

# 10 Noise

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## 10 Noise

### 10.1 Executive Summary

- 10.1.1 This Chapter summarises the assessment of the potential noise effects of the Proposed Development on the residents of nearby dwellings for the construction and operational stages
- 10.1.2 Construction noise has been assessed by a desk study of a potential construction programme and by assuming the Proposed Development is constructed using standard and common methods. Noise levels have been calculated for receiver locations closest to the areas of work and compared with guideline values. Construction noise, by its very nature, tends to be temporary and highly variable and therefore much less likely to cause adverse effects. Various mitigation methods have been suggested to reduce the effects of construction noise, the most important of these being suggested restrictions of hours of working. It is concluded that noise generated through construction activities will have a **minor** effect that is not significant in Environmental Impact Assessment (EIA) terms. Decommissioning is likely to result in less noise than the construction phase of the Proposed Development, therefore decommissioning will, in the worst case, also have **minor** noise effects in EIA terms.
- 10.1.3 Operational turbines emit noise from the rotating blades as they pass through the air. This noise can sometimes be described as having a regular ‘swish’. The amount of noise emitted tends to vary depending on the wind speed. When there is little wind the turbine rotors will turn slowly and produce lower noise levels than during high winds when the turbine reaches its maximum output and maximum rotational speed. Background noise levels at nearby properties will also change with wind speed, increasing in level as wind speeds rise due to wind in trees and around buildings, etc.
- 10.1.4 Noise levels from operation of the turbines have been predicted for those locations around the Proposed Development most likely to be affected by noise. Noise surveys for the previous Linfairn wind farm application have sufficiently established existing baseline noise levels at a number of these properties. Noise limits have been derived from data about the existing noise environment following the method stipulated in national planning guidance. Predicted noise levels take full account of the potential combined effect of the wind turbine noise from the Proposed Development along with Dersalloch wind farm (operational), Hadyard Hill wind farm (operational), Craiginmoddie Wind Farm (in planning) and Carrick wind farm (Scoping). Other, more distant wind farms were not considered as they do not make an acoustically relevant contribution to cumulative noise levels.
- 10.1.5 Predicted operational noise levels have been compared to the limit values to demonstrate that turbines of the type and size which would be installed can operate within the limits so derived. It is concluded therefore that operational noise levels from the wind turbines are considered not significant in EIA terms.
- 10.1.6 The Proposed Development would also include a substation and an energy storage facility, which would emit some noise during operation. Based on experience of similar installations and professional judgement, in conjunction with the large separation distances to the nearest receptor locations, the associated levels of operational noise would be negligible and are considered not significant in EIA terms.

### 10.2 Introduction

- 10.2.1 This Chapter summarises the assessment of the potential noise effects of the Proposed Development on the residents of nearby dwellings. The assessment has been undertaken by Hoare Lea LLP (HL). This Chapter has been written by Mark Jiggins MSc, Associate Acoustic Consultant at HL, who is a member of the Institute of Acoustics (MIOA). Full details of the noise assessment can be found in the HL Technical Report, included as Technical Appendix 10.1. The assessment considers the Proposed Development’s construction, operation and decommissioning.

- 10.2.2 Assessment of the operational noise effects accounts for the cumulative effect of the Proposed Development with other wind farms including the Dersalloch wind farm (operational, to the north-east), Hadyard Hill wind farm (operational, to the west), Craiginmoddie wind farm (in planning, to the west) and Carrick wind farm (Scoping and adjacent to the south) and). Other, more distant wind farms were not considered as they do not make an acoustically relevant contribution to cumulative noise levels. As the Institute of Acoustics (IOA) Good Practice Guidance (GPG) suggests that cumulative noise effects need not be considered where differences between existing and proposed wind farm noise levels are 10 dB(A) or more.
- 10.2.3 For the construction phase, details of relevant working practices, traffic routes, and proposed working hours are described in Chapter 3. In addition, the assessment of noise and vibration from traffic associated with the construction work is based on the assessment presented in Chapter 12.

## 10.3 Legislation, Policy and Guidelines

- 10.3.1 Whilst Scottish Planning Policy (SPP) suggests that noise impacts are one of the aspects that will need to be considered in the context of an application for wind farm development, it provides no specific advice with regards to noise.
- 10.3.2 Planning Advice Note PAN1/2011 provides general advice on the role of the planning system in preventing and limiting the adverse effects of noise without prejudicing investment in enterprise, development and transport. PAN1/2011 provides general advice on a range of noise related planning matters, including references to noise associated with both construction activities and operational wind farms. In relation to operational noise from wind farms, Paragraph 29 states that:
- “There are two sources of noise from wind turbines - the mechanical noise from the turbines and the aerodynamic noise from the blades. Mechanical noise is related to engineering design. Aerodynamic noise varies with rotor design and wind speed and is generally greatest at low speeds. Good acoustical design and siting of turbines is essential to minimise the potential to generate noise. Web based planning advice on renewable technologies for Onshore wind turbines provides advice on ‘The Assessment and Rating of Noise from Windfarms’ (ETSU-R-97) published by the former Department of Trade and Industry [DTI] and the findings of the Salford University report into Aerodynamic Modulation of Wind Turbine Noise.”*
- 10.3.3 The Scottish Government’s Online Renewables Planning Advice on Onshore Wind Turbines provides further advice on noise and confirms that the recommendations of ‘The Assessment and Rating of Noise from Windfarms’ (ETSUR97) *“should be followed by applicants and consultees and used by planning authorities to assess and rate noise from wind energy developments”*.
- 10.3.4 Guidance on good practice on the application of ETSU-R-97 has been provided by the IOA GPG. This was subsequently endorsed by the Scottish Government which advised in the Online Renewables Planning Advice note that the GPG *“should be used by all IOA members and those undertaking assessments to ETSU-R-97”*.
- 10.3.5 PAN1/2011 and the Technical Advice Note accompanying PAN1/2011 note that construction noise control can be achieved through planning conditions that limit noise from temporary construction sites, or by means of the Control of Pollution Act (CoPA).
- 10.3.6 The Control of Pollution Act (CoPA) 1974 provides two means of controlling construction noise and vibration. Section 60 provides the Local Authority with the power to impose at any time operating conditions on the development site. Section 61 allows the developer to negotiate a prior consent for a set of operating procedures with the Local Authority before commencement of site works.

## 10.4 Consultation

- 10.4.1 Full details of the consultation process with South Ayrshire Council (SAC) and their acoustic consultants ACCON UK Ltd are provided in Section 3.5 of Technical Appendix 10.1, with a summary of the key issues shown below in Table 10.1.

**Table 10.1 – Consultation Key Issues**

<b>Key Issues</b>	<b>Applicant Action</b>
Baseline data surveyed for the Linfairn Wind Farm application were agreed to be representative for the assessment.	Noise limits based on background noise surveys already completed.
Proposed methodology suitable.	N/A
Ground-borne vibration and low frequency noise can be scoped out of the assessment.	Scoped out of the assessment.
Operational noise from the substation and routine maintenance visits can be scoped out of the assessment provided the substation is located at least 500 m from any noise sensitive receptor.	Confirmation of distances being greater than 500 m and therefore scoped out of the assessment (see Section 3.6 of Technical Appendix 10.1).
Recommended the fixed part of the operational noise limit be 35 dB(A) day-time and 38 dB(A) night-time.	ETSU-R-97 specifies the fixed part of the day-time limit should be between 35 dB(A) to 40 dB(A) based upon site-specific factors, and during the night-time set at 43 dB(A). Values of 38 dB(A) day-time and 43 dB(A) night-time have been adopted, consistent with national planning guidance.

## 10.5 Assessment Methodology and Significance Criteria

### ***Construction Noise and Vibration***

- 10.5.1 Detailed guidance on construction noise and its control is provided by BS 5228-1 ‘Code of practice for noise and vibration control on construction and open sites’ (2009, amended 2014). Analysis of construction noise impacts has been undertaken in accordance with the methodologies outlined in this standard, which provides methods for predicting construction noise levels on the basis of reference data for the emissions of typical construction plant and activities. These methods include the calculation of construction traffic along access tracks and haul routes, and construction activities at fixed locations including the bases of turbines, temporary construction compounds, and the substation. The construction noise assessment has been based on indicative data for the types of plant likely to be used during the construction works, as presented in BS 5228-1.
- 10.5.2 BS 52281 provides guidance on a range of considerations relating to construction noise including the legislative framework, general control measures, example methods for estimating construction noise levels and example criteria which may be considered when assessing effect significance. Similarly, BS 52282 provides general guidance on legislation, prediction, control and assessment criteria for construction vibration. Changes in the predicted traffic noise level on existing public roads can be calculated using the Calculation of Road Traffic Noise (CRTN) methodology and changes in noise levels assessed using the Design Manual for Roads and Bridges (see para. 3.3.4 of Technical Appendix 10.1).
- 10.5.3 Planning Advice Note PAN50 ‘Controlling the Environmental Effects of Surface Mineral Workings’ gives guidance on the environmental effects of mineral working. The main document summarises the key issues with regard to various environmental impacts relating to surface mineral extraction and processing such as road traffic, blasting, noise, dust, visual intrusion etc. In addition, several annexes to the main document have been published which consider specific aspects in more detail: Annex A, ‘The Control of Noise at Surface Mineral Workings’ and Annex D ‘The Control of Blasting

at Surface Mineral Workings'. BS 5228-1 and BS 5228-2 also provide guidance relating to surface mineral extraction including the assessment of noise and vibration effects associated with quarry blasting.

- 10.5.4 The noise-sensitive locations considered for the construction noise and vibration assessment include those closest to the proposed turbines and those considered in the operational noise assessment (see Table 2 of Technical Appendix 10.1). Additional residential dwellings located alongside the two proposed routes for the access tracks and associated construction traffic routes, were also considered.
- 10.5.5 The nature of works and distances involved in the construction of the Proposed Development are such that the risk of significant effects relating to ground borne vibration are very low (excluding blasting). Occasional momentary vibration can arise when heavy vehicles pass dwellings at very short separation distances, but again this is not sufficient to constitute a risk of significant effects in this instance. Accordingly, vibration impacts (excluding blasting) do not warrant detailed assessment and are therefore not discussed further in this Chapter.
- 10.5.6 The transmission and magnitude of ground vibrations associated with blasting operations at borrow pits are subject to many complex influences including charge type and position, and importantly, the precise nature of the ground conditions (material composition, compaction, discontinuities) at the source, receiver, and at every point along all potential ground transmission paths. Clearly any estimation of such conditions is subject to considerable uncertainty, thus limiting the utility of predictive exercises. Mitigation of potential effects of these activities is best achieved through on-site testing processes carried out in consultation with SAC so as not to exceed relevant vibration levels at neighbouring properties. In accordance with the guidance in PAN50 Annex D, ground vibration caused by blasting operations would be considered acceptable if Peak Particle Velocity (PPV) levels, at the nearest sensitive locations, do not exceed 6 mm/s for 95 % of all blasts measured over any six month period, and no individual blast exceeds a PPV of 12 mm/s.
- 10.5.7 Because of the difficulties in predicting noise and air overpressure resulting from blasting operations at the proposed borrow pits, these activities are best controlled following the use of good practice during the setting and detonation of charges.

### ***Operational Noise***

- 10.5.8 The assessment of operational noise impacts has been carried out in accordance with the methodology set out in ETSU-R-97. ETSU-R-97 has become the accepted standard for such developments within the UK and is specified as the appropriate assessment and rating guidance for wind farms in current Scottish Planning Policy. It is described in more detail in Technical Appendix 10.1. Technical guidance on current good practice in the application of the ETSU-R-97 methodology, as described in the IOA GPG has also been referenced, as is recommended in the Scottish Government's Online Renewables Planning Advice on Onshore wind turbines (Scottish Government, 2014).
- 10.5.9 The exact model of turbine to be used for the Proposed Development would be the result of a future tendering process and therefore an indicative candidate turbine model has been assumed for the operational noise assessment. This operational noise assessment is based upon the noise specification of the Vestas EnVentus V150 6.0 MW wind turbine, which is a variable speed, pitch-regulated machine with a rotor diameter of 150 m and a hub height of 125 m (assumed on a precautionary basis to apply to those turbines with a lower hub height). This model is indicative and was determined to both fit the proposed turbine dimension parameters for both the 200m and 180m tip heights, and also provide a representation of the typical noise emission levels for the range of turbine models which may be installed.
- 10.5.10 To undertake the assessment of noise impact in accordance with the methodology in ETSU-R-97, the following steps are required:
- specify the number and locations of the wind turbines and other wind farms to be included in the assessment;

- determine the day-time and night-time noise limits from the measured background noise levels at the nearest neighbours;
  - specify the wind turbine model and its noise emission characteristics;
  - calculate noise immission levels from the operation of the turbines associated with the Proposed Development as well as the contribution to cumulative noise immission levels from other nearby wind farms as a function of site specific wind speed at the nearest neighbours; and
  - compare the calculated wind turbine noise immission levels with the derived noise limits and assess in the light of planning requirements.
- 10.5.11 Note 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.
- 10.5.12 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 therefore needs to consider the combined operational noise of the Proposed Development with other wind farms in the area to be satisfied that the combined cumulative noise levels are within the relevant ETSU-R-97 criteria. Full details of the operational noise assessment, including details of the noise output of the candidate turbine for the Proposed Development and the calculation parameters on which predictions have been based, as well as a full description of the ETSU-R-97 assessment methodology, can be found in Technical Appendix 10.1.

### ***Assessment of Potential Effect Significance***

- 10.5.13 BS 5228-1 indicates that a number of factors are likely to affect the acceptability of construction noise including location, existing ambient noise levels, duration of operations, hours of work, attitude of the operator and the noise characteristics of the work being undertaken. Based on the range of guidance values set out in BS 5228 Annex E and other reference criteria provided by the World Health Organization, the significance criteria presented in Table 1 of Technical Appendix 10.1 have been derived. The values have been chosen in recognition of the relatively low ambient noise typically observed in rural environments.
- 10.5.14 When considering the impact of short-term changes in traffic, associated with the construction activities, on existing roads in the vicinity of the Proposed Development, reference can be made to the criteria set out in the Design Manual for Roads and Bridges (DMRB). This classification can be considered in addition to the criteria of Table 1 of Technical Appendix 10.1. Major or moderate construction impacts are considered ‘significant’ in the context of the EIA Regulations.
- 10.5.15 The acceptable limits for wind turbine operational noise are clearly defined in ETSUR97. Consequently, the test applied to operational noise is whether or not the calculated wind farm noise immission levels at nearby noise sensitive receptors lie below the noise limits derived in accordance with ETSUR97. If predicted noise levels are within the ETSUR97 derived noise limits, operational noise is considered not significant in EIA terms. If predicted noise levels are above the ETSUR97 noise limits, operational noise is considered significant in EIA terms.

### ***Requirements for Mitigation***

- 10.5.16 Measures to control construction noise include:
- construction works 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, unless otherwise approved in advance by SAC (except in case of an emergency);
  - 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 undertaken away from residential properties, set back by the maximum possible distances;
- a Construction Traffic Management Plan will be developed to control the movement of vehicles to and from the site; and
- construction plant capable of generating high noise and vibration levels will be operated in a manner to restrict the duration of the higher magnitude levels.

10.5.17 Unless otherwise agreed in consultation with SAC, for example due to large separation distances, if blasting is to be employed at some of the borrow pits, the potential noise and vibration effects of blasting operations will be reduced (unless otherwise agreed with SAC) according to the guidance set out in the relevant BS and PAN50 Annex D:

- blasting will take place under controlled conditions with the agreement of the relevant authorities, at times within the working week, that is, Mondays to Fridays, between the hours of 10:00 and 16:00. Blasting on Saturday mornings will be a matter for negotiation between the Contractor and SAC;
- vibration levels at the nearest sensitive properties are best controlled through on-site testing processes carried out in consultation with SAC. This site testing-based process will include the use of progressively increased minor charges to gauge ground conditions both in terms of propagation characteristics and the level of charge needed to release the requisite material. If required, the use of on-site monitoring at neighbouring sensitive locations during the course of this preliminary testing can then be used to define upper final charge values that would ensure vibration levels remain within the criteria set out previously, as described in BS 5228-2 and BS 6472-2;
- blasting operations will adhere to good practice as set out in BS 5228-2, and in PAN50, Annex D, Paragraph 95 in order to control air overpressure; and
- a scheme will be submitted to SAC for approval of blasting details, which will outline the mitigation measures to be adopted.

10.5.18 For operational noise, selection of the final turbine to be installed at the site will be made on the basis of enabling the relevant ETSU-R-97 noise limits to be achieved at the surrounding properties.

## 10.6 Baseline Conditions

10.6.1 The Study Area for the assessment includes residential dwellings located in the vicinity of both the Proposed Development and the proposed construction route options. The Proposed Development is located in an area of relatively low population density. The noise environment in the surrounding area is generally characterised by 'natural' sources, such as wind disturbed vegetation, birds, farm animals and water flow sounds. Other sources of noise include agricultural vehicle movements in the area, and occasional road traffic on minor roads and distant aircraft.

10.6.2 The area of the Proposed Development is similar to the previous Linfairn Wind Farm application for which a detailed survey of baseline background noise levels was completed at six locations in 2018, related to wind speeds measured within the Proposed Development. These 2018 baseline survey results remain applicable and appropriate for assessment of the Proposed Development. These baselines were submitted to and agreed by SAC to be suitable for the purpose of assessing the Proposed Development through their Scoping Response (see Section 10.4 above). The methodology and results of this survey are set out in detail in the Scoping Report and are therefore not repeated here. Derived from this baseline information, and in accordance with the guidance in ETSUR97, applicable noise limits were determined as detailed in Technical Appendix 10.1.

10.6.3 Three of the locations surveyed for the Proposed Development have also been subsequently surveyed separately by others for the assessment of Carrick wind farm. In order to consider whether any differences in surveyed background noise levels might alter the assessment outcomes, noise limits derived from these alternate baselines have been also included in this assessment.



## 10.7 Standard Mitigation

- 10.7.1 The turbine layout of the Proposed Development has been iteratively developed so as to ensure that significant noise effects are avoided, based on a representative candidate turbine model, whilst maintaining as far as possible the generation capacity of the Proposed Development (in addition to other design considerations). This included consideration of the cumulative effects of neighbouring wind farms, where relevant, as well as consideration of the significant reduction in the energy generating potential that could be accommodated, were the ETSU-R-97 day-time limit set at 35 dB(A). Specifically, the process involved the calculation of noise emission levels for the initial turbine layout, and layout design advice was provided on this basis to the design team to demonstrate compliance with successive iterations, based on the fixed threshold of the ETSU-R-97 noise limit set at 38 dB(A) during the day-time and 43 dB(A) during night-time periods, including cumulative effects from the operation of other wind farms.

## 10.8 Receptors Brought Forward for Assessment

- 10.8.1 Six noise-sensitive locations are considered in the operational noise assessment and set out in Table 2 of Technical Appendix 10.1 (also shown on the plans in Figures B1 and B2 of Annex B of Technical Appendix 10.1). Please note that this list of receptor locations is not intended to be exhaustive but sufficient to be representative of noise levels typical of those receptors closest to the Proposed Development.

## 10.9 Potential Effects

### **Construction**

- 10.9.1 Predicted noise levels at the closest noise sensitive receptors for each of the key activities during construction of the Proposed Development are presented in Table 5 of Technical Appendix 10.1. The proposed construction activities would generally occur at large distances from the residential properties considered, such that the resulting predicted noise levels would not exceed 62 dB  $L_{Aeq}$ . With reference to the derived construction noise criteria, the noise impact from these activities would therefore be negligible.
- 10.9.2 For the main access track upgrades and construction, these activities are closest to the receptor location Knockskae (X:237279, Y:601396), resulting in increased noise levels predicted on a worst-case basis (71 dB  $L_{Aeq}$  for the track construction). These noise levels are likely to represent those which could occur for a very short-term period. Noise levels would quickly diminish as track construction progresses, quickly moving the activity further from the property. Considering the short duration of the work, along with the likelihood of the levels being lower in practice and the construction noise criteria, the associated effects are predicted to result in a temporary minor effect, which is not significant in EIA terms.
- 10.9.3 If blasting is employed to win stone from the proposed borrow pits, there is a potential for this to affect the nearest properties (410 m from Knockskae). These activities are best controlled through a monitoring programme and following the use of good practice during the setting and detonation of charges, as set out in the mitigation section.
- 10.9.4 In addition to on-site activities, construction-related traffic passing to and from the Proposed Development would also represent a potential source of noise to surrounding properties. Based on the prediction methodology in BS 5288, the worst-case predicted noise level, due to heavy vehicles moving on the site access track, at the closest dwelling is 48 dB  $L_{Aeq}$ . This corresponds to a negligible impact. The effect of traffic on existing roads was assessed using the CRTN methodology, with a maximum predicted increase of 0.6 dB(A) in the day-time average noise level. Based on the criteria set out in the DMRB, this predicted short-term change in traffic noise levels corresponds to a negligible impact. For those roads with low traffic flows (less than 100 vehicles per day), the CRTN methodology cannot be directly applied, however based on the predicted noise levels that CRTN suggests for the lowest flow value, it can be deduced that noise related to construction vehicles would be below 60 dB  $L_{Aeq}$  and would correspond to a temporary minor effect at most. In

conclusion, noise from construction activities has been assessed and is predicted to result in a temporary minor effect, which is not significant in EIA terms.

### **Operation**

- 10.9.5 The predictions of operational noise for the Proposed Development in isolation at the noise sensitive locations are detailed in Table 7 of Technical Appendix 10.1. These vary between 19 to 23 dB(A) at low wind speeds and 31 to 35 dB(A) at high wind speeds. Similarly, tabular values of predicted noise levels are provided for each of the other wind farms included in the cumulative assessment. Cumulative predicted noise levels are shown in Table 12 of Technical Appendix 10.1. The full ETSU-R-97 cumulative assessment accounted for operational noise of the Proposed Development together with the Dersaloch wind farm (operational to the north-east), the Hadyard Hill wind farm (operational to the west), Craiginmoddie wind farm (in planning, to the west) and Carrick wind farm (proposed and adjacent to the south).
- 10.9.6 Predicted cumulative operational noise levels vary between 27 to 31 dB(A) at low wind speeds and 36 to 38 dB(A) at high wind speeds. These predictions are also overlaid on the ETSU-R-97 derived noise limits in the charts of Annex D in Technical Appendix 10.1. The assessment presented within Table 13 and Table 14 of Technical Appendix 10.1 demonstrates that the derived ETSU-R-97 noise limits (Table 3 and Table 4 of Technical Appendix 10.1) are predicted to be achieved in the cumulative case at all wind speeds and all assessment locations, with the smallest margin being 0.2 dB(A).
- 10.9.7 Satisfactory control of cumulative noise immission levels will be achieved through enforcement of the individual consent limits for each of the individual wind farms. Specific noise limits for the Proposed Development are set out in Table E1 and Table E2 of Annex E in Technical Appendix 10.1, with relevant limit values assuming, on a precautionary basis, that the adjacent Carrick Windfarm and Craiginmoddie Wind Farm are also consented, with their own site-specific noise limits (also set out in Annex E of Technical Appendix 10.1). Relevant limits values were determined such that compliance of the Proposed Development with these noise limits would maintain the conclusion of the cumulative assessment and result in cumulative levels which do not exceed the derived ETSU-R-97 noise criteria. Should the adjacent wind farms not be consented then apportioned limits could still be applied to the Proposed Development, but these should be revised accordingly.

### **Decommissioning**

- 10.9.8 Decommissioning is likely to result in less noise than the construction phase of the Proposed Development. The construction phase has been considered to have minor noise effects, therefore decommissioning will, in the worst case, also have minor noise effects, which is not significant in EIA terms.

## **10.10 Additional Mitigation and Enhancement**

- 10.10.1 The selection of the final turbines to be installed at the Proposed Development will be made on the basis of enabling these derived site specific noise limits to be achieved at surrounding properties, including any relevant tonality corrections.
- 10.10.2 Conditions attached to the planning consent should include the requirement that, in the event of a noise complaint, noise levels resulting from the operation of the Proposed Development are measured in order to demonstrate compliance with the noise limits. Such monitoring should be done in full accordance with ETSU-R-97 and current good practice and include penalties for characteristics of the noise (if present).

## **10.11 Residual Effects**

### **Construction & decommissioning**

- 10.11.1 The adoption of the identified mitigation measures would reduce the potential noise and vibration effects during construction (and therefore also decommissioning), restricting noisy activities

occurring outside of the range of hours on which the construction criteria were based. Comparing the predicted noise levels to the typical background noise levels measured for other developments around the Proposed Development suggests that the noisier construction activities could be audible at various times throughout the construction phase. However, based on the considerations presented above, the associated effects would be a negligible to minor temporary adverse impact and therefore not significant.

### **Operation**

- 10.11.2 The basis of the ETSU-R-97 method is to define noise limits thought to offer reasonable protection to residents in areas around wind farm developments. At some locations under some wind conditions and for a certain proportion of the time, the Proposed Development noise may be audible; however, operational noise immission levels do not exceed ETSU-R-97 noise limits, which is the guidance commended by planning policy for the assessment of wind farm noise, and therefore considered not significant in EIA terms.

## **10.12 Summary**

- 10.12.1 Hoare Lea (HL) has undertaken the noise assessment for the construction and operation of the Proposed Development. Noise would be emitted by equipment and vehicles used during construction and operation of the Proposed Development.
- 10.12.2 Construction noise has been assessed by a desk study of a potential construction programme and by assuming the Proposed Development is constructed using standard and common methods. Noise levels have been calculated for receiver locations closest to the areas of work and compared with guideline values. Construction noise, by its very nature, tends to be temporary and highly variable and therefore much less likely to cause adverse effects. Various mitigation methods have been suggested to reduce the effects of construction noise, the most important of these being suggested restrictions of hours of working. It is concluded that noise generated through construction activities will have a minor effect that is not significant in Environmental Impact Assessment (EIA) terms. Decommissioning is likely to result in less noise than the construction phase of the Proposed Development, therefore decommissioning will, in the worst case, also have minor noise effects in EIA terms which are not significant.
- 10.12.3 Operational turbines emit noise from the rotating blades as they pass through the air. This noise can sometimes be described as having a regular 'swish'. The amount of noise emitted tends to vary depending on the wind speed. When there is little wind the turbine rotors will turn slowly and produce lower noise levels than during high winds when the turbine reaches its maximum output and maximum rotational speed. Background noise levels at nearby properties will also change with wind speed, increasing in level as wind speeds rise due to wind in trees and around buildings, etc.
- 10.12.4 Noise levels from operation of the turbines have been predicted for those locations around the Proposed Development most likely to be affected by noise. Noise surveys for the previous Linfairn Wind Farm application have already sufficiently established existing baseline noise levels at a number of these properties. Noise limits have been derived from data about the existing noise environment following the method stipulated in national planning guidance. Predicted noise levels take full account of the potential combined effect of the wind turbine noise from the Proposed Development along with Dersalloch wind farm (operational), Hadyard Hill wind farm (operational), Craiginmoddie wind farm (in planning), and Carrick wind farm (Scoping) Other, more distant wind farms were not considered as they do not make an acoustically relevant contribution to cumulative noise levels.
- 10.12.5 Predicted operational noise levels have been compared to the limit values to demonstrate that turbines of the type and size which would be installed can operate within the limits so derived. It is concluded therefore that operational noise levels from the turbines are considered not significant in EIA terms.
- 10.12.6 The Proposed Development would also include a substation and an energy storage facility, which would emit some noise during operation. Based on experience of similar installations and

professional judgement, in conjunction with the large separation distances to the nearest receptor locations, the associated levels of operational noise would be negligible and are considered not significant in EIA terms.

**Table 10.2 – Summary of Effects**

Description of Effect	Significance of Potential Effect		Mitigation Measure	Significance of Residual Effect	
	Significance	Beneficial/ Adverse		Significance	Beneficial/Adverse
Noise from construction and decommissioning	Not significant	Adverse	Production and implementation of a CEMP and traffic management plan	Not significant	Adverse
Cumulative noise from operation of all wind turbines	Not significant	Adverse	None proposed	Not significant	Adverse
Noise from operation of the substation and energy storage facility	Not significant	Adverse	Specification of facilities such that noise limits are met at NSRs	Not significant	Adverse

## 10.13 References

Scottish Planning Policy (SPP), Scottish Government, 2014.

Planning Advice Note 1/2011: Planning & Noise, Scottish Government, March 2011.

Scottish Government, Onshore Wind Turbines: Planning Advice  
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PAN1/2011 Technical Advice Note – Assessment of Noise, Scottish Government, March 2011.

Control of Pollution Act, Part III, HMSO, 1974.

BS 5228: 1997 Noise and Vibration Control on Construction and Open Sites, Parts 1 to 4.

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