Drumlins Park Wind Farm Substation & Grid Connection

Chapter 11: Noise & Vibration

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Contents

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 proposed Drumlins Park Wind Farm Substation and Grid Connection.

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

11.1.2 Statement of Authority

This chapter has been prepared by Mike Simms BE MEngSc MIOA MIET, Senior Acoustic Consultant at AWN Consulting Ltd. Mike has worked in the field of acoustics for over 19 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 baseline noise monitoring was undertaken by Cormac McPhillips, Project Technician at Galetech Energy Services (GES). Cormac has extensive experience of undertaking noise monitoring programmes in accordance with relevant standards and best practice methods.

11.1.3 Description of the Proposed Development

A full description of the proposed development is presented in **Chapter 3**. In summary, the proposed development comprises the following main components:-

- A 110 kilovolt (kV) 'loop-in/loop-out' Air-Insulated Switchgear (AIS) electrical substation, including single-storey control buildings and all associated electrical equipment;
- Approximately 700m of 110kV underground electricity lines;
- Replacement of 1 no. existing pole-set with 2 no. lattice-type end masts, to a maximum height of up to 16m; and
- All associated and ancillary site development, excavation, construction, landscaping and reinstatement works, including provision of site drainage infrastructure.

The entirety of the proposed development is located within the administrative area of County Monaghan; while candidate quarries which may supply construction materials are also located within County Cavan.

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 in **Figure 11.1** and shows a quiet bedroom at around 35 dB(A), a nearby (at 7m) noisy HGV at 90 dB(A) and a pneumatic drill (at 7m) at about 100 dB(A).

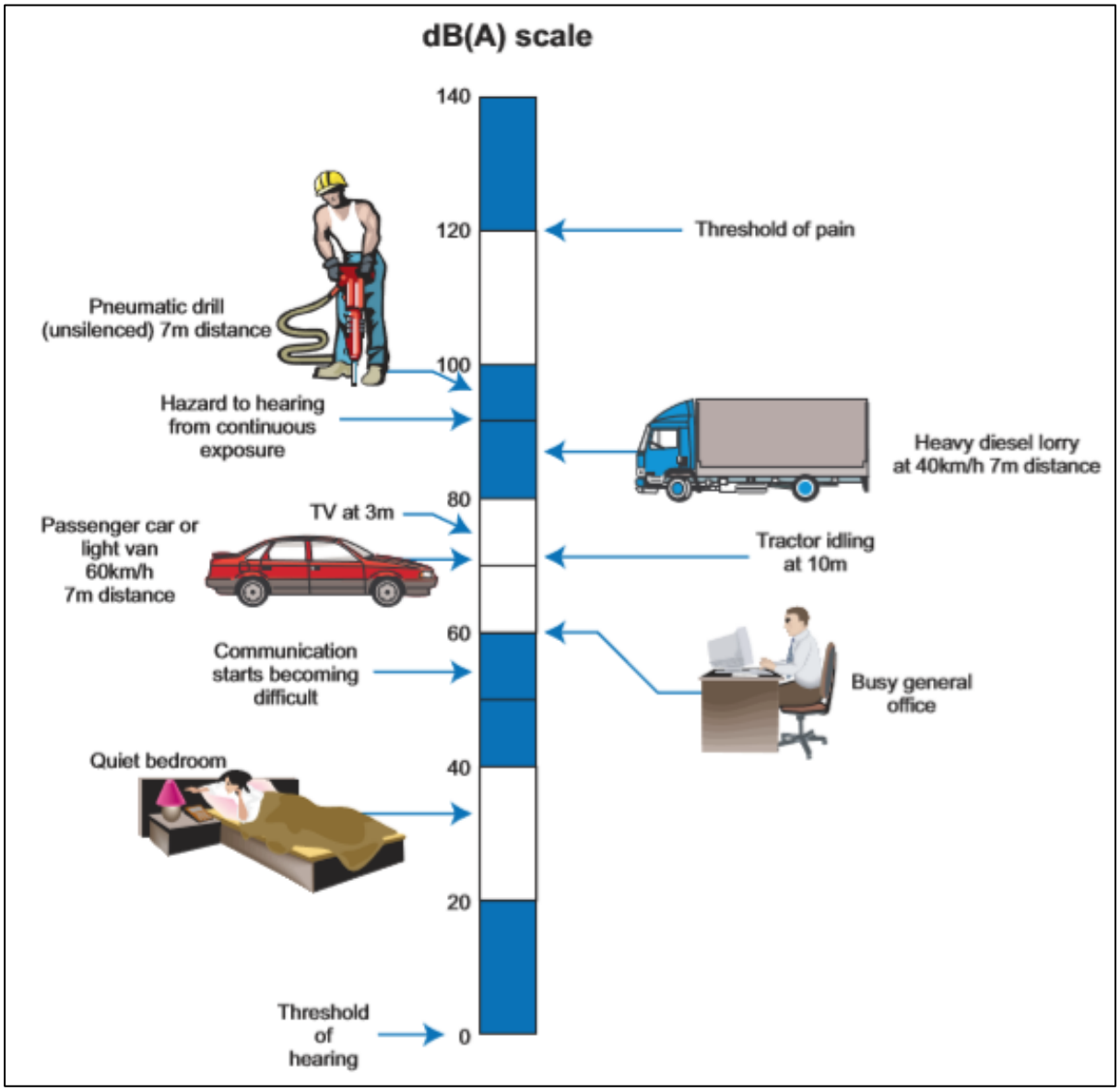

Figure 11.1: The level of typical common sounds on the dB(A) scale (NRA Guidelines for the Treatment of Noise and Vibration in National Road Schemes, 2004)

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 proposed development.

11.3.1 Construction Phase

11.3.1.1 Noise

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 normally control construction activities by imposing limits on the hours of operation and may consider noise limits at their discretion.

In the absence of specific noise limits, appropriate criteria relating to permissible construction noise levels for a development of this scale may be found in the British Standard *BS* 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Noise*.

The approach adopted here 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 threshold noise value that, if exceeded (construction noise only), may indicate that a significant noise impact is associated with the construction activities.

Table 11.1 sets out the values which, when exceeded, may signify a significant effect at the facades of residential receptors as recommended by *BS 5228 – 1*. These levels relate to construction noise only.

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 Note D	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 following assessment method is only valid for residential properties.

For the appropriate period (e.g. daytime), the ambient noise level is determined and rounded to the nearest 5 dB. In this instance, given the rural nature of the site, properties near the proposed development have daytime ambient noise levels that typically range from 45 to 55 dB $L_{Aeq,1hr}$. Therefore, all properties will be afforded a Category A designation.

If the specific construction noise level exceeds the appropriate category value (i.e. 65 dB $L_{Aeq,T}$ during daytime periods) then a significant effect is assessed as likely to have occurred.

11.3.1.2 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 proposed development, 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).

BS 7385 states that there should typically be no cosmetic damage if transient vibration does not exceed 15 mm/s at low frequencies rising to 20 mm/s at 15 Hz and 50 mm/s at 40 Hz and above. These guidelines relate to relatively modern buildings

and should be reduced to 50% or less for more critical or sensitive buildings.

BS 5228 recommends that, for soundly constructed residential property and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a peak particle velocity of 15 mm/s for transient vibration at frequencies below 15 Hz and 20 mm/s at frequencies greater than 15 Hz.

Transport Infrastructure Ireland (TII) (formerly National Roads Authority (NRA)) document *Guidelines for the Treatment of Noise and Vibration in National Road Schemes* (NRA, 2004) also contains information on the permissible construction vibration levels during the construction phase, as shown in **Table 11.2**.

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 11.2: Allowable Transient Vibration at Properties

11.3.2 Operational Phase

11.3.2.1 Noise

British Standard BS 8233:2014 provides guideline values for internal noise levels within residential dwellings. The following guideline values for indoor noise levels are presented in the standard:-

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

Table 11.3: 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	dB LAmax, F
Dwelling indoors	Speech intelligibility and moderate annoyance, daytime and evening	35 dB $L_{Aeq, 16hour}$	-
Inside bedrooms	Sleep disturbance, night-time	30 dB $L_{Aeq, 8hour}$	45

Table 11.4: WHO Indoor Noise Levels

The 45 dB L_{AFmax} criterion applies to "single sound events" within bedrooms at night. This guideline is generally interpreted as the value that individual noise events should not normally exceed.

Making reference to the above documents, the following daytime and night-time internal noise criteria are proposed for residential dwellings in the vicinity of operational phase plant items:-

- 35 dB $L_{Aeq,\ 16\ hr}$ within living rooms and dining rooms during daytime periods (07:00 to 23:00hrs);
- 30 dB $L_{Aeq,\ 8\ hr}$ within bedrooms during the night-time period (23:00 to 07:00hrs), and;
- A value of 45 dB L_{AFmax} is not normally exceeded in bedrooms at night.

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 15 dB.

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 proposed development:-

- Daytime (07:00 to 23:00 hours): 50 dB $L_{Aeq,\ 16hr}$;
- Night time (23:00 to 07:00 hours): 45 dB $L_{Aeq,\ 8hr}$; and
- Night time (23:00 to 07:00 hours): 60 dB L_{AFmax}.

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 Additional Vehicular Traffic Activity on Public Roads

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

It is noted that a Noise Action Plan (Monaghan County Council, 2018) has been prepared; however, this document is targeted at major road projects with in excess of 3 million vehicular movements. The proposed development will not generate substantial vehicular movements and, therefore, the Action Plan has not been considered further.

11.3.2.3 Vibration

Reference is made to British Standard BS 6472-1:2008 which provides the following vibration dose value (VDV) ranges which result in various probabilities of adverse comment within residential buildings.

Place and Time	Low probability of adverse comment $m\ s^{-1.75}$ (Note 1)	Adverse comment possible $m\ s^{-1.75}$	Adverse comment probable $m\ s^{-1.75}$ (Note 2)
Residential buildings, 16 h day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings, 8 h night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Table 11.5: BS 6472 VDV Ranges and associated Probabilities

Note 1: Below these ranges adverse comment is not expected
Note 2: Above these ranges adverse comment is very likely

Any vibration emissions from operational phase plant items, while considered highly

unlikely, will be designed so as not to exceed the VDV values that result in low probability of adverse comment i.e. VDV ≤0.2 $m \cdot s^{-1.75}$ (daytime) and ≤0.1 $m \cdot s^{-1.75}$ (night-time).

11.3.2.4 EPA Description of Effects

The significance of effects of the proposed development shall be described in accordance with the EPA guidance document *Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports Draft, August 2017*. Details of the methodology for describing the significant of the effects are provided in **Chapter 1**.

11.4 Description of the Existing Environment

As outlined above, prior to undertaking noise prediction modelling, it is crucial to understand the typical background noise levels at the nearest NSLs to the proposed development 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 Noise Measurement Location

The noise measurement location was selected by AWN Consulting. As the proposed 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 east and being a similar distance from the local road. Coordinates for the noise monitoring location are detailed in **Table 11.6**.

Coordinates (ITM)	
Easting	**Northing**
655397	819885

Table 11.6: Measurement Location Coordinates

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 monitoring apparatus. The location of the unattended noise monitor is shown in **Figure 11.3**

Figure 11.2: Noise Measurement Equipment

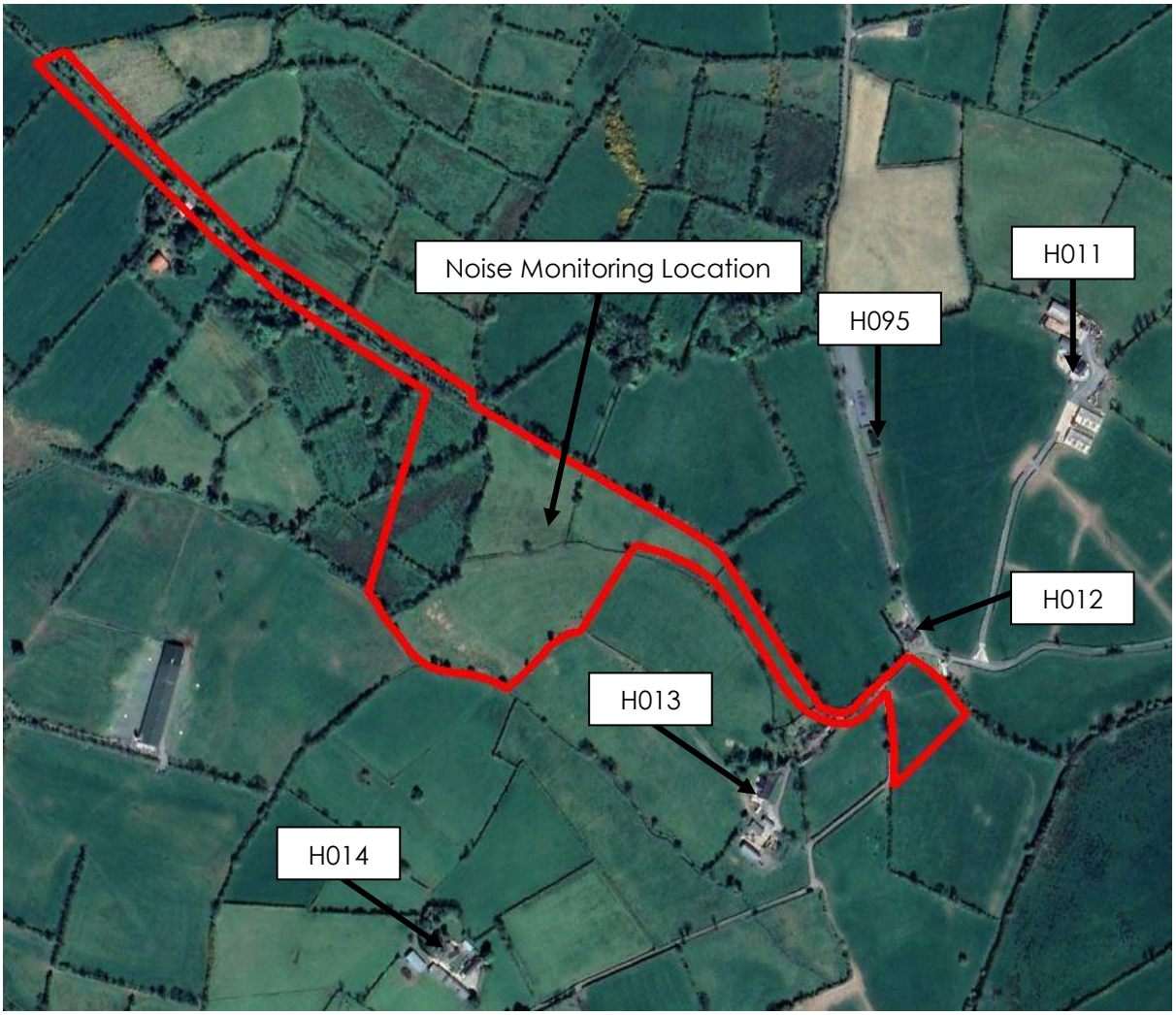

Figure 11.3: Noise Survey Location

11.4.2 Measurement Period

Noise measurements were conducted over the period outlined in **Table 11.7**

Start Date	End Date
14:40hrs on 20 May 2020	16:10hrs on 25 May 2020

Table 11.7: Measurement Period

Wind speeds were generally low and the lowest background noise levels are selected as the basis for assessment as discussed at **Section 11.4.6**

11.4.3 Personnel and Instrumentation

All noise monitoring apparatus was installed and removed by Cormac McPhillips (GES), with the following instrumentation being used:

Equipment	Serial Number
Svantek 977	46010

Table 11.8: 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 in **Annex 11.2**.

11.4.4 Procedure

Measurements were conducted at the measurement location outlined in **Table 11.6** and over the time period outlined at **Table 11.7**. Noise levels were logged continuously at 10-minute interval periods for the duration of the survey.

11.4.5 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;
- $L_{Aeq\,T}$: This is the equivalent continuous sound pressure level over a time interval;
- L_{A90}: Noise level exceeded for 90% of measurement period (steady underlying noise level);
- L_{A10}: Noise level exceeded for 10% of measurement period. It is typically a descriptor of traffic noise;
- L_{Amax}: Maximum A weighted noise level measured; and
- L_{Amin}: Minimum A weighted noise level measured.

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 $2x10^{-5}$ Pascal (pa).

11.4.6 Results of Unattended Noise Survey

On review of the measured data, it is confirmed that the typical noise levels were as follows:-

- Daytime ambient noise levels of between 40 and 56dB $L_{Aeq,T}$;
- Daytime background noise levels of between 32 and 50dB $L_{A90,T}$;

- Night time ambient noise levels of between 41 and 49dB $L_{Aeq,T}$; and
- Night time background noise levels of between 29 and 43dB $L_{A90,T}$.

Date	LAeq,16hr	LA90 (Arithmetic Average)
Wednesday 20 May	40	32
Thursday 21 May	43	36
Friday 22 May	56	50
Monday 25 May	44	38
Saturday 23 May	48	42
Sunday 24 May	43	34

Table 11.9: Daytime Measured Noise Levels

Date	LAeq,8hr	LA90 (Arithmetic Average)
Wed 20 May to Thursday 21 May	43	30
Thu 21 May to Fri 22 May	48	43
Fri 22 May to Sat 23 May	49	43
Sat 23 May to Sun 24 May	44	37
Sun 24 May to Mon 25 May	41	29

Table 11.10: Night-time Measured Noise Levels

11.4.7 Vibration

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

11.5 Description of Likely Effects

11.5.1 Do Nothing Scenario

If the proposed development 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 proposed development. 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.

11.5.2.1 Noise – Electricity Substation

As per TII guidance, noise levels associated with construction may be 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.

Table 11.1 of **Section 11.3.1.1** identifies appropriate construction noise criteria for the proposed development site. With reference to the measured noise levels at the nearest NSL's discussed in **Section 11.4.6**, ambient noise levels were in the range of 40 and 56dB $L_{Aeq,T}$. In accordance with the relevant criteria, if the specific construction noise level exceeds the appropriate category threshold value of 65dB $L_{Aeq,T}$ during daytime periods then a significant effect is deemed to occur.

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 H013 located approximately 290m southeast of the proposed development.

Table 11.11 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 290 m (i.e. H013) (dB $L_{Aeq,T}$)
HGV Movement (C.2.30)	Removing spoil and transporting fill and other materials.	79	43
Tracked Excavator (C.4.64)	Removing soil and rubble in preparation for foundation.	77	41
General Construction (Various)	All general activities plus deliveries of materials and plant	84	48
Mobile Telescopic Crane (C4.64)	Lifting	75	39
Dewatering Pumps (D.7.70)	If required.	80	44
JCB (D.8.13)	For services, drainage and landscaping.	82	46
Vibrating Rollers (D.8.29)	Road surfacing.	77	41
Combined L_{Aeq} from all works			53

Table 11.2: Indicative Noise Calculations for Construction of Electricity Substation

The predicted noise levels at H013 are within the criterion of 65 dB $L_{Aeq,T}$. Following the same method of calculation for H095 (c. 300m), H014 (c. 350m), H012 (c. 350m) and H011 (c. 480m); the predicted noise levels are 53 dB $L_{Aeq,T}$ at H095, 51 dB $L_{Aeq,T}$ at H012, 51 dB $L_{Aeq,T}$ at H012 and 48 dB $L_{Aeq,T}$ at H011.

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

11.5.2.2 Noise – Grid Connection

The proposed electricity substation is located c. 380m northwest of the existing Lisdrum-Shankill overhead electricity transmission line. In order to connect the respective developments, it is proposed to install c. 700m of underground 110kV electricity transmission line. The route of this underground cable will pass within approximately 20m of noise-sensitive location H012.

Table 11.13 presents outline noise calculations, considering the anticipated methods of construction. Similarly, the calculations assume that plant items are operating for 66% of the time and that there is no acoustic screening 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 20 m (dB $L_{Aeq,T}$)	Predicted Noise Level at 40 m (dB $L_{Aeq,T}$)
HGV Movement (C.2.30)	Removing spoil and transporting fill and other materials.	79	69	63
Tracked Excavator (C.4.64)	Removing soil and rubble in preparation for foundation.	77	67	61
Combined L_{Aeq} from all works			72	65

Table 11.3: Indicative Noise Calculations for Construction of Grid Connection

The worst-case predicted noise level at H012, for when the works are at their closest point, is 72 dB $L_{Aeq,T}$,which is in excess of the criterion for significant impacts from **Table 11.1**. However, due to the linear nature of the proposed development at this location, construction activities will be transient and will only be located within this proximity of H012 for 1-2 no. days; thus the effects on H012 are temporary and are not considered to be a significant effect in overall EIA terms.

The rightmost column in **Table 11.13** illustrates that at distance of 40m and greater from the proposed grid connection works, the predicted noise level is within the criterion of 65 dB $L_{Aeq,T}$ and will not be significant.

It is also noted that a temporary residence is located immediately adjacent to NSL H012. The proposed electricity lines will also be located c. 20m from this residence and, therefore, predicted noise levels are similar to those predicted at H012.

11.5.2.3 Vibration

While there are some activities proposed to be undertaken during the construction of the proposed electricity substation 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, there are no vibration effects anticipated at sensitive locations during the construction phase. Notwithstanding the above, all construction activities undertaken on the site will be required to operate below the recommended vibration criteria set out in **Table 11.2**.

11.5.3 Operational Phase

11.5.3.1 Noise

The following extract from the *EirGrid 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 110kV 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 proposed development has comparable noise emissions to the 110kV unit discussed above and considering the distance between the proposed development and the nearest noise sensitive location (i.e. 290m), noise from the proposed substation is not assessed as likely to result in significant adverse noise effects. It is predicted, therefore, that the expected noise levels experienced at the nearest dwelling will be less than 25dBA.

It is concluded, therefore, that there will be no significant noise emissions from the operation of the proposed development.

With respect to the EPA's guidance for description of effects, likely effects at the nearest NSL as a result of the operation of the proposed development 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 **3.8**), the proposed development will form part of the national electricity network and decommissioning of the electricity substation and associated infrastructure is not proposed. Therefore, decommissioning phase effects will not occur.

11.5.5 Cumulative Effects

This assessment has considered the likely cumulative effects for the construction, operational and decommissioning phases of the proposed development in combination with the permitted Drumlins Park Wind Farm. Following a detailed evaluation, it is considered that there are no other existing, permitted or proposed developments in the local area 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.

Construction Phase

It is anticipated that the proposed development will be constructed concurrently with the permitted Drumlins Park Wind Farm. With reference to the predicted noise levels associated with the construction of the proposed development outlined in **Section 11.5.2.1.** (i.e. 65 dB L_{Aeq} at the nearest NSL), given the similarities between the plant and machinery to be used in the construction of the proposed and permitted developments and the increased separation distance between receptors and Drumlins Park Wind Farm construction activities, there is no likelihood of the total construction noise level increasing.

Therefore, should construction of the proposed development occur concurrently with the construction of the Drumlins Park Wind Farm, it is assessed that there will be no cumulative effects that would give rise to significant effects at the nearest NSL's.

Operational Phase

Once the proposed development is completed, the likelihood of noise effects in the surrounding environment is not significant. The operation of the proposed development is not expected to generate any noise over or above the existing background noise environment at the nearest NSL and, therefore, cumulative noise effects are not assessed as likely.

The receiving environment has not changed since the assessment of likely noise effects arising from the Drumlins Park Wind Farm was undertaken. No existing or permitted dwellings, additional to the 123 no. located within 1,800m (10-times overall tip height) of a (now) permitted wind turbine assessed at **Chapter 11** (**Volume III**), have been identified. Therefore, a full re-assessment of the likely cumulative noise effects is not necessary

Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the electricity substation and associated infrastructure is not proposed. Therefore, cumulative decommissioning phase effects will not occur.

11.6 Mitigation and Monitoring Measures

11.6.1 Construction Phase

For the majority of the construction period, typical construction noise thresholds are not predicted to exceed appropriate limits, except for a short period of 1-2 no. days when the proposed grid connection works are at their closet to H012. However, it is important to note that these works will be undertaken by standard construction plant and machinery and would be similar to standard roadworks or agricultural activities.

In order to minimise noise levels insofar as possible, the contractors completing the construction works will be required to undertake noise abatement measures where necessary and comply with the recommendations of *BS5228-1:2009+A1:2014*.

It is proposed that various practices will be adopted during construction as required, including the following:-

- Limiting the hours during which site activities likely to create high levels of noise or vibration are permitted;
- Establishing channels of communication between the contractor/developer, local authority and residents;

- Appointing a site representative responsible for matters relating to noise and vibration;
- Monitoring typical levels of noise and vibration during critical periods and at sensitive locations; and
- Keeping site access tracks even to mitigate the likelihood of vibration from HGVs.

Furthermore, a variety of practical noise control measures will be employed. These include:-

- Selection of plant with low inherent likelihood of generation of noise and/or vibration;
- Placing of noisy/vibratory plant as far away from sensitive properties as permitted by site constraints, and;
- Regular maintenance and servicing of plant items.

11.6.1.1 Noise

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 in **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 in **Table 11.3**. 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%.

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

11.6.2 Operational Phase

Noise emissions associated with the proposed development during the operational phase will not be significant and are predicted to be well within the criteria set out in **Section 11.3.2**. Therefore, no mitigation measures are required.

11.6.3 Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and its decommissioning is not proposed. Therefore, no decommissioning phase mitigation measures are required.

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

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and its decommissioning is not proposed. Therefore, no decommissioning phase monitoring is required.

11.7 Residual Effects

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

11.7.1 Do Nothing Scenario

If the proposed development 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 of the development 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, and construction hours, along with implementation of appropriate noise and vibration mitigation measures, will ensure that noise and vibration effects are unlikely to be significant. During the proposed grid connection construction works, noise levels are predicted to exceed appropriate limits for a temporary duration of 1-2 no. days while in the immediate vicinity of H012; however, due to the short term and transient nature of construction activities at this location, the effects are not assessed to be significant in overall EIA terms. For the remainder of the construction activity, the residual effects are assessed to be likely, negative, slight, temporary; and unlikely to be significant.

11.7.3 Operational Phase

The effects of the day to day operation of the proposed development, in combination with the operational Drumlins Park Wind Farm, have been assessed and no significant residual effects are assessed as likely.

There is no anticipated source of vibration related with the operational phase of the proposed development and therefore no residual effect is assessed as likely.

11.7.4 Cumulative Effects

There are no existing, permitted or proposed developments which are likely to give rise to significant cumulative residual effects on noise sensitive locations in the study area.

11.8 Summary

This noise and vibration impact assessment of the proposed development has been undertaken for both the long-term operational and short-term construction phases.

The predicted noise and vibration levels associated with the construction phase are predicted 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 operational phase of the proposed development.

The likely cumulative effects for both the construction and operational phases of the proposed development with the permitted Drumlins Park Wind Farm have been assessed and have been determined not to be significant.