Compliance Table – Likely Cumulative Noise – Daytime



NAL		Wind	Spee	d (ms⁻¹)	as star	ndardis	ed to 10)m heig	lht				
		1	2	3	4	5	6	7	8	9	10	11	12
	Exceedance Level	-	-	-	-10.9	-7.4	-4.2	-2.8	-2.8	-2.8	-3.5	-4.7	-6.0
NAL12 – Blairoch	Total ETSU-R-97 Noise Limit L _{A90}	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.8	42.0	43.3
Cairnhead	Cumulative Predictions L _{A90}	-	-	-	29.7	33.3	36.6	38.0	38.0	38.0	38.0	38.0	38.0
	Exceedance Level	-	-	-	-10.3	-6.7	-3.4	-2.0	-2.0	-2.0	-2.8	-4.0	-5.3
NAL13 – Cairnhead	Total ETSU-R-97 Noise Limit L _{A90}	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.8	42.0	43.3
(Bothy)	Cumulative Predictions L _{A90}	-	-	-	30.2	33.8	37.0	38.3	38.4	38.4	38.4	38.4	38.4
	Exceedance Level	-	-	-	-9.8	-6.2	-3.0	-1.7	-1.6	-1.6	-2.4	-3.6	-4.9

*Mitigation applied to the Proposed Development (see Section 10.13.10 below for further information)

Table 10.11 – ETSU-R-97 Compliance Table – Likely Cumulative Noise – Night-time

NAL		Wind	Speed	(ms ⁻¹) a	as stan	dardise	ed to 10	m heig	ht				
		1	2	3	4	5	6	7	8	9	10	11	12
NAL1 - Shinnelhead	Site Specific Noise Limit L _{A90}	43.0	43.0	43.0	43.0	41.9	40.0	33.0	33.0	33.0	33.0	33.0	33.8
	Predictions LA90	-	-	22.7	24.4	27.8	31.3	33.0	33.0	33.0	33.0	33.0	33.0
	Exceedance Level	-	-	-20.3	-18.6	-14.1	-8.7	0.0	0.0	0.0	0.0	0.0	-0.8
NAL2 - High Appin	Site Specific Noise Limit L _{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Predictions LA90	-	-	23.2	24.9	28.3	31.8	33.5	33.5	33.5	33.5	33.5	33.5
	Exceedance Level	-	-	-19.8	-18.1	-14.7	-11.2	-9.5	-9.5	-9.5	-9.5	-9.5	-9.5
NAL3 – Appin Lodge	Site Specific Noise Limit L _{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Predictions L _{A90}	-	-	20.0	21.7	25.1	28.6	30.3	30.3	30.3	30.3	30.3	30.3
	Exceedance Level	-	-	-23.0	-21.3	-17.9	-14.4	-12.7	-12.7	-12.7	-12.7	-12.7	-12.7
NAL4 – High Auchenbrack	Site Specific Noise Limit L _{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Predictions L _{A90}	-	-	19.2	20.9	24.3	27.8	29.5	29.5	29.5	29.5	29.5	29.5
	Exceedance Level	-	-	-23.8	-22.1	-18.7	-15.2	-13.5	-13.5	-13.5	-13.5	-13.5	-13.5
NAL5 - Kilnmark	Site Specific Noise Limit L _{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Predictions LA90	-	-	16.7	18.5	21.9	25.4	27.0	27.0	27.0	27.0	27.0	27.0
	Exceedance Level	-	-	-26.3	-24.5	-21.1	-17.6	-16.0	-16.0	-16.0	-16.0	-16.0	-16.0
NAL6 - Auchenbrack	Site Specific Noise Limit L _{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Predictions LA90	-	-	16.8	18.5	21.9	25.4	27.1	27.1	27.1	27.1	27.1	27.1
	Exceedance Level	-	-	-26.2	-24.5	-21.1	-17.6	-15.9	-15.9	-15.9	-15.9	-15.9	-15.9
NAL7 - Kirkconnel	Site Specific Noise Limit L _{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Predictions LA90	-	-	13.7	15.5	18.9	22.4	24.0	24.0	24.0	24.0	24.0	24.0
	Exceedance Level	-	-	-29.3	-27.5	-24.1	-20.6	-19.0	-19.0	-19.0	-19.0	-19.0	-19.0
NAL8 – Dalwhat	Site Specific Noise Limit L _{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0



NAL		Wind	Speed	(ms ⁻¹) a	as stan	dardise	d to 10	m heig	ht				
		1	2	3	4	5	6	7	8	9	10	11	12
Farm Cottage	Predictions LA90	-	-	14.5	16.2	19.6	23.1	24.8	24.8	24.8	24.8	24.8	24.8
	Exceedance Level	-	-	-28.5	-26.8	-23.4	-19.9	-18.2	-18.2	-18.2	-18.2	-18.2	-18.2
NAL9 - Corriedow	Site Specific Noise Limit L _{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	42.2	42.2	42.2
	Predictions LA90	-	-	17.4	19.2	22.6	26.1	27.7	27.7	27.7	27.7	27.7	27.7
	Exceedance Level	-	-	-25.6	-23.8	-20.4	-16.9	-15.3	-15.3	-15.3	-14.5	-14.5	-14.5
NAL10 - Glenjaan	Site Specific Noise Limit L _{A90}	43.0	43.0	43.0	43.0	43.0	43.0	42.2	42.2	42.0	41.8	41.8	41.8
	Predictions LA90	-	-	19.0	20.8	24.2	27.7	29.3	29.3	29.3	29.3	29.3	29.3
	Exceedance Level	-	-	-24.0	-22.2	-18.8	-15.3	-12.9	-12.9	-12.7	-12.5	-12.5	-12.5
NAL11 – Benbuie	Site Specific Noise Limit L _{A90}	43.0	43.0	43.0	43.0	43.0	42.2	42.1	42.0	41.9	41.7	41.7	41.7
	Predictions LA90	-	-	25.7	27.4	30.8	34.3	36.0	36.0	36.0	36.0	36.0	36.0
	Exceedance Level	-	-	-17.3	-15.6	-12.2	-7.9	-6.1	-6.0	-5.9	-5.7	-5.7	-5.7
NAL12 – Blairoch	Site Specific Noise Limit L _{A90}	43.0	43.0	43.0	43.0	43.0	42.2	42.1	42.1	42.0	41.9	41.9	41.9
Cairnhead	Predictions LA90	-	-	26.6	28.4	31.8	35.3	36.9	36.9	36.9	36.9	36.9	36.9
	Exceedance Level	-	-	-16.4	-14.6	-11.2	-6.9	-5.2	-5.2	-5.1	-5.0	-5.0	-5.0
NAL13 – Cairnhead	Site Specific Noise Limit L _{A90}	43.0	43.0	43.0	43.0	43.0	42.0	41.9	41.8	41.8	41.7	41.7	41.7
(Bothy)	Predictions L _{A90}	-	-	26.4	28.1	31.5	35.0	36.7	36.7	36.7	36.7	36.7	36.7
	Exceedance Level	-	-	-16.6	-14.9	-11.5	-7.0	-5.2	-5.1	-5.1	-5.0	-5.0	-5.0

Operational Phase- Derivation of Site Specific Noise Limits for the Proposed Wind Farm (Stage 3)

- 10.13.10 In order to protect residential amenity, in accordance with ETSU-R-97 cumulatively, all wind farms (including the Proposed Development) should operate within the Total ETSU-R-97 Noise Limits, as demonstrated in Stage 2 above.
- 10.13.11 Another recommendation is that each wind farm should operate within their own limit, whilst the cumulative situation of Stage 2 is still met. 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 apportionment options provided in the IOA GPG were considered to determine the most appropriate option for each NAL as summarised in Table 6.8 of in **Technical Appendix 10.2**.
- 10.13.12 The Site Specific Noise Limits and noise predictions for the Proposed Development on its own, based on a Vestas V162 7.2 MW with serrated trailing edge blades, are summarised in **Table 10.13** and **Table 10.14** below.
- 10.13.13 The results show that the pred turbine noise levels from the Proposed Development operating on its own meet the Site Specific Noise Limits under all conditions at NALs 2 12 during the daytime and night-time period. As such there would be **no significant effects**.
- 10.13.14 At NAL1, an exceedance of the Site Specific Noise Limit ranging from 0.7 dB to 3 dB between 6 ms⁻¹ and 10 ms⁻¹ during the daytime was predicted when the turbines were modelled operating in full mode. At those wind speeds, this would result in a **significant effect** for certain wind directions.

Table 10.12 – Site Specific Noise Limit Compliance Table – Daytime

NAL		Wind	Speed	d (ms ⁻¹)	as star	dardis	ed to 10)m heig	ht				
		1	2	3	4	5	6	7	8	9	10	11	12
NAL1 - Shinnelhead	Site Specific Noise Limit L _{A90}	35.0	35.0	35.0	35.0	35.0	30.0	30.0	30.0	30.5	32.3	41.0	43.3
	Predictions LA90	-	-	23.7*	25.5*	28.2*	29.7*	29.9*	29.9*	29.9*	29.9*	29.9*	29.9*
	Exceedance Level	-	-	-11.3	-9.5	-6.8	-0.3	-0.1	-0.1	-0.6	-2.4	-11.1	-13.4



NAL		Wind	Speed	d (ms ⁻¹)	as star	ndardis	ed to 10)m heig	ht				
		1	2	3	4	5	6	7	8	9	10	11	12
NAL2 - High Appin	Site Specific Noise Limit L _{A90}	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.2	36.6	38.0	38.8	39.5
	Predictions L _{A90}	-	-	23.2	24.9	28.3	31.8	33.5	33.5	33.5	33.5	33.5	33.5
	Exceedance Level	-	-	-11.8	-10.1	-6.7	-3.2	-1.5	-1.7	-3.1	-4.5	-5.3	-6.0
NAL3 – Appin Lodge	Site Specific Noise Limit L _{A90}	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.2	36.6	38.0	38.9	39.6
	Predictions L _{A90}	-	-	20.0	21.7	25.1	28.6	30.3	30.3	30.3	30.3	30.3	30.3
	Exceedance Level	-	-	-15.0	-13.3	-9.9	-6.4	-4.7	-4.9	-6.3	-7.7	-8.6	-9.3
NAL4 – High Auchenbrack	Site Specific Noise Limit L _{A90}	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.2	36.6	38.0	39.2	40.5
	Predictions LA90	-	-	19.2	20.9	24.3	27.8	29.5	29.5	29.5	29.5	29.5	29.5
	Exceedance Level	-	-	-15.8	-14.1	-10.7	-7.2	-5.5	-5.7	-7.1	-8.5	-9.7	-11.0
NAL5 - Kilnmark	Site Specific Noise Limit L _{A90}	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.2	36.6	38.0	39.4	40.5
	Predictions LA90	-	-	16.7	18.5	21.9	25.4	27.0	27.0	27.0	27.0	27.0	27.0
	Exceedance Level	-	-	-18.3	-16.5	-13.1	-9.6	-8.0	-8.2	-9.6	-11.0	-12.4	-13.5
NAL6 - Auchenbrack	Site Specific Noise Limit L _{A90}	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.2	36.6	38.0	39.4	40.5
	Predictions LA90	-	-	16.8	18.5	21.9	25.4	27.1	27.1	27.1	27.1	27.1	27.1
	Exceedance Level	-	-	-18.2	-16.5	-13.1	-9.6	-7.9	-8.1	-9.5	-10.9	-12.3	-13.4
NAL7 - Kirkconnel	Site Specific Noise Limit L _{A90}	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.2	36.6	38.0	39.4	40.5
	Predictions LA90	-	-	13.7	15.5	18.9	22.4	24.0	24.0	24.0	24.0	24.0	24.0
	Exceedance Level	-	-	-21.3	-19.5	-16.1	-12.6	-11.0	-11.2	-12.6	-14.0	-15.4	-16.5
NAL8 – Dalwhat	Site Specific Noise Limit L _{A90}	35.0	35.0	35.0	35.0	35.1	36.1	37.3	38.4	39.2	40.1	42.0	43.3
Cottage	Predictions LA90	-	-	14.5	16.2	19.6	23.1	24.8	24.8	24.8	24.8	24.8	24.8
	Exceedance Level	-	-	-20.5	-18.8	-15.5	-13.0	-12.5	-13.6	-14.4	-15.3	-17.2	-18.5
NAL9 - Corriedow	Site Specific Noise Limit L _{A90}	35.0	35.0	35.0	35.0	35.1	36.1	37.3	38.4	38.5	39.4	41.0	42.6
	Predictions L _{A90}	-	-	17.4	19.2	22.6	26.1	27.7	27.7	27.7	27.7	27.7	27.7
	Exceedance Level	-	-	-17.6	-15.8	-12.5	-10.0	-9.6	-10.7	-10.8	-11.7	-13.3	-14.9
NAL10 - Glenjaan	Site Specific Noise Limit L _{A90}	35.0	35.0	35.0	35.0	35.1	36.1	37.3	38.2	37.7	38.6	40.4	42.2
	Predictions L _{A90}	-	-	19.0	20.8	24.2	27.7	29.3	29.3	29.3	29.3	29.3	29.3
	Exceedance Level	-	-	-16.0	-14.2	-10.9	-8.4	-8.0	-8.9	-8.4	-9.3	-11.1	-12.9
NAL11 – Benbuie	Site Specific Noise Limit L _{A90}	35.0	35.0	35.0	35.0	35.1	36.1	37.3	37.7	37.3	38.3	40.3	42.1
	Predictions LA90	-	-	25.7	27.4	30.8	34.3	36.0	36.0	36.0	36.0	36.0	36.0
	Exceedance Level	-	-	-9.3	-7.6	-4.3	-1.8	-1.3	-1.7	-1.3	-2.3	-4.3	-6.1
NAL12 – Blairoch	Site Specific Noise Limit L _{A90}	35.0	35.0	35.0	35.0	35.1	36.1	37.3	38.0	37.7	38.8	40.6	42.3
Cairnhead	Predictions LA90	-	-	26.6	28.4	31.8	35.3	36.9	36.9	36.9	36.9	36.9	36.9
	Exceedance Level	-	-	-8.4	-6.6	-3.3	-0.8	-0.4	-1.1	-0.8	-1.9	-3.7	-5.4



NAL		Wind	I Speed	d (ms⁻¹)	as star	ndardise	ed to 10)m heig	ht				
		1	2	3	4	5	6	7	8	9	10	11	12
NAL13 – Cairnhead	Site Specific Noise Limit L _{A90}	35.0	35.0	35.0	35.0	35.1	36.1	37.3	37.3	37.1	38.3	40.3	42.1
(Bothy)	Predictions L _{A90}	-	-	26.4	28.1	31.5	35.0	36.7	36.7	36.7	36.7	36.7	36.7
	Exceedance Level	-	-	-8.6	-6.9	-3.6	-1.1	-0.6	-0.6	-0.4	-1.6	-3.6	-5.4

*Predicted noise levels inclusive of indicative mitigation.

Table 10.13 – Site Specific Noise Limit Compliance Table – Night-time

NAL		Wind	I Speed	d (ms⁻¹)) as sta	Indardi	ised to	10m h	eight				
		1	2	3	4	5	6	7	8	9	10	11	12
NAL1 - Shinnelhead	Site Specific Noise Limit LA90	43.0	43.0	43.0	43.0	41.9	40.0	33.0	33.0	33.0	33.0	33.0	33.8
	Predictions LA90	-	-	22.7	24.4	27.8	31.3	33.0	33.0	33.0	33.0	33.0	33.0
	Exceedance Level	-	-	-20.3	-18.6	-14.1	-8.7	0.0	0.0	0.0	0.0	0.0	-0.8
NAL2 - High Appin	Site Specific Noise Limit L _{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Predictions LA90	-	-	23.2	24.9	28.3	31.8	33.5	33.5	33.5	33.5	33.5	33.5
	Exceedance Level	-	-	-19.8	-18.1	-14.7	-11.2	-9.5	-9.5	-9.5	-9.5	-9.5	-9.5
NAL3 – Appin Lodge	Site Specific Noise Limit L _{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Predictions LA90	-	-	20.0	21.7	25.1	28.6	30.3	30.3	30.3	30.3	30.3	30.3
	Exceedance Level	-	-	-23.0	-21.3	-17.9	-14.4	-12.7	-12.7	-12.7	-12.7	-12.7	-12.7
NAL4 – High Auchenbrack	Site Specific Noise Limit L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Predictions LA90	-	-	19.2	20.9	24.3	27.8	29.5	29.5	29.5	29.5	29.5	29.5
	Exceedance Level	-	-	-23.8	-22.1	-18.7	-15.2	-13.5	-13.5	-13.5	-13.5	-13.5	-13.5
NAL5 - Kilnmark	Site Specific Noise Limit LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Predictions L _{A90}	-	-	16.7	18.5	21.9	25.4	27.0	27.0	27.0	27.0	27.0	27.0
	Exceedance Level	-	-	-26.3	-24.5	-21.1	-17.6	-16.0	-16.0	-16.0	-16.0	-16.0	-16.0
NAL6 - Auchenbrack	Site Specific Noise Limit LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Predictions L _{A90}	-	-	16.8	18.5	21.9	25.4	27.1	27.1	27.1	27.1	27.1	27.1
	Exceedance Level	-	-	-26.2	-24.5	-21.1	-17.6	-15.9	-15.9	-15.9	-15.9	-15.9	-15.9
NAL7 - Kirkconnel	Site Specific Noise Limit L _{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Predictions LA90	-	-	13.7	15.5	18.9	22.4	24.0	24.0	24.0	24.0	24.0	24.0
	Exceedance Level	-	-	-29.3	-27.5	-24.1	-20.6	-19.0	-19.0	-19.0	-19.0	-19.0	-19.0
NAL8 – Dalwhat	Site Specific Noise Limit LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
Cottage	Predictions LA90	-	-	14.5	16.2	19.6	23.1	24.8	24.8	24.8	24.8	24.8	24.8
	Exceedance Level	-	-	-28.5	-26.8	-23.4	-19.9	-18.2	-18.2	-18.2	-18.2	-18.2	-18.2
NAL9 - Corriedow	Site Specific Noise Limit LA90	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	42.2	42.2	42.2
	Predictions LA90	-	-	17.4	19.2	22.6	26.1	27.7	27.7	27.7	27.7	27.7	27.7
	Exceedance Level	-	-	-25.6	-23.8	-20.4	-16.9	-15.3	-15.3	-15.3	-14.5	-14.5	-14.5



NAL		Wind	Speed	l (ms ⁻¹)	as sta	ndardi	sed to	10m h	eight				
		1	2	3	4	5	6	7	8	9	10	11	12
NAL10 - Glenjaan	Site Specific Noise Limit LA90	43.0	43.0	43.0	43.0	43.0	43.0	42.2	42.2	42.0	41.8	41.8	41.8
	Predictions L _{A90}	-	-	19.0	20.8	24.2	27.7	29.3	29.3	29.3	29.3	29.3	29.3
	Exceedance Level	-	-	-24.0	-22.2	-18.8	-15.3	-12.9	-12.9	-12.7	-12.5	-12.5	-12.5
NAL11 – Benbuie	Site Specific Noise Limit LA90	43.0	43.0	43.0	43.0	43.0	42.2	42.1	42.0	41.9	41.7	41.7	41.7
	Predictions L _{A90}	-	-	25.7	27.4	30.8	34.3	36.0	36.0	36.0	36.0	36.0	36.0
	Exceedance Level	-	-	-17.3	-15.6	-12.2	-7.9	-6.1	-6.0	-5.9	-5.7	-5.7	-5.7
NAL12 – Blairoch	Site Specific Noise Limit LA90	43.0	43.0	43.0	43.0	43.0	42.2	42.1	42.1	42.0	41.9	41.9	41.9
Cairnhead	Predictions L _{A90}	-	-	26.6	28.4	31.8	35.3	36.9	36.9	36.9	36.9	36.9	36.9
	Exceedance Level	-	-	-16.4	-14.6	-11.2	-6.9	-5.2	-5.2	-5.1	-5.0	-5.0	-5.0
NAL13 – Cairnhead	Site Specific Noise Limit LA90	43.0	43.0	43.0	43.0	43.0	42.0	41.9	41.8	41.8	41.7	41.7	41.7
(Bothy)	Predictions L _{A90}	-	-	26.4	28.1	31.5	35.0	36.7	36.7	36.7	36.7	36.7	36.7
	Exceedance Level	-	-	-16.6	-14.9	-11.5	-7.0	-5.2	-5.1	-5.1	-5.0	-5.0	-5.0

Committed Additional Mitigation

10.13.15 No significant operational effects are predicted; therefore, no additional mitigation measures are required.

Residual Operational Effects

- 10.13.16 For the purpose of demonstrating the effectiveness of a potential noise mitigation measure for the cane turbine considered here, the predicted noise levels at NAL1 have been reduced to ensure that the limits are met, this would be achieved by the adoption of low noise modes, but this would only be required for a limited range of wind speeds and directions.
- 10.13.17 To demonstrate that this level of reduction is practicable, predicted turbine noise at NAL1 during the daytime has been obtained assuming the use of low noise modes available to the candidate turbine.
- 10.13.18 The results of the noise assessment show that, subject to the adoption of mitigation measures (at NAL1) when required for the cane turbine, the predicted turbine noise levels would meet the Site Specific Noise Limits under all conditions and at all locations for both daytime and night-time periods. and there would be **no significant residual effects** from operational noise. There are a number of turbine makes and models that would be suitable for the Proposed Development and that may not require the use of low noise modes.
- 10.13.19 At some locations, under some wind conditions and for a certain proportion of the time operational wind farm noise would be audible; however, it would be at an acceptable level in relation to the ETSU-R-97 guidelines.

10.14 Cumulative Assessment

10.14.1 Cumulative assessment is based on existing and proposed developments in the area.

Construction

Predicted Cumulative Effects During Construction

10.14.2 The construction noise assessment predicts that noise levels may exceed the evening and weekend threshold levels for a short period of time as the access track is upgraded (month 2) at two properties (CNAL5 and CNAL6). For the remainder of the construction phase (months 3 – 18), all construction activities are likely to be considerably further from these CNALs and construction noise levels attributable to the Proposed Development will be much lower. Specifically, noise levels will be at least 10 dB below threshold levels during months 3 – 18, such that cumulative construction noise levels could not result in an exceedance of the threshold levels. Although the threshold levels may be exceeded during month 2, the duration of this exceedance will be short term in nature. As such, **no significant cumulative construction noise effects are anticipated**.

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Committed Additional Mitigation

10.14.3 No significant cumulative effects during construction are predicted, therefore no additional mitigation measures are required.

Residual Cumulative Effects During Construction

10.14.4 No additional mitigation measures are proposed to lessen the impacts and **no significant residual** effects are anticipated.

Operation

Predicted Cumulative Effects During Operation

10.14.5 The result of the likely cumulative operational wind farm noise assessment show that the Proposed Development can operate concurrently with the operational, consented or proposed wind farms near to the NALs, whilst still meeting the Total ETSU-R-97 Noise limits established in accordance with ETSU-R-97 at all NALs. There would be **no significant cumulative operational noise effects**.

Committed Additional Mitigation

10.14.6 No significant cumulative effects during operation are predicted, therefore no additional mitigation measures are required.

Residual Cumulative Effects During Operation

10.14.7 Predicted cumulative wind farm operational noise levels at all the NALs lie below the Total ETSU-R-97 daytime and night-time Noise Limits. There would be **no significant residual cumulative operational effects**.

10.15 Further Survey Requirements and Monitoring

Construction Phase Monitoring

10.15.1 As no significant effects are anticipated, monitoring is not required.

Operational Phase Monitoring

10.15.2 Suggested noise related planning conditions are included the Standard Conditions and contain a mechanism for the Planning Authority to request compliance monitoring in the event of a complaint.

10.16 Summary of Effects

- 10.16.1 Predicted construction noise levels compared with the Category A criteria outlined in Section E.3 of BS 5228: Part 1 2009+A1:2014 indicate that construction noise levels are below the guidelines considered acceptable at all receptors for all construction phases during the weekday and Saturday daytime periods. At some receptors, noise levels have been calculated to be equal to, or above, the evening and weekend threshold level, however, this is unlikely to result in a significant impact, as duration of exposure will be limited. Therefore, **no significant effects** are anticipated.
- 10.16.2 The construction noise assessment predicts that noise levels may exceed the evening and weekend threshold levels for a short period of time at two receptors as the access track is constructed. However, noise levels will be at least 10 dB below threshold levels during the remainder of the construction period. such that cumulative construction noise levels could not result in an exceedance of the threshold levels. Although the threshold levels may be exceeded during access track construction, the duration of this exceedance will be short term in nature. As such, no significant cumulative construction noise effects are anticipated and there would be no significant residual effects.
- 10.16.3 The guidance contained within ETSU-R-97 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 site, wind turbine noise would meet the noise criteria established in accordance with ETSU-R-97 at all NALs.
- 10.16.4 There are a range of turbine models that could be appropriate for the Proposed Development. If the proposal receives consent, further data would be obtained from the supplier for the final choice of turbine model to demonstrate compliance with the operational noise limits derived in this report.
- 10.16.5 Predicted cumulative wind farm operational noise levels at all the NALs lie below the Total ETSU-R-97 daytime and night-time Noise Limits. There would be **no significant residual effects**.



Table 10.14 – Summary	of Potential	Significant E	ffects of th	he Proposed	Development
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Predicted Effects	Significance	Committed Additional Mitigation	Significance of Residual Effect
Impacts at residential receptors from noise generated by construction activities associated with the Proposed Development	Not Significant	Activities relating to access track construction will not be undertaken in proximity to CNAL5 and CNAL6 outwith normal daytime working hours (Mon-Fri 07:00 – 19:00 and Saturday 07:00 – 13:00).	Not Significant
Impacts at residential receptors (NALs 2 -12) due to noise generated by the operation of the Proposed Development	Not Significant	None identified	Not Significant
Impacts at residential receptor (NAL1) due to noise generated by the operation of the Proposed Development	Significant	Mode management for certain wind speeds and wind directions. Turbine control system (subject to selection of final turbine). Consideration of an alternative turbine could eliminate the requirement for mode management.	Not Significant

10.17 References

Scottish Government (2023). The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017

HM Government. Control of Pollution Act 1974 Chapter 40. London: Her Majesty's Stationery Office, 1974

Scottish Government (1997). Town and Country Planning (Scotland) Act 1997

HM Government (1989). Electricity Act 1989

Scottish Government (2023). National Planning Framework 4

Scottish Government (2014). Onshore wind: policy statement 2022 [Online] Available From https://www.gov.scot/publications/onshore-wind-policy-statement-2022/ [Accessed 30th August 2024]

Scottish Government (2011). PAN 1/2011 Planning and Noise Scotland

Scottish Government (2014) Web Based Renewables Advice: 'Onshore Wind Turbines' [Online] Available From https://www.gov.scot/publications/onshore-wind-turbines-planning-advice/ [Accessed 30th September 2023]

British Standard BS 5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites' – Part 1: Noise

The Working Group on Noise from Wind Turbines (1996). ETSU-R-97 The Assessment and Rating of Noise From Wind Farms. UK: Energy Technology Support Unit

IOA (2013). A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise'. UK: Institute of Acoustics.

ISO (2024). ISO 9613-2: 2024 Acoustics – Attenuation of Sound during Propagation Outdoors: Part 2 – Engineering method for the prediction of sound pressure levels outdoors' . Geneva: International Organization for Standardisation.

British Standard BS 5228-2: 2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites' – Part 2: Vibration

British Standard BS 7385-2: 1993 'The Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration'

British Standard BS 6472: 2008 'Guide to evaluation of human exposure to vibration in buildings. Blastinduced vibration'

