

# 11 NOISE AND VIBRATION

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## 11.1 Introduction

- 11.1.1 This chapter summarises the assessment of the potential noise effects of the Proposed Development on the residents of nearby dwellings. Full details of the noise assessment can be found in the Hoare Lea Technical Report, included as **Appendix 11.1**. The assessment considers the Proposed Development's construction, its operation and decommissioning.
- 11.1.2 Assessment of the operational noise effects accounts for the cumulative effect of the Proposed Development as well as the proposed Strath Tirry Wind Farm. Other, more distant wind farms were not considered because their potential noise contribution was considered negligible.

## 11.2 Scope and Methodology

### Scope

- 11.2.1 Noise and vibration which arises from the construction of a wind farm is a factor which should be taken into account when considering the total effect of the Proposed Development. However, in assessing the effects of construction noise, it is accepted that the associated works are of a temporary nature. The main work locations for construction of the proposed turbines are distant from the nearest noise sensitive residences and are unlikely to cause significant effects. The construction and use of access tracks and some of the required infrastructure would, however, occur at lesser separation distances. Assessment of the temporary effects of construction noise is primarily aimed at understanding the need for dedicated management measures and, if so, the types of measures that are required. Further details of construction traffic routes and proposed working hours are described in **Chapter 2: Proposed Development**.
- 11.2.2 Once constructed and operating, wind turbines may emit two types of noise: aerodynamic noise from the blades, and mechanical noise from other components (which is easier to minimise by good engineering design). Aerodynamic noise tends to be perceived when the wind speeds are low, although at very low wind speeds the blades do not rotate or rotate very slowly and so, at these wind speeds, negligible aerodynamic noise is generated. In higher winds, aerodynamic noise is generally masked by the normal sound of wind blowing through trees and around buildings. The level of this natural 'masking' noise relative to the level of wind turbine noise determines the subjective audibility of the wind farm. The relationship between wind turbine noise and the naturally occurring masking noise at residential dwellings around the site will therefore generally form the basis of the assessment of the levels of noise against accepted standards.
- 11.2.3 The Proposed Development will also include a substation and battery storage facility which will emit some noise during operation.
- 11.2.4 The following effects have been assessed in full:
- the potential effect of noise and vibration during construction and decommissioning of the Proposed Development (including construction traffic noise and potential cumulative effects); and

- the potential effect of noise during operation of the Proposed Development, including cumulative effects.

11.2.5 On the basis of the desk-based work undertaken, the professional judgement of the EIA team, experience from other relevant projects and policy guidance or standards, the following effects have been ‘scoped out’:

- The results of previous research detailed in Annex A of **Appendix 11.1** has demonstrated that vibration resulting from the operation of wind farms is imperceptible at typical separation distances. Therefore, vibration effects during operation do not warrant detailed assessment and have not been considered further as part of this chapter.

### Data Sources

11.2.6 The following data sources have informed the assessment:

- Ordnance Survey (OS) information concerning the locations of all noise sensitive receptors in the vicinity of the site;
- British Standard (BS) reference material for the sound emission characteristics of various construction activities associated with Proposed Development;
- manufacturer data for the candidate and proposed neighbouring turbines considered, as set out in **Appendix 11.1**; and
- EIA Report for the proposed Strath Tirry Wind Farm considered in the cumulative assessment.

### Study Area

11.2.7 The study area for the assessment of operational noise comprises noise-sensitive residential properties nearest to the proposed turbines, located at approximate distances of up to 3 km from the turbines of the Proposed Development. The cumulative assessment also considers residential properties closer to the proposed Strath Tirry Wind Farm (see **Figure 6.1.6** showing the location of the latter project).

11.2.8 The assessment of construction noise has considered the same residential properties as the operational assessment, as well as dwellings located alongside the construction traffic route.

### Assessment Methods

#### *Methodology for Assessing Construction Noise Impacts*

11.2.9 Detailed guidance on construction noise and its control is provided by British Standard<sup>123</sup> BS 5228-1: 2009. 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 to the Proposed Development, and construction activities at fixed locations including the bases of turbines, temporary construction compounds, and the substation. The construction noise assessment has

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<sup>123</sup> British Standard BS 5228-1:2009-A:2014 (2009). ‘Code of practice for noise and vibration control on construction and open sites – Part 1: Noise’

been based on indicative data for the types of plant likely to be used during the construction works, as presented in BS 5228-1.

- 11.2.10 Changes in the predicted traffic noise level on existing roads were calculated using the Calculation of Road Traffic Noise (CRTN)<sup>124</sup> methodology.
- 11.2.11 When considering the potential for blasting to be employed at the proposed borrow pits, reference can be made to the guidance of Planning Advice Note<sup>125</sup> PAN50, which considers 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<sup>126</sup> 5228-2 also provide guidance relating to surface mineral extraction including the assessment of noise and vibration effects associated with quarry blasting. 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 (see **Appendix 11.1**).
- 11.2.12 Based on the range of guidance values set out in BS 5228-1 Annex E, and other relevant guidance (including consultation responses from THC set out below), the significance criteria presented in **Table 11.1** have been derived. The values have been chosen in recognition of the relatively low ambient noise typically observed in rural environments. The presented criteria have been normalised to free-field day-time noise levels occurring over a time period, T, equal to the duration of a working day on site. Specifically, the criteria relate to day-time hours from 07:00 to 19:00 on weekdays, and 07:00 to 13:00 on Saturdays and that construction working is limited to these times.

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<sup>124</sup> Department of Transport (1988). 'Calculation of Road Traffic Noise'.

<sup>125</sup> The Scottish Office (1996). 'Planning Advice Note 50: Controlling the Environmental Effects of Surface Mineral Workings'

<sup>126</sup> British Standard BS 5228-2:2009-A:2014 (2009). 'Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration'.

**Table 11.1 Significance Criteria for Construction Noise**

Impact Significance	Definition
<b>Major</b>	Construction noise is generally greater than 75 dB $L_{Aeq,T}$ during the construction period, or with periods of more than 85 dB $L_{Aeq,T}$ lasting not more than 4 weeks in any 12 month period.
<b>Moderate</b>	Construction noise is generally less than or equal to 75 dB $L_{Aeq,T}$ during the construction period, with periods of up to 85 dB $L_{Aeq,T}$ lasting not more than 4 weeks in any 12 month period.
<b>Slight</b>	Construction noise is generally less than or equal to 65 dB $L_{Aeq,T}$ during the construction period, with periods of up to 75 dB $L_{Aeq,T}$ lasting not more than 4 weeks in any 12 month period.
<b>Negligible</b>	Construction noise is generally less than or equal to 55dB $L_{Aeq,T}$ , with periods of up to 65 dB $L_{Aeq,T}$ lasting not more than 4 weeks in any 12 month period.

11.2.13 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)<sup>127</sup>. A classification of magnitudes of changes in the predicted traffic noise level for short-term changes, such as those associated with construction activities, is set out in **Table 11.2**. This classification can be considered in addition to the criteria of **Table 11.1**.

**Table 11.2- Significance Criteria for Changes in Traffic Noise Associated with Construction Traffic**

Impact Significance	Definition
<b>Major</b>	More than 5 dB
<b>Moderate</b>	3 to 5 dB
<b>Slight</b>	1 to 3 dB
<b>Negligible</b>	Less than 1 dB

11.2.14 BS 5228-2 provides general guidance on legislation, prediction, control and assessment criteria for construction vibration. 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, see below). Occasional momentary vibration can arise when heavy vehicles pass dwellings at very short separation distances, as is the case with the existing traffic in the area, but again this is not sufficient to constitute a risk of significant effects in this instance. On this basis, construction vibration effects are not considered further in this chapter.

<sup>127</sup> The Highways Agency, Transport Scotland, Transport Wales and The Department for Regional Development (Northern Ireland) (2020). 'Design Manual for Roads and Bridges, LA 111 Noise and vibration', revision 2.

*Methodology for Assessing Operational Noise Impacts*

- 11.2.15 The assessment of operational noise impacts has been carried out in accordance with the methodology set out in ETSU-R-97, which is described in more detail in Appendix 11.1.
- 11.2.16 Technical guidance on current good practice in the application of the ETSU-R-97 methodology<sup>128</sup>, as described in the Institute of Acoustics (IOA) Good Practice Guide (GPG, 2013)<sup>129</sup> has also been referenced, as is recommended in the Scottish Government's Online Renewables Planning Advice on Onshore wind turbines<sup>130</sup>.
- 11.2.17 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;
  - identify the locations of the nearest, or most noise sensitive, neighbours;
  - determine the background noise levels as a function of site wind speed at the nearest neighbours, or at least at a representative sample of the nearest neighbours, either through direct measurement or by reference to data already obtained during previous surveys in the area;
  - determine the day-time and night-time noise limits from the measured background noise levels at the nearest neighbours;
  - specify the type and noise emission characteristics of the wind turbines;
  - calculate noise immission levels from the operation of the turbines associated with the proposed wind farm as well as the contribution to cumulative noise immission levels from other nearby wind farms as a function of site wind speed at the nearest neighbours; and
  - compare the calculated wind farm noise immission<sup>131</sup> levels with the derived noise limits and assess in the light of planning requirements in consultation with the local planning authority.
- 11.2.18 Full details of the operational noise assessment, including details of the noise output of the candidate turbine for this scheme and the calculation parameters on which predictions have been based, can be found in **Appendix 11.1**.
- 11.2.19 The acceptable limits for wind turbine operational noise are clearly defined in ETSU-R-97. Consequently, the test applied to operational noise is whether or not the calculated wind farm noise immission levels (cumulative from all wind turbines) at nearby noise sensitive properties lie below the noise limits derived in accordance with ETSU-R-97. The assessment will therefore need 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.

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<sup>128</sup> ETSU-R-97, the Assessment and Rating of Noise from Wind Farms, Final ETSU-R-97 Report for the Department of Trade & Industry. The Working Group on Noise from Wind Turbines, 1996.

<sup>129</sup> M. Cand et al (2013). 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise'. Institute of Acoustics.

<sup>130</sup> Scottish Government (2014). Onshore Wind Turbines: Planning Advice. <https://www.gov.scot/publications/onshore-wind-turbines-planning-advice/>

<sup>131</sup> 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 a wind farm.

- 11.2.20 In summary, ETSU-R-97 noise limits are defined in relation to measured background noise levels during quiet periods and their variation with wind speeds:
- For day-time periods, the limit is either a fixed level between 35 and 40 dB(A), or 5dB above the derived background noise level, whichever is the higher; and
  - For night-time periods, the limit is either a fixed level of 43 dB(A), or 5dB above the derived background noise level, whichever is the higher.
- 11.2.21 For day-time periods, the precise choice of fixed limit within the range 35 dB(A) to 40 dB(A) according to ETSU-R-97 depends on a number of factors: the number of noise-affected properties, the likely duration and level of exposure and the consequences of the choice on the potential power generating capability of the wind farm. During the consultation, The Highland Council (THC) have highlighted that they have a preference for this lower limit to be set at 35 dB(A), the lowest end of the range of 35 to 40 dB(A) prescribed in ETSU-R-97. This topic is discussed in paragraph 11.5.4. For night-time periods, THC have suggested that a fixed level of 38 dB(A) should be used instead of 43 dB(A) set out in ETSU-R-97.
- 11.2.22 Where a property occupier has a financial involvement in the wind farm development, the lower fixed portion of the noise limit at that property may be increased to 45 dB(A) during both the day-time and the night-time periods.
- 11.2.23 ETSU-R-97 also offers an alternative simplified assessment methodology: if predicted noise levels do not exceed 35 dB(A) up to a wind speed of 10 m/s, then they are considered acceptable and background noise surveys are not considered necessary.

*Low Frequency Noise, Vibration and Amplitude Modulation*

- 11.2.24 Low-frequency noise and vibration resulting from the operation of wind farms are all issues that have been discussed in detail over the past 20 years, as detailed in Annex A of **Appendix 11.1**. In summary of the information provided therein, the current recommendation is that ETSU-R-97 should continue to be used for the assessment and rating of operational noise from wind farms.
- 11.2.25 Annex A of **Appendix 11.1** also discusses the most recently published research on the subject of wind turbine blade swish or Amplitude Modulation (or AM). The IOA has recently published an objective technique developed for quantifying AM noise. The UK Government also commissioned a review on subjective responses to AM noise which outlines considerations for the control of this feature based on the IOA methodology. The Scottish Government is currently reviewing this recommendation in the context of the Scottish planning system.

*Statement of Significance*

- 11.2.26 Major or moderate construction impacts are considered '**significant**' in the context of the EIA Regulations.
- 11.2.27 If predicted cumulative noise levels are within the ETSU-R-97 derived noise limits, operational noise is considered acceptable, and therefore **not significant** in EIA terms. If predicted noise levels are above the ETSU-R-97 noise limits, operational noise is considered unacceptable and **significant** in EIA terms.

## Noise Predictions

- 11.2.28 The predictions of construction noise were made using the methodology of BS 5228 and representative emission levels based on the types and number of equipment typically associated with key phases of constructing a wind farm and precautionary assumptions about working practices and propagation (see **Appendix 11.1**).
- 11.2.29 The level of construction noise that occurs at the surrounding properties would be highly dependent on a number of factors such as the final construction 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 the construction. The types and number of equipment usually associated with the key phases of constructing a wind farm have been based on experience of similar sites. The conservative assumptions made would likely offset the uncertainty in the exact details of the construction activities.
- 11.2.30 For operational noise, 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 turbine model has been assumed for the operational noise assessment. Specifically, the operational noise assessment is based upon the noise specification of the Nordex N163 wind turbine. 16 turbines have been modelled using the layout as indicated on **Figure 11.1**.
- 11.2.31 Assessment of the operational noise effects accounts for the cumulative effect of the Proposed Development as well as the proposed Strath Tirry Wind Farm. Other, more distant wind farms were not considered because their potential noise contribution was considered negligible.
- 11.2.32 In all cases, the assumptions made on noise emission levels and the prediction methodology used are in accordance with the IOA GPG (see **Appendix 11.1**).

## Field Survey

- 11.2.33 A survey was undertaken at one noise monitoring location, to help characterise the baseline background noise environment around the site. This location, Dalnessie<sup>132</sup> (easting/northing 263026 / 915249), was identified as the only noise-sensitive location in sufficient proximity of the site and selected in consultation with THC. The assessment of operational noise from the Proposed Development would also be undertaken at Dalnessie.
- 11.2.34 The background noise monitoring exercise was conducted in April and May 2021, over a period of four weeks, with full details in **Appendix 11.1**. The data were measured and analysed in accordance with the guidance of the IOA GPG.
- 11.2.35 The measured noise levels were related to standardised ten metre height wind speeds, derived from measurements extrapolated to a height of 125 m, which was considered to be representative of the highest hub height which could be used at the site, in accordance

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<sup>132</sup> The location denoted as Dalnessie on Ordnance Survey mapping and in the present chapter includes two dwellings, Dalnessie Lodge and Estate Manager's Cottage.

with the preferred methodology of the IOA GPG, with full details provided in Annex F of **Appendix 11.1**.

## 11.3 Consultation Undertaken

- 11.3.1 Prior to undertaking the background survey, and as recommended in the THC scoping response, the survey approach was discussed with THC representatives. The proposed monitoring at Dalnessie and a summary of the proposed assessment approach was forwarded to the Environmental Health Department of THC for comment, and the proposed location was agreed to be representative for the purpose of an ETSU-R-97 assessment.
- 11.3.2 In response to the initial scoping request, THC also expressed several requirements, including in particular a preference for more stringent noise limits than the general recommendations of ETSU-R-97, as set out above in **section 11.2**. These more stringent noise limits have been adopted in the present assessment.
- 11.3.3 A summary of the consultation undertaken is set out in **Table 11.3**.

**Table 11.3 Summary of Consultation**

Consultee and consultation type	Response Received	Action taken
THC, scoping response	<p>THC required a detailed operational noise assessment in line with ETSU-R-97 and the IOA GPG.</p> <p>More stringent noise limits than those set out in ETSU-R-97 were recommended (see <b>11.2.21</b>).</p> <p>THC also set out detailed requirements in relation to the information required and approach to the assessment of cumulative noise levels.</p> <p>THC recommended that background noise survey locations are agreed with the Council's Environmental Health Department.</p> <p>THC also presented advice regarding construction noise and amplitude modulation</p>	<p>The advice received was taken into account in the present chapter and associated technical appendix which presents the required information.</p> <p>The proposed stringent noise limits were adopted in the assessment.</p>
THC, letter to Environmental Health Department dated 25/03/2021	<p>The proposed background noise monitoring location at Dalnessie was considered acceptable.</p> <p>An officer from the Environmental Health Department of THC was invited to site when the equipment was deployed but declined the invitation.</p>	<p>The details of the final installed survey location were provided to THC following installation of the monitoring equipment and no adverse comments received.</p>

## 11.4 Statutory and Planning Context

- 11.4.1 Scottish Planning Policy (SPP, 2014)<sup>133</sup> provides advice on how the planning system should manage the process of encouraging, approving and implementing renewable energy proposals including onshore wind farms.
- 11.4.2 Planning Advice Note PAN1/2011 (2011)<sup>134</sup> 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.
- 11.4.3 The Scottish Government's online guidance ('Onshore wind turbines: planning advice', 2014), referenced in PAN1/2011, provides further advice on noise, and confirms that the recommendations of 'The Assessment and Rating of Noise from Wind Farms' (ETSU-R-97) *"should be followed by applicants and consultees, and used by planning authorities to assess and rate noise from wind energy developments"*.
- 11.4.4 Guidance on good practice on the application of ETSU-R-97 has been provided in 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"*.
- 11.4.5 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)<sup>135</sup>.
- 11.4.6 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.
- 11.4.7 The Highland-wide Local Development Plan (April 2012) includes policy 67 (Renewable Energy Developments), which explains that THC will support a proposal if it is satisfied that they will not be significantly detrimental, either in isolation or cumulatively, with regards to a number of effects which include noise on occupied residential buildings.
- 11.4.8 THC's Onshore Wind Energy Supplementary Guidance (Nov 2016) makes reference to the ETSU-R-97 guidance but notes (as discussed above) that the Council will seek to achieve noise limits at the lower end of the range associated in this national guidance and encourages early engagement with THC. It advises that consideration of cumulative impacts should have regard to current best practice.

## 11.5 Existing Environment

- 11.5.1 The baseline noise environment at the survey location at Dalnessie was typically dominated by 'natural' noise sources such as wind disturbed vegetation, with little noise from human activities. Therefore, the measured baseline noise levels are considered

<sup>133</sup> Scottish Government (2014). 'Scottish Planning Policy (SPP)'

<sup>134</sup> Scottish Government (2011). Planning Advice Note 1/2011: Planning & Noise.

<sup>135</sup> UK Government (1974). 'Control of Pollution Act, Part III'.

consistent with those that would be expected in a rural environment. There was no influence from existing operating wind farms at this location, in accordance with ETSU-R-97 requirements.

11.5.2 Existing noise conditions at the survey location as a function of site wind speeds, during quiet periods, are represented in Charts E1 and E2 of Annex E in **Appendix 11.1**. These measured baseline noise levels satisfy the requirements of ETSU-R-97 and the IOA GPG. The background levels at the measurement location typically varied, during quiet day-time periods, between 25 to 35 dB  $L_{A90,10min}$  at low wind speeds (up to 5 m/s) and 30-45 dB  $L_{A90,10min}$  at the highest wind speeds in the range of up to 12 m/s considered under ETSU-R-97. For night-time periods, a similar range of levels was generally observed between low and high wind speeds.

### Noise Limits

11.5.3 ETSU-R-97 noise limits were determined on the basis of these background levels at all properties: this results in the limits set out in **Tables 4 and 5 of Appendix 11.1**. For the avoidance of doubt, these limits have been derived as follows:

- the ETSU-R-97 daytime limit of 35 dB(A), or 5 dB above the prevailing background noise level, whichever is the higher; and
- the minimum ETSU-R-97 night-time fixed lower limit of 38 or 43 dB(A), or 5 dB above the prevailing background noise level, whichever is the higher.

11.5.4 The derivation of the 35 dB(A) fixed limit for day-time periods, based on the criteria specified in ETSU-R-97, is considered in detail in **section 5.7 of Appendix 11.1**. The factors considered include the very low number of dwellings potentially affected relative to the scale of the Proposed Development, the limited duration/level of exposure of turbine noise above baseline noise levels (given that Dalnessie would be upwind of the proposed turbines under prevailing south-westerly winds). This means that it would be considered wholly appropriate to set the limit towards the middle of the range of 35 to 40 dB(A) specified in ETSU-R-97. Nonetheless, a limit at the lowest end of the range (35 dB(A)) was selected in line with THC preferences, which represents a conservative assessment of operational noise.

11.5.5 The resulting limits are also set out in **Table 11.4** below.

**Table 11.4 – Derived Noise Limits ( $L_{A90}$ , dB) at Dalnessie**

Noise limit	Standardised Wind Speed (m/s)								
	4	5	6	7	8	9	10	11	12
Day-time	35.0	35.0	35.9	37.8	40.0	42.3	44.8	47.5	47.5
Night-time (ETSU-R-97)	43.0	43.0	43.0	43.0	43.0	43.0	45.3	48.6	48.6
Night-time (THC preference)	38.0	38.0	38.0	38.0	39.5	42.2	45.3	48.6	48.6

## 11.6 Predicted Impacts

### Construction Impacts

- 11.6.1 Predicted noise levels at the closest noise sensitive receptor for each of the key activities during construction of the Proposed Development are presented in **Table 5** of **Appendix 11.1**.
- 11.6.2 The proposed construction activities within the Proposed Development site and around the turbines would occur at relatively large distances from nearby residential properties, such that the resulting predicted noise levels would not exceed 55 dB  $L_{Aeq}$ . With reference to the derived criteria of **Table 11.1**, the noise effects from these activities would therefore be negligible.
- 11.6.3 For the activities closest to Dalnessie, track upgrade and construction of the mobilisation compounds, predicted noise levels of up to 66 to 71 dB are assessed, but this would represent a very short-term period when activity is closest to the receptor (less than 4 weeks). Noise levels will quickly diminish as track upgrade works progresses, moving the activity further from the property. The short-term nature of these activities consequently categorises the effects to be of minor significance according to **Table 11.1**.
- 11.6.4 If blasting is employed to quarry the borrow pit (BP1) nearest to Dalnessie (see **Figure 2.2**), there is a potential for this to affect the property. 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 earlier in this Chapter and in the proposed mitigation (see **11.7.4**). For the other borrow pit search area (BP2) identified, given the separation with Dalnessie of at least 2 km, it is very unlikely that these activities would cause unacceptable adverse effects, and therefore no specific mitigation is considered to be required for these activities.
- 11.6.5 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. 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 53 dB  $L_{Aeq}$ . This corresponds to a **negligible** impact.
- 11.6.6 The effect of traffic on existing roads was assessed using the CRTN methodology, where possible, with a maximum predicted increase of 1 to 2 dB(A) in the day-time average noise level for most of the roads considered. Based on the criteria set out in the DMRB, this predicted short-term change in traffic noise levels corresponds to a negligible to minor impact. For some of the roads considered, the relative increase in traffic during some phases of the construction will be larger; however, the overall traffic volumes remain low (even based on worst-case assumptions) such that overall noise levels at properties along these roads would not exceed 65 dB  $L_{Aeq}$ , corresponding to a **minor** impact at most.
- 11.6.7 In conclusion, noise from construction activities has been assessed and is predicted to result in a temporary **negligible to minor** impact on highly sensitive receptors in most cases, which represents a slight effect, which is **not significant** in EIA terms.

### Decommission Impacts

- 11.6.8 Decommissioning is likely to result in less noise than during construction of the Proposed Development. The construction phase has been considered to generally have **negligible**

to **minor** noise effects, therefore most decommissioning activities would, in the worst case, also have **minor** noise effects, which is **not significant** in EIA terms. Activities which were potentially associated with significant effects would not be required for the decommissioning phase and so this is not relevant to this assessment.

### Operational Noise

- 11.6.9 The predictions of operational noise at Dalnessie for the Proposed Development in isolation are detailed in **Table 10** of **Appendix 11.1** and are also illustrated on **Figure 11.1**. These varied between 24 dB(A) at low wind speeds to 36 dB(A) at high wind speeds, over the range of 3 to 12 m/s over which predictions were made (in line with ETSU-R-97 guidance).
- 11.6.10 The ETSU-R-97 assessment set out in **Table 11** and **Table 12** of **Appendix 11.1** demonstrates that these predictions comply with the derived noise limits (**Table 11.3** above) at all wind speeds. This conclusion is reached based on a lower day-time limit of 35 dB, and a lower night-time limit of either 38 dB (THC preference) or 43 dB(A) (as per ETSU-R-97).
- 11.6.11 This means that the predicted operational noise levels from the Proposed Development are considered acceptable in line with relevant noise limits set out in ETSU-R-97 and also accounts for the consultation feedback from THC.

### Substation and Battery Storage

- 11.6.12 The main noise sources associated with the onsite grid substation are likely to be the power transformers and the cooling fans. Operational noise associated with any ancillary services such as the battery energy storage facility would arise from ventilation/air conditioning systems, modular inverters and lower-voltage transformers and higher-voltage transformers associated with grid connection (were this not to be shared with the main wind farm substation).
- 11.6.13 Given the large separation distances of more than 1 km between the substation with battery storage area and the nearest residential properties and based on experience of similar installations and professional judgement, the associated levels of operational noise are unlikely to be significant. Therefore, no specific mitigation would be required in this instance.

### Cumulative Effects

- 11.6.14 **Section 5.8** of **Appendix 11.1** considers the potential cumulative operational noise effects with the proposed Strath Tirry Wind Farm (see location on **Figure 6.1.6**). The potential contribution of noise from the proposed Strath Tirry Wind Farm at properties closest to the Proposed Development (and *vice-versa*) would be more than 10 dB below the lowest applicable noise limits which is considered negligible in line with guidance in the IOA GPG.
- 11.6.15 The assessment of noise from onsite construction activities is based on the period when each potential activity would occur closest to each of the nearest noise-sensitive locations. Therefore, onsite construction activities from other sites are considered unlikely to produce any additional noise impacts, even if the construction periods were to coincide, given the conservative nature of this approach.

- 11.6.16 In conclusion, cumulative operational effects in relation to noise can be considered **negligible** and **not significant** in EIA terms.
- 11.6.17 Furthermore, **Appendix 11.1** considers the implication of the cumulative traffic analysis presented in **Chapter 12: Traffic and Transportation**. Even on the worst-case basis set out therein, which is considered unlikely, the associated noise impacts for receptors located alongside the site access route would remain minor as either overall traffic flows levels would remain low, or the relative increase would correspond to an increase of less than 2 dB. On this basis, the associated impacts would remain **minor** at most on highly sensitive receptors and therefore **not significant** in EIA terms.

## 11.7 Mitigation

- 11.7.1 The selection of the final turbine to be installed for the Proposed Development would be made on the basis of enabling the relevant noise limits, as set out in **Table 11.3**, to be achieved at the neighbouring property at Dalnessie, including any relevant tonality corrections.
- 11.7.2 This could be secured through conditions attached to the planning consent, including the requirement that, in the event of a noise complaint, noise levels resulting from the operation of the wind farm are measured in order to demonstrate compliance with the conditioned noise limits. Such monitoring should be done in full accordance with ETSU-R-97.
- 11.7.3 To reduce the potential effects of construction noise, the following mitigation measures are proposed:
- As proposed in **Chapter 2: Proposed Development**, those activities that may give rise to audible noise at the surrounding properties and heavy goods vehicle deliveries to the site would be limited to the hours 07:00 to 19:00 Monday to Friday and 08:00 to 13:00 on Saturdays unless otherwise approved in advance by THC (except in case of an emergency). Those activities that are unlikely to give rise to noise audible at the project area boundary, or light vehicle traffic accessing the site such as that involved with staff mobilisation, may continue outside of the stated hours.
  - All construction activities shall adhere to good practice as set out in BS 5228.
  - All equipment would 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 would be undertaken away from residential properties, set back by the maximum possible distances.
  - A Construction Traffic Management Plan (CTMP) will be developed and secured through planning condition to control the movement of vehicles to and from the Proposed Development site.
  - Construction plant capable of generating high noise and vibration levels would be operated in a manner to restrict the duration of the higher magnitude levels.
- 11.7.4 The potential noise and vibration effects of blasting operations at the borrow pit (BP1) nearest to Dalnessie would be reduced according to the guidance set out in the relevant British Standards and PAN50 Annex D and discussed below:
- Blasting should take place under strictly controlled conditions with the agreement of THC, at regular times within the working week, that is, Mondays to Fridays,

between the hours of 10.00 and 16.00. Blasting on Saturday mornings should be a matter for negotiation between the contractor and the local authorities.

- Vibration levels at the nearest sensitive properties are best controlled through on-site testing processes carried out in consultation with THC. This site testing-based process would 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. The use of onsite monitoring at neighbouring sensitive locations during the course of this preliminary testing can then be used to define upper final charge values. Measured levels should not exceed 6 mm/s for 95% of all blasts measured over any 6-month period, and no individual blast should exceed a PPV of 12 mm/s.
- Blasting operations shall adhere to good practice as set out in BS 5228-2, and in PAN50, Annex D, Paragraph 95 in order to control air overpressure.
- A scheme would be submitted to THC, for approval of blasting details, which would outline the mitigation measures to be adopted.

## 11.8 Summary of Effects

- 11.8.1 The adoption of the identified mitigation measures would reduce the potential noise and vibration effects during construction. In particular, the proposed restriction on some weekend works near Dalnessie reduce the associated worst-case effects to be **minor** at most. The effects associated with construction activities would therefore be **negligible to minor** and temporary, and therefore **not significant** in EIA terms.
- 11.8.2 Decommissioning is likely to result in less noise than during construction of the Proposed Development. Decommissioning would, in the worst-case, have **minor** temporary adverse noise effects which are **not significant** in EIA terms.
- 11.8.3 Operational noise levels from the Proposed Development were predicted to be compliant with noise limits derived in accordance with the ETSU-R-97 guidance. The noise levels were also predicted to be compliant with more stringent alternative noise limits derived in accordance with THC preferences. This could be secured in practice through appropriate planning conditions.
- 11.8.4 The cumulative effects of another proposed wind farm in the area, Strath Tirry, was concluded to be **negligible** and **not significant** in EIA terms.
- 11.8.5 Depending on the levels of background noise, the satisfaction of the ETSU-R-97 derived limits could lead to a situation whereby, at some locations under some wind conditions and for a certain proportion of the time, the wind farm noise may be audible. However, noise levels at the properties in the vicinity of the Proposed Development would still be within levels considered acceptable under the ETSU-R-97 assessment method and therefore **not significant** in EIA terms.

## 11.9 References

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- British Standard BS 5228-2:2009-A:2014 (2009). 'Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration'.
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- UK Government (1974). 'Control of Pollution Act, Part III'.