



White Hill Wind Farm Electricity
Substation & Electricity Line

Environmental Impact Assessment Report

Chapter 11: Noise & Vibration

White Hill Wind Limited

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Contents

11.1 Introduction.....	1
11.1.1 Background and Objectives	1
11.1.2 Statement of Authority	1
11.1.3 Description of the Project	1
11.2 Methodology	2
11.2.1 Proposed Approach	2
11.2.2 Fundamentals of Acoustics	2
11.3 Guidance Documents and Assessment Criteria	3
11.3.1 Construction Phase	3
11.3.2 Operational Phase	7
11.3.3 Decommissioning Phase	8
11.3.4 Forecasting Methods	8
11.4 Description of the Existing Environment	9
11.4.1 Unattended Noise Monitoring at Electricity Substation Site	9
11.4.2 Attended Noise Monitoring along Underground Electricity Line	12
11.4.3 Vibration	14
11.5 Description of Likely Effects.....	14
11.5.1 Do Nothing Scenario	14
11.5.2 Construction Phase	14
11.5.3 Operational Phase	18
11.5.4 Decommissioning Phase	18
11.5.5 Cumulative Effects	18
11.6 Mitigation and Monitoring Measures	19
11.6.1 Construction Phase	19
11.6.2 Operational Phase	20
11.6.3 Decommissioning Phase	20
11.6.4 Monitoring	21
11.7 Residual Effects	21
11.7.1 Do Nothing Scenario	21
11.7.2 Construction Phase	21
11.7.3 Operational Phase	21
11.7.4 Decommissioning Phase	21
11.7.5 Cumulative Effects	21
11.8 Summary	22



11.1 Introduction

11.1.1 Background and Objectives

This chapter describes the assessment undertaken of the likely noise and vibration effects arising from the construction, operation and decommissioning of the White Hill Electricity Substation & Electricity Line.

This chapter provides a baseline assessment of the environmental setting of the project in terms of noise and vibration and discusses the likely and significant effects that the construction and operation of the project will have on them. Where required, appropriate mitigation measures to limit any significant noise and vibration effects identified, are presented. The residual effects and cumulative effects of the project post-mitigation are also assessed.

11.1.2 Statement of Authority

This chapter has been prepared by Robert Holohan BA(Hons) MSc, Acoustic Consultant at AWN Consulting Ltd. Robert has a BA in Geography and Business Marketing from Maynooth University as well as an environmental science background from his MSc in Coastal and Marine Environments from the University of Galway. From his studies, he has gathered extensive experience in environmental mapping and surveying using drone and satellite imagery and has worked on producing impact assessments for both coastal and residential areas. He also carried out the attended baseline noise survey for this assessment.

This chapter has been reviewed by Mike Simms BE MEngSc MIOA MIET, Principal Acoustic Consultant at AWN Consulting Ltd. Mike has worked in the field of acoustics for over 20-years. He has extensive experience in all aspects of environmental surveying, noise modelling and impact assessment for various sectors including, wind energy, industrial, commercial and residential.

The unattended baseline noise monitoring was undertaken by Cormac McPhillips, Technical Services Manager at Galetech Energy Services (GES). Cormac has extensive experience of undertaking noise monitoring programmes in accordance with relevant standards and best practice methods; and has a Certificate of Competence in Environmental Noise Measurement from the Institute of Acoustics.

11.1.3 Description of the Project

The project site is located in rural County Kilkenny and County Carlow, approximately 11 kilometres (km) northeast of Kilkenny City, c. 15km southwest of Carlow Town, c. 3km west of Muine Bheag and c. 1km north of Paulstown. In summary, the project comprises the following main components as described in full at **Chapter 3:-**

- A 110kV 'loop-in/loop-out' electricity substation;
- Approximately 320 metres (m) of 110kV underground electricity line between the electricity substation and the Kellis-Kilkenny overhead transmission line and the provision of 2 no. interface masts;
- An electrical control unit at the permitted White Hill Wind Farm site;
- Approximately 8.5km of underground electricity line between the electricity substation and the electrical control unit; and,
- All associated and ancillary site development, access, excavation, construction, landscaping and reinstatement works, including provision of site drainage

infrastructure.

The project site traverses the administrative boundary between counties Kilkenny and Carlow; with the electricity substation and c. 4km of the underground electricity line located in County Kilkenny and c. 4.5km of the underground electricity line located in County Carlow. Electrical equipment suppliers, construction material suppliers and candidate quarries which may supply aggregates are located nationwide.

11.2 Methodology

11.2.1 Proposed Approach

The following methodology has been adopted for this assessment:-

- Review appropriate guidance in order to identify appropriate noise and vibration criteria for the site operations;
- Carry out baseline noise monitoring at a location representative of nearest sensitive properties to identify existing levels of noise in the vicinity; and,
- Comment on predicted noise levels against the appropriate construction and operational phase criteria and outline required mitigation measures (if any).

Annex 11.1 (Volume II) presents a glossary of the acoustic terminology used throughout this document. In the first instance, it is considered appropriate to review some fundamentals of acoustics.

11.2.2 Fundamentals of Acoustics

A sound wave travelling through the air is a regular disturbance of the atmospheric pressure. These pressure fluctuations are detected by the human ear, producing the sensation of hearing. To take account of the vast range of pressure levels that can be detected by the ear, it is convenient to measure sound in terms of a logarithmic ratio of sound pressures. These values are expressed as Sound Pressure Levels (SPL) in decibels (dB).

The audible range of sounds expressed in terms of Sound Pressure Levels is 0dB (for the threshold of hearing) to 120dB (for the threshold of pain). In general, a subjective impression of doubling of loudness corresponds to a tenfold increase in sound energy which conveniently equates to a 10dB increase in SPL. It should be noted that a doubling in sound energy (such as may be caused by a doubling of traffic flows) increases the SPL by 3 dB.

The frequency of sound, which is the rate at which a sound wave oscillates, is expressed in Hertz (Hz). The sensitivity of the human ear to different frequencies in the audible range is not uniform. For example, hearing sensitivity decreases markedly as frequency falls below 250Hz. In order to rank the SPL of various noise sources, the measured level must be adjusted to give comparatively more weight to the frequencies that are readily detected by the human ear. The 'A-weighting' system, defined in the international standard BS ISO 226:2003 Acoustics - Normal Equal-loudness Level Contours, has been found to provide the best correlations with human response to perceived loudness. SPLs measured using 'A-weighting' are expressed in terms of dB(A).

An indication of the level of some common sounds on the dB(A) scale is presented at **Figure 11.1** and shows a quiet bedroom at around 35dB(A), a nearby (at 7m) noisy HGV at 90dB(A) and a pneumatic drill (at 7m) at about 100dB(A).

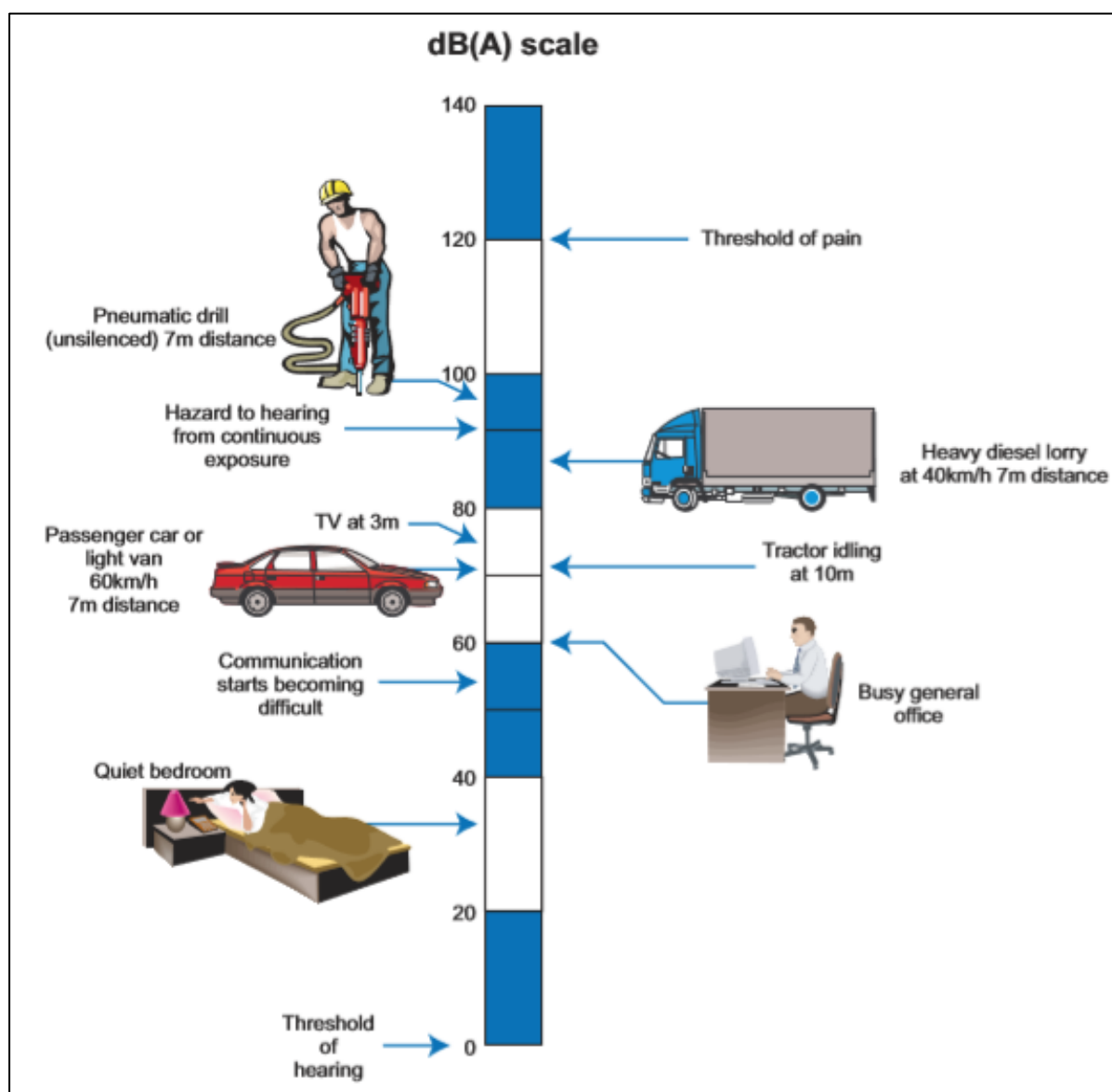


Figure 11.1: The Level of Typical Common Sounds on the dB(A) scale

Source: NRA Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes, 2014)

11.3 Guidance Documents and Assessment Criteria

The following sections review best practice guidance that is commonly adopted in relation to developments such as the subject project.

11.3.1 Construction Phase

11.3.1.1 Electricity Substation and Electrical Control Unit

The following comments apply to the works for the electrical control unit and the electricity substation.

There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. Local authorities or An Bord Pleanála typically control construction activities by imposing limits on the hours of operation and/or applying noise limits for construction noise at noise-sensitive locations.

In the absence of specific noise limits, appropriate criteria relating to permissible construction noise levels for the electricity substation are taken from BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Noise* (Annex E, Section E.3.2).

The approach adopted in BS 5228-1 calls for the designation of a noise sensitive location into a specific category (A, B or C) based on existing ambient noise levels in the absence of construction noise. This then sets a Construction Noise Threshold (CNT) noise value that, if exceeded at a location, indicates a likely significant noise effect is associated with the construction activities, depending on the context. It should be noted that, in accordance with BS 5228-1 guidance, these assessment criteria are only applicable to residential receptors.

Table 11.1 sets out the values which, when exceeded, signify a likely significant effect at the facades of residential receptors. These values relate to construction noise levels only and not the cumulative noise level due to construction noise plus existing ambient noise.

Assessment category and threshold value period (T)	Threshold values, $L_{Aeq,T}$ dB		
	Category A Note A	Category B Note B	Category C Note C
Night-time (23:00 to 07:00hrs)	45	50	55
Evenings and weekends <i>Note D</i>	55	60	65
Daytime (07:00 – 19:00hrs) and Saturdays (07:00 – 13:00hrs)	65	70	75

Table 11.1: Example Threshold of Significant Effects at Dwellings

Note A Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.

Note B Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.

Note C Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.

Note D 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

The approach is described as follows: for the applicable assessment period (in this instance, daytime), the ambient noise level is determined and rounded to the nearest 5dB. Baseline monitoring carried out as part of this assessment (refer to **Section 11.4**) indicates that the threshold values for Category A are appropriate in terms of the nearest noise sensitive locations being considered in this instance.

The CNT for the electricity substation works, which will take place during daytime periods only, is therefore 65 dB $L_{Aeq,T}$.

11.3.1.2 Underground Electricity Line

For the construction of the underground electricity line, reference has been made to the Transport Infrastructure Ireland (formerly NRA) (TII) document *Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes* (TII, 2014) for appropriate criteria. The TII guidelines define states that construction noise limits are to be applied to the facade of dwellings. Whilst this document is specifically intended for the purposes of New National Road Schemes; given that the underground electricity line consists of a linear scheme, and in the absence of other national guidelines relating to the specific project under consideration, the guidelines are assessed a relevant to determine the likelihood of significant noise effects arising from the underground electricity line. These maximum permissible noise levels are set

out at **Table 11.2**.

Days and Times	Noise Levels (dB re. 2×10^{-5} Pa)	
	$L_{Aeq,1hr}$	L_{Amax}
Monday to Friday 07:00 to 19:00hrs	70	80
Monday to Friday 19:00 to 22:00hrs	60	65
Saturdays 08:00 to 16:30hrs	65	75
Sundays & Bank Holidays 08:00 to 16:30hrs	60	65

Table 11.2: Maximum Permissible Noise Levels at the Façade of Dwellings during Construction of Linear Projects

For underground electricity line works, which will take place during daytime periods only, the CNT is 70dB $L_{Aeq,1hr}$ for weekdays and 65dB $L_{Aeq,1hr}$ for Saturdays.

11.3.1.3 Interpretation of Construction Noise Thresholds

In order to assist with interpretation of CNTs, **Table 11.3** provides guidance as to the likely magnitude of effect associated with construction activities, relative to the CNT. This guidance is derived from Table 3.16 of United Kingdom Highways England (now National Highways) (UKHE) *Design Manual for Roads and Bridges (DMRB) Sustainability & Environment Appraisal LA 111 Noise and Vibration Revision 2* (UKHE, 2020); this guidance has been adapted to include the relevant significance of effect levels from the EPA Guidelines (EPA 2022).

Guidelines for Noise Impact Magnitude Assessment of Significance (DMRB)	CNT per Assessment Category and Threshold Value Period	EPA EIA Significance Effects	Determination of Significance in EIA terms
Negligible	Below or equal to baseline noise level	Not Significant	Not Significant
Minor	Above baseline noise level and below or equal to CNT	Slight to Moderate	CNTs at the upper end of this range will result in higher likely effects, therefore this range is categorised as Slight to Moderate, acknowledging that values approaching the CNT are greater than Slight. In accordance with <i>DMRB Noise and Vibration</i> (UKHA 2020) and BS 5228-1 ((BSI 2009 +A1 2014a), noise levels below the CNT are deemed 'Not Significant'.
Moderate	Above CNT and below or equal to CNT +5dB	Moderate to Significant	Depending on CNT, duration and baseline noise level. In accordance with the <i>DMRB Noise and Vibration</i> (UKHA 2020), construction noise effects shall constitute a significant effect where it is determined that a moderate or major magnitude of effect will occur for a duration exceeding:
Major	Above CNT +5 to +15 dB	Significant, to Very Significant	Ten or more days or night in any 15 no. consecutive day or nights; and A total number of days exceeding 40 no. in any 6 no. consecutive months.
	Above CNT +15 dB	Very Significant to Profound	

Table 11.3: Construction Noise Significance Criteria

The adapted DMRB Noise and Vibration (UKHA 2020) guidance outlined is used to assess the predicted construction noise levels at NSLs and comment on the likely effects during the construction phase.

11.3.1.4 Vibration

Vibration standards come in two varieties: those dealing with human comfort and those dealing with cosmetic or structural damage to buildings. With respect to the project, the range of relevant criteria used for building protection is expressed in terms of Peak Particle Velocity (PPV) in mm/s.

Guidance relevant to acceptable vibration within buildings is contained in the following documents:-

- *British Standard BS 7385 – Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration (1993); and*
- *British Standard BS 5228 – Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration (2009+A1:2014).*

BS7385-2 and BS5228-2 advise that, for soundly constructed residential properties and similar light-framed structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a peak component particle velocity (in frequency range of predominant pulse) of 15mm/s at 4Hz increasing to 20mm/s at 15Hz and 50mm/s at 40Hz and above for transient vibration.

Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values at Table B.2 of BS5228-2 may need to be reduced by up to 50%. On a cautious basis, therefore, continuous vibration limits are set as 50% of those for transient vibration across all frequency ranges. For buildings or structures that are structurally unsound, lower vibration magnitudes will apply, typically 50% of those for structurally sound buildings. Protected or historic buildings are not automatically assumed to be more vulnerable to vibration unless they have existing structural defects.

The TII guidelines also provide information on permissible vibration levels during the construction phase, as detailed at **Table 11.4**.

Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of		
Less than 10Hz	10 to 50Hz	50 to 100Hz (and above)
8 mm/s	12.5 mm/s	20 mm/s

Table 11.4: Allowable Transient Vibration at Properties

11.3.1.5 Construction Traffic

Vehicular movement to and from the construction works for the project will make use of the existing road network. In order to assess the potential noise effect of this additional traffic at NSLs, the following guidelines are referenced; DMRB Noise and Vibration (United Kingdom Highways England (now National Highways), 2020) and the EPA EIA Guidelines (EPA, 2022). Due to the short-term period over which this effect occurs, the magnitude of effects is assessed against the 'short term' period in accordance with the DMRB document. **Table 11.5** sets out the classification of changes in noise level to affect human perception based on the guidance contained in these documents.

Change in Sound Level (dB)	Subjective Reaction	DMRB Magnitude of Effect (Short-term)	EPA Significance of Effect
Less than 1 dB	Inaudible	Negligible	Imperceptible
1 – 2.9	Barely Perceptible	Minor	Not Significant
3 – 4.9	Perceptible	Moderate	Slight, Moderate
≥ 5	Up to a doubling of loudness	Major	Significant

Table 11.5: Classification of magnitude of traffic noise changes in the short-term

11.3.2 Operational Phase

11.3.2.1 Noise – Electricity Substation

British Standard Institute (BSI) *BS 8233: 2014: Guidance on Sound Insulation and Noise Reduction for Buildings* (BSI, 2014) provides guideline values for internal noise levels within residential dwellings. The standard provides recommendations for indoor ambient noise levels as presented in **Table 11.6**.

Activity	Location	Daytime*	Night-time**
Resting	Living room	35dB LAeq, 16hour	-
Dining	Dining room/area	40dB LAeq, 16hour	-
Sleeping (daytime resting)	Bedroom	35dB LAeq, 16hour	30dB LAeq, 8hour

Table 11.6: BS 8233 Indoor Noise Levels

*Daytime assessment period – 07:00 to 23:00hrs
 **Night-time assessment period – 23:00 to 07:00hrs

The BS 8233:2014 values are broadly in-line with the values as presented in the WHO *Guidelines for Community Noise 1999*, which are also presented below:-

Specific Environment	Critical Health Effect(s)	dB LAeq,T
Dwelling indoors	Speech intelligibility and moderate annoyance, daytime and evening	35dB LAeq, 16hour
Inside bedrooms	Sleep disturbance, night-time	30dB LAeq, 8hour

Table 11.7: WHO Indoor Noise Levels

It is appropriate to derive external noise limits based on the internal criteria noted above. This is carried out by factoring in the degree of noise reduction afforded by a partially open window. Annex G in BS 8233:2014 comments that, if partially open windows were relied upon for background ventilation, the noise insulation would be reduced to approximately 15dB.

It is also acknowledged that the level of difference through a window partially open for ventilation can vary depending on the window type and this is nominally deemed to fall in the range of 10-15dB. Therefore, an inside-to-outside level difference in the range of between 10-15dB is appropriate to define maximum external operational criteria.

Recommended Criteria

Following the evaluation of relevant guidance, the following noise criteria are

proposed at the façades of residential properties in the vicinity of the project:-

- Daytime (07:00 to 23:00 hours): 45-50dB $L_{Aeq, 16hr}$;
- Night-time (23:00 to 07:00 hours): 40-45dB $L_{Aeq, 8hr}$; and

It should be noted that equipment and plant noise emissions are designed such that they are not tonal and do not have impulsive characteristics at noise sensitive locations.

11.3.2.2 Noise – Underground Electricity Line

As the underground electricity line will not generate any noise during the operational phase due to the absence of moving parts and its sub-surface location, an assessment of operational phase noise levels is not required. Therefore, no operational phase noise criteria are required for this element of the project.

11.3.2.3 Noise – Electrical Control Unit

As the electrical control unit will not generate any noise during the operational phase due to the absence of moving parts and an electrical transformer, an assessment of operational phase noise levels is not required. Therefore, no operational phase noise criteria are required for this element of the project.

11.3.2.4 Noise - Additional Vehicular Traffic

Once operational, the project will be visited periodically for maintenance purposes, with a total of 1-2 trips per week. The vehicles used will typically be a light goods vehicle (LGV) or van. The number of vehicle trips is not such that any significant additional noise levels are likely to be generated.

11.3.2.5 Vibration

There is no expected source of vibration associated with the operational phase, therefore, vibration criteria have not been specified for this phase of the project.

11.3.3 Decommissioning Phase

As set out at **Chapter 3 (Sections 3.2 and 3.7)**, the electricity substation will form part of the national electricity network and decommissioning will not occur. The underground electricity line will be decommissioned upon decommissioning of the White Hill Wind Farm. The electricity line will be removed from its ducting and transported to an approved waste handling facility for re-use or recycling; while the electrical control unit will also be decommissioned and removed from site.

Noise and vibration effects are likely to be similar to the construction phase but of a reduced magnitude.

11.3.4 Forecasting Methods

Construction noise calculations have been conducted generally in accordance with *BS 5228: 2009+A1:2014: Code of practice for noise control on construction and open sites - Noise*.

Changes in road traffic noise on the local road network have been assessed using prediction guidance contained within Calculation of Road Traffic Noise (CRTN) issued by the Department of Transport in 1988.

11.4 Description of the Existing Environment

As outlined above, prior to undertaking the assessment of likely noise effects, it is crucial to understand the typical background noise levels at the nearest NSLs to the project site. The background noise survey was conducted by installing an unattended sound level meter at a location representative of the quiet noise environment of the noise sensitive receptor locations.

The installation, retrieval and management of all measurement instrumentation detailed in this section has been carried out by GES. GES has confirmed that all measurement data collected during the baseline noise surveys has been carried out in accordance with ISO 1996-2:2007 "Acoustics -- Description, measurement and assessment of environmental noise -- Part 2: Determination of environmental noise levels".

The analysis and assessment of the survey data has been carried out by AWN Consulting.

11.4.1 Unattended Noise Monitoring at Electricity Substation Site

11.4.1.1 Noise Measurement Location

The noise measurement location was selected by AWN Consulting. As the electricity substation operates continuously, it is important to capture the quietest daytime and night-time periods, free of influence from noise generated at the noise-sensitive locations themselves, for example by heating systems. The selected noise monitoring location was chosen to reflect the noise environment at the nearest dwelling, located to the south of the electricity substation. Coordinates for the noise measurement location are provided at **Table 11.8**.

Coordinates (ITM)	
Easting	Northing
526916	702931

Table 11.8: Noise Measurement Location

Significant noise sources in this area were noted to be distant traffic movements and wind generated noise from local foliage and other typical anthropogenic sources typically found in such rural settings. There was no perceptible source of vibration noted at the survey location.

Figure 11.2 illustrates the installed noise measurement apparatus. The location of the unattended noise monitor is illustrated at **Figure 11.3**



Figure 11.2: Unattended Noise Measurement Equipment



Figure 11.3: Unattended Noise Measurement Location (UN1)

11.4.1.2 Measurement Period

Noise measurements were conducted over the period outlined at **Table 11.9**.

Start Date	End Date
14:10hrs on 24 June 2024	08:50hrs on 27 June 2024

Table 11.9: Measurement Period

11.4.1.3 Personnel and Instrumentation

All noise monitoring apparatus was installed and removed by GES with the following instrumentation being used.

Equipment	Serial Number
Svantek 977	46436

Table 11.10: Instrumentation Details

Prior to and after the survey, the measurement apparatus was checked and calibrated using a sound level calibrator where appropriate. Relevant calibration certificates are presented at **Annex 11.2**.

11.4.1.4 Procedure

Measurements were conducted at the measurement location outlined at **Table 11.8** and over the time period outlined at **Table 11.9**. Noise levels were logged continuously at 10-minute interval periods for the duration of the survey. Survey personnel also noted the primary sources contributing to noise build-up during installation and removal.

11.4.1.5 Measurement Parameters

Several parameters were measured in order to interpret the noise levels. These included the following:-

- L_{Aeq} : This is the equivalent continuous A weighted sound pressure level. It is an average of the total sound energy (noise) measured over a specified time period; and,
- L_{A90} : Noise level exceeded for 90% of measurement period (steady underlying noise level).

The 'A' suffix denotes that the sound levels have been 'A-weighted' to account for the non-linear nature of human hearing. The 'F' suffix denotes that the parameter has been measured with 'Fast' time-weighting applied. All sound levels in this report are expressed in terms of decibels (dB) relative to 2×10^{-5} Pascal (pa).

11.4.1.6 Results of Unattended Noise Survey

Measured noise levels are summarised in **Tables 11.11** and **11.12**. On review of the measured data, it is confirmed that the typical noise levels were as follows:-

- Daytime ambient noise levels of between 54 and 60dB $L_{Aeq,T}$;
- Daytime background noise levels of between 47 and 55dB $L_{A90,T}$;
- Night time ambient noise levels of between 49 and 54dB $L_{Aeq,T}$; and,
- Night time background noise levels of between 34 and 40dB $L_{A90,T}$.

Date	$L_{Aeq,16hr}$	L_{A90} (Arithmetic Average)
Monday 24 June 2024	56	47
Tuesday 25 June 2024	54	48

Wednesday 26 June 2024	56	49
Thursday 27 June 2024 (07:00 – 08:50)	60	55
Overall	56	48

Table 11.11: Daytime Measured Noise Levels

Date	LAeq,16hr	LA90 (Arithmetic Average)
Monday 24 to Tuesday 25 June 2024	49	34
Tuesday 25 to Wednesday 26 February 2024	48	37
Wednesday 26 to Thursday 27 June 2024	54	40
Overall	51	37

Table 11.12: Night-time Measured Noise Levels

11.4.2 Attended Noise Monitoring along Underground Electricity Line

11.4.2.1 Noise Measurement Locations

A noise survey to quantify the existing baseline noise environment at NSLs in proximity to the underground electricity line route was conducted by AWN Consulting. The survey was carried out in general accordance with ISO 1996: *Description, measurement, and assessment of environmental noise*. The details of the baseline noise survey are presented in the following sections.

5 no. attended measurement locations were selected to inform the assessment and to obtain a representative baseline of noise levels at typical noise sensitive locations. The noise monitoring locations were identified on review of the route such that samples of various noise environments were obtained across the study area. The selection of monitoring locations was supplemented by reviewing aerial images of the study area and other online sources of information (e.g., Google Earth). **Figure 11.4** identifies the 5 no. measurement locations (AT1-AT5) and **Table 11.13** confirms the coordinates of the Attended Noise Monitoring Locations.

Location Reference	Coordinates (ITM)	
	Easting	Northing
AT1	660,673	664,574
AT2	663,267	664,181
AT3	664,157	663,534
AT4	665,114	662,831
AT5	665,565	661,333

Table 11.13: Attended Noise Monitoring Locations

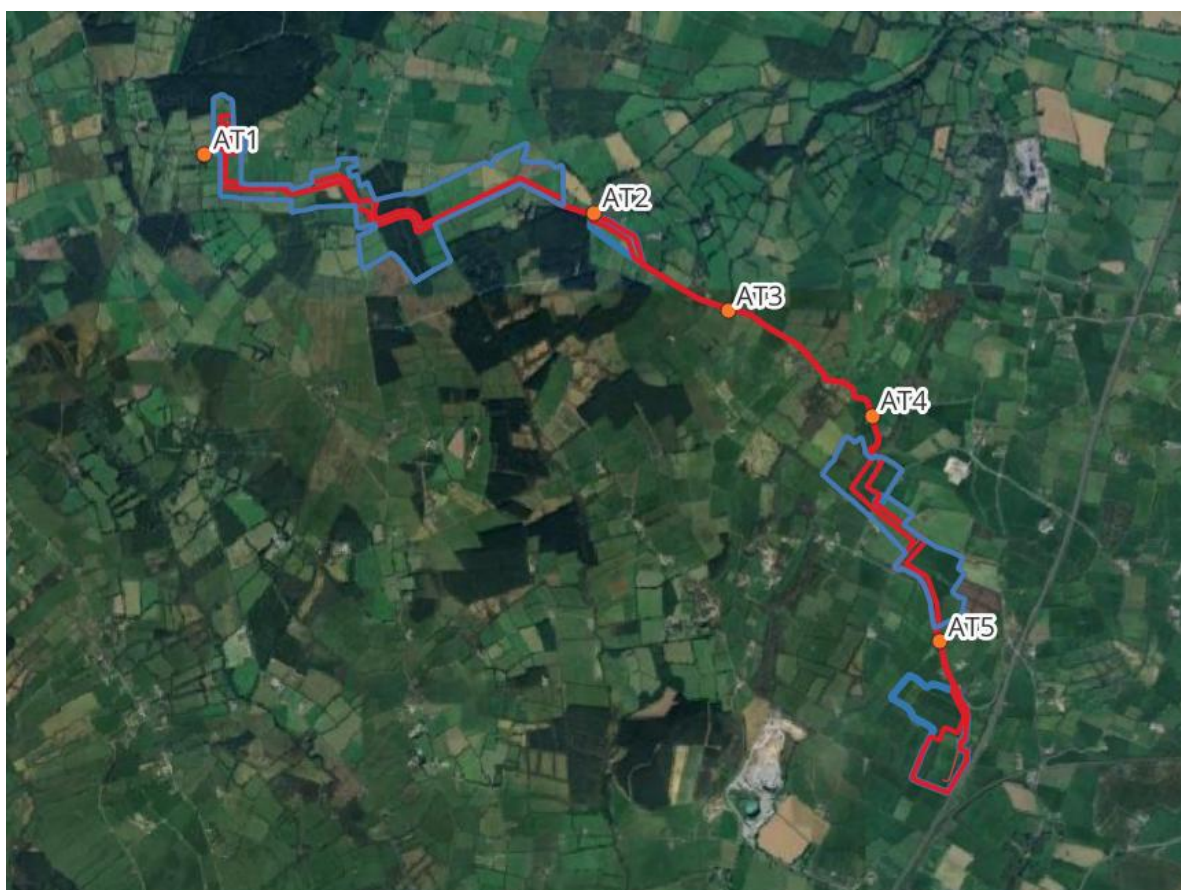


Figure 11.4: Attended Noise Monitoring Locations

11.4.2.2 Survey Periods

Attended noise surveys were undertaken to obtain typical baseline noise levels at noise sensitive locations. The surveys were carried out over the periods listed at **Table 11.14** below. Each survey location was visited 3 no. times in cyclical fashion and noise measurements recorded for 15-minutes per visit.

Location	Survey Times/Date
AT1	10:00 – 12:45 on 11 July 2024
AT2	
AT3	
AT4	13:04 – 14:49 on 11 July 2024
AT5	

Table 11.14: Attended Noise Monitoring Locations Survey Periods

11.4.2.3 Personnel and Instrumentation

The attended noise measurements were undertaken using the following instrumentation by AWN Consulting staff.

Type	Manufacturer	Equipment Model	Serial Number	Calibration Date
Sound Level Meter	RION	NL-52	00976162	02/09/2022
Calibrator	RION	NC-75	34313057	25/10/2023

Table 11.15: Attended Noise Monitoring Instrumentation

The sound level meter was mounted on a tripod approximately 1.5m above ground level and at least 4m away from any reflective surfaces other than the ground.

11.4.2.4 Procedure

The survey data was saved to the instrument memory for later analysis. Survey personnel noted the primary sources contributing to noise build-up during installation and removal.

11.4.2.5 Measurement Parameters

Similar to the unattended survey discussed at **Section 11.4.1.5**, the L_{Aeq} and L_{A90} parameters were recorded.

11.4.2.6 Meteorological Conditions

The weather during the survey period was dry with varying cloud cover. Wind speeds were generally low during the surveys and the lowest background noise levels have been selected as the basis for assessment.

11.4.2.7 Baseline Noise Survey Results

Noise levels measured along the route of the underground electricity line have been collated in order to determine the prevailing baseline ambient and background noise levels. These are presented at **Table 11.16**.

Location	Period	Average Baseline Noise Levels (dB)	
		L_{Aeq}	L_{A90}
AT1	Day	59	45
AT2	Day	51	43
AT3	Day	48	39
AT4	Day	46	35
AT5	Day	56	43

Table 11.16: Measure Baseline Noise Levels During the Attended Surveys

11.4.3 Vibration

There are no significant sources of vibration present in the receiving environment and, therefore, it is not assessed as necessary to measure baseline vibration.

11.5 Description of Likely Effects

11.5.1 Do Nothing Scenario

If the project is not progressed, the existing noise environment in the vicinity of the subject site and noise sensitive receptors will remain unchanged.

11.5.2 Construction Phase

A variety of items of plant and machinery will be in use for the purposes of site preparation and construction of the project. There will be vehicular movements to and from the site that will make use of existing roads. Due to the nature of these activities, the generation of significant levels of noise is possible.

Noise levels associated with construction have been calculated in accordance with the methodology set out in BS 5228-1:2009+A1:2014. This standard sets out sound

power and sound pressure levels for plant items normally encountered on construction sites which, in turn, enables the prediction of noise levels at selected locations. However, it is often not possible to conduct detailed prediction calculations for the construction phase of a project due to the fact that the noise emission levels for the assumed plant items are indicative, the programme for construction works has not been established fully and may change as the project develops (i.e. in the event that the construction contractor identifies alternative working methods or procedures). Noise predictions are therefore presented in outline form to highlight typical expected noise levels at noise sensitive receivers and to discuss the typical noise mitigation measures that can be utilised to reduce effects as far as is reasonably practicable.

The anticipated construction hours are 07:00 to 19:00hrs Monday to Friday and 07:00 to 13:00hrs on Saturday.

With reference to the measured noise levels at the nearest NSL's discussed in **Section 11.4.1.6**, daytime ambient noise levels were in the range of 54 to 60dB $L_{Aeq,T}$. Using the criteria in **Table 11.1**, the daytime ambient noise environment is assessed as falling within Category A and the CNT is therefore set at 65dB $L_{Aeq,T}$ for daytime periods.

The closest sensitive receptor is located approximately 165m north of the electricity substation compound, as illustrated at **Figure 11.3**. An access track is also proposed, which lies c. 35m to the west of the nearby house.

11.5.2.1 Construction of Access Track

An access track from the public road to the electricity substation compound will be located c. 35m to the west of the dwelling house.

Table 11.17 presents noise calculations for the construction of the access track considering the anticipated methods of construction. Calculations have been prepared taking account of the distances to the nearest NSLs and assume that plant items are operating for 66% of the time.

Plant Item (BS 5228 Ref.)	Activity/Notes	Plant Noise level at 10m Distance (dB $L_{Aeq,T}$)	Predicted Noise Level (dB $L_{Aeq,T}$) at distance (m)		
			35 m	45 m	65 m
Wheeled excavator (C.5.11)	Removing broken surface	73	58	55	52
Vibratory Roller (C.5.26)	Rolling and compaction	77	62	59	56
HGV Movement (C.2.30)	Transporting material	79	64	61	58
Combined L_{Aeq} from all works			67	64	61

Table 11.17: Indicative Noise Levels for Construction of Access Track

As discussed in **Section 11.3.1.1**, the construction noise threshold for the electricity substation is 65dB $L_{Aeq,T}$. In this context, and based on **Table 11.3**, a predicted construction noise level of 67dB would indicate a likely significant noise effect.

However, it is important to note that the works for the construction of the access track line will only for short duration (2-3 days) in the vicinity of the dwelling house.

In conclusion, in accordance with **Table 11.3**, on the basis that the duration of the noise effect at any NSL will be short-term and temporary, a significant noise effect is

not assessed as likely and mitigation measures are not required.

11.5.2.2 Electricity Substation

Several noise sources that would be expected on a construction site of this nature have been identified and predictions of the likely noise emissions calculated at the closest sensitive receptor. In this scenario, the closest sensitive receptor is located approximately 165m north of the electricity substation compound, as illustrated at **Figure 11.5**.

Table 11.17 presents outline noise calculations, considering the anticipated methods of construction. The calculations assume that plant items are operating for 66% of the time and that there is no acoustic screening (i.e. barriers) in place between the site works and the NSL.

Plant Item (BS 5228 Ref.)	Activity/Notes	Plant Noise level at 10m Distance (dB L _{Aeq,T})	Predicted Noise Level at 165m (dB L _{Aeq,T})
HGV Movement (C.2.30)	Removing spoil and transporting fill and other materials.	79	45
Tracked Excavator (C.4.64)	Removing soil and rubble in preparation for foundation.	77	43
General Construction (Various)	All general activities plus deliveries of materials and plant	84	50
Mobile Telescopic Crane (C4.64)	Lifting	75	41
Dewatering Pumps (D.7.70)	If required.	80	46
JCB (D.8.13)	For services, drainage and landscaping.	82	48
Vibrating Rollers (D.8.29)	Access track surfacing.	77	43
Combined L _{Aeq} from all works			55

Table 11.18: Indicative Noise Levels for Construction of Electricity Substation

The predicted noise levels are lower than the CNT of 65dB L_{Aeq,T}. According to the criteria at **Table 11.3**, the effect is assessed as 'not significant'.

With respect to guidance for the description of effects, the likely effect at the nearest NSL associated with the construction of the electricity substation are assessed to be negative, temporary and not significant.

11.5.2.3 Underground Electricity Line

Table 11.18 presents noise calculations for the construction of the underground electricity line considering the anticipated methods of construction. Calculations have been prepared taking account of the distances to the nearest NSLs and assume that plant items are operating for 66% of the time.

Plant Item (BS 5228 Ref.)	Activity/Notes	Plant Noise level at 10m	Predicted Noise Level (dB L _{Aeq,T}) at distance (m)
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		Distance (dB L _{Aeq,T})	20	25	40
Mini excavator with hydraulic breaker (C.5.2)	Breaking road surface	83	75	71	66
Wheeled excavator (C.5.11)	Removing broken surface	73	65	61	56
Vibratory Roller (C.5.26)	Rolling and compaction	77	69	65	60
HGV Movement (C.2.30)	Transporting material	79	71	67	62
Generator (C.2.44)	For general plant	77	69	65	60
Combined L _{Aeq} from all works			78	74	69

Table 11.19: Indicative Noise Levels for Construction of Underground Cable

As discussed in **Section 11.3.1.2**, the construction noise threshold for the electricity line works is 70dB L_{Aeq,T}. In this context, and based on **Table 11.3**, a predicted construction noise level of 70dB would indicate that at distances of 40m and greater, the noise effect is assessed as likely to be not significant.

At distance of 25m or less, the predicted construction noise level of 74dB (or greater) would indicate that this distance, the noise effect is potentially significant. However, it is important to note that the works for the construction of the underground electrical line will vary and will not be continuous in nature. The associated construction works will occur for short durations (rolling construction method, approx. 50–100m per day) at varying distances from NSLs. Works will therefore be in the immediate proximity of the closest NSLs for limited amount of time, i.e. less than 1-day.

In conclusion, in accordance with **Table 11.3**, on the basis that the duration of the noise effect at any NSL will be short-term and temporary, a significant noise effect is not expected and mitigation measures are not required.

11.5.2.4 Electrical Control Unit

In respect of the construction of the electrical control unit, the nearest noise-sensitive locations are in excess of 200m. On the basis that construction plant and methodologies are similar to those of the substation, noise levels are assessed as likely to be within the construction noise criteria. A significant noise effect is not assessed as likely and mitigation measures are not required.

11.5.2.5 Vibration

While there are some activities proposed to be undertaken during the construction of the electricity substation and electrical control unit which will result in the generation of vibration effects (e.g. compaction of access track aggregates); due to the localised nature of these works and the distance to nearby receptors, no vibration effects are assessed as likely to arise at sensitive locations during the construction phase. Notwithstanding the above, all construction activities undertaken will be required to operate below the recommended vibration criteria set out at **Table 11.4**.

11.5.3 Operational Phase

11.5.3.1 Electricity Substation

The substation will be operational 24/7 and the noise levels likely to be experienced at the nearest NSL have been assessed to identify the likelihood of significant noise effects.

The following extract from the EirGrid document *Evidence Based Environmental Studies Study 8: Noise – Literature review and evidence-based field study on the noise effects of high voltage transmission development* (May 2016) states the following in relation to noise effects associated with 110kVA substation installations:-

"The survey on the 110kV substation at Dunfirth indicated that measured noise levels (LAeq) were less than 40dB(A) at 5m from each of the boundaries of the substation. This is below the WHO night-time free-field threshold limit of 42dB for preventing effects on sleep and well below the WHO daytime threshold limits for serious and moderate annoyance in outdoor living areas (i.e. 55dB and 50dB respectively). Spectral analysis of the data recorded at this site demonstrated that there were no distinct tonal elements to the recorded noise level. To avoid any noise impacts from 110kV substations at sensitive receptors, it is recommended that a minimum distance of 5m is maintained between 110kV substations and the land boundary of any noise sensitive property."

The electricity substation will have comparable noise emissions to the substation discussed above; and, considering the additional distance to the NSL (i.e. 165m), the noise from the operation of the electricity substation is assessed as not likely to be significant at the nearest NSL.

As such, the operational phase noise effects are assessed to be negative, not significant and long-term.

11.5.4 Decommissioning Phase

As set out at **Chapter 3 (Sections 3.2 and 3.7)**, the electricity substation itself will form part of the national electricity network and decommissioning of the substation and associated infrastructure is not proposed.

However, it is proposed to decommission the underground electricity line in conjunction with the decommissioning of the White Hill Wind Farm. Noise levels will be similar to those for the construction of the underground electricity line and the electrical control unit, and of similar, but reduced, magnitude temporary duration. Therefore, no significant noise or vibration effects are assessed as likely.

11.5.5 Cumulative Effects

This assessment has considered the likely cumulative effects for the construction, operational and decommissioning phases of the project in combination with the permitted White Hills Wind Farm. Following a detailed evaluation, it is considered that there are no other existing, permitted or proposed developments in the local area; including those listed at **Chapter 1**; capable of contributing to cumulative noise or vibration effects. Other developments have been discounted from further assessment due to their specific type or nature or due to the separation distances involved.

11.5.5.1 Construction Phase

It is likely that the subject project will be constructed concurrently with the permitted

White Hill Wind Farm.

With reference to the predicted noise levels associated with the construction of the project as outlined at **Section 11.5.2**, the increased separation distance between receptors and the White Hill Wind Farm construction activities, it is assessed that there is no likelihood of the total construction noise level increasing as a consequence of the concurrent construction of the projects. The contractor for the subject project will coordinate with the contractor for the White Hill Wind Farm such that significant cumulative construction noise effects are avoided. Therefore, should construction of the project occur concurrently with the construction of the White Hill Wind Farm, it is assessed that there will be no cumulative effects that would give rise to likely significant effects at the nearest NSLs.

Having regard to the geographic location, separation distance to the project and/or specific characteristics of the projects listed at **Chapter 1**, it is assessed that cumulative effects will not arise as a consequence of the subject project.

11.5.5.2 Operational Phase

During the operational phase, it is assessed that cumulative noise effects are not likely to arise. The operation of the electrical control unit and underground electricity line will not generate any noise emissions while the electricity substation is remote from other projects as listed at **Chapter 1**. Accordingly, it is assessed that cumulative operational phase effects will be negative, not significant and long-term.

11.5.5.3 Decommissioning Phase

As described at **Chapter 3 (Sections 3.2 and 3.7)**, the electricity substation will not be decommissioned and will continue to be operated as part of the national electricity network. It is likely that decommissioning of the electrical control unit and underground electricity line will be undertaken concurrently with the White Hill Wind Farm. However, having regard to the works to be undertaken during the decommissioning phase, significant noise emissions are not likely to be generated or experienced at nearby NSLs

11.6 Mitigation and Monitoring Measures

11.6.1 Construction Phase

11.6.1.1 Noise

Section 11.5.2 has assessed that significant noise and vibration effects are not expected at NSLs. While specific noise mitigation measures are not required, the following sections present general guidance which will be followed by the contractor to ensure that no significant noise effects occur.

General Construction Noise Best-Practice Measures

The contractors involved in the construction phase will be obliged, under contract, to undertake specific noise abatement measures and comply with the recommendations of *BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise*. The following list of measures will be implemented, as relevant, to ensure compliance with the relevant construction noise criteria:-

- No plant or machinery will be permitted to cause a public nuisance due to noise;
- The best means practicable, including proper maintenance of plant, will be

employed to minimise the noise produced by on site operations;

- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract;
- Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers;
- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use;
- Any plant, such as generators or pumps, which may be required to operate outside of general construction hours will be surrounded by an acoustic enclosure or portable screen;
- During the course of the construction programme, supervision of the works will include ensuring compliance with the limits detailed at **Table 11.1** using methods outlined in *BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise*; and,
- The hours of construction activity will be limited to avoid unsociable hours where possible. Construction operations shall generally be restricted to between 07:00 and 19:00 Monday to Friday and between 07:00hrs and 13:00hrs on Saturdays (unless in the event of an emergency), with no operations on Sundays or public holidays.

Based on assessment of the geological composition of the site, it is concluded that rock-breaking will not be required. In the unlikely event that rock breaking is necessary, the following measures will be implemented to mitigate noise emissions:-

- Fit suitably designed muffler or sound reduction equipment to the rock breaking tool to reduce noise without impairing machine efficiency;
- Ensure all air lines are sealed;
- Use a dampened breaking bit to eliminate a 'ringing' sound; and,
- Erect an acoustic screen around breaking activities. Where possible, line of sight between top of machine and reception point should be obscured.

11.6.1.2 Vibration

Vibration from construction activities shall be limited to the values set out at **Table 11.4**. It should be noted that these limits are not absolute but provide guidance as to magnitudes of vibration that are very unlikely to cause cosmetic damage. Magnitudes of vibration slightly greater than those in the table are normally unlikely to cause cosmetic damage, but construction work creating such magnitudes should proceed with caution. Where there is existing damage these limits may need to be reduced by up to 50%.

Given the substantial distances between locations where vibration may be generated and the nearest sensitive locations, no significant effect is likely to be experienced. Therefore, no mitigation measures are proposed.

11.6.2 Operational Phase

Having regard to the assessment of likely noise effects during the operational phase, it is assessed that mitigation measures are not required.

11.6.3 Decommissioning Phase

As set out at **Chapter 3 (Sections 3.2 and 3.7)**, the electricity substation will form part of the national electricity network and its decommissioning is not proposed. Therefore, no decommissioning phase mitigation measures are required.

As discussed in **Section 11.5.4**, no significant noise effects are assessed as likely during the decommissioning phase and, accordingly, no mitigation measures are required, over and above the general best-practice measures described in **Section 11.6.1** above.

11.6.4 Monitoring

11.6.4.1 Construction Phase

No monitoring of noise levels during the construction phase is proposed.

11.6.4.2 Operational Phase

No monitoring of noise levels during the operational phase is proposed.

11.6.4.3 Decommissioning Phase

No monitoring of noise levels during the decommissioning phase is proposed.

11.7 Residual Effects

This section outlines the likely residual noise and vibration effects associated with the project taking account of the proposed mitigation measures.

11.7.1 Do Nothing Scenario

If the project were not to proceed then the existing noise environment will remain unchanged.

11.7.2 Construction Phase

During the construction phase, there will likely be some effect on nearby noise sensitive locations due to noise emissions from site traffic and other activities. However, given that the construction phase is temporary in nature and the distances between the main construction works and nearby noise sensitive properties, it is assessed that the noise generated will not be excessively intrusive. Furthermore, the application of noise limits in accordance with best practice standards, construction hours and the implementation of appropriate noise and vibration mitigation measures, will ensure that noise and vibration effects are unlikely to be significant. The residual effects are assessed to be likely, negative, not significant, and temporary.

11.7.3 Operational Phase

The residual effects due to the operation of the electricity substation are assessed as likely to be negative, not significant and long-term

11.7.4 Decommissioning Phase

During the decommissioning phase, it is assessed as likely that noise levels will be similar to those for the construction of the electrical control unit and underground electricity line, and of similar temporary duration but of a reduced magnitude. No significant noise or vibration effects are assessed as likely to occur.

11.7.5 Cumulative Effects

In respect of construction and decommissioning phase noise, due to distance and the linear nature of the development, the cumulative construction noise of the White Hill Wind Farm and the subject project are not assessed as likely to give rise to noise levels

in excess of the construction noise criteria at noise-sensitive locations. A similar assessment applies to vibration during the construction phase. Similarly, cumulative noise effects with other projects are not assessed as likely to be significant.

In respect of operational noise, the underground electricity line and electrical control unit do not generate noise and, as such, there is no likelihood of cumulative operational phase noise effects. Other developments are sufficiently distant or are of a particular type such that no significant cumulative noise or vibration effects are likely.

In summary, the likelihood of cumulative noise and vibration effects is not significant.

11.8 Summary

This assessment has been undertaken for both the long-term operational and short-term construction and decommissioning phases of the project.

With mitigation measures in place where required, the predicted noise and vibration levels associated with the construction phase are assessed as likely to be within criteria thresholds. Notwithstanding the above, all construction activities will incorporate noise abatement measures where necessary and comply with the recommendations of *BS5228-1:2009+A1:2014*.

The assessment has concluded that there are no likely significant noise and vibration effects associated with the operation or decommissioning phases of the project individually or in combination with other existing, permitted or proposed developments.

