Chapter 11: Noise and Vibration

Chapter 11
Noise and Vibration

Introduction

11.1 This chapter considers the potential Noise and Vibration effects of the proposed An Càrr Dubh Wind Farm (the Proposed Development) on noise-sensitive receptors. It details whether there are any likely significant effects resulting from the construction and operation of the Proposed Development on the acoustic environment of the area. This chapter is supported by **Figure 11.1** and further information is provided in **Appendix 11.1: Noise**, as referenced throughout this chapter.

11.2 The Noise and Vibration assessment was undertaken by Hoare Lea LLP and this chapter has been prepared by Bow Acoustics Limited on behalf of Hoare Lea LLP.

11.3 This chapter has been prepared with reference to information provided in **Chapter 4: Project Description**, **Chapter 5: Statutory and Policy Framework** and **Chapter 12: Traffic and Transport**.

Scope of the Assessment

Effects Assessed in Full

11.4 The following effects were identified at the Scoping stage for consideration in this assessment:

- Noise generated during the construction of the Proposed Development, including construction-related traffic on nearby roads; and
- Noise during the operation of the Proposed Development, including cumulatively with Blarghour Wind Farm.

Effects Scoped Out

11.5 On the basis of the desk based and field survey work undertaken, the professional judgement of the Environmental Impact Assessment (EIA) team, experience from other relevant projects and policy guidance or standards, and feedback received from consultees, the following topic areas have been 'Scoped out' of detailed assessment, as proposed in the EIA Scoping Report:

- Levels of ground-borne vibration generated by operational wind turbines are very low. The separation distances to the nearest sensitive receptor that are required to ensure no significant effect from airborne noise are such that there can be no potential for any ground-borne vibration effects. An assessment of vibration during the operation of the Proposed Development can therefore be scoped out.
- Specific assessments of infrasound and low frequency noise are not proposed. However latest supporting information on these topics and the topic of amplitude modulation are presented below.

11.6 In addition to the considerations listed above that were addressed in the Scoping Report, the following areas have also been scoped out:

- The nature of the works and distances involved in the construction of a wind farm are such that the risk of significant effects relating to ground-borne vibration are very low. Therefore, an assessment of construction vibration can be scoped out.
- As noted in **Chapter 2: Approach to the EIA**, an assessment of potential effects associated with decommissioning has not been assessed in the EIA, however, decommissioning of the Proposed Development will be likely to result in less noise than during construction. The assessment of construction noise will therefore present a maximum case for any effects during decommissioning.
- Occasional momentary vibration can arise when heavy vehicles pass dwellings at very short separation distances, but this is not sufficient to constitute a risk of significant effects. Therefore, although the effects of construction traffic noise are assessed in this chapter, associated vibration effects are not considered further.
- No significant noise effects are anticipated from the operation of the onsite substation or the Battery Energy Storage System (BESS), given the distance to the nearest noise sensitive receptor (3.5 kilometres (km) from Blarghour) between the these items and nearest NSR. Substation and BESS noise has therefore been scoped out of further assessment and is not considered in this chapter.
- Cumulative noise effects from other wind farms that are more distant than Blarghour Wind Farm do not add to the overall level of wind turbine noise and therefore, can be scoped out.

Assessment Methodology

Legislation and Guidance

Legislation

11.7 This assessment is carried out in accordance with the principles contained within the following legislation:

- Control of Pollution Act (CoPA) 1974[1].

Guidance

11.8 This assessment is carried out in accordance with the principles contained within the following documents:

- Scottish Planning Framework 4[2];
- Planning Advice Note PAN1/2011[3];
- Planning Advice Note PAN50[4];
- The Scottish Government's Online Renewables Planning Advice on Onshore wind turbines[5];
- ETSU-R-97[6];
- Institute of Acoustics (IOA) Good Practice Guide (GPG)[7];
- Design Manual for Roads and Bridges (DMRB), Transport Scotland[8];
- Calculation of Road Traffic Noise (CRTN), HMSO Department of Transport[9];
- ISO 9613-2:1996 'Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation', International Standards Organisation[10]; and
- British Standards BS 5228, Code of practice for noise and vibration control on construction and open sites[11].

[1] UK Government (1974) Control of Pollution Act, Part III
[2] Scottish Government (2022) National Planning Framework 4.
[3] Scottish Government (2011) PAN1/2011 Technical Advice Note – Assessment of Noise
[4] Scottish Government (1996) Planning Advice Note PAN 50: Controlling the environmental effects of surface mineral workings
[5] Scottish Government (2014) Onshore wind turbines: planning advice [online]. Available at: https://www.gov.scot/publications/onshore-wind-turbines-planning-advice/
[6] The Working Group on Noise From Wind Turbines (1996) ETSU-R-97, The Assessment and Rating of Noise from Wind Farms, Final Report for the Department of Trade and Industry
[7] Cand, M., Davis, R., Jordan, C., Hayes, M. and Perkins, R. (2013) A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise (Institute of Acoustics)
[8] Transport Scotland (X) Design Manual for Roads and Bridges (Volume 11, Section 3, Part 7, Traffic Noise and Vibration)
[9] Department of Transport (1988) Calculation of Road Traffic Noise
[10] International Standards Organisation (1996) ISO 9613 2:1996 'Acoustics – Attenuation of sound during propagation outdoors' (Part 2: General method of calculation)
[11] British Standard (2009) BS 5228-1:2009-A:2014 'Code of practice for noise and vibration control on construction and open sites' (Part 1: Noise and Part 2: Vibration)

Consultation

11.9 In undertaking the assessment, consideration has been given to the Scoping responses and other consultation which has been undertaken as detailed in **Table 11.1**.

Table 11.1: Consultation responses

Consultee and Date	Scoping/Other Consultation	Issue Raised	Response/Action Taken
Argyll and Bute Council (ABC) April 2021	Formal Scoping consultation	No objection to the proposed approach set out in the Scoping Report. The noise assessment report should be formatted as per Table 6.1 of the Institute of Acoustics Good Practice Guide (IOA GPG).	Where possible, EIA Report noise chapter has followed the format of Table 6.1 of the IOA GPG whilst respecting the report template and format.
ABC Environmental Health Department Letter dated 4th October 2021 and follow up email 29th April 2022.	Other consultation (assessment methodology)	No response was received from ABC to the initial letter and follow up email.	The approach to the assessment and this chapter follows the methodology set out in the letter and current best practice.
General Public August 2021	Other consultation (public exhibition)	Concern was raised over noise propagating across the water affecting properties on the west of Loch Awe.	Additional receptors included in the assessment, R11, R12 and R13 (**Table 11.2**), to represent those west of Loch Awe. Acoustically reflective propagation assumed for them.

Study Area

11.10 The study area for the assessment of operational noise is limited to the area where the predicted cumulative wind farm noise level is greater than 35 decibel (dB) $L_{A90,10min}$, unless the predicted levels are dominated by those of another wind farm and the contribution of the Proposed Development is relatively negligible. Consideration is given to noise sensitive receptors (NSR) within this area, which in the case of the Proposed Development are all dwellings. It is not necessary to assess at every NSR within this area, but sufficient to consider a representative selection of those closest to the Proposed Development as a maximum case. Where multiple NSRs are in the same area, it may be appropriate to present results for just one of these which represents the maximum-case for all.

11.11 The locations of the NSRs assessed are detailed in **Table 11.2** below, as shown in **Figure 11.1**.

Table 11.2: Noise assessment locations

NSR ID	Description	Easting	Northing	Approximate Distance to Closest Turbine	Closest Proposed Development Turbine
R1	Blarghour	199771	713437	2,460m	T9
R2	Ardchonnel Croft	198467	712711	3,320m	T13
R3	Ardchonnell	198385	712319	3,200m	T13
R4	Blarghour Farm Cottages	199694	713585	2,600m	T9
R5	Old School House	197655	711696	3,690m	T13
R6	Sallachry	207672	712225	3,230m	T2
R7	Kilmun	207796	712712	3,440m	T2
R8	High Balantyre	207842	711683	3,370m	T1
R9	Loch Awe House	200482	714928	2,830m	T10
R10	Upper Barr Beithe	200723	715261	2,970m	T10
R11	Dalavich Chalet Park Cabins	197274	713265	4,630m	T13
R12	Newyork	196574	711514	4,730m	T13
R13	Barnaline Lodge	197157	713804	4,990m	T9

11.12 It should be noted that the receptor coordinates listed in **Table 11.2** have been selected to be representative of external amenity spaces associated with the various properties, on a conservative basis. As such, these may not be the same as coordinates given in other parts of this EIA Report, which could refer to property centre points or boundaries, and therefore the approximate distances may also vary. This list of receptor locations is also not intended to be exhaustive but sufficient to be representative of operational noise levels typical of those receptors closest to the Proposed Development.

11.13 The Site access track joins the A819 away from the operational noise assessment locations set out in **Table 11.2** and there is an additional section that connects the A83 to the A819, bypassing Inveraray. Furthermore, there are a total of three borrow pits proposed within the Site. Therefore, it is necessary to assess construction noise at different receptors that are closer to the construction works, as set out in **Table 11.3**.

Table 11.3: Construction noise assessment locations

NSR ID	Description	Easting	Northing
R14	Electric Cottage	208606	709920
R15	Maltlands	208910	709908
R16	Croit A Bhile	209156	708797
R17	South Cromalt Lodge	208398	707065

Desk Based Research and Data Sources

11.14 The following data sources have informed the assessment:

- Ordnance Survey information concerning the locations of all noise sensitive receptors in the vicinity of the Site;
- Manufacturer data for the Vestas V150 6.0 Megawatt (MW) turbine (see below);
- Manufacturer data for the Vestas V117 3.45 Megawatt (MW) turbine; and
- Environmental Statements/EIA Reports and consent conditions for the Blarghour Wind Farm.

Methodology for Assessing Construction Noise Effects

11.15 BS 5888-1 has been used as the appropriate reference for the method of calculation and assessment of construction noise effects. At this stage of a project it is not feasible to accurately specify exact construction techniques or locations where construction activity is likely to take place. Therefore, various assumptions have been made based on best practice and typical wind farm construction projects. The calculation follows Annex F of BS 5228-1 and assumes the following:

- Plant is operational for between 75% and 100% of the working day;
- There would be no screening effects;
- Propagation over mixed ground (50% hard 50% soft); and

- Construction activity is assumed to occur at a single point from receiver.

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

11.17 Rock extraction from borrow pits by means of blasting operations is not anticipated but could be required; however, as a worst case has been included in the assessment. Blasting operations can generate airborne pressure waves or *"air overpressure"* which contains both audible (approximately 20Hz to 20kHz) and infrasonic pressure waves (<20Hz), which, although outside the range of human hearing, can sometimes be felt. The relevant guidance documents advise controlling air overpressure with good practices during the setting and detonation of charges as opposed to absolute limits on the levels produced; therefore, no absolute limits for air overpressure or noise from blasting can be presented in the assessment. Other site activity associated with blasting, such as stone crushing and the operation of plant including excavators, breakers and conveyors will be included in the noise assessment.

11.18 Separate consideration is also given to the possible noise effects of construction-related traffic passing to and from the Site along local surrounding roads. In considering potential noise levels associated with construction traffic movement on public roads, reference is made to the accepted UK prediction methodology provided by CRTN.

11.19 Road traffic data have been provided for roads used by construction vehicles which represents the Average Annual Weekday Total (AAWT) two-way flows between the hours of 0600 and 2400 for the worst-case period of construction. The full prediction given in CRTN results in an absolute road traffic noise level at a receiver location. For the purpose of this assessment the change in road traffic noise is of concern and not the absolute level. This has been achieved by calculating the Basic Noise Level (BNL) with corrections for heavy vehicles and low flow as described in CRTN. This is considered acceptable to provide a reasonable estimate of the likely change in road traffic noise. For any roads considered with a traffic flow below the applicability threshold of CRTN (1,000 vehicles per day), the haul route method specified in BS5228-1 has been used.

Methodology for Assessing Operational Noise Effects

11.20 The assessment of operational noise effects has been carried out in accordance with the methodology set out in ETSU-R-97. ETSU-R-97 has become the accepted standard for the assessment of operational noise from wind energy developments within the UK, and is commended in current UK and Scottish planning policy.

11.21 Noise limits are defined in terms of the $L_{A90,10\ min}$ noise indicator (a definition of the $L_{A90,10min}$ index is given in **Appendix 11.1**). The ETSU-R-97 assessment procedure specifies that noise limits should generally be set relative to existing background noise levels at the nearest properties and that these limits should reflect the variation in both turbine source noise and background noise with wind speed. The wind speed range which should be considered is between the speed at which the turbines begin to operate and 12 metre per second (m/s), where all wind speeds are standardised at a notional 10 metres (m) height. ETSU-R-97 also offers an alternative simplified assessment methodology *"For single turbines or wind farms with very large separation distances between the turbines and the nearest properties a simplified noise condition may be suitable. We are of the opinion that, if the noise is limited to an $L_{A90,10min}$ of 35dB(A) up to wind speeds of 10m/s at 10m height, then this condition alone would offer sufficient protection of amenity, and background noise surveys would be unnecessary. We feel that, even in sheltered areas when the wind speed exceeds 10m/s on the wind farm site, some additional background noise will be generated which will increase background levels at the property"*.

11.22 In the case of the Proposed Development, separation distances between the wind turbines and nearest residential dwellings are very large, such that at all locations noise levels will fulfil this simplified criterion, therefore background noise surveys are not required.

11.23 The noise limits defined in ETSU-R-97 relate to the total noise occurring at a dwelling due to the combined noise of all operational wind turbines. The assessment will therefore need to consider the combined operational noise of the Proposed Development with the other wind farms in the area to ensure that the combined cumulative noise levels are within the relevant ETSU-R-97 Criterion. The IOA GPG offers advice in this regard that if the proposed wind farm produces noise levels within 10dB of another wind farm at the same receptor location, then a cumulative noise impact assessment is necessary. If the contribution from one wind farm is 10dB or more below that of another or the applicable noise limit, it can then be considered negligible.

11.24 To undertake the assessment of noise effects in accordance with the foregoing methodology the following steps are required:

- Specify the number and locations of the wind turbines on all wind farms;
- Identify the locations of the nearest, or most noise sensitive, neighbours;
- Specify the type and noise emission characteristics of the wind turbines;
- Calculate the noise immission levels due to the operation of the wind turbines as a function of site wind speed at the nearest neighbours; and
- Compare the calculated wind farm noise immission levels with the simplified assessment criterion and assess in the light of planning requirements.

11.25 Note that in the above, and subsequently in this assessment, the term 'noise emission' relates to the sound power level actually radiated from each wind turbine, whereas the term 'noise immission' relates to the sound pressure level (the perceived noise) at any receptor location due to the combined operation of all wind turbines on the Proposed Development.

11.26 The exact model of turbine to be used at the Site will be the result of a future tendering process and therefore an indicative turbine model has been assumed for this noise assessment. The candidate turbine assessed in other chapters is the Siemens Gamesa 155 turbine model; however, this operational noise assessment is based upon the noise specification of the Vestas V150 6.0MW wind turbine operating in its unconstrained PO6000 mode, as it results in higher noise emissions at noise-sensitive receptors than for the Gamesa 155 turbine. 13 turbines have been modelled using the layout as indicated on **Figure 11.1**. The V150 turbine is a variable speed, pitch regulated machine with a rotor diameter of 150m and a hub height of 105m. Due to its variable speed operation the sound power output of the turbine varies considerably with wind speed, being quieter at the lower wind speeds when the blades are rotating more slowly.

11.27 Vestas have supplied noise emission data for the V150 turbine which represent the values that the manufacturer specify will not be exceeded in practice. In the absence of specific information about uncertainty allowances in the data, a further correction factor of +2dB was added to the specification data in line with advice in the IOA GPG. The sound power data has been made available for standardised 10m reference wind speeds of 3m/s to 12m/s inclusive. In addition to the overall sound power data, typical sound power frequency distribution for the turbine has been specified, based on an energetic average of the available information at each octave band. The overall sound power and spectral data are presented in **Appendix 11.1**.

11.28 Assessment of cumulative effects from operating Blarghour Wind Farm together with the Proposed Development also requires source information for the turbine type. Scottish Ministers granted consent to the Section 36 application under the Electricity Act 1989 for the construction and operation of Blarghour Wind Farm on 29 October 2021. The consent is for 17 turbines with a maximum blade tip height of 136.5m and the associated infrastructure. The noise assessment was based on the Vestas V117 4.2MW turbine. The overall sound power and spectral data for the V117 turbine is also presented in **Appendix 11.1**. These data include an uncertainty of +2dB and a further uplift of +2.8dB such that the immission level from Blarghour Wind Farm is at the consented limit of 35dB L_{A90} at a controlling property for that development, Upper Barr Beithe.

11.29 The cumulative assessment set out in this chapter is based on the consented Blarghour Wind Farm application as detailed above. However in March 2023, a revised application for Blarghour Wind Farm was submitted which comprises a reduction in the total number of turbines to 14, with an increase in blade tip height to 180m, and change of candidate turbine to the slightly quieter Siemens Gamesa SG155 6.6MW model fitted with serrated trailing edges. It is noted that the noise assessment for the revised Blarghour Wind Farm scheme still shows that Upper Barr Beithe (referenced as R06 in the EIA Report for the revised Blarghour Wind Farm application) has the highest predicted levels and therefore represents the controlling property; however, there is a reduction in predicted noise at this location (and others) when compared to the original Blarghour Wind Farm application. The cumulative assessment in the present chapter therefore represents a worst-case. If the revised application is consented, it would not change the conclusions of the cumulative assessment presented in this chapter as the predicted turbine immission levels assumed have been uplifted to the highest level possible without exceeding the noise limit of the existing consent, which has not changed as a result of the revised application. This approach is in line with the IOA GPG guidance.

11.30 The Blarghour Wind Farm noise assessment considers the cumulative effect from the turbines in the proposed Upper Sonachan Wind Farm. Following the submission of Blarghour Wind Farm, Upper Sonachan Wind Farm has subsequently been refused permission and withdrawn from the planning system. Therefore, these turbines were not included in the present assessment. Other turbines that are more distant from the Proposed Development, including An Suidhe Wind Farm, are predicted to produce noise immission levels at least 10dB less than the Proposed Development at the NSRs set out in **Table 11.2**. Therefore, they do not contribute to the cumulative effects, as discussed above.

11.31 The ISO 9613-2 model has been used to calculate the operational noise immission levels at the selected nearest residential neighbours as advised in the IOA GPG. The model accounts for the attenuation due to geometric spreading, atmospheric absorption, and barrier and ground effects. All attenuation calculations have been made on an octave band basis and, therefore, account for the sound frequency characteristics of the turbines. The model assumes:

- The Vestas V150 6.0MW turbine with emission levels in line with IOA GPG guidance, as provided in **Appendix 11.1**;
- Mixed ground absorption factor of G=0.5;
- Air absorption based on temperature of 10°C and 70% relative humidity;
- Receiver height 4m;
- Screening effects limited to 2dB(A); and
- Downwind propagation assumed between all turbines and receivers.

11.32 The exception to the above, for receptors R11, R12 and R13, that are all situated on the other side of Loch Awe, acoustically hard ground (G=0) has been used for the middle region and receiver region of the propagation path, as defined in ISO 9613-2. This is to represent, on a conservative basis, the potential effect of the water on the propagation of noise, as recommended in the IOA GPG.

11.33 Where concave ground is present along the propagation path between a wind turbine and NSR a +3dB correction has been added due to the presence of additional reflection paths that are not present over more flat ground. The following formula, from the IOA GPG, has been used to determine if concave ground is present:

$$h_m \geq 1.5 \times \left(\frac{abs(h_s - h_r)}{2}\right)$$

11.34 Where h_m is the mean height above the ground of the direct line of sight from the receiver to the source, and h_s and h_r are the heights above local ground level of the source and receiver respectively.

11.35 This method is consistent with the recommendations of the IOA GPG. The IOA GPG also allows for directional effects to be included within the noise modelling: under upwind propagation conditions the wind farm noise immission level at a receiver can be as much as 10dB(A) to 15dB(A) lower than the level predicted using the ISO 9613-2 model. However, predictions have been made assuming downwind propagation from every turbine to every receptor at the same time as a worst case.

11.36 The assessment assumes that the wind turbine noise contains no audible tones. Where tones are present a correction is added to the measured or predicted noise level before comparison with the recommended limits. The audibility of any tones can be assessed by comparing the narrow band level of such tones with the masking level contained in a band of frequencies around the tone called the critical band. The ETSU-R-97 recommendations suggest a tone correction which depends on the amount by which the tone exceeds the audibility threshold and should be included as part of the consent conditions. The turbines to be used for the Proposed Development will be chosen such that the noise emitted will comply with the requirements of ETSU-R-97, including any relevant tonality corrections.

Low-Frequency Noise and Infrasound

11.37 A study, published in 2006 by acoustic consultants Hayes McKenzie[12] on the behalf of the Department of Trade and Industry (DTI), investigated low frequency noise from wind farms (Hayes McKenzie, 2006). This study concluded that there is no evidence of health effects arising from infrasound or low frequency noise generated by wind turbines, but that complaints attributed to low frequency noise were possibly due to a phenomenon known as Amplitude Modulation (AM).

11.38 Further, in February 2013, the Environmental Protection Authority of South Australia[13] published the results of a study into infrasound levels near wind farms (Environment Protection Authority, 2013). This study measured infrasound levels at urban locations, rural locations with wind turbines close by, and rural locations with no wind turbines in the vicinity. It found that infrasound levels near wind farms are comparable to levels away from wind farms in both urban and rural locations. Infrasound levels were also measured during organised shut-downs of the wind farms; the results showed there was no noticeable difference in infrasound levels, whether the turbines were active or inactive.

11.39 Bowdler et al. (2009)[14] concludes that *"...there is no robust evidence that low frequency noise (including 'infrasound') or ground-borne vibration from wind farms generally has adverse effects on wind farm neighbours".*

11.40 It is therefore current practice to not carry out a specific assessment of infrasound and low-frequency noise, as per the Scoping Report. This is consistent with advice in the Scottish Government's Onshore Wind Turbine web-based guidance document.

Amplitude Modulation (AM)

11.41 A study was carried out on behalf of the Department for Business, Enterprise and Regulatory Reform (BERR) by the University of Salford[15], which investigated the incidence of noise complaints associated with wind farms and whether these were associated with AM (University of Salford, 2007). This report defined AM as aerodynamic noise fluctuations from wind turbines at blade passing frequency. Its aims were to ascertain the prevalence of AM on UK wind farm sites, to try and gain a better understanding of the likely causes, and to establish whether further research into AM is required.

11.42 The study concluded that AM with a greater degree of fluctuation than normal had occurred at only a small number of wind farms in the UK (4 of 133), and only for between 7% and 15% of the time. It also states that, at the time of writing, the causes of this were not well understood and that prediction of the effect was not currently possible.

11.43 This research was updated in 2013 by an in-depth study undertaken by Renewable UK[16], which considered 'other AM' (OAM) defined as AM with atypical characteristics which could not be explained by standard causal factors. The study identified that many of the previously suggested causes of OAM have little or no association to the occurrence of OAM in practice. The generation of OAM was likely based upon the interaction of several factors, the combination and contributions of which are unique to each site. With the current knowledge, it is not possible to predict whether any particular site is more or less likely to give rise to OAM.

11.44 In 2016, the IOA proposed a measurement technique to quantify the level of AM present in any particular sample of wind farm noise (Institute of Acoustics, 2016)[17]. This technique is supported by the Department of Business, Energy and Industrial Strategy (BEIS, formerly the Department of Energy and Climate Change) who have published guidance[18], which follows on from the conclusions of the IOA study in order to define an appropriate assessment method for AM, including a penalty scheme and an outline planning condition (BEIS, 2016). On publication of the report, BEIS encouraged local authorities in England to consider the research but provided limited guidance on how the outcomes were to be accounted for within the planning system. The Scottish Government is understood to be reviewing this report in the context of the Scottish planning system[19].

11.45 Section 7.2.1 of the IOA GPG remains current, stating *"The evidence in relation to 'Excess' or 'Other' Amplitude Modulation (AM) is still developing. At the time of writing, current practice is not to assign a planning condition to deal with AM".*

11.46 It is therefore current practice not to carry out a specific assessment of AM, as per the Scoping report.

Operational Vibration

11.47 Research undertaken by Snow[20] found that levels of ground-borne vibration 100m from the nearest wind turbine were significantly below criteria for 'critical working areas' given by British Standard BS 6472:1992 Evaluation of human exposure to vibration in buildings (1Hz to 80Hz) and were lower than limits specified for residential premises by an even greater margin (Snow, 1997).

11.48 Ground-borne vibration from wind turbines can be detected using sophisticated instruments several kilometres from a wind farm site, as reported by Keele University[21] (Keele University, 2005). This report clearly shows that, although detectable using highly sensitive instruments, the magnitude of the vibration is orders of magnitude below the human level of perception and does not pose any risk to human health.

11.49 It is therefore current practice not to carry out a specific assessment of vibration arising from the operation of wind turbines effecting human health, as per the Scoping report.

[12] Hayes McKenzie (2006) The measurement of low frequency noise at three UK wind farms (DTI URN 06/1412)
[13] Environment Protection Authority (2013) Infrasound levels near wind farms and in other environments
[14] Bowdler et al. (2009) Prediction and assessment of wind turbine noise: Agreement about relevant factors for noise assessment from wind energy projects (Institute of Acoustics: Acoustic Bulletin, Volume 34, No 2, March/April 2009)
[15] University of Salford (2007) Research into aerodynamic modulation of wind turbine noise
[16] Renewable UK (2013) Wind turbine amplitude modulation: Research to improve understanding as to its cause and effects
[17] Institute of Acoustics (2016) A Method for Rating Amplitude Modulation in Wind Turbine Noise
[18] Department of Business, Energy and Industrial Strategy (2016) Review of the evidence on the response to amplitude modulation from wind turbines
[19] Scottish Government (2022) Onshore wind policy statement 2022
[20] Snow, D. J. (1997) Low frequency noise and vibrations measurement at a modern wind farm (ETSU W/13/00392/REP)
[21] Styles et al. (2005) Microseismic and Infrasound Monitoring of Low Frequency Noise and Vibrations from Windfarms (Keele University)

Assessing Significance

Sensitivity

11.50 The only relevant NSRs within the assessment area are dwellings, which are of high sensitivity. This applies to both construction and operational noise.

Magnitude

11.51 Operational noise effects have been determined following ETSU-R-97 and the IOA GPG, which if they do not exceed noise limits derived following the same guidance, are considered to be not significant in EIA terms.

11.52 The calculated construction noise levels have been compared against absolute noise limits for temporary construction activities which are commonly regarded as providing an acceptable level of protection from the short-term noise levels associated with construction activities. British Standard 5228:2009+A1:2014 Part 1 (BS 5228-1) Annex E provides example criteria of absolute noise limits for construction activities and has been used to determine the significance of any construction noise effects within this assessment. The criteria do not represent mandatory limits but rather a set of example approaches intended to reflect the type of methods commonly applied to construction noise. In broad terms, the example criteria are based on a set of fixed limit values which, if exceeded, may result in a significant effect unless ambient noise levels are sufficiently high to provide a degree of masking of construction noise. BS 5228 also advises that the duration and nature of the works should be taken into consideration.

Significance

11.53 The predicted significance of the effect was determined through a standard method of assessment based on professional judgement, considering both sensitivity and magnitude of change.

11.54 The range of guidance values detailed in BS 5228-1 Annex E and other reference criteria such as PAN50 have been used to numerically define the magnitude of impact, accounting for the rural nature of the noise environment at the receptors considered. As construction noise will always be an introduction of a noise source which would otherwise not be there, where effects are identified to occur, they will always be adverse:

- Where construction noise levels at receptors are below the adopted daytime noise limit of 65dB L_{Aeq} for a sustained period of time, this is determined to be '**Not Significant**'; and
- Where construction noise levels at receptors are above the adopted daytime noise limit of 65dB L_{Aeq} for a sustained period of time, this is determined to be '**Significant**'.

11.55 For construction traffic effects on roads that have been determined using the CRTN methodology, the significant effect of change in the BNL has been determined using guidance found in CRTN and the 'Design Manual for Roads and Bridges' criteria for short-term noise effects:

- Where the change in BNL (due to construction traffic) is predicted to be less than 3dB, this is determined to be '**Not Significant**'; and
- Where the change in BNL (due to construction traffic) is predicted to be more than 3dB, this is determined to be '**Significant**'.

11.56 For construction traffic effects on roads that have been determined using the BS5228 haul route method, the significance of effect has been determined using the construction noise criteria discussed above.

11.57 These adverse effects, while important at a local scale, are temporary and would only occur during the anticipated construction period.

11.58 The assessment of the significance of effects from operational and cumulative wind turbine noise is made as follows, with reference to ETSU-R-97 and Scottish Planning Guidance:

- Where operational and cumulative noise levels at receptors are below the relevant ETSU-R-97 noise limits, this is determined to be '**Not Significant**'; and
- Where operational and cumulative noise levels at receptors are above the relevant ETSU-R-97 noise limits, this is determined to be '**Significant**'.

Assessment Limitations

11.59 For operational noise, the exact model of turbine to be used at the Site would be the result of a future tendering process and therefore, an indicative turbine model (Vestas V150 6.0MW) has been assumed for the operational noise assessment. The turbine model assumed is considered representative of the upper end of the range of noise emissions for turbines which may be installed at the Site. For operational, proposed or consented sites, robust assumptions of the potential noise emissions which may be allowed for each of these sites under their consent were considered in line with current good practice.

Existing Conditions

11.60 The Site is located in an area of relatively low population density. Baseline noise surveys were not required to inform this assessment; however, noise surveys were carried out in 2013 for development on the same site, Ardchonnel Wind Farm, which is no longer in the planning system. The 2013 baseline noise surveys found that the existing noise environment at properties along Loch Awe was typically dominated by natural noise sources such as wind-disturbed vegetation and birdsong, as well as occasional coastal water movements to the west of the Site. Although the Ardchonnel Wind Farm baseline noise survey was nearly 10 years ago, no significant changes to the noise climate are expected.

Implications of Climate Change

11.61 Chapter 14: Other Issues provides details of the climate change projections in the west of Scotland for the 2050s, when the operational period of the Proposed Development is likely to end. In summary, the projections highlight that in the 2050s, summer and winter temperatures are likely to be greater than the current baseline (greater for summer), with winter rainfall increasing and summer rainfall decreasing.

11.62 The consequences of the projected climate change scenario are unlikely to substantially affect baseline noise conditions for the purpose of the assessment in this chapter, given that periods of rainfall are excluded and the variation with wind speed was taken into account, in line with requirements of ETSU-R-97 and current good practice.

Future Baseline in the Absence of the Proposed Development

11.63 In the absence of the Proposed Development, environmental noise levels in the area are likely to remain largely similar to those currently experienced, barring any significant Proposed Development which would affect these levels.

Design Considerations

11.64 Noise levels were calculated for progressive configurations of the Proposed Development and compared against the derived noise limits. Advice was provided to the design team, including confirmation that noise levels for the final layout complied with the ETSU-R-97 criteria, mainly due to the large separation distances involved.

Micrositing

11.65 The proposed micrositing tolerance of 50m for turbines will correspond to potential differences in the wind turbine noise level of less than 0.5dB(A) at any given property. A level change of this order will not alter the findings of this assessment with respect to construction or operational noise. Irrespective of the degree of micrositing employed (within the consented tolerance), noise immissions from the Proposed Development will still be required to meet the derived noise limits.

Good Practice Measures

11.66 To reduce the potential effects of construction noise, the following good practice measures are proposed and where appropriate are to be included in the Construction Environmental Management Plan:

- Those activities that may give rise to audible noise at the surrounding properties and heavy goods vehicle deliveries to the Site will be limited to the hours 07:00 to 19:00 Monday to Friday and 07:00 to 13:00 on Saturdays. Turbine deliveries will only take place outside these times with the prior consent of ABC and Police Scotland. Those activities that are unlikely to give rise to noise audible at the site boundary will continue outside of the stated hours.
- All construction activities shall adhere to good practice as set out in BS 5228.

- All equipment will be maintained in good working order and any associated noise attenuation such as engine casing and exhaust silencers shall remain fitted at all times.
- Where flexibility exists, activities will be separated from residential neighbours by the maximum possible distances.
- A site management regime will be developed to control the movement of vehicles to and from the Proposed Development site.
- Construction plant capable of generating significant noise and vibration levels will be operated in a manner to restrict the duration of the higher magnitude levels.

Assessment of Effects

11.67 The assessment of effects is based on the project description as outlined in **Chapter 4**. Unless otherwise stated, potential effects identified are considered to be negative.

Construction Effects

Predicted Construction Effects

11.68 The level of construction noise that occurs at the surrounding properties will be highly dependent on a number of factors such as the final site programme, equipment types used for each process, and the operating conditions that prevail during construction. It is not practically feasible to specify each and every element of the factors that may affect noise levels, therefore it is necessary to make reasonable allowance for the level of noise emissions that may be associated with key phases of construction.

11.69 To determine representative emission levels for this study reference has been made to the scheduled sound power data provided by BS 5228. Based on experience of the types and number of equipment usually associated with the key phases of constructing a wind farm, the scheduled sound power data has been used to deduce the upper sound emission level over the course of a working day. In determining the rating applicable to the working day, it has generally been assumed that the plant will operate for between 75% and 100% of the working day. In many instances, the plant will actually be expected to operate for a reduced percentage, thus resulting in noise levels lower than predicted in this assessment.

11.70 To relate the sound power emissions to predicted noise levels at surrounding properties, the prediction methodology outlined in BS 5228 has been adopted. The prediction method accounts for factors including screening and soft ground attenuation. The size of the Site and resulting separation distances to surrounding properties allows the calculations to be reliably based on positioning all the equipment at a single point within a particular working area. For example, in the case of turbine erection, it is reasonable to assume all associated construction plant is positioned at the base of the turbine under consideration. In applying the BS 5228 methodology, it has been conservatively assumed that there are no screening effects, and that the ground cover is characterised as 50% hard / 50% soft.

11.71 The majority of construction work will take place at a substantial distance from the nearest NSRs (more than 2km) and as such construction noise levels will be of no significant effect. Construction activity at these greater distances which need not be assessed further include constructing:

- Site compounds;
- Substation;
- Crane hard standings;
- Turbine foundations; and
- Turbines.

11.72 Table 11.4 lists the key construction activities that will take place closer to NSRs, the associated types of plant normally involved, the expected worst-case sound power level over a working day for each activity, the property which will be closest to the activity for a portion of construction, and the predicted noise level. It must be emphasised that these predictions only relate the noise level occurring during the time when the activity is closest to the referenced property. In many cases such as access track construction, the separating distances will be considerably greater for the majority of the construction period and the predictions are therefore the worst-case periods of the construction phase.

Table 11.4: Predicted construction noise levels

Task Name	Plant/Equipment	Upper Collective Sound Emission dB L_{WA}	Nearest Receiver	Minimum Distance to Nearest Receiver	Predicted Upper Daytime L_{Aeq}
Upgrade access tracks	Excavators/dump trucks/ tippers/dozers/vibrating rollers	121	R16	15m	89
			R17	50m	78
			R14	180m	66
			R15	240m	63
Borrow pit quarry 1	Primary and secondary stone crushers/excavators/screening systems/pneumatic breakers/ conveyors	121	R16	450m	63
Borrow pit quarry 2	Primary and secondary stone crushers/excavators/screening systems/pneumatic breakers/ conveyors	121	R14	927m	56

11.73 As discussed above, the majority of the construction works will result in no significant effect. For the access track upgrade construction activity that will take place much closer to dwellings, as set out in **Table 11.4**, the threshold of significance for construction noise is predicted to be exceeded when existing access tracks are upgraded and work taking place is at the minimum possible distance to R14, R16 and R17. However, the predicted worst-case noise levels represent only a short period when works occur at the closest point to the receptors affected. Noise levels will quickly diminish as track upgrading progresses, quickly moving the activity further from the property, and not represent a sustained effect and therefore not considered significant. Additional measures are however proposed below to minimise the associated noise levels.

11.74 In addition to on-site activities, construction traffic passing to and from the Site will also represent a potential source of noise to surrounding properties. Changes in road traffic noise due to construction vehicles are set out in **Table 11.5** which have been extracted from the transport assessment set out in **Chapter 12**. The vehicle flow values in the assessment of construction noise do not include other development flows as a worst case, as a greater change in noise will be present with a smaller baseline flow and a larger development flow. **Table 11.5** contains the BNL, as described above, which has been corrected for Heavy Goods Vehicle (HGV) percentage and low flow, where appropriate.

Table 11.5: Predicted changes in road traffic noise due to construction vehicles

Road	2026 No Construction Traffic			2026 with Construction Traffic			Difference in BNL, dB
	HGVs	Cars/Lights	BNL, dB	HGVs	Cars/Lights	BNL, dB	
A819, Site Entrance	144	1,340	61.1	243	1,388	62.6	1.5
A83 (T), Ardgenavan	659	5,634	69.0	660	5,644	69.0	0.0
A83 (T), south of Inveraray	323	2,944	66.0	422	2,992	66.6	0.6
A83 (T), Minard	323	2,631	65.6	325	2,655	65.7	0.0
A83 (T), Lochgilphead	505	7,195	69.1	507	7,219	69.1	0.0
A83 (T), south of Ardrishaig	210	2,032	63.8	212	2,056	63.9	0.1

11.75 The greatest predicted change in BNL occurs on the A819, Site Entrance, at 1.5dB. This is below the threshold of significance; therefore construction traffic noise effects will be **Not Significant**.

Proposed Mitigation

11.76 For the upgrade of access track works occurring within 200m of a receptor, construction noise can be minimised through the Construction Environmental Management Plan by:

- Selecting quieter alternative plant and equipment;
- Fitting silencers, where available; and
- Introducing temporary acoustics barriers in the direct line of sight between noisy plant and the receptor at its closest point.

11.77 It is possible, that for the closest receptor, R16 Croit A Bhile, while access track upgrade works are occurring at the minimum distance, the construction noise threshold of 65dB may still be briefly exceeded after the above mitigation is employed. This elevated noise level will however quickly diminish as work progresses along the access track and the distance increases. For other locations, the mitigation will reduce noise from construction activity below the threshold.

Residual Construction Effects

11.78 With mitigation measures, the construction noise levels are likely to be below the relevant noise limit of 65dB $L_{Aeq,1hr}$ for sustained operations, and therefore construction noise effects will be **Not Significant**.

Operational Effects

Predicted Operational Effects

11.79 The predicted operational noise immission levels of the Proposed Development, at each of the identified receptors are presented numerically in **Table 11.6**.

Table 11.6: Operational noise assessment for the Proposed Development, dB L_{A90}

NSR ID	Description	Noise Level, dB L_{A90}, at standardised wind speed, m/s						
		4	5	6	7	8	9	10
R1	Blarghour	20	24	27	28	28	28	28
R2	Ardchonnel Croft	17	22	25	26	26	26	26
R3	Ardchonnell	18	22	25	26	26	26	26
R4	Blarghour Farm Cottages	19	23	26	27	27	27	27
R5	Old School House	14	18	22	23	23	23	23
R6	Sallachry	16	21	24	25	25	25	25
R7	Kilmun	16	20	24	24	24	24	24
R8	High Balantyre	16	21	24	25	25	25	25
R9	Loch Awe House	17	21	25	26	26	26	26
R10	Upper Barr Beithe	17	21	24	25	25	25	25
R11	Dalavich Chalet Park Cabins	18	22	26	27	27	27	27
R12	Newyork	15	20	23	24	24	24	24
R13	Barnaline Lodge	19	23	26	27	27	27	27

11.80 It can be seen in **Table 11.6** that the predicted wind turbine noise immission level from the Proposed Development does not exceed the ETSU-R-97 simplified noise limit of 35dB L_{A90} at any receptor for any given wind speed and will, therefore, be **Not Significant**. This was determined based on the Vestas V150 6.0MW turbine model operating in PO6000 mode, which is considered representative of the turbines which would be installed for the Proposed Development.

11.81 ETSU-R-97 however requires consideration of cumulative noise levels and this is addressed in the relevant section below.

Proposed Mitigation

11.82 The selection of the final turbine to be installed at the Site would be made on the basis of enabling the relevant noise limits (**Table 11.10**) to be achieved at the surrounding properties, accounting for any correction for tonality if relevant.

Residual Operational Effects

11.83 The residual operational noise effects from the Proposed Development would be **Not Significant**.

In-Combination Effects with the Blade Transfer Areas During Construction

Predicted In-Combination Effects During Construction

11.84 Two blade transfer areas are proposed enroute, off the A83, to be situated between West Tarbert and Tarbert and near to Castleton. As with the assessment of construction noise associated with the Proposed Development, there are a number of assumptions and calculation parameters that are relevant. These are set out above, and equally apply to the prediction of in-combination effects with the blade transfer areas during construction.

11.85 The types of plant anticipated to be required for the construction of the blade transfer areas are listed in **Table 11.7** along with overall worst-case sound power level over a working day, the closest NSR and the calculated upper level of construction noise.

Table 11.7: Predicted in-combination construction noise levels

Blade Transfer Area	Plant/Equipment	Upper Collective Sound Emission dB L_{WA}	Nearest Receiver	Minimum Distance to Nearest Receiver	Predicted Upper Daytime L_{Aeq}
Blade Transfer Area 1	Excavators/dump trucks/ tippers/rollers/delivery trucks	118	Creag Glas, Campbeltown Road, Tarbert.	175m	63
Blade Transfer Area 2	Excavators/dump trucks/ tippers/rollers/delivery trucks	121	The Rhinns Achnaba, Lochgilphead.	400m	55

11.86 The blade transfer area construction activity, as set out in **Table 11.7**, would result in noise levels at the nearest NSR below the threshold of significance for construction noise and therefore would be **Not Significant**.

Proposed Mitigation

11.87 The in-combination effects during construction are below the threshold of significance and therefore mitigation would not be required.

Residual In-Combination Effects During Construction

11.88 The residual in-combination noise effects with the blade transfer areas during construction would be **Not Significant**.

In-Combination Effects with the Blade Transfer Areas During Operation

Predicted In-Combination Effects During Operation

11.89 The operation of the blade transfer areas takes place during the construction phase of the Proposed Development. As such, any associated in-combination noise effects have been fully considered during the construction assessment and no further effects are anticipated.

Proposed Mitigation

11.90 There would be no operational in-combination noise effects associated with the blade transfer areas; therefore, mitigation is not required.

Residual In-Combination Effects During Operation

11.91 The residual in-combination noise effects with the blade transfer areas during operation would be **Not Significant**.

Cumulative Effects During Construction

Predicted Cumulative Effects During Construction

11.92 At this stage, it is not possible to determine if the construction of the Proposed Development would coincide with the construction of Blarghour Wind Farm, such that cumulative effects could occur. Notwithstanding this, consideration has been given to this scenario as a worst case.

11.93 As summarised in the assessment of construction effects, construction activity for the Proposed Development will be of no significant effect. The assessment for Blarghour Wind Farm concluded that construction noise is unlikely to exceed 65dB $L_{Aeq,\ 12\ hour}$ at distances greater than 100m, but no distances or predicted construction noise levels were provided. As with the Proposed Development, the majority of construction work takes place several kilometres from nearby receptors; therefore, even if construction programmes coincide cumulative noise levels would remain substantially below the threshold of significance for these activities. Some localised transient construction activity may occur closer to receptors that results in a higher noise level, but it is unlikely that such short-lived events would occur at the same time, in similar locations for both developments for any period of time. Therefore, the cumulative construction noise effects would be **Not Significant**.

11.94 The **Cumulative Effects During Construction** section of **Chapter 12**, sets out the potential total vehicle flows of the Proposed Development together with Blarghour Wind Farm construction traffic, should the construction programmes overlap. **Table 11.8** summarises the relevant traffic information and the BNL corrected for HGV percentage and low flow, where relevant.

Table 11.8: Predicted changes in road traffic noise due to construction vehicles and committed development traffic

Road	2026 No Construction Traffic			2026 with Construction + Other Traffic			Difference in BNL, dB
	HGVs	Cars/Lights	BNL, dB	HGVs	Cars/Lights	BNL, dB	
A819, Site Entrance	144	1,340	61.1	354	1,388	63.8	2.7
A83 (T), Ardgenavan	659	5,634	69.0	716	5,643	69.2	0.2
A83 (T), south of Inveraray	323	2,944	66.0	534	2,992	67.2	1.2
A83 (T), Minard	323	2,631	65.6	381	2,655	66.1	0.4
A83 (T), Lochgilphead	505	7,195	69.1	563	7,219	69.3	0.2
A83 (T), south of Ardrishaig	210	2,032	63.8	268	2,056	64.4	0.6

11.95 The greatest predicted change in BNL due to cumulative construction traffic with other committed developments occurs on the A819, Site Entrance, at 2.7dB. This is below the threshold of significance; therefore cumulative construction traffic noise effects would be **Not Significant**.

Cumulative Effects During Operation

Predicted Cumulative Effects During Operation

11.96 The predicted noise immission levels of the Proposed Development operating cumulatively with Blarghour Wind Farm and the margin, at each of the identified receptors are presented numerically in **Table 11.9**. A positive margin value indicates the cumulative turbine immission exceeds the limit and a negative value shows it is below the limit. The cumulative operational noise limit is 35dB L_{A90} for all windspeeds and times of the day. The noise levels shown in these tables are predicted for a standardised wind speed range of 4-10m/s.

Table 11.9: Cumulative operational noise assessment for the Proposed Development and Blarghour Wind Farm, dB L_{A90}

NSR ID	Detail	Noise Level, dB L_{A90}, at standardised wind speed, m/s						
		4	5	6	7	8	9	10
R1	Cumulative Wind Turbine Immission	23	28	31	33	33	33	33
	Margin	-12	-7	-4	-2	-2	-2	-2
R2	Cumulative Wind Turbine Immission	20	25	28	30	30	30	30
	Margin	-15	-10	-7	-5	-5	-5	-5
R3	Cumulative Wind Turbine Immission	21	25	29	31	31	31	31
	Margin	-14	-10	-6	-4	-4	-4	-4
R4	Cumulative Wind Turbine Immission	23	27	31	33	33	33	33
	Margin	-12	-8	-4	-2	-2	-2	-2
R5	Cumulative Wind Turbine Immission	17	22	26	27	28	28	28
	Margin	-18	-13	-9	-8	-7	-7	-7
R6	Cumulative Wind Turbine Immission	20	24	28	30	30	30	30
	Margin	-15	-11	-7	-5	-5	-5	-5
R7	Cumulative Wind Turbine Immission	20	24	28	30	30	30	30
	Margin	-15	-11	-7	-5	-5	-5	-5
R8	Cumulative Wind Turbine Immission	19	24	28	29	30	30	30
	Margin	-16	-11	-7	-6	-6	-6	-6
R9	Cumulative Wind Turbine Immission	24	29	33	35	35	35	35
	Margin	-11	-6	-2	0	0	0	0
R10	Cumulative Wind Turbine Immission	25	29	33	35	35	35	35
	Margin	-10	-6	-2	0	0	0	0
R11	Cumulative Wind Turbine Immission	23	28	32	34	34	34	34
	Margin	-12	-7	-3	-1	-1	-1	-1
R12	Cumulative Wind Turbine Immission	20	25	29	31	31	31	31

NSR ID	Detail	Noise Level, dB L_{A90}, at standardised wind speed, m/s						
		4	5	6	7	8	9	10
	Margin	-15	-10	-6	-4	-4	-4	-4
R13	Cumulative Wind Turbine Immission	23	28	32	34	34	34	34
	Margin	-12	-7	-3	-1	-1	-1	-1

11.97 It can be seen in **Table 11.9** that the predicted cumulative wind turbine noise immission level from the Proposed Development and Blarghour Wind farm does not exceed the ETSU-R-97 noise limit at any receptor for any given wind speed and would, therefore, be **Not Significant**. It should be noted that R9 and R10 have no margin between the cumulative wind turbine immission level and the noise limit because of the additional uplift applied, specifically to increase the noise from Blarghour Wind Farm to the limit. Furthermore, the predicted contribution of the Proposed Development at these properties is approximately 10dB below that of the Blarghour Wind Farm and therefore can be considered to represent a very low or negligible contribution to the cumulative total.

Proposed Mitigation

11.98 The selection of the final turbine to be installed at the Site would be made on the basis of enabling the relevant noise limits, derived from the cumulative total noise limit of 35dB L_{A90}, to be achieved cumulatively at the surrounding properties, accounting for any correction for tonality if relevant. The apportioned noise limit for the Proposed Development is set out below in **Table 11.10** for the relevant dwellings; more distant locations, where the immission from the Proposed Development is low, need not be included. The maximum possible noise immission level that Blarghour Wind Farm could produce within their consented noise limits, using the uplift detailed above, has been subtracted logarithmically from the total available limit for each NSR to provide the noise limit for the Proposed Development.

Table 11.10: Apportioned noise limits for the Proposed Development, dB L_{A90}

NSR ID	Description	Noise Limit, dB L_{A90}, at all windspeeds up to 10m/s
R1	Blarghour	32
R2	Ardchonnel Croft	34
R3	Ardchonnell	34
R4	Blarghour Farm Cottages	32
R5	Old School House	34
R6	Sallachry	34
R7	Kilmun	34
R8	High Balantyre	34

Residual Cumulative Effects During Operation

11.99 The residual cumulative operational noise effects would be **Not Significant**.

Interrelationship Between Effects

11.100 Information contained within **Chapter 12** has been used to inform the assessment of construction traffic noise.

11.101 No significant health effects are expected.

Summary of Significant Effects

11.102 The effect of construction noise, including construction traffic, is predicted to be **Not Significant** and no specific mitigation measures are considered necessary.

11.103 The effect of operational noise, including cumulative operational noise, is also predicted to be **Not Significant** and no specific mitigation measures are considered necessary.