Chapter 10: Noise and vibration

Introduction

10.1 This chapter assesses the potential implications of the proposed development on noise and vibration. The work was carried out by Hayes McKenzie and assesses potential impacts during the construction and operation of the wind farm. During the scoping exercise, noise and vibration was considered to be a primary issue. The references and data sources used during the assessment are set out in table 10.1.

ETSU, 1996, ETSU-R-97: The assessment and rating of noise from wind farms
ETSU, 1990, WN 5066: The prediction of propagation of noise from wind turbines with regard to community disturbance
ETSU, 1997, W/13/00392/REP: Low frequency noise and vibrations measurement at a modern wind farm
International Standard IEC 651-1:1979, Sound Level Meters
International Organisation for Standardization, 1996, ISO 9613-1 Acoustics – Attenuation of sound during propagation outdoors, part 1: Method of calculation of the attenuation of sound by atmospheric absorption
International Organisation for Standardization, 1996, ISO 9613-2 Acoustics – Attenuation of sound during propagation outdoors, part 2: General method of calculation
Danish Environmental Protection Agency, Statutory Order No. 304, Noise from Wind Turbines
Bergland, B. and Lindvall, T. (eds), 1995, Community Noise – Document Prepared for the World Health Organisation, Archives of the Centre for Sensory Research Vol. 2(1)
ODPM, 2004, Planning for Renewable Energy: A Companion Guide to PPS 22
ODPM, 2004, Planning Policy Statement 22: Renewable Energy
Leventhall, G., 2003, A Review of Published Research on Low Frequency Noise and its Effects

Table 10.1: references and data sources

Noise in the environment

10.2 Noise is defined as unwanted sound. Human ears are typically able to respond to sound in the frequency range 16 Hz to 18 kHz and over the audible range of 0 dB (the threshold of perception) to 140 dB (the threshold of pain). The ear does not respond equally to different frequencies; it is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates the response of the human ear, a weighting mechanism is used. This reduces the importance of lower and higher frequencies, in a similar manner to the human ear.

10.3 The weighting mechanism that best corresponds to the response of the human ear is the A-weighting scale. To help understand the range of noise levels that may be encountered, an indication of the level of some common sounds on the dB(A) scale is given in table 10.2.

Source or activity	Indicative noise level dB(A)
Threshold of hearing	0
Rural night-time background	20-40
Quiet bedroom	35
Busy road at 5 km	35-45
Car at 65 km/h at 100 m	55
Busy general office	60
Conversation	60
Truck at 50 km/h at 100 m	65
City traffic	90
Pneumatic drill at 7 m	95
Jet aircraft at 250 m	105
Threshold of pain	140

Table 10.2: typical noise levels

10.4 The decibel scale is logarithmic rather than linear, so a 3 dB(A) increase in sound level represents a doubling of the sound energy present. The perception of sound level is subjective, but as a general guide a 10 dB(A) increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3 dB(A) is generally regarded as the minimum difference needed to perceive a change.

Noise measurement

10.5 Measured noise levels can be expressed in a variety of ways. Two noise indices will be referred to in this chapter:

$L_{Aeq,T}$: this is defined as the value of the A-weighted sound pressure level of a continuous, steady sound that within a specified time interval T, has the same acoustical energy as a sound whose level varies with time during the same time interval T. This is a unit commonly used to describe construction, industrial and activity noise, and is generally referred to as the ambient noise level.

$L_{A90,T}$: the A-weighted noise level that is exceeded at the measurement position for 90% of the time period, T; this generally describes the background noise level. This noise index is often used in the assessment of the possibility of complaints due to industrial noise.

Noise from wind farms

10.6 Noise is generated from wind turbines as they rotate to generate power. This only occurs in the range above the 'cut-in' wind speed and below the 'cut-out' wind speed within which the turbine is designed to operate. Below the cut-in wind speed there is insufficient strength in the wind to generate electricity efficiently, and above the cut-out wind speed the turbine is automatically shut down to prevent any malfunctions. The cut-in speed at turbine hub height is 2.5 m/s, and the cut-out wind speed is 25 m/s.

10.7 The principal sources of noise are the rotation of the blades in the air (aerodynamic noise) and the internal machinery located in the nacelle (mechanical noise). The blades are designed to minimise noise whilst optimising power transfer from the wind. Particular attention is paid to the design of the blade tip shape and the trailing edge profile to achieve this. The mechanical noise usually arises from the gearbox and, to a lesser extent, the generator. The nacelle assembly is designed to minimise the transmission of noise radiated from the gearbox, generator and other components, and to reduce structure-borne noise transmission from these components to the external surfaces of the wind turbine, notably the tower and blade assembly.

Legislation and policy

10.8 The Government's national policies on noise-related planning issues are set out in Planning Policy Guidance Note 24: *Planning and noise* (PPG24). This gives guidance to local authorities in England on the use of their planning powers to minimise the adverse impact of noise, outlining some of the main considerations that should be taken into account when determining planning applications for development proposals that will either generate noise or be exposed to existing noise sources.

10.9 Planning Policy Statement 22: *Renewable Energy* (PPS22) acknowledges that renewable technologies may generate small increases in noise levels. It states that the 1997 Report by ETSU for the Department of Trade and Industry should be used to assess and rate noise from wind energy development.

10.10 ETSU-R-97: *The Assessment and Rating of Noise from Wind Farms* sets out a framework for the measurement of wind farm noise and contains suggested noise limits derived from existing standards and guidance relating to noise emission from various sources (table 10.3).

Criteria	Noise limit	Notes
Day-time hours	35-40 dB(A) or 5 dB(A) above the prevailing background during quiet day-time periods*, whichever is greater	Actual value within the range depends on the number of dwellings in the vicinity, the effect of the limit on the number of kWh generated, and the duration of the level of exposure
Night-time hours (23:00-07:00)	43 dB(A) or 5 dB(A) above the prevailing background, whichever is greater	The 43 dB(A) lower limit is based on a sleep disturbance criteria of 35 dB(A), with an allowance of 10 dB(A) for attenuation through an open window and 2 dB(A) subtracted to account for the use of L_{A90} rather than the L_{Aeq}

Table 10.3: noise limits suggested in ETSU-R-97

*Quiet day-time periods are defined as evenings from 18:00-23:00, plus Saturday afternoons from 13:00-18:00 and Sundays from 07:00-18:00.

10.11 The limits are applicable up to a wind speed of 12 m/s measured at 10 metres height within the development site. Where the occupier of a property has a commercial involvement with the wind farm, the day and night-time lower noise limits can be increased to 45 dB(A) and consideration can be given to increasing the permissible margin above background.

10.12 Where predicted noise levels are low at the nearest residential properties, a simplified noise limit is suggested of 35 dB(A) for wind speeds up to 10 m/s at 10 metres height. This removes the need for extensive background noise measurements for smaller or more remote schemes.

10.13 The suggested noise limits take into account the fact that all wind turbines exhibit the character of noise described as 'blade swish' to a certain extent. The report recommends that a penalty should be added to the predicted noise levels where any tonal component is present. The level of this penalty is related to the level by which any tonal components exceed audibility.

10.14 General guidance on the control of noise and vibration from the construction process is contained in British Standard BS5228: *Noise and vibration control on construction and open sites* (1997). This standard represents the generally accepted industry best practice for controlling noise and vibration from works of construction, excavation and demolition.

Methodology

Baseline

10.15 Baseline noise measurements were undertaken at seven locations representative of the nearest dwellings to the proposed development (table 10.4 and figure 10.1). These locations were agreed with the IoWC.

Ref	Property	Description	Distance to nearest turbine
1	Hartshole Cottage	Residential property to the north of the site. Noise environment dominated by wind noise in trees and hedges	820 m
2	Dodpits House	Isolated residential property on Dodpits Lane to the east of the site. Noise environment dominated by wind noise in trees and bushes	1,280 m
3	Churchills Farmhouse	Isolated property along a track off Dodpits Lane to the east of the site. Noise environment dominated by wind noise in trees and bushes	550 m
4	No. 8 Tapnell Cottages	Residential property adjacent to Tapnell Farm off the B3399, to the south-west of the site. Noise environment dominated by wind noise in trees and bushes	750 m
5	Dog Kennel Cottage	Isolated property on Broad Lane, to the west of the site. Noise environment characterised by wind noise in the trees	720 m
6	Chessell Pottery	Small business and residential property off the B3399, to the south of the site. Noise environment characterised by noise from wind in the trees and traffic	1,300 m
7	Shalcombe Cottage	Residential property at the crossroads of the B3399 and Broad Lane, to the south of the site. Noise environment characterised by wind in the trees and road traffic noise	1,040 m

Table 10.4: locations of noise monitoring

10.16 The monitoring equipment was set up in the following locations:

- Hartshole Cottage – garden to the east side of the property
- Dodpits House – rear garden
- Churchills Farmhouse – walled garden to the side of the property
- No. 8 Tapnell Cottages – front garden
- Dog Kennel Cottage – rear garden
- Chessell Pottery – paddock adjacent to the property
- Shalcombe Cottage – garden.

10.17 The measurements were made with Larsen Davis model LD-820 Precision Integrating Sound Level Meters. These were fitted with half-inch microphones, which comply with the type 1 standard in IEC651. The microphones were fitted with double skin windshields, based on the Gracey and Associates model 8310 design, and mounted on tripods at a height of 1.2 metres. Calibration was undertaken using a Brüel and Kjær model 4231 Acoustic Calibrator (s/n 2218188) and checked at the end of the monitoring period. Changes of no more than 0.9 dB were noted at any of the locations.

10.18 The sound level meters were left at the seven measurement points for 15 days between 14th and 29th July 2004. The meters were programmed to measure a number of statistical noise indices, including the L_{A90}, together with the maximum and minimum levels and the L_{Aeq} over consecutive 10-minute periods. Results were automatically stored at the end of each period and the equipment was time-synchronised to wind speed measurements at an on-site anemometry mast to allow for correlation between the two during the analysis. Wind speed measurements were recorded simultaneously by a 10-metre wind monitoring mast located on site, together with wind direction measurements at the same height.

Impact assessment

10.19 The turbines considered in this assessment are of the twin-speed type, which operate with a reduced rotor speed at lower wind speeds to minimise noise impact and conditions when background masking noise is lowest.

10.20 Noise predictions were carried out using International Standard ISO 9613, *Acoustics – Attenuation of Sound During Propagation Outdoors*. The propagation model described in Part 2 of this standard provides for the prediction of sound pressure levels based on either short-term downwind (ie worst case) conditions or long-term averages. Only downwind conditions were considered in this assessment, ie for wind blowing from the site towards the nearby residential properties. Noise levels will be significantly lower when the wind is blowing in the opposite direction, particularly where there is shielding between the site and the houses.

10.21 The ISO propagation model calculates the predicted sound pressure level by taking the source sound power level for each turbine in separate octave bands and subtracting a number of attenuation factors according to the following equation:

$$\text{Predicted Octave Band Noise Level} = L_W + D - A_{geo} - A_{atm} - A_{gr} - A_{bar} - A_{misc}$$

10.22 The attenuation factors are discussed in paragraphs 10.23 to 10.35. The predicted octave band levels from each of the turbines are summed together to give the overall ‘A’ weighted predicted sound level from all the turbines acting together.

L_W (source sound power level)

10.23 The sound power level of a noise source is normally expressed in dB re: 1pW. Noise predictions have been based on the sound power level of a Vestas V82 wind turbine. These turbines can be run in two modes depending on the wind speed, which allows for quieter operation below a specific speed. The turbines change to the higher speed mode at wind speeds of 7 m/s and down to the lower speed mode at 6 m/s. The sound power levels for various wind speeds up to 9 m/s, warranted by the manufacturer, are shown in table 10.5.

Wind speed at 9 m height (m/s)	Sound power level high speed (dB L_{Aeq})	Sound power level low speed (dB L_{Aeq})
3	-	93.8
4	-	94.3
5	-	95.4
6	101.3	97.1
7	101.9	97.4
8	102.9	-
9	103.1	-

Table 10.5: assumed turbine sound power level

10.24 The noise spectrum used (table 10.6) has been taken from measurements carried out on a sample turbine at 8 m/s according to IEC 61400-11, normalised to the warranted sound power level at each integer wind speed.

Octave band centre frequency (Hz)	63	125	250	500	1000	2000	4000	8000
Assumed octave band sound power level (dB(A))	84.9	91.9	96.5	96.6	97.5	94.5	92.6	83.1

Table 10.6: assumed noise spectrum

D (directivity factor)

10.25 The directivity factor allows for an adjustment to be made where the sound radiated in the direction of interest is higher than that for which the sound power level is specified. In this case, the sound power level is measured in a downwind direction, which corresponds to the worst-case propagation conditions considered here and needs no further adjustment.

A_{geo} (geometrical divergence)

10.26 The geometrical divergence accounts for spherical spreading in the free-field from a point sound source resulting in an attenuation (depending on distance) according to:

$$A_{geo} = 20 \times \log(d) + 11 \quad \text{where d = distance from the turbine}$$

10.27 Each wind turbine may be considered as a point source beyond distances corresponding to one rotor diameter.

A_{atm} (atmospheric absorption)

10.28 Sound propagation through the atmosphere is attenuated by the conversion of the sound energy into heat. This attenuation is dependent on the temperature and relative humidity of the air through which the sound is travelling. It is frequency dependent, with increasing attenuation towards higher frequencies. The attenuation depends on distance according to:

$A_{atm} = d \times \alpha$ where d = distance from the turbine
α = atmospheric absorption coefficient in dB/m.

10.29 The noise impact assessment has used published values of 'α' from ISO 9613 Part I, corresponding to a temperature of 15ºC and a relative humidity of 70%. These give relatively low levels of atmospheric attenuation and worst-case noise predictions (table 10.7).

Octave band centre frequency (Hz)	63	125	250	500	1000	2000	4000	8000
Atmospheric absorption coefficient (dB/m)	0.0001	0.0004	0.0011	0.0023	0.0041	0.0087	0.0264	0.0937

Table 10.7: atmospheric absorption coefficients

A_{gr} (ground effect)

10.30 Ground effect is the effect of sound reflected by the ground interfering with the sound propagating directly from source to receiver. The prediction of ground effects is inherently complex and depends on the source height, receiver height, propagation height between the source and receiver, and ground conditions.

10.31 The ground conditions are described according to a variable G, which varies between 0 for 'hard' ground (including paving, water, ice, concrete and any sites with low porosity) and 1 for 'soft' ground (including ground covered by grass, trees or other vegetation).

10.32 Predictions have made using a source height corresponding to the proposed heights of the turbine nacelles, a receiver height of 1.2 m and an assumed ground factor G of 0. This ground factor corresponds to hard ground between the source and receiver and represents a worst-case equivalent to waterlogged or frozen ground. In practice, noise levels may be up to 2 dB lower.

A_{bar} (barrier attenuation)

10.33 The effect of any barrier between the noise source and the receiver position is that noise will be reduced according to the relative heights of the source, receiver and barrier and the frequency spectrum of the noise.

10.34 The barrier attenuations predicted by the ISO 9613 model have been shown to be significantly greater than those measured in practice under downwind conditions. ETSU's (1990) study of noise propagation from wind farm sites concluded that an attenuation of just 2 dB(A) should be allowed where the direct line of sight between the source and receiver is just interrupted, and that 10 dB(A) should be allowed where a barrier lies within 5 m of a receiver and provides a significant interruption to the line of sight. There is no screening at the West Wight site between the proposed turbines and the nearest housing.

A_{misc} (miscellaneous other effects)

10.35 ISO 9613 includes effects of propagation through foliage, industrial plant and housing as additional attenuation effects. These have not been included in this assessment, and any such effects are unlikely to reduce noise levels significantly below those predicted.

Predicted noise levels

10.36 Noise predictions were carried out for a 5 km by 4 km grid centred on the site for a wind speed of 9 m/s at 10 m height.

Baseline

10.37 A 2nd order polynomial regression line was calculated through the measured baseline background noise data to give the prevailing background noise data. These levels at the measurement points are shown in table 10.8 for night-time noise and 10.9 for amenity hours noise. The baseline measured background noise at the measurement points is plotted on figures 10.3-10.6 (see post-construction effects section). The full results of the noise measurements and wind direction information over the survey period are available on request from YEL.

Wind speed at 10 m height	**L_{A90} sound pressure (dB) at monitoring points**						
	Hartshole Cottage	Dodpits House	Churchills Farmhouse	Tapnell Cottages	Dog Kennel Cottage	Chessell Pottery	Shalcombe Cottage
0	23.42	26.36	21.72	27.14	31.47	24.82	25.03
1	22.42	24.82	20.29	25.07	31.01	24.97	23.74
2	22.10	24.30	20.00	24.04	30.94	25.36	23.36
3	22.46	24.78	20.86	24.05	31.27	25.99	23.51
4	23.50	26.28	22.85	25.10	31.99	26.85	24.56
5	25.22	28.79	25.98	27.20	33.12	27.95	26.39
6	27.62	32.31	30.26	30.33	34.64	29.30	29.00
7	30.70	36.84	35.67	34.52	36.56	30.88	32.39
8	34.47	42.39	42.23	39.74	38.88	32.69	36.55
9	38.90	48.94	49.93	46.01	41.60	34.75	41.50
10	44.02	56.51	58.76	53.32	44.72	37.05	47.22

Table 10.8: prevailing background night-time noise at measurement points

Wind speed at 10 m height	L_{A90} sound pressure (dB) at monitoring points						
	Hartshole Cottage	Dodpits House	Churchills Farmhouse	Tapnell Cottages	Dog Kennel Cottage	Chessell Pottery	Shalcombe Cottage
0	23.05	25.95	20.93	26.42	30.54	25.73	26.89
1	23.79	26.75	22.12	26.85	30.86	27.61	28.57
2	24.87	27.90	23.62	27.69	31.52	29.42	30.27
3	26.30	29.40	25.43	28.95	32.50	31.15	31.98
4	28.07	31.24	27.56	30.62	33.81	32.79	33.71
5	30.18	33.43	30.00	32.70	35.45	34.37	35.46
6	32.64	35.97	32.75	35.20	37.41	35.86	37.23
7	35.45	38.85	35.82	38.10	39.71	37.27	39.01
8	38.60	42.08	39.19	41.42	42.33	38.61	40.81
9	42.09	45.66	42.88	45.16	45.28	39.86	42.62
10	45.93	49.58	46.89	49.30	48.57	41.04	44.46

Table 10.9: prevailing background amenity hours noise at measurement points

Effects during construction and decommissioning

Noise from the construction process

10.38 Methods exist for the calculation of noise from construction activities, but these require a level of detailed information regarding the specific plant and equipment to be used and the programming of the works, which is not available at this stage of the proposals. It has therefore been judged that any noise level predictions made at this stage could be misleading and the level of potential error unacceptable.

10.39 The greatest potential for noise during construction is likely to arise from track laying and excavation and the construction of the turbine foundations. However, there is not expected to be any road stone quarrying or crushing at the site.

10.40 BS5228 (1992) provides guidance on acceptable noise levels during construction. In rural areas, a limit of 70 dB_{LAeq} at the outside of a noise-sensitive building is recommended. The relatively large distances between the site and the nearest residence (550 m from the closest turbine) means that construction noise is unlikely to exceed 70 dB_{LAeq} at the sensitive receptors. However, construction noise may be perceptible at the closest locations during particular processes.

10.41 The main method of controlling and reducing noise from construction activities is the adoption of Best Practicable Means (BPM) as defined in the Control of Pollution Act 1974. Tables 10.10 to 10.13 sets out a number of BPM measures that could be employed during the construction phase of these proposals.

Plant and equipment
- **modern, silenced and well-maintained plant will be used at all times, conforming to standards set out in EU Directives**
- **equipment including vehicles will be shut down when not in use**
- **engine compartments will be closed when equipment is in use and the resonance of body panels and cover plates will be reduced by the addition of suitable dampening materials. Any rattling noise will be addressed by the tightening of loose parts or the addition of resilient materials**
- **semi-static equipment is to be sited and orientated as far as is reasonably practicable away from noise sensitive receptors and have localised screening if deemed necessary**
- **generators and water pumps required for 24-hour operation will be super-silenced or screened as appropriate**
- **crane spindles, pulley wheels, telescopic sections and moving parts of working platforms shall be adequately lubricated in order to prevent undue screeching and squealing**
- **where possible mains electricity will be used rather than generators.**

Table 10.10: Best Practical Means to control noise from construction plant

Methods of working
- **where ground conditions permit first preference shall be given to reaction piling methods (‘silent piling’). Otherwise vibratory piling methods, together will pre-auguring, shall be used. Percussive piling shall only be considered where ground condition precludes the use of other methods and prior agreement should be sought from the local authority**
- **where practicable, pile caps will be cut and then broken with hydraulic rams to minimise the use of heavy air-powered breakers**
- **large concrete pours (for which an extension of working hours may be necessary) will commence as early as possible within normal working hours so that the activities can be completed within normal working hours as far as possible.**

Table 10.11: Best Practical Means to control noise from construction methods

Decommissioning
- **when breaking out concrete, an oversized breaker will be used to minimize the blow rate and hence the percussive nature of the noise produced. This should also minimize the time taken to complete the breaking out works. Where concrete obstructions arise these will be removed and taken to a less sensitive location before being broken up**
- **hydraulic ‘munchers’ will be used where reasonably practicable in preference to breakers**
- **all materials will be handled, stored and used in a manner that minimises noise**
- **concrete bursting and cutting will be considered where practical.**

Table 10.12: Best Practical Means to control noise from decommissioning

Management of works programme
- **wherever practicable, noisy works, which are audible at the site boundary, should be undertaken during normal daytime hours, e.g. between 07.30 and 18.00 Monday to Friday and between 07.30 and 13.00 on Saturdays**
- **choice of routes and programming for the transportation of construction materials and personnel are to be carefully considered in order to minimise the overall noise impact generated by these movements**
- **personnel will be instructed on BPM measures to reduce noise and vibration as part of their site induction training**
- **shouting and raised voices shall be kept to a minimum e.g. in cases where warnings of danger must be given. Use of radios is to be prohibited except where two-way radios are required for reasons of safety and communication.**

Table 10.13: Best Practical Means to control noise – management works programme

10.42 Under Section 60 of the Control of Pollution Act, local authorities have powers to control activities at construction sites, for example by limiting hours of operation and the use of various items of plant. In addition, Section 61 of the Act enables developers to agree construction protocols with a local authority prior to works commencing. It is considered that these powers present the best method for minimising any noise effects that may arise during the construction phase of the development.

10.43 All construction works are by their nature temporary, and any effects that may arise will be so also.

Traffic noise

10.44 Predicted construction traffic flows have been compared to the existing baseline traffic flows in table 13.12 of chapter 13. The largest predicted proportional increase as a result of construction traffic is 3.515%. The Design Manual for Roads and Bridges advises that an increase in traffic of 25% corresponds to an increase in noise levels of 1 dB(A). Therefore, an increase in traffic of 3.515% or less will lead to a negligible change in noise from traffic during construction. No significant effects are predicted.

Effects during operation

Residential receptors

10.45 The results of the noise predictions are shown as noise contours on figure 10.2 and are summarised in table 10.14 for the measurement locations. It should be noted that this represents downwind propagation in all directions simultaneously, which cannot happen in practice. The predicted turbine noise L_{Aeq} has been reduced by 2 dB(A) to give the equivalent L_{A90}. These contours represent worst-case downwind conditions and assume no attenuation from any ground effects. Noise levels will not exceed these at the given wind speeds, and will be lower for the majority of the time.

Location	Noise level at 9 m/s (dB L_{A90})
Hartshole Cottage	39.0
Dodpits House	31.3
Churchills Farmhouse	39.0
No. 8 Tapnell Cottages	37.5
Dog Kennel Cottage	36.5
Chessell Pottery*	32.0
Shalcombe Cottage	35.7

Table 10.14: summary of noise predictions for noise measurement locations
*Nearest residence

10.46 The measured L_{A90} background noise levels have been plotted against wind speed at the measurement locations for night-time and the hours during which people could be enjoying the amenity of their properties (quiet day-time periods in table

10.3), which are defined as sensitive periods of the day in the ETSU-R-97 recommendations (figures 10.3-10.6).

10.47 The derived ETSU-R-97 noise limits are shown on the plots to provide the noise limits at any given wind speed, based on the background level plus 5 dB or the fixed lower limit, whichever is greater. The predicted turbine noise levels are also shown for the nearest properties in each area.

Hartshole Cottage

10.48 Figure 10.3a shows that the predicted night-time turbine noise level at Hartshole Cottage is below the night-time noise limit by at least 4 dB. The predicted turbine noise level is below the lower noise limit during amenity hours by at least 0.5 dB (figure 10.3a), and is below the prevailing background for wind speeds greater than 8 m/s.

Dodpits House

10.49 The predicted turbine noise level at Dodpits House during the night hours is below the night-time noise limit by a minimum margin of 13 dB (figure 10.3b). It is also below the prevailing background noise for all wind speeds. For the amenity hours, the predicted turbine noise level is below the lower noise limit by at least 10.5 dB and below the prevailing background noise at all wind speeds (figure 10.3b).

Churchills Farmhouse

10.50 Figure 10.4a shows that the predicted night-time turbine noise level at Churchills Farmhouse is below the night noise limit by a minimum margin of 5 dB. It is also below the prevailing background noise level for wind speeds above 7.5 m/s. The predicted turbine noise level is below the lower amenity noise limit by a minimum margin of 0.5 dB (figure 10.4a). It is also below the prevailing background noise level for wind speeds above 8 m/s.

Tapnell Cottages

10.51 The predicted turbine noise level at Tapnell Cottages during the night hours is below the night-time noise limit by at least 6 dB (figure 10.4b). It is also below the prevailing background noise level for wind speeds above 7.5 m/s. Figure 10.4b shows that the predicted turbine noise level is below the lower amenity hours noise limit by at least 4.5 dB. It is below the prevailing background noise level at all wind speeds except approximately 6 m/s for high-speed operation.

Dog Kennel Cottage

10.52 Figure 10.5a shows that the predicted night-time turbine noise level at Dog Kennel Cottage is below the night-time noise limit by a minimum margin of 7 dB. It does not exceed the prevailing background level for any wind speed conditions. The predicted noise level for the amenity hours is below the lower noise limit by at least 7.5 dB (figure 10.5a) and below the prevailing background noise level at all wind speeds.

Chessell Pottery

10.53 The predicted turbine noise level at Chessell Pottery during the night hours is below the night-time noise limit by a minimum margin of 11 dB (figure 10.5b). It is also below the prevailing background noise for wind speeds above 7 m/s. Figure 10.5b shows that the predicted turbine noise level is below the lower amenity hours noise limit by at least 11 dB and below the prevailing background noise at all wind speeds.

Shalcombe Cottage

10.54 Figure 10.6a shows that the predicted night-time noise level at Shalcombe Cottage is below the night-time noise limit by at least 7.5 dB. It is also below the prevailing background noise for wind speeds above 7.5 m/s. The predicted noise level for the amenity hours is below the lower noise limit by a minimum margin of 8 dB (figure 10.6a) and below the prevailing background noise at all wind speeds.

Other residential properties

10.55 There are additional properties within the 35 dB noise contour (figure 10.2) that require detailed noise assessment. Prospect Cottage, The Quarries and Shalcombe Holding are all located within 0.5 km of the southern site boundary. The predicted turbine noise at Prospect Cottage is 4.5 dB higher than at Shalcombe Cottage. Figure 10.6b shows the predicted noise level overlaid on the background noise measurements made at Shalcombe Cottage, which is the nearest measurement location. Shalcombe Cottage is nearer to the B3399, but the background noise plots indicate that this is not a significant source of noise. The B3399 contributes a similar level of background noise at Shalcombe Cottage as at Tapnell Cottages, which are a similar distance from the road as Prospect Cottage.

10.56 The predicted turbine noise level is below the night-time noise limit at Prospect Cottage by at least 3 dB, based on the background measurements from Shalcombe Cottage. The predicted noise level for the amenity hours at Prospect Cottage is below the lower noise limit by a minimum of 4 dB. It is below this prevailing background noise at all wind speeds, except for those from 6-7 m/s for high speed operation.

10.57 Predicted turbine noise at The Quarries is 1.5-2 dB lower than at Prospect Cottage, giving lower levels of noise impact. Predicted turbine noise levels at Shalcombe Holding are similar to those at Shalcombe Cottage, resulting in a similar level of impact. Hartshole Cottage represents the worst case assessment for properties in Wellow, with the highest predicted turbine noise levels.

10.58 The contour plot in figure 10.2 shows that predicted turbine noise will be below the 35 dB criterion for all other properties at the wind speed of 9 m/s for which these plots have been produced. Turbine noise at 10 m/s is not expected to be significantly higher, suggesting that the remaining properties in the area will be below the ETSU-R-97 simplified criterion.

10.59 A warranty will be sought from the manufacturers of the turbines for the site that the noise output will not require a correction under the ETSU-R-97 scheme (paragraph 10.13).

Traffic noise

10.60 A negligible volume of traffic will be generated by the scheme during operation (see chapter 13). These will be no significant increase in traffic noise.

Low frequency and infrasonic noise

10.61 Low frequency noise spans the infrasonic and audible range and is generally considered to range from approximately 10 Hz to 200 Hz. The entire low frequency range is audible, although high sound pressure levels are required to exceed the hearing threshold at the lower frequencies (Leventhall, 2003).

10.62 PPS 22 does not require the assessment of low frequency noise from wind farms, as the required assessment methodology is the use of ETSU-R-97. The Companion Guide to PPS 22 states that:

> *'there is no evidence that ground transmitted low frequency noise from wind turbines is at a sufficient level to be harmful to human health.'* (Paragraph 45 of Planning for Renewable Energy: A Companion Guide to PPS 22)

10.63 Measurements of low frequency and infrasonic noise around a modern wind farm by ETSU (1997) found that the vibration levels 100 m from the nearest turbine were 10 times lower than the safety requirements for modern laboratories and lower again than the limits specified for residential premises. Noise and vibration levels were shown to comply with the recommended residential criteria on the wind farm site itself. Tones above 3.0 Hz were found to attenuate rapidly with distance from the turbines, with the higher frequencies attenuating at a progressively increasing rate. The nearest potential residential receptor to the West Wight site is approximately 550 m away.

10.64 There is no evidence that there are any effects of low frequency sound at levels below perceptibility. The Community Noise document produced for the World Health Organisation in 1995 states that 'there is no reliable evidence that infrasounds below the hearing threshold produce physiological or psychological effects'.

Effect of noise on birds

10.65 There is no research that has conclusively established whether noise from wind farms affects bird populations and breeding densities. The noise generated by the turbines on site is predicted to decrease quickly with distance from the turbines, frequently to below the existing background noise level. The turbines will not generate loud screeches or sudden bangs that could cause birds to take flight. It is not considered likely that there will be a significant effect on breeding bird densities on site or in the surrounding area as a result of noise generated by the proposals. The results of a research project by Thomas (1999) are set out in the birds chapter. He found no significant difference between breeding bird abundance in wind farms and adjacent controls, and concluded that wind farms have a minimal impact on bird abundance.

Cumulative effects

10.66 No significant noise impacts are predicted as a result of the proposals and there are no consented wind farm proposals in close proximity to the site, so there is no potential for generation of cumulative noise effects.

Mitigation

10.67 No mitigation measures are required.

Residual effects

10.68 There will be no significant residual noise and vibration effects as a result of the proposed development.