Craiginmoddie Wind Farm

Environmental Impact Assessment Report
Chapter 10: Noise

December 2020

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FIGURES

10 NOISE

Introduction and Overview

10.1 This chapter considers the likely significant environmental effects in terms of noise of the Proposed Development at noise sensitive receptors (NSRs). The NSRs in the area are all homes. Noise can have an effect on the environment and on the quality of life enjoyed by individuals and communities. This chapter provides details on the assessment methodology; the baseline conditions currently existing at the Site and surroundings; the likely noise effects during the construction, operation and decommissioning phases of the Proposed Development; the mitigation measures required to prevent, reduce or offset any significant adverse effects; and the likely residual effects after these measures have been employed.

10.2 The primary author of this chapter is Dave McLaughlin, Principal Consultant in Wood's Vibration, Dynamics and Noise team, who has 13 years' experience in wind farm noise assessment, including serving on three BSI committees, and 22 years previous experience in other areas of noise and vibration.

Legislation, Policy and Guidance

10.3 An overview of key guidance with respect to noise is outlined below, and further details of legislation, policy and guidance specifically for construction and operational noise are set out in following sections.

10.4 The Scottish Government's planning guidance in respect of noise is set out in Planning Advice Note (PAN) 1/2011 (SG, 2011), which states:

> *'The preparation and consideration of planning applications that raise significant noise issues can be greatly assisted by a Noise Impact Assessment (NIA). Planning authorities can require a NIA either as part of an Environmental Impact Assessment or separately'(PAN 1/2011, Paragraph 19).*

10.5 Paragraph 169 of the Scottish Planning Policy (SPP) sets out a number of considerations to be taken into account including impacts on communities and individual dwellings from noise.

10.6 South Ayrshire Council (herein referred to as SAC) Local Development Plan 2014 (SAC, 2014) contains a number of policies of relevance to the consideration of noise:

- LDP policy: air, noise and light pollution
- LDP policy: minerals and aggregates
- LDP policy: wind energy

10.7 SAC Supplementary Guidance: Wind Energy 2015 (SAC, 2015) provides further guidance on noise, whileSAC Wind Turbine Development Planning Submission Guidance Note (SAC) includes guidance on noise limits.

10.8 Construction noise has been assessed in accordance with British Standard 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise (BSI, 2014), with a noise propagation model more appropriate to longer ranges.

10.9 Noise propagation has been modelled in accordance with International Standard ISO 9613-2: 1996 Acoustics – Attenuation of Sound Propagation Outdoors – Part 2: General Method of Calculation (ISO, 1996).

10.10 The effect of operational noise has been assessed in accordance with ETSU-R-97 (ETSU, 1996), taking cognisance of the most recent good practice guide (GPG) of the Institute of Acoustics (IOA, 2013), and Supplementary Guidance Notes (IOA, 2013-2014).

Stakeholder Consultation

10.11 The scoping responses relating to noise are summarised in Table 10.1 below.

Table 10.1: Consultation responses relating to noise

Organisation	Summary of relevant response	Comment
Accon UK Environmental Consultants on behalf of South Ayrshire Council	In line with Scottish Government policy, the Scoping Opinion (ECU, 2020) quotes advice stating that the operational noise assessment should follow the requirements of ETSU-R-97 and take account of 'A Good Practice Guidance to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise' (IOA GPG) published by the IOA. The assessment should also take account of 'Wind Turbine Development: Submission Guidance Note' (SGN) issued by South Ayrshire Council Environmental Health. The Scoping Report comments that there are a number of existing operational, consented and proposed wind farms in the vicinity of the development that will need to be considered as part of a cumulative assessment of wind turbine noise and proposes that only other wind farms that make 'a significant (>1dB) contribution need to be assessed in terms of cumulative noise impact'. This is at slight variance with the IOA GPG which advises that if predicted noise levels of another wind farm are within 10 dB of the predicted level of the proposed wind farm, then the other wind farm should be included in the cumulative assessment. It is therefore recommended that the noise assessment should follow the IOA GPG guidance on this matter. ACCON also note that the noise section of the Scoping Report has not at this stage identified the likely other existing operational, consented and proposed wind farms to be considered in the cumulative assessment.	The cumulative noise assessment is provided in Tables 10.15 and 10.16.
	At paragraph 5.160 noise limits applying to night-time and quiet daytime are discussed. The applicants should note that ETSU-R-97 methodology requires background noise survey data to be used to derive daytime noise limits. However, the noise limits derived in this way are subsequently applied in planning conditions to the usual daytime period of 07:00 to 23:00, not just the quiet daytime periods defined in ETSU-R-97.	The noise limits are discussed in paragraphs 10.24 to 10.37.
	The applicants should note that the planning consent for the Hadyard Hill wind farm includes a daytime noise limit of 38 dB L_{A90} for properties without a financial involvement in the wind farm. This daytime noise limit has subsequently been interpreted as a fixed minimum limit. That is, daytime noise levels are limited to 38 dB L_{A90} or the background noise level plus 5 dB, whichever is the higher. When the Hadyard Hill Extension wind farm was under consideration, this noise limit was adopted as a cumulative daytime noise limit. Taking the same approach to the cumulative noise limits for the Craiginmoddie wind farm would be recommended in order to protect the amenity of residents living nearby.	The noise limits are discussed in paragraphs 10.24 to 10.37.
	It is expected that noise measurement surveys will be necessary to obtain background noise levels for the wind turbine noise assessment. The applicant's acoustic consultants should consult with SAC on the proposed noise monitoring locations. In place of contacting the Environmental Health team, the Council's preferred approach for this is to submit proposals for noise monitoring to the	The background noise measurements have been taken from the Hadyard Hill Extension Environmental Statement (SSE,

Organisation	Summary of relevant response	Comment
	Planning Officer so that the Council's consultants (ACCON) can advise on the suitability of the proposals. It is likely that directional filtering of noise monitoring data will be required when processing noise survey data given the proximity of other wind farms, in particular Hadyard Hill.	2015). The Proposed Development is significantly smaller than the Hadyard Hill Extension and the receptors and measurement locations are considered to be representative. A limited set of attended measurements from a site visit on 12th November 2020 demonstrate that the earlier noise monitoring data for Hadyard Hill Extension remains valid. Further details are provided in the 'Baseline Conditions' section below. This approach has been discussed with the South Ayrshire Council Environmental Health Officer who noted it would require to be justified in the chapter.
	Noise from operational road traffic is considered unlikely to result in any significant effects according to the Scoping Report. ACCON agree with this point and consider that a detailed assessment of this aspect can be scoped out of the noise assessment.	The operational noise from road traffic has been scoped out of the EIAR.
	The Scoping Report identifies correctly that noise from the construction of the proposed development should be considered utilising the guidance in BS 5228 'Code of practice for noise and vibration control on construction and open sites. ACCON advise that should the proposals include blasting for borrow pits, the potential effects of vibration and air over-pressure from these operations would need to be addressed.	The construction noise assessment is detailed in paragraphs 10.38 to 10.57.

Assessment Methodology & Significance Criteria

Construction Phase

10.12 Construction noise effects are normally of a temporary nature and result from both moving and static sources. Assessment allows the temporary impact of construction noise to be understood and for suitable mitigation measures to be identified to minimise any potential adverse effects.

10.13 Time-dependent construction noise limits are derived based on Table E.1 within BS 5228-1.

10.14 Likely construction machinery is identified with Annex C of BS 5228-1. The activity is analysed to determine the percentage of the construction time that it is being used for and how many are in use. Using this information, a total equivalent noise level is calculated. The dispersion of this total noise level is then modelled, accounting for distance and ground absorption, with the overall levels compared with the planning limits.

Criteria

10.15 Construction noise is assessed using the ABC method detailed in BS 5228-1, where receptors are categorised as A, B or C as shown in Table 10.2 and following paragraphs.

Table 10.2: Construction Noise Level Limits at Noise Sensitive Receptors

Assessment category and threshold value	**Threshold value, LA,eq (dB)**		
Period	**Category A**	**Category B**	**Category C**
Night-time	45	50	55
Evenings and weekends	55	60	65
Daytime	65	70	75

10.16 Night-time is considered to be between 23:00 and 07:00. Evenings and weekends are considered to be 19:00 – 23:00 on weekdays, 13:00 – 23:00 on Saturdays and 07:00 – 23:00 on Sundays. Daytime is considered to be 07:00 – 19:00 on weekdays and s 07:00 – 13:00 on Saturdays.

10.17 At this stage it is proposed that construction activities on Site would only take place between the hours of 07:00 to 18:00 on Monday to Friday inclusive and 07:00 to 13:00 hours on Saturday, with no construction works on Sundays or Bank Holidays. However, it should be noted that outside of these hours, there may be a requirement to take advantage of low wind speeds for the erection of turbines. In addition, turbine erection works cannot suddenly cease – in the event of a delay or complication it may be necessary to continue works beyond normal hours until they can end safely. Other activities that may take place outside these hours are limited to emergency works and dust suppression.

10.18 The NSR is defined as Category A if the ambient noise levels (rounded to the nearest 5 dB) are less than those stated for category A (refer to Table 10.2).

10.19 The NSR is defined as Category B if the ambient noise levels (rounded to the nearest 5 dB) are equal to those stated for category A (refer to Table 10.2).

10.20 The NSR is defined as Category C if the ambient noise levels (rounded to the nearest 5 dB) are greater than those stated for category A (refer to Table 10.2).

Significance Criteria

10.21 There are no formal significance criteria for assessing operational noise from wind farms. However, for the purposes of this assessment the noise impact is considered to be not significant if the limits prescribed here are met and significant if breaches of these limits are predicted.

10.22 Construction noise is assessed against an adopted daytime criterion of 65dB and the impact is therefore judged to be not significant if this criterion is met.

Operational Phase

10.23 When operational, turbines emit two types of noise – mechanical noise and aerodynamic noise. The main sources of mechanical noise are from internal components housed within the nacelle, such as gearbox and generator. Mechanical noise from a modern turbine is negligible as designs are highly refined. Aerodynamic noise occurs from the movement of the blades passing through the air. At high wind speeds, that aerodynamic noise is usually masked by the increasing sound of wind blowing through trees and around buildings, and turbulent noise within the air itself. The level of masking determines the perceived audibility of the wind farm. The noise impact assessment establishes the relationship between turbine noise and the natural masking noise and assesses levels against established standards.

10.24 ETSU-R-97 (ETSU, 1996) limits operational noise in daytime and night-time to the levels set out in Table 10.3**Error! Reference source not found.**. ETSU-R-97 also recommends a simplified procedure to be applied in situations where the noise at receptors is predicted to be below 35 dB(A), in which background noise measurements are unnecessary.

Table 10.3: Operational Noise Level Limits at Noise Sensitive Receptors

Period	L_{Aeq} (dB)	Or
Day (07:00 – 23:00)	A value in the range 35 -40	Background + 5 dB
Night (23:00 – 07:00)	43	Background + 5 dB

10.25 As the neighbouring Hadyard Hill Wind Farm was consented with a daytime limit of 38 dB(A), the limit for the Proposed Development is assumed to be 38 dB(A) or 5 dB above background, whichever is greater.

10.26 Wind farm noise increases with increasing wind speed, up until the point where the power curve levels off, while background noise continues to rise as a result of the wind blowing through trees and around buildings etc. It is therefore unreasonable to restrict wind farm noise to artificially low levels in situations where the background noise, due to wind or other sources, is so high that the wind farm noise is inaudible. Wind farm operational noise can be assessed as a function of wind speed, against existing background noise (BGN) levels

at the same wind speed, with fixed lower limits, that only affect the lowest wind speeds. If modelling predicts that the wind farm noise is likely to be below 35 dB(A), this assessment is unnecessary.

10.27 Separate noise limits should apply for daytime and for night-time as during the night the protection of external amenity becomes less important and the emphasis should be on preventing sleep disturbance. Absolute noise limits and margins above background should relate to the cumulative effect of all turbines in the area contributing to the noise received at the properties in question. Any existing turbines should not be considered as part of the prevailing BGN.

10.28 The sound propagation over distance, including the effect of atmospheric absorption, was calculated using the WindPRO model based on ISO 9613-2. In accordance with the GPG, a ground absorption factor of 0.5 was used. The receiver height was taken to be 4 m and air absorption characteristic of 10°C, 70% relative humidity was used. Topographical screening of -2 dB and valley effect penalty of 3 dB is considered in the model, but neither of these factors applies in this scenario.

Baseline Conditions

10.29 BGN is usually measured in the external amenity of nearby NSRs. Measurements are made in ten-minute intervals over an extended period.

10.30 BGN measurements have been taken from the Hadyard Hill Extension Environmental Statement (SSE, 2015), specifically, Chapter 6, which was prepared by TNEI. That assessment has been reviewed by Wood and shows all signs of the measurements having been competently carried out, with reference to all appropriate standards and guidance. Receptors were grouped into areas likely to have similar acoustic environments, and a characteristic receptor chosen as a proxy to represent all receptors in each area.

10.31 The measurement locations near each receptor were appropriately sited far enough from reflective facades and foliage that may elevate background noise in wind. Where running water was audible at one receptor, other receptors were considered, and the one judged to have least such noise was chosen as the most conservative to represent the group. A SAC Environmental Health Officer attended at the time of installation and agreed all measurement locations.

10.32 The Proposed Development is considerably smaller than the Hadyard Hill Extension, and the receptors and measurement locations used for the TNEI noise assessment were considered to be appropriate and relevant for the Proposed Development.

10.33 As it is possible that the baseline conditions could have changed in the intervening period since the Hadyard Hill Extension noise monitoring was undertaken, a site visit was undertaken on 12th November 2020. This demonstrated that there had been no developments in the area that would significantly affect the acoustic environment.

10.34 During the site visit, a limited set of attended noise measurements were undertaken and these returned values within the range measured in 2015, showing that these earlier measurements remain valid[1].

10.35 In the absence of any evidence of significant changes to the acoustic environment, and in view of the TNEI survey being undertaken appropriately, this existing data are considered satisfactorily representative of the current acoustic environment and therefore appropriate for use in the noise assessment for the Proposed Development.

10.36 A list of receptors is shown in Table 10.5 with corresponding background noise measurement locations. The values of the polynomials fitted through the measurements are tabulated in **Error! Reference source not found.**6. In a few cases, the curves have been flattened at high wind speeds because of a shortage of measured data. Given the reduced scale of the Proposed Development from that of Hadyard Hill Extension, some of these receptors are now some distance from the Site. Nevertheless, there is the potential for them to experience cumulative noise, hence their consideration in this assessment.

10.37 Locations of receptors and background noise measurement locations are shown in Figure 10.1.

[1] Without a meteorological mast, such attended measurements are acknowledged as being indicative.

Table 10.5: Noise Sensitive Receptors and Corresponding BGN Measurement Locations

ID	Name	Easting	Northing	Financial interest	BGN measurement location
1	Delamford Cottage	229045	599160	FALSE	Knockrochar
2	Knockrochar	229733	600740	FALSE	Knockrochar
3	Dobbingstone	230179	600461	FALSE	Knockrochar
4	Doughty Farm	232453	597677	TRUE	Doughty Farm
5	Dalquhairn House	232099	596259	FALSE	Dalwynne Cottage
6	Daljedburgh Farm	230801	596312	FALSE	Dalwynne Cottage
7	Corphin Cottage	228709	596675	FALSE	Doughty Farm
8	Milton Farm	229064	596009	FALSE	Milton Farm
9	Alton Albany Lodge	227746	594448	FALSE	16 Glenginnet Road
10	Lanes Farm	226165	595977	FALSE	Doughty Farm

Table 10.6: Background Noise Values at Measurement Locations noted in Table 10.5

BGN measurement location	Wind speed (m/s at 10 metres)								
	4	5	6	7	8	9	10	11	12
	Daytime Sound Pressure Level (dB(A))								
Knockrochar	31.4	32.9	35.1	37.8	40.9	44.1	47.2	50.0	52.2
Doughty Farm	29.4	30.7	32.4	34.3	36.5	38.7	41.1	43.5	45.8
Dalwynne Cottage	33.6	34.9	36.6	38.6	40.8	43.2	45.6	48.0	48.0
Milton Farm	30.3	31.8	33.5	35.3	37.2	39.3	41.3	43.3	45.2
16 Glenginnet Road	28.5	30.4	32.4	34.6	36.9	39.2	39.2	39.2	39.2
	Night-time Sound Pressure Level (dB(A))								
Knockrochar	30.5	32.0	34.1	36.7	39.7	42.8	46.1	49.2	52.2
Doughty Farm	28.5	29.8	31.6	33.8	36.2	38.7	41.3	43.9	46.3
Dalwynne Cottage	32.8	34.2	36.0	37.9	40.1	42.3	44.6	47.0	49.3
Milton Farm	29.8	31.3	32.9	34.6	36.5	38.4	40.4	42.4	44.5
16 Glenginnet Road	26.9	27.6	28.8	30.8	34.0	38.6	44.9	44.9	44.9

Identification and the Evaluation of Key Effects

Construction Noise

10.38 The background noise levels, as shown in Table 10.6, indicate that all of the selected nearby NSRs would be considered within Category A as defined in Table 10.2 resulting in a 65 dB threshold for daytime work, and a 55 dB threshold for weekend work.

Forestry Quasi-static Plant

10.39 BS 5228 does not give sound power levels for forestry equipment. Hence a generic value of 115 dB(A) has been assumed, as in previous assessments undertaken by Wood. This is almost as high as the cumulative noise of all other activities in any given phase and effectively represents a worst case scenario.

10.40 Given that the forestry activity is spread over turbine locations and access roads, the worst-case noise in any phase will occur when the activity is within the area closest to the receptor.

10.41 At the closest point, the forestry activity comes within about 930 m of receptor Doughty Farm. At that distance, the sound pressure level, with air absorption but no ground absorption, will be about 45.4 dB(A), well below the 65 dB(A) limit.

Compound Static and Access Road Quasi-static Plant

10.42 Two borrow-pit search areas have been identified and these could be used for the extraction of stone on site. Depending on the suitability of the stone that could be recovered from the borrow-pits, it is possible that some or all stone could be delivered from off-Site locations. Noise implications in the event that these borrow pits are used as well as a scenario where all stone is brought to Site have therefore been considered. If the borrow pits are used, once the surface preparation has been completed, material will be transported from the borrow pits to the construction location. Delivered material, from whatever source, will be tipped from the dump trucks and spread by a low ground pressure dozer in successive layers until a sufficient load bearing depth has been achieved.

10.43 Once the main construction works are complete the roads will be surveyed. If refining of gradients or profiles is required additional trimming and filling will be implemented until the final design has been achieved. The same plant will be used for constructing both compounds and roads. When working in the compounds, the plant will be considered static; while on the roads, quasi-static. The plant items and expected utilisation factors used in the compound and road construction are listed in Table 10.7. The construction compound will be built at the same time.

Table 10.7: Site Preparation Static Plant Utilisation

Plant Item	No of	Utilisation %	BS 5228 reference	LAeq at 10m, dB	SWL dB(A)
Tracked excavator	2	50%	Table C2 No. 29	79	107
Dozer	2	50%	Table C2 No. 36	81	109
Lorry	2	50%	Table C2 No. 34	80	108
Grader	1	20%	Table C6 No. 31	86	107
Articulated dump truck	2	50%	Table C2 No. 33	81	109
Compactor	2	20%	Table C2 No. 42	78	102
Crane	1	40%	Table C3 No. 29	70	94
Tree felling	1	50%		87	112
Equivalent ∑	116 dB(A) SWL				

10.44 The closest point of approach of any paved area to any receptor is at the entry to the borrow pit search area nearest Doughty Farm (NSR 4). At that distance, the sound pressure level will be 45.4 dB(A); and therefore, comfortably below the 65 dB(A) limit.

Borrow Pit Quasi-static Plant

10.45 Table 10.8 shows the likely plant utilisation at each of the borrow pits during rock ripping.

Table 10.8: Borrow Pit Static Plant Utilisation

Plant Item	No of	Utilisation %	BS 5228 reference	LAeq at 10m, dB	SWL dB(A)
Mobile crusher	1	100%	Table C9 No. 14	90	118
Face shovel	1	50%	Table C9 No. 8	86	111
Excavator	1	50%	Table C9 No. 5	83	108
Dump truck (tipping)	3	10%	Table C9 No. 23	85	108
Equivalent ∑	119 dB(A) SWL				

10.46 The nearest borrow pit area of search is some 731 m from Doughty Farm (NSR 4), leading to a sound pressure level of 51.2 dB(A). Again, this is comfortably below the 65 dB(A) daytime limit.

Access Road Construction Mobile Plant Traffic

10.47 Mobile plant activities during access track build will be heavy plant movements to the access track from the remote quarry transporting the road build materials as the build progresses. It is intended that the base road refurbishment will be largely completed before road grading and profiling follow later. The pace of road refurbishment will be determined by the varying amounts of material required per unit run to provide adequate load bearing on varying qualities of ground surface. If the resource allocation is to be constant, the rate of progress will depend upon the nature of the surface upon which the road is being built or upgraded. As the access track build progresses, the pattern of road

traffic movement will alter affecting the contribution from this source to the various receptors over the duration of the build of the access road.

10.48 The noise contribution, from the lorries transporting material along the access road, at the receptors, will vary as the distance along the haul road varies. This contribution to the energy averaged noise level at the receptors can be calculated from the following expression:

$L_{Aeq} = L_{WA} – 33 + 10\log_{10}Q – 10\log_{10}V -10\log_{10}d + A$ – air absorption – ground absorption

where

- L_{WA} = Sound power level of plant item, taken as a single engine vehicle of sound power 118 dB(A)
- Q = Number of plant item journeys per hour, assumed as a maximum of 7.5.
- d = distance to centre of haul road
- A = $10\log_{10}$ a/180
- a = Angle of view of the haul road
- V = Speed of vehicle, taken as 24 km per hour

10.49 Air absorption is taken as 0.0035 dBm^{-1} and attenuation due to ground absorption is assumed negligible.

10.50 There are two candidates for the critical piece of road: the long section from U25 (229416, 597714) to (231965, 599884), with closest point of approach (CPA) 1,597 m from Dobbingstone, and the section from (231645, 598369) to (232999, 599554) near U27 with CPA 1,053 m from Doughty. These may be approximated as straight lines, one with centre 2,089 m from Dobbingstone, where it subtends an angle of 88°, and one with centre 1,291 m from Doughty, where it subtends an angle of 66°. These result in sound pressure levels of 36.3 dB(A) at Dobbingstone and 39.9 dB(A) at Doughty, both also comfortably below the daytime noise limit. Even considered cumulatively with any other activities on Site, this would not contribute notably to an excess noise level.

Turbine Foundation Excavation and Construction

10.51 Plant utilisation during the excavation and construction of the turbine foundations is given in Table 10.9. The utilisation figures used are considered a conservative worst case.

Table 10.9: Turbine Foundation Excavation and Construction Static Plant Utilisation

Plant Item	No of	Utilisation %	BS 5228 reference	LAeq at 10m, dB	SWL dB(A)
Concrete mixer truck	1	50%	Table C4 No. 20	80	105
Concrete pump	1	50%	Table C3 No. 25	78	103
Poker vibrator	2	50%	Table C4 No. 33	78	106
Excavator	1	50%	Table C9 No. 5	83	108
Piling equipment	1	100%	Table C12 No. 27	87	115
Dump truck	1	10%	Table C9 No. 23	85	103
Equivalent ∑	116 dB(A) SWL				

10.52 The closest turbine foundation to any receptor is turbine 11, at a distance of approximately 1,130 m from Doughty Farm (NSR 4). At that distance, the sound pressure level will be 43.0 dB(A). This is comfortably below the 65 dB(A) limit.

Turbine Erection

10.53 Plant utilisation during the erection of the turbines is given in Table 10.10.

Table 10.10: Turbine Erection Static Plant Utilisation

Plant Item	No of	Utilisation %	BS 5228 reference	LAeq at 10m, dB	SWL dB(A)
Concrete mixer truck	1	50%	Table C4 No. 20	80	105
Concrete pump	1	50%	Table C3 No. 25	78	103
Poker vibrator	2	50%	Table C4 No. 33	78	106
Equivalent ∑	116 dB(A) SWL				

10.54 The closest turbine foundation to any receptor is turbine 11, at a distance of approximately 1,130 m from Doughty. At that distance, the sound pressure level will be 43.0 dB(A). This is comfortably below the 65 dB(A) limit.

Construction noise should be managed in accordance with the best practice set out under

10.55 Mitigation Measures below.

Cumulative Noise

10.56 Even if all the above activities were carried out simultaneously, the total noise at the closest receptor would be no greater than 54.1 dB(A).

Construction noise effect conclusion

10.57 The likely environmental effects resulting from the construction of the Proposed Development are assessed as not significant.

Operation

10.58 The criteria for operational noise are subject to fixed lower limits for daytime and night-time. These limits account for the overall noise levels received at NSRs including background noise in addition to modelled turbine predicted noise.

10.59 At levels above the criteria, the noise emissions from the Proposed Development would be considered a significant adverse effect.

Turbine Noise Emission Data

10.60 The candidate WTG is the Siemens Gamesa SG 6.0-155 6.6 MW machine, 122.5 m hub height, for a tip height of 200 m.

10.61 The sound power level as a function of hub height wind speed, as supplied by Siemens Gamesa to EMD, the developers of the WindPRO modelling software, is given in Table 10.11. Because this is as a function of hub height wind speed, WindPRO can scale it in accordance with IEC 61400-11 to 10-metre wind speeds for both hub heights.

Table 10.11: Siemens Games SG 6.0-155 6.6 MW Apparent Sound Power Level (dB(A))

Hub height wind speed (m/s)	L_{WA} (dB)
3	92.0
4	92.0
5	94.8
6	98.8
7	102.1
8	105.0
9	105.0
10	105.0
11	105.0
12	105.0

10.62 Frequency spectra are also supplied at two wind speeds, 6 and 8 m/s. It is common for turbine manufacturers to supply frequency data at only a limited range of speeds. At

8 m/s, as seen in Table 10.11, the sound power level will already have reached its maximum. The frequency spectra are shown in Table 10.12.

Table 10.12: Siemens Gamesa SG 6.0-155 6.6 MW Apparent Sound Power Level Spectra (dB(A))

Octave band centre frequency (Hz)	Hub height wind speed (m/s)	
	6	8
63	78.4	84.6
125	85.8	92.0
250	90.4	96.6
500	92.7	98.9
1000	92.5	98.7
2000	92.8	99.0
4000	86.2	92.4
8000	71.2	77.4

10.63 In view of manufacturers' common practice of allowing a measurement uncertainty in their noise warranty terms, and in accordance with best practice[2] 2 dB has been added to the values in Table 10.11 and Table 10.12 bringing the total sound power level to 107.0 dB(A) before modelling the sound propagation.

Operations Phase Assessment Effects

10.64 The noise impact assessment assumes that the sound energy propagates in all directions from the turbine. Some energy will be absorbed in the air and some by the ground. On that basis, the predicted levels received at the NSRs, at a hub height (122.5 m) wind speed of 10 m/s, by which time the maximum has been reached are shown as a noise contour map in Figure 10.2. The level at each of the receptors is shown in in Table 10.13 **Error! Reference source not found.** against the daytime noise limit and in Table 10.14 against the night-time limit.

[2] A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise, Institute of Acoustics (IOA), 2013

Table 10.13: Sound Pressure Levels and any Excesses over Limits, 122.5 m Hub Height, Daytime

Receptor	Wind speed (m/s at 10 metres)								
	4	5	6	7	8	9	10	11	12
1	Delamford Cottage (229045, 599160)								
Proposed Development	26.0	30.8	32.6	32.6	32.6	33.4	33.4	33.4	33.4
Noise limit	38.0	38.0	40.1	42.8	45.9	49.1	52.2	55.0	57.2
Excess	-12.0	-7.2	-7.5	-10.2	-13.3	-15.7	-18.8	-21.6	-23.8
2	Knockrochar (229733, 600740)								
Proposed Development	25.9	30.7	32.6	32.6	32.6	33.3	33.3	33.3	33.3
Noise limit	38.0	38.0	40.1	42.8	45.9	49.1	52.2	55.0	57.2
Excess	-12.1	-7.3	-7.5	-10.2	-13.3	-15.8	-18.9	-21.7	-23.9
3	Dobbingstone (230179, 600461)								
Proposed Development	27.2	32.0	33.8	33.8	33.8	34.5	34.5	34.5	34.5
Noise limit	38.0	38.0	40.1	42.8	45.9	49.1	52.2	55.0	57.2
Excess	-10.8	-6.0	-6.3	-9.0	-12.1	-14.6	-17.7	-20.5	-22.7
4	Doughty (232453, 597677)								
Proposed Development	31.3	36.1	38.0	38.0	38.0	38.6	38.6	38.6	38.6
Noise limit	45.0	45.0	45.0	45.0	45.0	45.0	46.1	48.5	50.8
Excess	-13.7	-8.9	-7.0	-7.0	-7.0	-6.4	-7.5	-9.9	-12.2
5	Dalquhairn House (232099, 596259)								
Proposed Development	22.8	27.6	29.4	29.5	29.5	30.2	30.2	30.2	30.2
Noise limit	38.6	39.9	41.6	43.6	45.8	48.2	50.6	53.0	53.0
Excess	-15.8	-12.3	-12.2	-14.1	-16.3	-18.0	-20.4	-22.8	-22.8
6	Daljedburgh Farm (230801, 596312)								
Proposed Development	24.7	29.5	31.4	31.4	31.4	32.1	32.1	32.1	32.1
Noise limit	38.6	39.9	41.6	43.6	45.8	48.2	50.6	53.0	53.0
Excess	-13.9	-10.4	-10.2	-12.2	-14.4	-16.1	-18.5	-20.9	-20.9
7	Corphin Cottage (228709, 596675)								
Proposed Development	23.9	28.7	30.5	30.6	30.6	31.3	31.3	31.3	31.3
Noise limit	38.0	38.0	38.0	39.3	41.5	43.7	46.1	48.5	50.8
Excess	-14.1	-9.3	-7.5	-8.7	-10.9	-12.4	-14.8	-17.2	-19.5
8	Milton Farm (229064, 596009)								
Proposed Development	20.8	25.7	27.5	27.5	27.5	28.3	28.3	28.3	28.3
Noise limit	38.0	38.0	38.5	40.3	42.2	44.3	46.3	48.3	50.2
Excess	-17.2	-12.3	-11.0	-12.8	-14.7	-16.0	-18.0	-20.0	-21.9

Receptor	Wind speed (m/s at 10 metres)								
9	Alton Albany Lodge (227746, 594448)								
Proposed Development	16.5	21.3	23.2	23.2	23.2	24.1	24.1	24.1	24.1
Noise limit	38.0	38.0	38.0	39.6	41.9	44.2	44.2	44.2	44.2
Excess	-21.5	-16.7	-14.8	-16.4	-18.7	-20.1	-20.1	-20.1	-20.1
10	Lanes Farm (226165, 595977)								
Proposed Development	12.2	17.0	18.9	18.9	18.9	19.9	19.9	19.9	19.9
Noise limit	38.0	38.0	38.0	39.3	41.5	43.7	46.1	48.5	50.8
Excess	-25.8	-21.0	-19.1	-20.4	-22.6	-23.8	-26.2	-28.6	-30.9

Table 10.14: Sound Pressure Levels and any Excesses over Limits, 122.5 Hub Height, Night-time

Receptor	Wind speed (m/s at 10 metres)								
	4	5	6	7	8	9	10	11	12
1	Delamford Cottage (229045, 599160)								
Proposed Development	26.0	30.8	32.6	32.6	32.6	33.4	33.4	33.4	33.4
Noise limit	43.0	43.0	43.0	43.0	44.7	47.8	51.1	54.2	57.2
Excess	-17.0	-12.2	-10.4	-10.4	-12.1	-14.4	-17.7	-20.8	-23.8
2	Knockrochar (229733, 600740)								
Proposed Development	25.9	30.7	32.6	32.6	32.6	33.3	33.3	33.3	33.3
Noise limit	43.0	43.0	43.0	43.0	44.7	47.8	51.1	54.2	57.2
Excess	-17.1	-12.3	-10.4	-10.4	-12.1	-14.5	-17.8	-20.9	-23.9
3	Dobbingstone (230179, 600461)								
Proposed Development	27.2	32.0	33.8	33.8	33.8	34.5	34.5	34.5	34.5
Noise limit	43.0	43.0	43.0	43.0	44.7	47.8	51.1	54.2	57.2
Excess	-15.8	-11.0	-9.2	-9.2	-10.9	-13.3	-16.6	-19.7	-22.7
4	Doughty (232453, 597677)								
Proposed Development	31.3	36.1	38.0	38.0	38.0	38.6	38.6	38.6	38.6
Noise limit	43.0	43.0	43.0	43.0	43.0	43.7	46.3	48.9	51.3
Excess	-11.7	-6.9	-5.0	-5.0	-5.0	-5.1	-7.7	-10.3	-12.7
5	Dalquhairn House (232099, 596259)								
Proposed Development	22.8	27.6	29.4	29.5	29.5	30.2	30.2	30.2	30.2
Noise limit	43.0	43.0	43.0	43.0	45.0	47.3	49.6	52.0	54.3
Excess	-20.2	-15.4	-13.6	-13.5	-15.5	-17.1	-19.4	-21.8	-24.1
6	Daljedburgh Farm (230801, 596312)								
Proposed Development	24.7	29.5	31.4	31.4	31.4	32.1	32.1	32.1	32.1
Noise limit	43.0	43.0	43.0	43.0	45.0	47.3	49.6	52.0	54.3
Excess	-18.3	-13.5	-11.6	-11.6	-13.6	-15.2	-17.5	-19.9	-22.2
7	Corphin Cottage (228709, 596675)								
Proposed Development	23.9	28.7	30.5	30.6	30.6	31.3	31.3	31.3	31.3
Noise limit	43.0	43.0	43.0	43.0	43.0	43.7	46.3	48.9	51.3
Excess	-19.1	-14.3	-12.5	-12.4	-12.4	-12.4	-15.0	-17.6	-20.0

Receptor	Wind speed (m/s at 10 metres)								
8	Milton Farm (229064, 596009)								
Proposed Development	20.8	25.7	27.5	27.5	27.5	28.3	28.3	28.3	28.3
Noise limit	43.0	43.0	43.0	43.0	43.0	43.4	45.4	47.4	49.5
Excess	-22.2	-17.3	-15.5	-15.5	-15.5	-15.1	-17.1	-19.1	-21.2
9	Alton Albany Lodge (227746, 594448)								
Proposed Development	16.5	21.3	23.2	23.2	23.2	24.1	24.1	24.1	24.1
Noise limit	43.0	43.0	43.0	43.0	43.0	43.6	49.9	49.9	49.9
Excess	-26.5	-21.7	-19.8	-19.8	-19.8	-19.5	-25.8	-25.8	-25.8
10	Lanes Farm (226165, 595977)								
Proposed Development	12.2	17.0	18.9	18.9	18.9	19.9	19.9	19.9	19.9
Noise limit	43.0	43.0	43.0	43.0	43.0	43.7	46.3	48.9	51.3
Excess	-30.8	-26.0	-24.1	-24.1	-24.1	-23.8	-26.4	-29.0	-31.4

10.65 Table 10.13 (Daytime) and 10.14 (Night-time) show that the predicted levels for total operational noise meet the ETSU derived limits at all receptors. The likely environmental effect is therefore assessed as not significant.

Infra-sound

10.66 Infra-sound is defined as noise occurring at frequencies below that at which sound is normally audible, i.e. at less than 20 Hz, due to the significantly reduced sensitivity of the ear at such frequencies. For sound to be perceptible in this frequency range, it has to be at very high amplitude; and it is generally considered that such sounds can cause considerable annoyance when perceptible.

10.67 Turbines have been cited as significant producers of infra-sound. This has been due to the high levels of infra-sound, as well as an audible, low frequency, thumping noise, occurring on older 'downwind' turbines of which many were installed in the USA prior to the large-scale take-up of wind power production in the UK. Downwind turbines are configured with the blades downwind of the tower such that the blades pass through the wake left in the wind stream by the tower resulting in a regular audible thump, with infra-sonic components, each time a blade passes the tower. All modern turbines are of the upwind design, with the blades upwind of the tower, thereby eliminating this effect

10.68 A study for the Department of Trade and Industry (DTI) (DTI, 2006) concluded that '*Infrasound noise emissions from turbines are significantly below the recognised threshold of perception for acoustic energy within this frequency range. Even assuming that the most sensitive members of the population have a hearing threshold which is 12dB lower than the median hearing threshold, measured infrasound levels are well below this criterion*'. It goes on to state that, based on information from the World Health Organisation, '*there is no reliable evidence that infrasound below the hearing threshold produce physiological or psychological effects*' it may be concluded that '*infrasound associated with modern turbines is not a source which may be injurious to the health of a wind farm neighbour*'. Therefore, it is concluded that this effect is negligible and not significant.

Low Frequency Noise

10.69 Noise from modern turbines is essentially broadband in nature in that it contains similar amounts of noise energy in all frequency bands from low to high frequency. As distance from a wind farm site increases, the noise level decreases as a result of the spreading out of the sound energy; but also due to air absorption which increases with rising frequency. This means that although the energy across the whole frequency range is reduced, higher frequencies are reduced more than lower frequencies with the effect that as distance from the site increases, the ratio of low to high frequencies also increases. This effect may be observed with road traffic noise or natural sources such as the sea where higher frequency components are diminished relative to lower frequency components at long distances. At such distances, however, overall noise levels from turbines are so low that this effect is negligible and not significant.

Amplitude Modulation

10.70 The RenewableUK research programme on amplitude modulation (AM) has concluded[3] that high levels of AM can occasionally be heard at long distances from turbines. While the mechanisms of EAM are well documented, an industry consensus on a methodology for its prediction is yet to be reached. It is noted that at this time Government advice towards the assessment of EAM has not changed from that included within the ETSU-R-97 Guidance, which indicates no specific consideration for EAM is required and no planning condition is necessary.

Decommissioning

10.71 It is considered that the noise effects of the decommissioning phase of the Proposed Development will be similar to those associated with the construction phase, though of a shorter duration, and effects would therefore be predicted to be not significant. Therefore, no additional assessment has been carried out for decommissioning.

Cumulative Effects and Interaction of Effects

10.72 There are two other wind farms close enough to dominate the cumulative impact, the existing Hadyard Hill immediately to the west of the Site, and the proposed Carrick wind farm to the east of the Site.

10.73 The GPG (IOA, 2013) states that consented wind farms should be modelled assuming they will operate up to their consented noise limits. The consented noise limit for Hadyard Hill is background noise plus 5 dB or 38 dB(A) daytime and 43 dB(A) night-time. To model Hadyard Hill operating at its noise limit, three models were built:

- It was initially modelled using the manufacturer's stated sound power level data and was seen to exceed the daytime and night-time limits at several wind speeds and at some receptors, particularly Lanes Farm.
- The sound power level of the turbines was then adjusted so that the sound pressure level at the critical receptor just met the limits at all wind speeds, in accordance with the GPG**Error! Bookmark not defined.**.
- Two more models were built, one just reaching the daytime limit, and one just reaching the night-time limit. These were then included in the cumulative models, day and night.

10.74 Carrick Wind Farm is currently at scoping stage; therefore, the proposed candidate turbine model is not known. For the purposes of the cumulative assessment, the 122.5 m hub height variant of the Siemens Gamesa 155 6.6 MW machine has been assumed.

[3] RenewableUK (2013). Wind Turbine Amplitude Modulation: Research to Improve Understanding as to its Cause and Effects - Brief Summary. **http://www.renewableuk.com/en/publications/reports.cfm/wind-turbine-am-cause-effects-briefing**.

10.75 The predicted cumulative levels received at the NSRs, at a hub height wind speed of 10 m/s are shown as a noise contour map in Figure 10.3 and Figure 10.4 for day and night, respectively.

10.76 The cumulative noise levels are shown in Table 10.15 and 10.16. At receptor Lanes Farm, the limits are sometimes exceeded by 0.1 dB. That is because Hadyard Hill is assumed to just meet its limit there, and the Proposed Development, being more than 20 dB quieter, increases the cumulative noise by 0.1 dB, which is imperceptible. Indeed, the GPG states that, where the Proposed Development is more than 10 dB below existing wind farms, cumulative noise need not be considered, as the increase, of less than 0.5 dB, is negligible.

Table 10.15: Cumulative Sound Pressure Levels and any Excesses over Limits, 122.5 m Hub Height, Daytime

Receptor	Wind speed (m/s at 10 metres)								
	4	5	6	7	8	9	10	11	12
1	Delamford Cottage (229045, 599160)								
Cumulative Noise	37.5	38.1	38.5	39.5	41.3	43.3	45.5	47.8	50.1
Noise limit	38.0	38.0	40.1	42.8	45.9	49.1	52.2	55.0	57.2
Excess	-0.5	0.1	-1.6	-3.3	-4.6	-5.8	-6.7	-7.2	-7.1
2	Knockrochar (229733, 600740)								
Cumulative Noise	30.9	33.2	34.4	34.8	35.7	37.3	38.8	40.6	42.5
Noise limit	38.0	38.0	40.1	42.8	45.9	49.1	52.2	55.0	57.2
Excess	-7.1	-4.8	-5.7	-8.0	-10.2	-11.8	-13.4	-14.4	-14.7
3	Dobbingstone (230179, 600461)								
Cumulative Noise	31.3	33.9	35.2	35.6	36.3	37.7	39.1	40.7	42.6
Noise limit	38.0	38.0	40.1	42.8	45.9	49.1	52.2	55.0	57.2
Excess	-6.7	-4.1	-4.9	-7.2	-9.6	-11.4	-13.1	-14.3	-14.6
4	Doughty (232453, 597677)								
Cumulative Noise	32.6	37.2	38.9	39.0	39.1	39.8	40.0	40.4	40.9
Noise limit	45.0	45.0	45.0	45.0	45.0	45.0	46.1	48.5	50.8
Excess	-12.4	-7.8	-6.1	-6.0	-5.9	-5.2	-6.1	-8.1	-9.9
5	Dalquhairn House (232099, 596259)								
Cumulative Noise	26.6	30.0	31.6	31.8	32.2	33.4	34.3	35.5	37.0
Noise limit	38.6	39.9	41.6	43.6	45.8	48.2	50.6	53.0	53.0
Excess	-12.0	-9.9	-10.0	-11.8	-13.6	-14.8	-16.3	-17.5	-16.0
6	Daljedburgh Farm (230801, 596312)								
Cumulative Noise	28.4	31.3	32.7	33.0	33.6	35.0	36.2	37.7	39.4
Noise limit	38.6	39.9	41.6	43.6	45.8	48.2	50.6	53.0	53.0
Excess	-10.2	-8.6	-8.9	-10.6	-12.2	-13.2	-14.4	-15.3	-13.6
7	Corphin Cottage (228709, 596675)								
Cumulative Noise	32.7	33.8	34.5	35.3	36.8	38.7	40.7	42.9	45.1
Noise limit	38.0	38.0	38.0	39.3	41.5	43.7	46.1	48.5	50.8
Excess	-5.3	-4.2	-3.5	-4.0	-4.7	-5.0	-5.4	-5.6	-5.7

Receptor	Wind speed (m/s at 10 metres)								
8	Milton Farm (229064, 596009)								
Cumulative Noise	29.3	30.5	31.2	32.0	33.4	35.3	37.3	39.4	41.5
Noise limit	38.0	38.0	38.5	40.3	42.2	44.3	46.3	48.3	50.2
Excess	-8.7	-7.5	-7.3	-8.3	-8.8	-9.0	-9.0	-8.9	-8.7
9	Alton Albany Lodge (227746, 594448)								
Cumulative Noise	28.0	28.7	29.1	30.1	31.8	33.9	36.0	38.3	40.5
Noise limit	38.0	38.0	38.0	39.6	41.9	44.2	44.2	44.2	44.2
Excess	-10.0	-9.3	-8.9	-9.5	-10.1	-10.3	-8.2	-5.9	-3.7
10	Lanes Farm (226165, 595977)								
Cumulative Noise	38.0	38.1	38.1	39.4	41.5	43.7	46.1	48.5	50.8
Noise limit	38.0	38.0	38.0	39.3	41.5	43.7	46.1	48.5	50.8
Excess	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0

Table 10.16: Cumulative Sound Pressure Levels and any Excesses over Limits, 122.5 m Hub Height, Night-time

Receptor	Wind speed (m/s at 10 metres)								
	4	5	6	7	8	9	10	11	12
1	Delamford Cottage (229045, 599160)								
Cumulative Noise	42.3	42.5	42.6	42.6	42.6	43.3	45.7	48.2	50.5
Noise limit	43.0	43.0	43.0	43.0	44.7	47.8	51.1	54.2	57.2
Excess	-0.7	-0.5	-0.4	-0.4	-2.1	-4.5	-5.4	-6.0	-6.7
2	Knockrochar (229733, 600740)								
Cumulative Noise	34.7	35.8	36.5	36.5	36.5	37.3	38.9	40.9	42.9
Noise limit	43.0	43.0	43.0	43.0	44.7	47.8	51.1	54.2	57.2
Excess	-8.3	-7.2	-6.5	-6.5	-8.2	-10.5	-12.2	-13.3	-14.3
3	Dobbingstone (230179, 600461)								
Cumulative Noise	34.8	36.2	37.0	37.0	37.0	37.7	39.2	41.0	43.0
Noise limit	43.0	43.0	43.0	43.0	44.7	47.8	51.1	54.2	57.2
Excess	-8.2	-6.8	-6.0	-6.0	-7.7	-10.1	-11.9	-13.2	-14.2
4	Doughty (232453, 597677)								
Cumulative Noise	33.4	37.5	39.1	39.2	39.1	39.8	40.0	40.4	41.0
Noise limit	43.0	43.0	43.0	43.0	43.0	43.7	46.3	48.9	51.3
Excess	-9.6	-5.5	-3.9	-3.8	-3.9	-3.9	-6.3	-8.5	-10.3
5	Dalquhairn House (232099, 596259)								
Cumulative Noise	29.3	31.5	32.6	32.6	32.6	33.4	34.4	35.7	37.3
Noise limit	43.0	43.0	43.0	43.0	45.0	47.3	49.6	52.0	54.3
Excess	-13.7	-11.5	-10.4	-10.4	-12.4	-13.9	-15.2	-16.3	-17.0
6	Daljedburgh Farm (230801, 596312)								
Cumulative Noise	31.7	33.3	34.2	34.3	34.2	35.0	36.3	38.0	39.8
Noise limit	43.0	43.0	43.0	43.0	45.0	47.3	49.6	52.0	54.3
Excess	-11.3	-9.7	-8.8	-8.7	-10.8	-12.3	-13.3	-14.0	-14.5
7	Corphin Cottage (228709, 596675)								
Cumulative Noise	37.3	37.7	38.0	38.0	38.0	38.7	40.9	43.3	45.5
Noise limit	43.0	43.0	43.0	43.0	43.0	43.7	46.3	48.9	51.3
Excess	-5.7	-5.3	-5.0	-5.0	-5.0	-5.0	-5.4	-5.6	-5.8

Receptor	Wind speed (m/s at 10 metres)								
8	Milton Farm (229064, 596009)								
Cumulative Noise	33.7	34.2	34.6	34.6	34.5	35.3	37.4	39.8	42.0
Noise limit	43.0	43.0	43.0	43.0	43.0	43.4	45.4	47.4	49.5
Excess	-9.3	-8.8	-8.4	-8.4	-8.5	-8.1	-8.0	-7.6	-7.5
9	Alton Albany Lodge (227746, 594448)								
Cumulative Noise	32.7	32.9	33.1	33.1	33.1	33.9	36.2	38.6	41.0
Noise limit	43.0	43.0	43.0	43.0	43.0	43.6	49.9	49.9	49.9
Excess	-10.3	-10.1	-9.9	-9.9	-9.9	-9.7	-13.7	-11.3	-8.9
10	Lanes Farm (226165, 595977)								
Cumulative Noise	43.0	43.0	43.0	43.0	43.0	43.7	46.3	48.9	51.3
Noise limit	43.0	43.0	43.0	43.0	43.0	43.7	46.3	48.9	51.3
Excess	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Mitigation Measures

Construction

10.77 Construction activities will be scheduled, unless otherwise agreed, from Monday to Friday 07:00 to 18:00 and Saturday 07:00 to 13:00. Unattended plant equipment should be kept to a minimum. Construction activities outside of these times, short term high transient noise events, or activities relatively close to NSRs should be scheduled in consultation with the residents to minimise their inconvenience.

10.78 As part of a planning condition, the Applicant would accept a requirement to produce and implement a Noise Management Plan or measures set out in a Construction Environmental management Plan (CEMP) for the construction phase. The plan would be taken forward for all construction works and any post construction works of a similar nature that are associated with the Proposed Development e.g. maintenance. The plan would include a clear construction schedule detailing the equipment to be used and the following information:

- Detailed plan showing how permitted working hours will be adhered to.
- Mitigation identified to attenuate noise levels at source (preferable) to ensure construction noise limits are met.
- A detailed plan on community relations, including a Stakeholder Engagement Plan (SEP) the setting up of a complaint phone line, a procedure to notify residents of any necessary work outside of the permitted working hours and an approach to the investigation of any complaints.

Operation

10.79 No specific mitigation measures are required during operation as appropriate operational noise limits are complied with.[4]

Decommissioning

10.80 Decommissioning noise will be similar to, or less than, construction noise. A similar approach to construction noise will reduce the likelihood of noise levels breaching advised limits.

Residual Effects

Construction Phase

10.81 The levels of noise attributable to the activities associated with the construction work should be kept to a minimum. A well-planned noise management programme as described in paragraph 10.78 will reduce the likelihood of complaints. Considering the separation distance of turbines to receptors and taking into account standard methodologies for site noise control, it is considered that even during the most intense

[4] As noted, while in combination with Hadyard Hill, the limits are sometimes exceeded by 0.1 dB at Lanes Farm, the Proposed Development is 20 dB quieter. GPG states that where a Proposed Development is more than 10 dB below existing wind farms, cumulative noise need not be considered as an increase of less than 0.5 dB is negligible.

period of construction works, noise at the receptors will not exceed the most stringent criterion derived from BS5228 (BSI 2014) and therefore will not be significant.

Operational Phase

10.82 The assessment has derived daytime and night-time noise limits for the Proposed Development using the methodology specified in ETSU-R-97 (ETSU, 1996). Noise levels would operate within acceptable limits, on which basis it is concluded that effects would be not significant.

Decommissioning Phase

10.83 Decommissioning noise will be similar to, or less than, construction noise and would therefore be not significant.

Summary

10.84 Construction noise has been assessed in accordance with BS 5228-1 (BSI, 2014). Worst-case construction noise is shown to be significantly below acceptable daytime limits.

10.85 Operational noise has been assessed in accordance with ETSU-R-97 (ETSU, 1996). Considered alone, the operational noise of the Proposed Development is shown to be below acceptable daytime and night-time limits.

10.86 Considered cumulatively with other existing and planned wind farms, the operational noise of the Proposed Development is shown to be below acceptable daytime and night-time limits, except where the contribution from the Proposed Development is more than 20 dB below the worst-case potential contribution from the existing Hadyard Hill wind farm, leading to an increase of 0.1 dB, which is far too low to be perceptible.

10.87 The likely environmental effect of the Proposed Development during construction and daytime and night-time operation is not significant.

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