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30 YEARS

CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED COOM GREEN ENERGY PARK, COUNTY CORK

VOLUME 2 – MAIN EIAR – CHAPTER 7 – NOISE AND VIBRATION

Prepared for: Coom Green Energy Park Limited

Date: **November 2020**

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7. NOISE AND VIBRATION

7.1 Introduction

This chapter contains an assessment of the potential noise and vibration impacts associated with the proposed Coom Green Energy Park (CGEP) development. The assessment including undertaking of background noise surveys has been carried out by Fehily Timoney and Company, based on information provided by the developer and in accordance with current guidance and best practice. Descriptions of the proposed development are provided in Chapter 3 – Volume 2 of the EIAR.

Potential construction noise and vibration impacts have been determined with reference to British Standard 5228:2009+A1:2014 *Code of Practice for Noise and Vibration Control on Construction and Open Sites Part 1 Noise*.

Potential operational noise impacts associated with the proposed development have been determined with reference to the UK Institute of Acoustics', *A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise* (2013). Operational noise associated with the proposed development includes noise from the proposed wind turbines, substations and battery storage. The operational noise is compared with noise limits derived in accordance with the Wind Energy Development Guidelines 2006 and the Draft Revised Wind Energy Development Guidelines (December 2019).

The draft guidelines were out to public consultation until the 19th February 2020 and may be subject to further revision. The 2006 guidelines are the guidelines currently in force under section 28 of the Planning and Development Act as amended. However, CGEP has been designed to be compliant with both the noise limits in the 2006 guidelines and the Draft Revised Wind Energy Development Guidelines (December 2019).

Decommissioning noise and vibration impacts have been assessed with similar references to the construction noise assessment.

7.2 Description of Noise and Vibration Impacts

7.2.1 Construction Noise & Vibration

Noise is generated from the construction of the turbine foundations, the erection of the turbines, the excavation of trenches for cables, and the construction of associated hard standings and access tracks, and construction of the substations.

Noise from vehicles on local roads and access tracks is also generated from the delivery of the turbine components and construction materials, notably aggregates, concrete and steel reinforcement.

Vibration is generated by construction activities such as rock breaking and passing heavy goods vehicles. The threshold of human perception of vibration is in the range of 0.14mm/s to 0.3mm/s[1], described as "*might just be perceptible*". The guideline values for damage to buildings from vibration are 15mm/s at 4Hz increasing to 20mm/s at 15Hz and 50mm/s at 40Hz and above.

[1] British Standard 5228 Part 2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites- Part 2: Vibration

Typical vibration generated from construction activities for the proposed Coom Green Energy Park are:

- Tracked excavators and disc cutters from cable trenching (0.8mm/s at 4m)
- Pneumatic breakers for cable trenching (0.7 mm/s at 10 m)
- Rock breaking at borrow pits (0.03 mm/s at 100 m)
- Excavation of turbine foundations (0.6 mm/s at 100 m)
- HGV traffic on normal road surfaces (0.01 to 0.5 mm/s) at footings of buildings located 20m from roadway.

The threshold of human perception of vibration is in the range of 0.14mm/s to 0.3mm/s[2], described as "*might just be perceptible*". The guideline values for damage to buildings from vibration are 15mm/s at 4Hz increasing to 20mm/s at 15Hz and 50mm/s at 40Hz and above. The nearest noise sensitive locations are sufficiently distant that vibration will not be perceivable by residents at their dwellings and building damage will not occur from construction incurred vibration. As such, construction vibration will not be considered further in this chapter.

7.2.2 Operational Noise & Vibration

Noise is generated by wind turbines as they rotate to generate power. This only occurs above the 'cut-in' wind speed and below the 'cut-out' wind speed. Below the cut-in wind speed there is insufficient strength in the wind to generate efficiently and above the cut-out wind speed the turbine is automatically shut down to prevent any malfunctions from occurring. The cut-in speed at the turbine hub-height is approximately 3 m/s and the cut-out wind speed is approximately 25 m/s.

The principal sources of noise are from the blades rotating in the air (aerodynamic noise) and from internal machinery, normally the gearbox and, to a lesser extent, the generator (mechanical noise). The blades are carefully designed to minimize noise whilst optimising power transfer from the wind.

Noise may also be generated from ancillary equipment such as transformers at on-site substations. However, these generally have low source noise levels compared to wind turbines themselves and, provided they are not located within the immediate vicinity of a residential dwelling, are unlikely to cause disturbance in the context of the other noise sources.

7.2.3 Blade Swish (Amplitude Modulation of Aerodynamic Noise)

This is the periodic variation in noise level associated with turbine operation, at the rate of the blade passing frequency (rotational speed multiplied by number of blades). It is often referred to as blade swish or amplitude / aerodynamic modulation (AM). This effect is discussed in ETSU-R-97, 'The Assessment and Rating of Noise from Wind Farms' (1996), which states that '… modulation of blade noise may result in variation of the overall A-Weighted noise level by as much as 3 dB(A) (peak to trough) when measured close to a wind turbine... ' and that at distances further from the turbine where there are'… more than two hard, reflective surfaces, then the increase in modulation depth may be as much as 6 dB(A) (peak to trough)'. It concludes that 'the noise levels (i.e. limits) recommended in this report take into account the character of noise described ... as blade swish'.

[2] British Standard 5228 Part 2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites- Part 2: Vibration

An observer close to a wind turbine will experience 'blade swish' because of the directional characteristics of the noise radiated from the trailing edge of the blades as it rotates towards and then away from them. This effect is reduced for an observer on or close to the (horizontal) turbine axis, and therefore would not generally be expected to be significant at typical separation distances, at least on relatively level sites.

The University of Salford carried out a study[3] on behalf the Department for Business, Enterprise and Regulatory Reform (BERR) to investigate the prevalence of amplitude modulation of aerodynamic noise on UK wind farm sites. The study concluded that AM has occurred at 4 out of 133 wind farms in the UK. A further investigation of the four sites by the Local Authority showed that the conditions associated with AM might occur between 7% and 15% of the time.

The most recent research into AM was conducted by RenewableUK[4], 'Wind Turbine Amplitude Modulation: Research to Improve Understanding as to its Cause and Effect' (December 2013).

This research focused on the less understood 'Other AM or OAM' where reported incidents are relatively limited and infrequent but is a recognised phenomenon. However, the occurrence and intensity of Other AM is specific to a location and its likelihood of occurrence cannot be reliably predicted.

Section 6 of the 'Summary of Research into Amplitude Modulation of Aerodynamic Noise from Wind Turbines - Wind Turbine Amplitude Modulation: Research to Improve Understanding as to its Cause and Effect' states that 'At present there is no way of predicting OAM at any particular location before turbines begin operation due to the general features of a site or the known attributes of a particular turbine.'

However, the Guidance Note on Noise Assessment of Wind Turbine Operations at EPA Licensed Sites (NG3) states…

features which are thought to enhance this effect are:

- *close spacing of turbines in linear rows*
- *tower height to rotor diameter ratio less than approximately 0.75*
- *stable atmospheric conditions*
- *topography leading to different wind directions being seen by the blades at different points in their rotation'*

The RenewableUK study 'has found that by minimising the onset of blade stall, the occurrence of OAM is also likely to be minimised.' It goes on to discuss 'the future involvement of turbine manufacturers in developing methods of avoiding or minimising the partial stall mechanism identified as a primary cause of OAM; and suggests that in future changes to blade design and the way in which the blade pitch (the angle of attack of the blade to the incoming air flow) is controlled are likely to have a role to play in achieving better management of the phenomenon.' Ultimately, further work is required to identify the exact on-blade conditions required for OAM to occur. The further work will aid in the development of a measure to fully mitigate the OAM. If OAM cannot be controlled by pitch regulation, shut down of wind turbines during conditions where OAM occurs will protect nearby noise sensitive locations. In the worst case, turbines would need to be stopped for 7 – 15% of the time to protect neighbouring amenity. It is therefore reasonable to conclude that even in the worst case, residential amenity can be appropriately protected.

[3] Research into aerodynamic modulation of wind turbine noise: final report, Moorhouse, AT, Hayes, M, von Hünerbein, S, Piper BJ and Adams, MD, 2007

[4] Summary of Research into Amplitude Modulation of Aerodynamic Noise from Wind Turbines - Wind Turbine Amplitude Modulation: Research to Improve Understanding as to its Cause and Effect, Report for Renewable UK, December 2013

The Draft Revised Wind Energy Development Guidelines (December 2019) consider special audible characteristics and propose a 'Relative Rated Noise Limit (RRNL)'. The rated wind turbine noise level (LA rated, 10 min) is determined by the measured noise level attributable to or related to the wind energy development plus any rating penalties for special audible characteristics. The guidelines propose a penalty scheme for amplitude modulation with a proposed penalty of up to 5 dB for AM. Low frequency noise and infrasound are discussed in Section 7.2.4 and tonal noise is discussed in Section 7.2.5.

In 2016, the IoA published 'A Method for Rating Amplitude Modulation in Wind Turbine Noise'[5]. It sets out a procedure for obtaining input noise data and the draft guidelines recommend using the IoA methodology to analyse noise data to assess for AM. The procedure proposed in the IoA guidance document is recommended by the Department of Business, Energy & Industrial Strategy (BEIS) who have published a study on amplitude modulation[6].

At present there is no method for predicting OAM at any particular location before turbines begin operation due to the general features of a site or the known attributes of a particular turbine. It is therefore proposed to undertake measurements once the site is operational to determine if OAM is occurring. In the unlikely event of OAM being present and following establishment of the likely cause, this can be addressed by turbine manufacturers as and when it occurs.

7.2.4 Infrasound & Low Frequency Noise

The definition of low frequency noise can vary, but it is generally accepted that low frequency noise is noise that occurs within the frequency range of 10 Hz to 160 Hz. Infrasound is noise occurring at frequencies below that at which sound is normally audible, that is, less than about 20 Hz, due to the significantly reduced sensitivity of the ear at such frequencies. In this frequency range, for sound to be perceptible, it must be at very high amplitude, and it is generally considered that when such sounds are perceptible then they can cause considerable annoyance. However, wind turbines do not produce infrasound at amplitudes capable of causing annoyance as outlined in the following paragraphs.

The UK Department of Trade and Industry study, 'The Measurement of Low Frequency Noise at Three UK Windfarms'[7], concluded that:

> *infrasound noise emissions from wind turbines are significantly below the recognised threshold of perception for acoustic energy within this frequency range. Even assuming that the most sensitive members of the population have a hearing threshold which is 12 dB lower than the median hearing threshold, measured infrasound levels are well below this criterion*.

It goes on to state that, based on information from the World Health Organisation, 'there is no reliable evidence that infrasound below the hearing threshold produce physiological or psychological effects'[8] and that 'it may therefore be concluded that infrasound associated with modern wind turbines is not a source which may be injurious to the health of a wind farm neighbour'.

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[5] Institute of Acoustics, IoA Noise Working Group (Wind Turbine Noise), Amplitude Modulation Working Group, A Method for Rating Amplitude Modulation in Wind Turbine Noise (Final Report), 9 August 2016 Version 1

[6] BEIS, (2016), Review of the evidence on the response to amplitude modulation from wind turbines

[7] W/45/00656/00/00, The Measurement of Low Frequency Noise at Three UK Windfarms, Department of Trade and Industry, 2006

[8] Community Noise - Document Prepared for the World Health Organization, Eds. Bergland B. & Lindvall T., Archives of the Centre for Sensory Research Vol. 2(1) 1995: Section 7.1.4 : Page 41

The study reports that low frequency noise is measurable but below the DEFRA low frequency noise criterion[9]. The study also assessed low frequency measurements against the Danish criterion of LpA,LF = 20 dB. It was found that internal levels do not exceed 20dB when measurements are undertaken within rooms with the windows closed. However, the study acknowledges that wind turbine noise (low frequency) may result in an internal noise level that is just above the threshold of audibility as defined in ISO 226[10]. The study goes on to say… 'However, at all the measurement sites, low frequency noise associated with traffic movement along local roads has been found to be greater than that from the neighbouring wind farm.'

Bowdler et al. (2009)[11] concludes that 'there is no robust evidence that low frequency noise (including 'infrasound') or ground-borne vibration from wind farms generally has adverse effects on wind farm neighbours'.

In January 2013, the Environmental Protection Authority of South Australia published the results of a study[12] into infrasound levels near wind farms. Measurements were undertaken at seven locations in urban areas and four locations in rural areas including two residences approximately 1.5 km from the wind turbines. The study concluded 'that the level of infrasound at houses near the wind turbines … is no greater than that experienced in other urban and rural environments and is also significantly below the human perception threshold.'

In 2016, the State Office for the Environment, Measurement and Nature Conservation of the Federal State of Baden-Württemberg in Germany published a report entitled 'Low-frequency noise incl. infrasound from wind turbines and other sources.' It assessed infrasound and low frequency sound from wind turbines and other sources. It found that for 'the measurements carried out even at close range, the infrasound levels in the vicinity of wind turbines – at distances between 150 and 300 m – were well below the threshold of what humans can perceive in accordance with DIN 45680 (2013).'

Furthermore, the '2019 Draft Guidelines' state… 'There is no evidence that wind turbines generate perceptible infrasound.' The guidelines go on to say… 'There is normally no excessive tonal or low frequency element in the noise from a wind turbine.' The statements in the '2019 Draft Guidelines' are in agreement with the studies outlined above.

We conclude that infrasound noise emissions from wind turbines are significantly below the recognised threshold of perception for acoustic energy within this frequency range. Infrasound is not a source which may be injurious to the health of a wind farm neighbour.

Wind turbines may produce low frequency noise at levels above the threshold of audibility. However, there is no evidence of health effects arising from low frequency noise generated by wind turbines. Given the evidence described above, an assessment of infrasound and low frequency noise from the wind farm has been scoped out.

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[9] Proposed Criteria for the assessment of low frequency noise disturbance: Report for DEFRA by Dr Andy Moorhouse, Dr David Waddington, Dr Mags Adams, December 2011, Contract No. NANR45

[10] ISO 226:2003 Acoustics – Normal equal-loudness-level contours

[11] Bowdler et al. (2009). Prediction and Assessment of Wind Turbine Noise: Agreement about relevant factors for noise assessment from wind energy projects. Acoustic Bulletin, Vol 34 No2 March/April 2009, Institute of Acoustics

[12] Environmental Protection Authority of South Australia, Infrasound levels near windfarms and in other environments, January 2013

7.2.5 Tonal Noise

ETSU-R-97 describes tonal noise as "noise containing a discrete frequency component most often of mechanical origin". Wind turbine sound can be tonal in some cases, for example if there is a defect in a turbine blade or a fault in the mechanical equipment such as the gearbox. Tonality from wind turbines is generally caused by structural resonances in the mechanical parts of the turbine and thus is highly specific not only to the turbine model but the specific components used, including tower height. However, a correctly operating wind turbine is not considered to have tonal sound emission.

7.2.6 Vibration

Vibration from operational wind turbines is low and will not result in perceptible levels at nearby sensitive receptors nor will the levels of vibration result in any structural damage. Research undertaken by Snow[13] found that levels of ground-borne vibration 100 m from the nearest wind turbine were significantly below criteria for 'critical working areas' given by British Standard BS 6472:1992 Evaluation of human exposure to vibration in buildings (1 Hz to 80 Hz) and were lower than limits specified for residential premises by an even greater margin. Hence, the level of vibration produced by wind turbines at this distance is low and does not pose a risk to human health.

More recently, the Low Frequency Noise Report[14] published by the Federal State of Baden-Württemberg simultaneously measured vibration at several locations, ranging from directly at the wind turbine tower to up to 285m distance from an operational Nordex N117 – 2.4 MW wind turbine with a hub height of 140.6m. The report concluded that at less than 300m from the turbine, the vibration levels had reduced such that they could no longer be differentiated from the background vibration levels.

Considering that the nearest sensitive receptor is over 700 m away, the level of vibration is significantly below any thresholds of perceptibility. Vibration from the turbines is too low to be perceived at neighbouring residential properties. Vibration levels will also be significantly below levels that would result in damage to the nearest buildings (including farm buildings and buildings on site). Therefore, operational vibration has been scoped out.

7.2.7 Decommissioning Noise & Vibration

The impacts associated with decommissioning of the project are comparable to those described for the construction phase.

[13] ETSU (1997), Low Frequency Noise and Vibrations Measurement at a Modern Wind Farm, prepared by D J Snow.

[14] Low-frequency noise incl. infrasound from wind turbines and other sources', State Office for the Environment, Measurement and Nature Conservation of the Federal State of Baden-Württemberg in Germany, 2016.

7.3 Methodology

The methodology adopted for this noise and vibration assessment is as follows:

- Review of appropriate guidance and specification of suitable construction and operational noise / vibration criteria;
- Characterisation of the receiving noise environment;
- Prediction of the noise impact associated with the proposed development, and;
- Evaluation of noise impacts.

7.3.1 Relevant Guidance

A list of relevant guidance documents is provided below. These have been referred to where referenced or applied in the sections hereafter.

EIA Guidance:

- Guidelines on the information to be contained in Environmental Impact Assessment Reports, Environmental Protection Agency (Draft), 2017
- Advice Notes on Current Practice, Environmental Protection Agency, Draft 2015
- Environmental Impact Assessment of Projects - Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU).

Noise Modelling Standards and Technical Advice:

- International Standard *ISO 9613-2: 1996 Attenuation of sound during propagation outdoors, Part 2: General method of calculation*
- UK Institute of Acoustics', *A Good Practice Guide to the Application of ETSU-R-97 for the Assessment at Rating of Wind Turbine Noise* (2013) and supplementary notes
- British Standard *BS 5228 Part 1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites Part 1: Noise*
- Irish Wind Energy Association, *Best Practice Guidelines for the Irish Wind Energy Industry* (2012)
- UK Department of Trade and Industry (DTI), ETSU-R-97, *The Assessment and Rating of Noise from Wind Farms* (1996).

Guideline Noise Levels:

- Wind Energy Development Planning Guidelines, Department of the Environment, Heritage and Local Government (2006)
- Draft Revised Wind Energy Development Guidelines (December 2019), Department of Housing, Planning and Local Government
- BS 5228 Part 1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. Part 1: Noise

7.3.2 Study Area

Construction and decommissioning noise have been assessed by comparing predicted construction activity activities against best practice construction noise criteria at the nearest residential dwellings to the construction activities. As such, if the construction noise meets the relevant noise limits at the nearest locations, it will also be below the relevant noise limits at more distant residential locations.

The operational noise study area includes all noise sensitive dwellings within the 35 dB L_{A90} noise contour.

The study area is in accordance with the UK Institute of Acoustics', *A Good Practice Guide to the Application of ETSU-R-97 for the Assessment at Rating of Wind Turbine Noise* (2013) whereby the guidance document defines the study area as "*the area within which noise levels from the proposed, consented and existing wind turbine(s) may exceed 35dB L_{A90} at up to 10 m/s wind speed*."

The IOA guidance documents also states… "During scoping of a new wind farm development consideration should be given to cumulative noise impacts from any other wind farms in the locality. If the proposed wind farm produces noise levels within 10 dB of any existing wind farm/s at the same receptor location, then a cumulative noise impact assessment is necessary." There is one consented wind turbine at Moneygorm to the northeast of the proposed development. However, it is unclear if the development will go ahead and for completeness it has been considered in the cumulative assessment and the operational study area of 35 dB L_{A90} includes the noise emissions from the single turbine at Moneygorm. The operational study area is presented in Figure 7.1. It includes 108 noise sensitive locations.

Since construction and operational vibration have been scoped out, there is no requirement to set study areas for each as they do not need to be assessed.

Path: R:\Map Production\2020\P20-099\Workspace\EIAR\P20-099_GIS_Fig7-1_NoiseReceptorLocationsWithinStudyArea_A3.mxd

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
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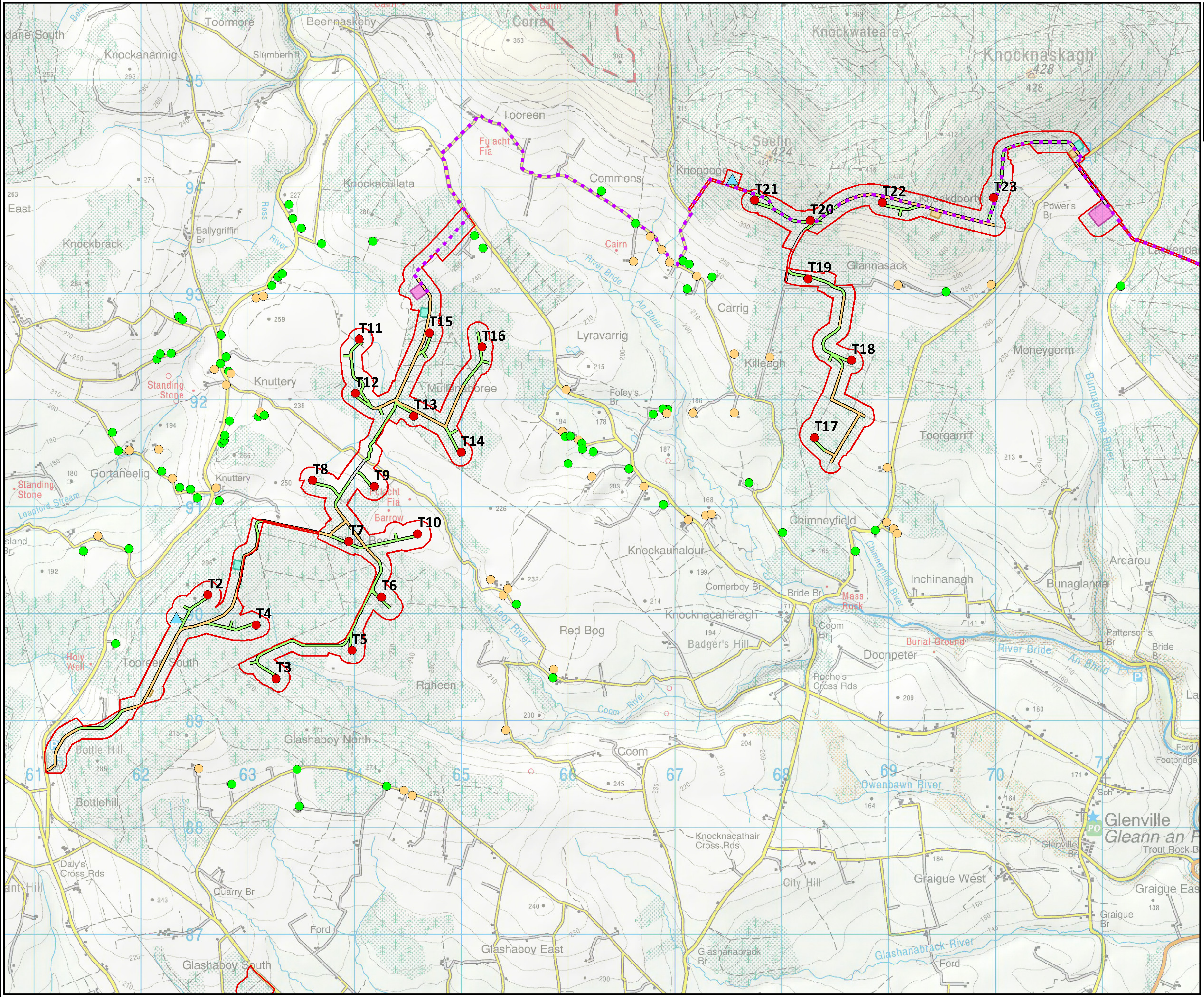

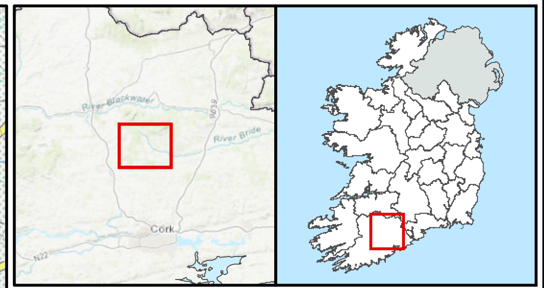

- Proposed Turbine Layout
- Proposed Permanent Met Masts
- Proposed Cable Route
- Proposed Development Boundary
- Existing Road
- Proposed Existing Road Upgrade
- Proposed New Road
- Proposed Borrow Pit
- Proposed Temporary Compound
- Proposed Substation

Receptors

- Residential
- Residential & Commercial

TITLE:	Receptor Locations within Study Area
PROJECT:	Coom Green Energy Park, Co. Cork
FIGURE NO:	7.1
CLIENT:	Coom Green Energy Park Ltd.
SCALE: 1:35000	REVISION: 0
DATE: 19/02/2020	PAGE SIZE: A3

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7.3.3 Evaluation Criteria

7.3.3.1 Construction Noise Criteria

There is no statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. In the absence of specific noise limits, appropriate emission 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 – Part 1 Noise.

BS 5228-1:2009+A1:2014 contains several methods for the assessment of the significance of noise effects. The *ABC Method* was used to derive appropriate noise limits for the proposed development. The threshold limit to be applied (as defined in Table 7.1) is dependent on the existing ambient noise levels (rounded to the nearest 5dB). If this limit is exceeded during construction, it indicates a potential significant effect.

Table 7.1: Threshold of Potential Significant Effect at Dwellings

Assessment category and threshold value period (L_{Aeq})	Threshold Value, in decibels (dB)		
	Category A [A)]	Category B [B)]	Category C [C)]
Night-time (23:00 to 07:00hrs)	45	50	55
Evenings and weekends [D)]	55	60	65
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75

A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.
B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.
C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.
D) 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

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. For the appropriate period (e.g. daytime), the ambient noise level is determined and rounded to the nearest 5dB.

The baseline noise survey results ambient (free-field) noise levels were analysed. A correction of +3dB was added to the noise levels to convert free-field noise levels to façade noise levels. The ambient façade noise level when rounded to the nearest 5dB varies, but for the most part it is less than 60 dB L_{Aeq}. The nearest residential dwellings to the proposed development are afforded Category A designation (65 dB $L_{Aeq,1hr}$ during daytime periods).

Section 7.5.2 provides the detailed assessment of construction activity in relation to this site. If the modelled construction noise level exceeds the appropriate category value (e.g. 65 dB $L_{Aeq,1hr}$ during daytime periods) then a potential significant effect is predicted.

7.3.3.2 Wind Farm Operational Noise Criteria

The operational noise assessment summarised in the following sections has been based on guidance in relation to acceptable noise levels from wind farms as contained in the Wind Energy Development Guidelines (2006) published by the Department of the Environment, Heritage, and Local Government, and the Draft Revised Wind Energy Development Guidelines (December 2019).

The Assessment and Rating of Noise from Wind Farm' (1996) published by the Department of Trade & Industry (UK) Energy Technology Support Unit (ETSU) and Institute of Acoustics' A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise, (May 2013) (IoA GPG) has been used to supplement the guidance contained within the 'Wind Energy Development Guidelines' and 'Draft Revised Wind Energy Development Guidelines' publication where necessary.

In preparing this assessment due consideration has also been given to the Cork County Development Plan 2014. Section 9.3 'Renewable Energy' of the Cork County Development Plan 2014 states 'Development of on-shore wind shall be designed and developed in line with the "Planning Guidelines for Wind Farm Development 2006" issued by the [Department of the Environment, Heritage and Local Government] and any updates of these guidelines.'

The DoEHLG guidelines (2006) contain recommended noise limits to control operational noise from wind farms and state...

> *In general, a lower fixed limit of 45 dB(A) or a maximum increase of 5dB(A) above background noise at nearby noise sensitive locations is considered appropriate to provide protection to wind energy development neighbours. However, in very quiet areas, the use of a margin of 5dB(A) above background noise at nearby noise sensitive properties is not necessary to offer a reasonable degree of protection and may unduly restrict wind energy developments which should be recognised as having wider national and global benefits. Instead, in low noise environments where background noise is less than 30 dB(A), it is recommended that the daytime level of the LA90,10min of the wind energy development noise be limited to an absolute level within the range of 35-40 dB(A).*
>
> *Separate noise limits should apply for day-time and for night-time. During the night, the protection of external amenity becomes less important and the emphasis should be on preventing sleep disturbance. A fixed limit of 43dB(A) will protect sleep inside properties during the night.*

It is also noted that on the 13th June 2017 details on a 'Preferred Draft Approach' for the review of the 2006 Wind Energy Development Guidelines was published. The 'Preferred Draft Approach' has been superseded by the publication of the Draft Revised Wind Energy Development Guidelines (December 2019) published by the Department of Housing, Planning and Local Government. The Draft Revised Wind Energy Development Guidelines were out to public consultation until the 19th February 2020 and may be subject to further revision. The 2019 Draft Guidelines states…

> *Relative rated noise levels (LA rated, 10min) resulting from wind energy development and taking into account the cumulative impact of noise levels resulting from other existing and approved wind energy developments shall not exceed:*
>
> > *(1) Background noise levels by more than 5 dB(A) within the range 35-43 dB(A), or*
> > *(2) 43 dB(A).*
> >
> > *both measured as $L_{90,10\,min}$ outdoors at specified noise sensitive locations.*

The '2019 Draft Guidelines' includes for penalties for special audible characteristics e.g. tonal and amplitude modulation, and zero-tolerance for low frequency noise. The Wind Energy Development Guidelines (2006) were in-force at the time of preparing this chapter and these have been assessed as they are the relevant guidelines to which the Board must have regard. However, the noise impact from the proposed development has also been assessed against the noise limits as derived using the '2019 Draft Guidelines'. Noise limits are based off the night-time background noise data with the evening period background noise curve taken as the night-time background noise curve plus 5 dB(A) and the daytime background noise curve taken as the night-time background noise curve plus 10 dB(A).

The operational noise criteria in the '2019 Draft Guidelines' includes noise from wind turbines and any other ancillary noise sources such as substation transformers and plant associated with the battery storage infrastructure.

7.3.4 Significance of Impact

The criteria for determining the significance of impacts and the effects are set out in the EPAs 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (Draft), August 2017'. The EPA guidelines do not quantify the impacts in decibel terms. In absence of such information, reference is made to relevant standards and guidance documents noise limits. If the predicted impact from the construction or operational phase are below the respective noise limits, it is considered that no significant effect occurs.

For this assessment, it has been assumed that dwellings have a medium to high sensitivity. Table 7.2 presents the impact significance criteria from the EPA guidelines.

Table 7.2: Impact Significance Criteria

Impact Significance	Criteria
Imperceptible	An impact capable of measurement but without noticeable consequences
Not significant	An impact which causes noticeable changes in the character of environment but without significant consequences
Slight impacts	An impact which causes noticeable changes in the character of the environment without affecting its sensitivities
Moderate impacts	An impact that alters the character of the environment in a manner that is consistent with existing and emerging trends
Significant impacts	An impact which, by its character, magnitude, duration or intensity significantly alters a sensitive aspect of the environment
Very Significant	An impact which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment
Profound impacts	An impact which obliterates sensitive characteristics

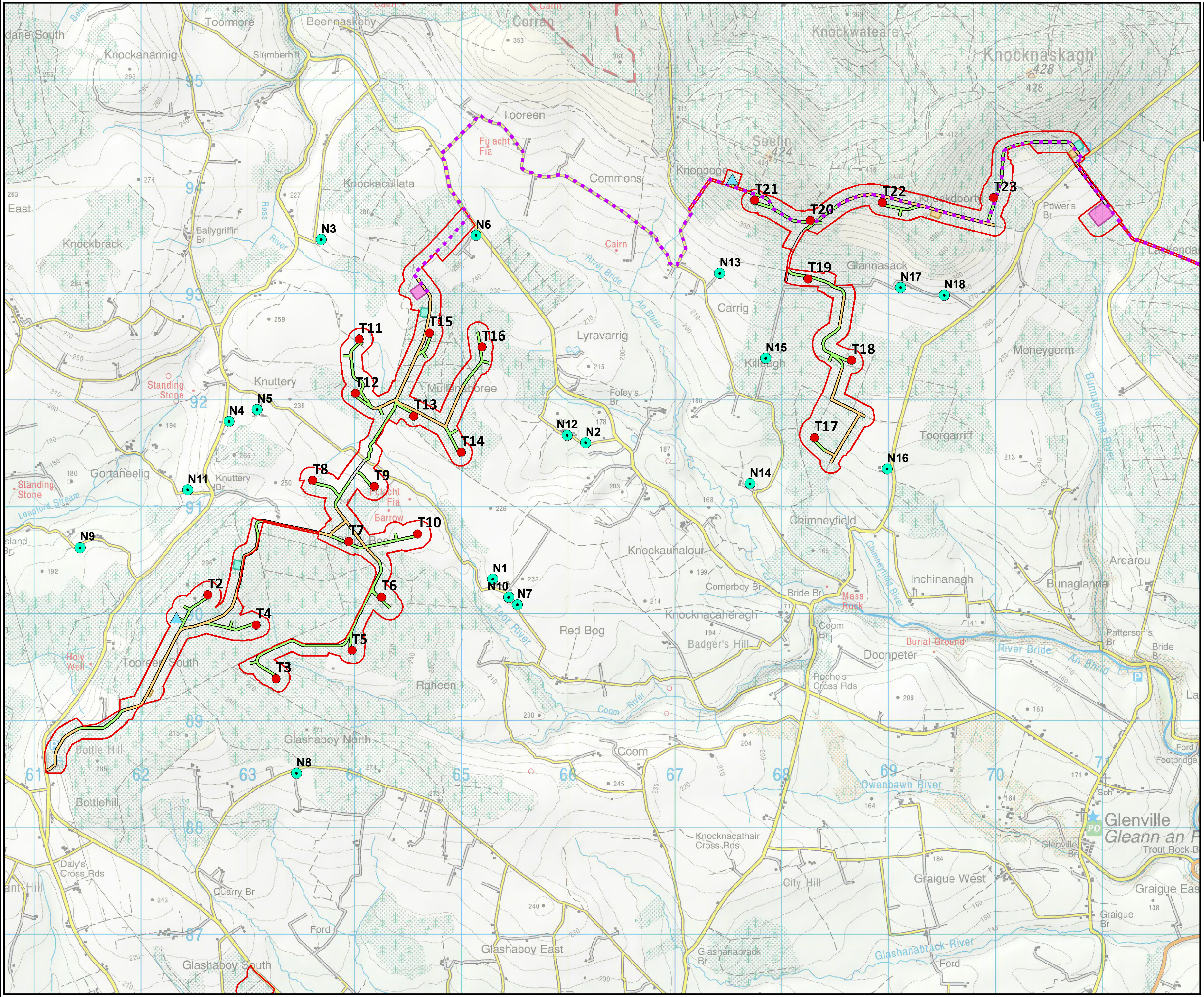
7.3.5 Consultation Requirements

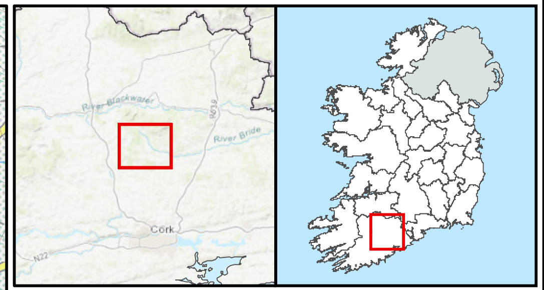
Chapter 5 of the EIAR refers to scoping consultation. Several submissions on noise were received as part of the consultation process as well as feedback from local residents some of whom expressed concern about noise during various forms of community engagement. Submissions and feedback have informed the project design and this EIAR chapter.

7.4 Existing Environment

Baseline noise monitoring was undertaken at eighteen receptor locations surrounding the proposed Coom Green Energy Park development to establish the existing background noise levels in the vicinity of the proposed energy park. These are some of the closest locations to the proposed development as well as representing different noise environments in the vicinity of the proposed development.

The 35dB L_{A90} study area as described in Section 7.3.2 and Figure 7.1 was reviewed to determine receivers to be considered for noise monitoring. Permission to access the noise measurement locations was arranged by the developer, with Fehily Timoney & Company setting up the noise monitoring equipment. Baseline noise data was collected at the eighteen locations, shown in Figure 7.2 and details of the noise monitoring locations are presented in Table 7.3. The rationale for the selection of these monitoring locations is described in Appendix 7.1. Details on the baseline measurements and data analysis are also presented in Appendix 7.1.





- Noise Monitoring Locations
- Proposed Turbine Layout
- Proposed Permanent Met Masts
- Proposed Cable Route
- Proposed Development Boundary
- Existing Road
- Proposed Existing Road Upgrade
- Proposed New Road
- Proposed Borrow Pit
- Proposed Temporary Compound
- Proposed Substation

TITLE:	Noise Monitoring Locations		
PROJECT:	Coom Green Energy Park, Co. Cork		
FIGURE NO:	7.2		
CLIENT:	Coom Green Energy Park Ltd.		
SCALE:	1:35000	REVISION:	0
DATE:	19/02/2020	PAGE SIZE:	A3

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N W E S

0 0.25 0.5 1 Kilometers

Table 7.3: Details on the Noise Monitoring Locations

Location ID	Easting	Northing	Description	Photograph
N1	165294	90322	Located to the front of a residential property (R55) approximately 20m from the façade.	Plate 7.1-1 (Appendix 7.1)
N2	166167	91598	Located to the rear of a residential property (R77) approximately 20m from the façade.	Plate 7.1-2 (Appendix 7.1)
N3	163690	93502	Located to the rear of a residential property (R40) approximately 10m from the façade.	Plate 7.1-3 (Appendix 7.1)
N4	162828	91801	Located to the rear of a residential property (R20) approximately 10m from the façade.	Plate 7.1-4 (Appendix 7.1)
N5	163088	91910	Located in an agricultural field (R25) approximately 50m from the façade.	Plate 7.1-5 (Appendix 7.1)
N6	165141	93544	Located to the rear of a residential property (R51) approximately 10m from the façade.	Plate 7.1-6 (Appendix 7.1)
N7	165526	90085	Located to the front of a residential property (R60) approximately 12m from the façade.	Plate 7.1-7 (Appendix 7.1)
N8	163458	88504	Located to the side of a residential property (R36) approximately 10m from the façade.	Plate 7.1-8 (Appendix 7.1)
N9	161429	90619	Located to the front of a residential property (R153) approximately 20m from the façade.	Plate 7.1-9 (Appendix 7.1)
N10	165444	90155	Located to the front of a residential property (R56) approximately 10m from the façade.	Plate 7.1-10 (Appendix 7.1)
N11	162438	91160	Located to the front of a residential property (R4) approximately 20m from the façade.	Plate 7.1-11 (Appendix 7.1)
N12	165995	91671	Located to the front of a residential property (R71) approximately 8m from the façade.	Plate 7.1-12 (Appendix 7.1)
N13	167420	93186	Located to the rear farm sheds approximately 85m from the dwelling (R101).	Plate 7.1-13 (Appendix 7.1)
N14	167705	91216	Located to the rear of a residential property (R106) approximately 7m from the façade.	Plate 7.1-14 (Appendix 7.1)
N15	167852	92391	Located to the front of a residential property (R107) approximately 30m from the façade.	Plate 7.1-15 (Appendix 7.1)
N16	168991	91354	Located to the rear of a residential property (R118) approximately 6m from the façade.	Plate 7.1-16 (Appendix 7.1)
N17	169117	93055	Located adjacent to a residential property (121) approximately 12m from the façade.	Plate 7.1-17 (Appendix 7.1)
N18	169526	92984	Located to the rear of a residential property (R122) approximately 16m from the façade.	Plate 7.1-18 (Appendix 7.1)

7.4.1 Analysis of the Baseline Data

The raw baseline L_{A90} noise data was reviewed to determine whether there are any periods of non-consistent noise level due to equipment malfunction. If there was any data which was inconsistent, these noise level data points were removed from the raw data. The raw noise level data was then correlated with the time synchronised 10 m standardised wind speed and rainfall data. Periods of rainfall, data affected by dawn chorus and atypical data was removed from the analysis. Once the remaining data sets were found to be representative of the noise environment, they were analysed to ensure that sufficient data sets remained to provide sufficient data coverage over the necessary wind speeds. A 'best fit' trend (not higher than a fourth order polynomial) was then derived to present the prevailing background noise level at each monitoring location. Appendix 7.1 presents the results of the data analysis.

The prevailing daytime noise levels at the eighteen noise monitoring locations are presented in Table 7.4. The prevailing night-time noise levels are presented in Appendix 7.1. In some instances, the prevailing background noise is higher at lower wind speeds, in keeping with the IoA guidelines, the lowest derived background noise level is adopted for all wind speeds below where this derived minimum occurs. Furthermore, the derived prevailing background noise polynomial curve was not extended beyond the range covered by adequate data points. Where a noise limit is required at higher wind speeds; it was restricted to the highest derived point.

Table 7.4: Prevailing Background Noise during Daytime Periods

Location	Prevailing Background Noise $L_{A90,10min}$ (dB) at 10 m Standardised wind speed (m/s)									
	3	4	5	6	7	8	9	10	11	12
N1	24.8	25.7	27.3	29.3	31.5	34.0	36.3	38.5	38.5§	38.5§
N2	25.7*	25.7*	25.7	26.9	29.7	33.4	36.6	37.5	37.5§	37.5§
N3	23.9	25.7	28.3	31.7	35.7	40.1	44.9	50.0	50.0§	50.0§
N4	25.0	26.0	27.9	30.4	33.2	36.0	38.4	39.8	39.8§	39.8§
N5	27.5	28.9	30.8	33.1	35.7	38.3	40.8	43.0	43.0§	43.0§
N6	26.0	27.2	28.9	31.3	34.3	38.0	42.8	48.9	48.9§	48.9§
N7	24.2	25.5	27.1	29.2	31.9	35.6	40.2	46.1	46.1§	46.1§
N8	24.1	25.0	27.2	30.4	34.0	37.8	41.2	43.8	43.8§	43.8§
N9	28.8	30.5	31.7	32.8	33.8	34.8	36.0	37.5	39.4§	39.4§
N10	23.9	25.4	27.4	29.8	32.6	35.6	38.6	41.7	44.7§	44.7§
N11	29.8	30.7	31.4	32.3	33.6	35.4	38.1	41.8	46.8§	46.8§
N12	29.0	29.5	30.7	32.5	34.8	37.5	40.4	43.5	46.6§	46.6§
N13	27.5	28.8	29.7	30.6	31.6	32.8	34.3	36.2	38.4	40.8
N14	28.1*	28.1*	28.1	28.9	30.3	32.3	34.6	37.1	39.6	42.0
N15	31.3*	31.3*	31.3	32.0	33.4	35.3	37.5	39.9	42.2	44.2
N16	28.9*	28.9*	28.9	29.7	31.4	33.5	36.0	38.6	41.0	43.0
N17	26.9	26.9	28.2	30.5	33.4	36.6	39.8	42.9	45.7	47.9
N18	23.8	24.3	25.6	27.5	29.9	32.6	35.3	37.9	40.3	42.2

* - lowest derived background noise level is adopted for all wind speeds below where this derived minimum occurs. For example, at monitoring location N2 the lowest derived background noise level occurs at a wind speed of 5 m/s. The trend line fitted to noise data showed a higher noise level at 3 and 4 m/s. Therefore, using this criterion, the noise level at 3 and 4 m/s has been assumed to be equal to that of the noise level at 5 m/s.

§ - noise level restricted to the highest derived point

7.4.2 Wind Farm Noise Limits

7.4.2.1 Derived Wind Farm Noise Limits

The standard approach (outlined in the IoA GPG) to derivation of noise limits is to carry out background measurements at several locations representative of different noise environments around the proposed site. As it is not usually possible to carry out measurements at every noise sensitive location (NSL), NSLs near to the measurement location are then assigned the same limits as the measurement location. The operational impact at each of the measurement locations was assessed in accordance with the IoA GPG.

The proposed development was assessed against the 'Wind Energy Development Guidelines' (2006) as these guidelines are currently in-force. The proposed development was also assessed against the 'Draft Revised Wind Energy Development Guidelines' (December 2019). This is discussed in detail in Appendix 7.3.

The 2006 guidelines state that a fixed limit of 43 dB L_{A90} applies during night-time periods. However, the derivation of the daytime noise limit uses the prevailing background noise data. Where low background noise levels are found, the 2006 guidelines recommend a limit of 35 to 40 dB L_{A90}. There is no further detail provided on which to determine how the appropriate noise limit be derived. However, the guidelines state… "An appropriate balance must be achieved between power generation and noise impact." Refence has also been made to planning permission adjacent to the development. Finally, since this limit is clearly taken from ETSU-R-97, reference is made to ETSU-R-97 which recommends that the following three factors be considered when determining the fixed limit:

1) *Number of dwellings in neighbourhood of the wind farm.*
2) *The effect of noise limits on the kWh.*
3) *Duration and level of exposure.*

The IOA GPG states the following with respect to the ETSU-R-97 criteria… *"It can be argued that assessing these factors do not represent an acoustic consideration but ultimately a planning consideration."*

The first factor to be considered is the "Number of dwellings in neighbourhood of the wind farm". ETSU-R-97 describes this factor as balancing the benefits from a wind energy project with the local environment impact, "The more dwellings that are in the vicinity of a wind farm the tighter the limits should be as the total environmental impact will be greater. Conversely if only a few dwellings are affected, then the environmental impact is less and noise limits towards the upper end of the range may be appropriate." The number of noise sensitive locations (includes planning permissions) within the 35dB L_{A90} study area is 108, indicating that a lower end limit range is appropriate.

The second factor is the effect of noise limits on the power output of the wind farm. Similarly, to the first factor, this balances the planning merit of the project against the local impact. The proposed development has 22 turbines. If the limit is lowered, then, based on the noise modelling results, curtailment would be required. Since this project is considered to have merit in assisting Ireland in meeting its renewable energy targets, the upper end of the limit range is appropriate.

The final ETSU factor relates to the duration and level of exposure. The prevailing background noise levels are described in detail in Section 7.4.1 and Appendix 7.1. The wind rose for the proposed development shows that at standardised 10m height wind speeds of 5, 6 and 7 m/s occur 18.8, 14.2, and 9.9 % of the time and on that basis a decrease in the limit towards the lower end of the limit range is appropriate as residents will experience these conditions for a significant percentage of the time.

The Wind Energy Development Guidelines (2006) states that "An appropriate balance must be achieved between power generation and noise impact." and the mid-range limit of 37.5 dB L_{A90} represents that balance.

Reference is also made to Condition 11 of Planning Reference PL04.241037 for a single turbine adjacent to the proposed development which states… "*Noise levels arising from the operation of the turbine (corrected for any tonal or impulsive components) shall not exceed 43 dB(A) L90,10min or 5 dB(A) above existing background noise levels, whichever is the greater, at existing habitable* houses." The noise limit is 3 dB above the Wind Energy Development Guidelines low background noise upper limit of 40 dB L_{A90}.

Given the information above, it is recommended that a fixed limit of 37.5 dB L_{A90} for low background conditions should apply for the proposed development. It represents an appropriate balance between power generation and noise impact as well as being 5.5 dB lower than the adjacent permitted development.

The derived noise limits with reference to the background noise environment found at dwellings surrounding the proposed development site and, where necessary, the meteorological conditions experienced during the survey are presented in Table 7.5.

Table 7.5: Derived Noise Limits

Location	Period	Prevailing Background Noise $L_{A90,10min}$ (dB) at 10 m Standardised wind speed (m/s)									
		3	4	5	6	7	8	9	10	11	12
N1	Daytime	37.5	37.5	37.5	37.5	45.0	45.0	45.0	45.0	45.0	45.0
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
N2	Daytime	37.5	37.5	37.5	37.5	37.5	45.0	45.0	45.0	45.0	45.0
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
N3	Daytime	37.5	37.5	37.5	45.0	45.0	45.1	49.9	55.0	55.0	55.0
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
N4	Daytime	37.5	37.5	37.5	45.0	45.0	45.0	45.0	45.0	45.0	45.0
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
N5	Daytime	37.5	37.5	45.0	45.0	45.0	45.0	45.8	48.0	48.0	48.0
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
N6	Daytime	37.5	37.5	37.5	45.0	45.0	45.0	47.8	53.9	53.9	53.9
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
N7	Daytime	37.5	37.5	37.5	37.5	45.0	45.0	45.2	51.1	51.1	51.1
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
N8	Daytime	37.5	37.5	37.5	45.0	45.0	45.0	46.2	48.8	48.8	48.8
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
N9	Daytime	37.5	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
N10	Daytime	37.5	37.5	37.5	37.5	45.0	45.0	45.0	46.7	46.7	46.7

Location	Period	Prevailing Background Noise $L_{A90,10min}$ (dB) at 10 m Standardised wind speed (m/s)									
		3	4	5	6	7	8	9	10	11	12
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
N11	Daytime	37.5	45.0	45.0	45.0	45.0	45.0	45.0	46.8	46.8	46.8
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
N12	Daytime	37.5	37.5	45.0	45.0	45.0	45.0	45.4	48.5	48.5	48.5
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
N13	Daytime	37.5	37.5	37.5	45.0	45.0	45.0	45.0	45.0	45.0	45.8
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
N14	Daytime	37.5	37.5	37.5	37.5	45.0	45.0	45.0	45.0	45.0	47.0
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
N15	Daytime	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	47.2	49.2
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
N16	Daytime	37.5	37.5	37.5	37.5	45.0	45.0	45.0	45.0	46.0	48.0
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
N17	Daytime	37.5	37.5	37.5	45.0	45.0	45.0	45.0	47.9	50.7	52.9
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
N18	Daytime	37.5	37.5	37.5	37.5	37.5	45.0	45.0	45.0	45.3	47.2
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0

The derived noise limits using the Draft Revised Wind Energy Development Guidelines are presented in Appendix 7.3.

7.5 Potential Impacts

7.5.1 Do Nothing Scenario

Under the Do-Nothing scenario, the proposed development is not constructed or operated. The noise environment remains largely unchanged. However, if Bottlehill Landfill opens, there is potential for an increase in noise levels at noise sensitive locations in the vicinity of Bottlehill Landfill. There will also be an increase in traffic volumes on local road on route to the landfill. The increase in noise level will be significant at dwellings adjacent to these local roads.

7.5.2 Potential Impacts during Construction

Noise predictions were undertaken to determine the likely impact during the construction works. BS 5228-1:2009+A1:2014 sets out sound power levels and L_{Aeq} noise levels of plant items normally encountered on construction sites, which in turn enables the prediction of noise levels at selected locations.

Construction noise modelling is based on the details presented in Section 3.7 of this EIAR as well as a review of other chapters of the EIAR. Noise modelling was carried out using guidance and plant noise data from BS 5228:2009+A1:2014. The ground cover is predominately acoustically soft (G=1)[15]. The noise model assumes that the ground cover is a mix between acoustically hard and soft ground with a ground cover of G=0.75 to allow for pockets of acoustically hard ground. Percentage on time[16] for plant is outlined for each of the plant items used during construction.

The construction noise model assessed several tasks with the potential to generate noise. These tasks included: deliveries and/or removal of material to and from site, preparation of access roads, excavation of material from borrow pits, preparation of hardstands and drainage, pouring of foundations, installation of wind turbines and works associated with grid connection.

Site Traffic

Detailed information on construction traffic is presented in Chapter 13. To summarise, additional light goods vehicles travelling to and from the site during the construction phase would be expected to peak during the morning (arrival of contractors at the site) and evening (departure of contractors from the site) and are envisaged not to be a continuous source of noise emissions from the site during a typical working day. The noise impact from construction personnel movements to and from the site is expected to be low.

All deliveries of turbine components to the site will only be by way of the proposed transport route outlined in Chapter 13. The most intensive period of the works programme will be Month 12. The busiest period is when hardstanding works, preparation of turbine foundations and substation works will be ongoing in parallel. The noise impact for construction works traffic will be mitigated by generally restricting movements along access routes to the standard working hours and exclude Sundays, unless specifically agreed otherwise. For example, during turbine erection and foundation pours, an extension to the working day may be required, i.e. 05:00 to 21:00, but this would be necessary only on a relatively small number of occasions. If turbine deliveries are required at night it will be subject to agreement with the relevant planning authority and it would be ensured that vehicles on local roads do not wait outside residential properties with their engines idling, and that the local residents will be informed of any activities likely to occur outside of normal working hours.

Borrow Pits

There are 3 no. borrow pits on site. The locations of the proposed borrow pits are shown in Figure 3-1. The proposed borrow pits shall provide site-won stone that will significantly reduce the amount of construction aggregates that would need to be delivered to site. As outlined in Section 9.3.6 of Chapter 9, intrusive site investigations undertaken at the proposed borrow pit locations identified overburden deposits comprising Gravels and Sands and Weathered Bedrock (BP01 and BP02) and Clay (BP03) suitable for use as General FILL for the construction of the proposed development.

There will no blasting required in the borrow pits. It is expected that a crusher will be required at the borrow pits. However, at this stage it is not apparent if a rock breaker will be required. For the purpose of this assessment, a worst-case scenario with the rock breaker and crusher operating was modelled. Table 7.6 presents the predicted noise levels from this activity at the nearest dwelling (R143) approximately 510 m away. Assuming all plant is operating at the borrow pit, the predicted cumulative noise is 51.9 dB $L_{Aeq,1hr}$. The predicted noise at the nearest noise sensitive location is below the daytime noise limit of 65 dB $L_{Aeq,1hr}$. The noise associated with the borrow pit activity is expected to have a slight impact and temporary in duration.

[15] G denotes the ground cover from an acoustic perspective. G=0 refers to acoustically hard or reflective surface and G=1 refers to acoustic soft or absorptive surface.

[16] Percentage on-time refers to the percentage of the assessment period for which the activity takes place.

Table 7.6: Borrow Pit – Likely Plant

Plant	BS 5228 Ref.	Activity	Percentage on-time (%)	Predicted Noise Level at R143
Diesel Pump	C4.88	Pump water	100	32.5
Tracked Hydraulic Excavator (37t)	C10.1	Face shovel extracting/ loading dump trucks	80	42.3
Rock Breaker	C9.12	Rock breaking	50	45.4
Crusher	C1.14	Crushing material	100	45.1
Tracked Excavator (21t)	C4.65	Trenching	80	33.8
Dozer (41t)	C2.10	Ground Excavation/Earthworks	80	42.7
Articulated Dump Truck (23t) *	C2.33	Distribution of Material	Maximum 48 two-way trips per day	46.9
Cumulative				51.9
* - Drive-by maximum sound level				

Preparation of Access roads, Hardstands and Drainage

Table 7.7 presents the likely plant required for the preparation of access roads, hardstanding and drainage. Also presented are the predicted noise levels at the nearest dwelling (R10) approximately 470 m away from one of the access roads. Assuming all construction activities required for the preparation of the access road occur simultaneously, the predicted noise level from the construction activities is 50.1 dB $L_{Aeq,1hr}$ which is below the 65dB $L_{Aeq,1hr}$ noise limit. The preparation of access roads, hardstands and drainage are expected to have a slight impact and temporary in duration.

Table 7.7: Preparation of Access roads, Hardstands and Drainage - Likely Plant and Predicted Levels

Plant	BS 5228 Ref.	Activity	Percentage on-time (%)	Predicted Noise Level at R10
Tracked Excavator (25t)	C2.19	Ground excavation/ earthworks	80	40.8
Articulated Dump Truck (23t)	C2.32	Tipping Fill	20	31.3
Dozer (14t)	C5.12	Spreading chipping/fill	80	40.0
Vibratory roller (3t)	C5.27	Rolling and Compaction	80	29.9
Excavator (21t)	C4.65	Trench for drainage	80	34.6

Plant	BS 5228 Ref.	Activity	Percentage on-time (%)	Predicted Noise Level at R10
Lorry*	C11.9	Delivery of Material	Maximum 88 two-way trips per day	48.8
Cumulative				50.1
* - Drive-by maximum sound level				

Preparation of Wind Turbine Foundations

Table 7.8 presents the likely plant required for the preparation of wind turbine foundations. Predicted noise levels at R27 is presented. This is the closest dwelling to wind turbines approximately 770 m from turbine T8. Assuming all construction activities required for the preparation of the turbine foundations occur simultaneously, the predicted noise level from the construction activities is 46.6 dB $L_{Aeq,1hr}$. The predicted noise levels are below the 65dB $L_{Aeq,1hr}$ noise limit. The construction works associated with the preparation of the turbine foundations are expected to have a slight impact and temporary in duration.

Table 7.8: Preparation of Wind Turbine Foundations - Likely Plant and Predicted Levels

Plant	BS 5228 Ref.	Activity	Percentage on-time (%)	Predicted Noise Level at R27
Tracked Excavator (25t)	C2.19	Ground excavation/earthworks	80	35.6
Excavator (23t)	C10.8	Loading sand / soil	80	38.3
Diesel Pump	C4.88	Pump water	100	27.8
Mobile telescopic crane	C4.41	Lifting reinforcing steel	80	32.9
Concrete mixer truck & concrete pump	C4.32	Concrete mixer truck + truck mounted concrete pump + boom arm	100	36.9
Lorry*	C11.9	Delivery and removal of material	Maximum 88 two-way trips per day	44.4
Cumulative				46.6
* - Drive-by maximum sound level				

Installation of Wind Turbines

Turbine components will be delivered to site and a mobile telescopic crane will lift the turbine components into place. A worst case of the two cranes lifting turbine components 100% of the time is assumed along with delivery of turbine components. The predicted noise levels are presented in Table 7.9. The predicted cumulative noise level at receptors R27 is 44.7 dB $L_{Aeq,1hr}$. The predicted noise levels are below the 65 dB $L_{Aeq,1hr}$ noise limit. The construction works associated with the installation of the wind turbines are expected to have a slight impact and temporary in duration.

Table 7.9: Installation of Wind Turbines - Likely Plant and Predicted Levels

Plant	BS 5228 Ref.	Activity	Percentage on-time (%)	Predicted Noise Level at R27
Mobile telescopic crane (x2)	C4.41	Lifting turbine components	100	32.9
Lorry *	C11.9	Delivery of Turbine Components	Maximum 88 two-way trips per day	44.4
Cumulative				44.7
* - Drive-by maximum sound level				

Construction of Substation

The construction of two substation buildings will occur during the construction phase of the proposed development. The construction works will be progressed in a number of phases:

- Site clearance and Preparation
- Preparation and pouring of foundations and floor areas
- Preparation of hardstanding areas
- Erection of blockwork/ installation concrete slabs
- General Construction including installation of electrical and mechanical plant

Table 7.10 presents the assumed plant required for the different construction phases of the proposed buildings to be constructed on site. The nearest occupied dwelling (R142) will be approximately 520 m away. The cumulative predicted noise levels for the worst combination of plant (Site Clearance and Preparation) is predicted to be 47 dB $L_{Aeq,1hr}$ at the nearest occupied dwelling which is below the construction noise limit of 65 dB $L_{Aeq,1hr}$. The works associated with the construction of the substation are expected to have a slight impact and temporary in duration.

Table 7.10: Construction of Substation - Likely Plant and Predicted Levels

Phase	Plant	BS 5228 Ref.	Activity	Percentage on-time (%)	Predicted Noise Level at R142
Site Clearance and Preparation	Tracked excavator (22t)	C2.3	Clearing Site	80	42.2
	Dozer (11t)	C2.12	Ground excavation/ earthworks	80	41.8
	Loading Lorry	C10.8	Loading Sand to Lorry	80	40.4
	Cumulative				46.3
Preparation and pouring of Foundations	Tracked Excavator (25t)	C2.19	Ground excavation/ earthworks	80	38.6
	Concrete mixer truck + truck mounted concrete pump + boom arm	C4.32	Concrete pumping	80	39.0
	Lorry*	C11.9	Delivery of material	Maximum of 48 two-way trips per day	35.0
	Cumulative				42.6
Preparation of hardstanding areas	Articulated Dump Truck (23t)	C2.33	Delivery/Removal of Material	Maximum of 24 two-way trips per day	33.3
	Tracked Excavator (25t)	C2.19	Ground excavation/earthworks	80	38.6
	Articulated Dump Truck (23t)	C2.32	Tipping Fill	20	28.2
	Dozer (14t)	C5.12	Spreading chipping/fill	80	37.9
	Vibratory roller (3t)	C5.27	Rolling and Compaction	80	27.8
	Lorry*	C11.9	Delivery of material	Maximum of 48 two-way trips per day	35.0
	Cumulative				43.0
Erection of blockwork/ installation concrete slabs	Mobile telescopic crane (80t)	C4.39	Lifting concrete slabs	80	37.9
	Lorry* (32t)	C11.9	Delivery of material	Maximum of 48 two-way trips per day	35.0
	Cumulative				39.7

Phase	Plant	BS 5228 Ref.	Activity	Percentage on-time (%)	Predicted Noise Level at R142
General Construction including installation of electrical and mechanical plant	Generator	C4.84	Power for site cabins	100	27.9
	Telescopic handler	C4.54	Lifting Plant	80	39.6
	Angle grinder (grinding steel)	C4.93	Miscellaneous	80	41.8
	Cumulative				44.0
* Drive-by maximum sound level					

Grid Connection Works including Link between Onsite Substations

It is proposed to construct 2 no. onsite electricity substations within the proposed development site as shown in Figure 3-1 in Chapter 3 of this EIAR. These will provide two connection points between the wind farm and the proposed grid connection point at the existing Barrymore substation. Each turbine will be connected to the on-site electricity substations via underground electricity cables. The cable route will follow the proposed access tracks between each turbine. There will sections where the cable route will be routed along public road. The main on-site substation is at Lackendarragh and a 110kV buried cable is proposed to connect to the existing Barrymore substation. The grid connection cable will travel along public roads.

The grid connection works will be carried out over a 10-month period and 'rolling road closures' will be implemented, whereby the site will progress each day along a road, which will have the effect of reducing the impact for residents. The likely plant required during the construction works are presented in Table 7.11.

Table 7.11: Grid Connection Works – Likely Plant and Predicted Noise Levels

Plant	Activity	Percentage on-time (%)	A-Weighted Sound Pressure Level, L_{Aeq}, dB			
			10m	25m	50m	100m
Road sweeper (C4.90)	Sweeping and dust suppression	10	49.5	41.6	35.6	29.6
Mini excavator with hydraulic breaker (C5.2)	Breaking Road Surface	25	78.9	71.4	65.5	59.5
Vibratory roller (C5.27)	Rolling and Compaction	50	66.3	58.6	52.6	46.6
Wheeled excavator (C5.34)	Trenching	50	69.9	62	56	50
Hand-held circular saw (petrol) (C5.36)	Cutting Concrete Slabs	10	79	71.6	65.6	59.6
Dump truck (tipping fill) (C2.30)	Tipping Fill	10	71.8	64.1	58.1	52.1
Vibratory plate (petrol) (C2.41)	Compaction	10	72.7	65.1	59.1	53.1

Table 7.11 also presents predicted noise level for a range of construction activities at distances of 10 m, 25 m, 50 m and 100 m from the works. The noise levels presented are predicted maximum expected levels and are expected to occur for only short periods of time at a very limited number of dwellings. There are zero dwellings within 10 m of the grid connection works, 12 dwellings within 25 m, 47 dwellings between 25 – 50 m and 4 dwellings between 50 - 100 m.

In some instances, the maximum predicted noise levels may be above the noise limit of 65 dB $L_{Aeq,1hr}$. However, these elevated noise levels will only occur for short durations at a limited number of dwellings. Given the nature of the grid connection works, construction activities will not occur over an extended period at any one location.

Mitigation measures will be employed to reduce any potential impacts. Mitigation measures are discussed in Section 7.6.1. With mitigation measures, there is potential for temporary elevated noise levels due to the grid connection works. However, these works will be for a short duration at a particular property (i.e. typically less than 3 days) and where the works are to occur over an extended period, a temporary barrier or screen will be used to reduce noise level below the noise limit. The works are expected to have a significant temporary impact.

Potential Cumulative impacts are detailed in Section 7.5.5.

7.5.3 Potential Impacts during Operation

7.5.3.1 Operation of Wind Turbines

Noise predictions have been carried out using International Standard ISO 9613, *Acoustics – Attenuation of Sound during Propagation Outdoors*. The propagation model described in Part 2 of this standard provides for the prediction of sound pressure levels based on either short-term downwind (i.e. worst case) conditions or long term overall averages. Only the worst-case downwind condition has been considered in this assessment, that is – for wind blowing from the proposed turbines towards the nearby houses. When the wind is blowing in the opposite direction noise levels may be significantly lower, especially where there is any shielding between the turbines and the houses.

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

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

These factors are discussed in detail below. The predicted octave band levels from the turbine are summed together to give the overall ‘A’ weighted predicted sound level.

L_W - Source Sound Power Level

The sound power level of a noise source is normally expressed in dB re:1pW. Noise predictions are based on sound power levels provided for the Enercon E-136 EP5 / 4650 kW with Trailing Edge Serrations (TES).

D – Directivity Factor

The directivity factor allows for an adjustment to be made where the sound radiated in the direction of interest is higher than that for which the sound power level is specified.

In this case the sound power level is measured in a downwind direction, corresponding to the worst-case propagation conditions considered here and needs no further adjustment.

A_{geo} – Geometrical Divergence

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

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

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

A_{atm} - Atmospheric Absorption

The atmospheric absorption accounts for the frequency dependant linear attenuation with distance of sound power over the frequency spectrum according to:

$A_{atm} = d \times \alpha$
where, α = the atmospheric absorption coefficient of the relevant frequency band

Published values of 'α' from ISO9613 Part 1[17] have been used, corresponding to a temperature of 10^0C and a relative humidity of 70%, the values specified in the IoA GPG, which give relatively low levels of atmospheric attenuation, and subsequently conservative noise predictions as given in Table 7.12.

Table 7.12: Atmospheric Octave Band Attenuation coefficients, dB/m

Octave Band Centre Frequency (Hz)							
63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
0.00012	0.00041	0.00104	0.00193	0.00366	0.00966	0.03280	0.11700

A_{gr} - Ground Effect

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

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

[17] ISO 9613-1, Acoustics - Attenuation of sound during propagation outdoors, Part 1: Method of calculation of the attenuation of sound by atmospheric absorption, International Organization for Standardization, 1992

The GPG states that use of G = 0.5 and a receptor height of 4 m should be used to predict the resultant turbine noise level at dwellings neighbouring a proposed development provided that an appropriate allowance for measurement uncertainty is accounted for within the stated source noise levels. Therefore, predictions in this report are based on G = 0.5 with a receptor height of 4 m and, due to the inclusion of the assumed uncertainty (see 'Overview of Input Datasets' for more details) within the source noise levels, these predictions are considered to be worst case.

A_{bar} - Barrier Attenuation

The effect of any barrier between the noise source and the receiver position is that noise will be reduced according to the relative heights of the source, receiver and barrier and the frequency spectrum of the noise. The barrier attenuations predicted by the ISO 9613 model have, however, been shown to be significantly greater than that measured in practice under downwind conditions. The results of a study of propagation of noise from wind farm sites carried out for ETSU concludes that an attenuation of just 2 dB(A) should be allowed where the direct line of site between the source and receiver is just interrupted and that 10 dB(A) should be allowed where a barrier lies within 5 m of a receiver and provides a significant interruption to the line of site.

The IoA GPG states that *'Topographic screening effects of the terrain (ISO 9613-2, Equation 2) should be limited to a reduction of no more than 2 dB, and then only if there is no direct line of sight between the highest point on the turbine rotor and the receiver location'*. As a conservative approach, this has not been accounted for in the noise model predictions.

A_{misc} – Miscellaneous Other Effects

ISO 9613 includes effects of propagation through foliage and industrial plants as additional attenuation effects. The attenuation due to forestry has not been included here and any such effects are unlikely to significantly reduce noise levels below those predicted.

The site topography was also analysed to determine if there is a valley correction (+3 dB) for concave ground profile, or where the ground falls away significantly, between the turbine and the receiver location. The IoA guidelines provide a criterion of application and it was determined that a valley correction is applicable for some turbine – noise sensitive location combinations for this site and +3 dB correction has been added when the IoA criterion is met. The valley correction for each wind turbine / noise sensitive location combination is presented in Appendix 7.5.

Predicted Noise Levels

The predicted turbine noise L_{Aeq} has been adjusted by subtracting 2 dB to give the equivalent L_{A90} as suggested in the IoA GPG.

Overview of Input Datasets

In order to calculate the noise levels at noise sensitive locations, an accurate representation of the source and receiver positions was necessary for the prediction modelling. The turbine locations are presented in Table 3.1 in Section 3.5.1 of Chapter 3 of this EIAR and noise sensitive locations are presented in Appendix 7.4. The closest dwellings are at least 700 m from the nearest turbine. For the purpose of this assessment a 20 m offset from the building façade was used for the calculation of predicted operational noise impacts. The 20 m offset was to account for the curtilage of the dwelling.

For the purposes of this assessment, noise predictions are based on sound power levels provided for the Enercon E-136 EP5 / 4650 kW with TES (candidate turbine). Several turbine options were considered which meet the wind turbine dimensional envelope and the Enercon E-136 EP5 was a worst-case from a noise perspective.

The actual turbines to be installed at the proposed wind farm will be the subject of a competitive tender process and may include turbines not amongst the turbine models currently available. Regardless of the make or model of the turbine eventually selected for installation on site, the noise it will give rise to will be of no greater significance than that used for the purposes of this assessment to ensure that the findings remain valid.

The sound power level and octave band values for the turbine are based on the noise levels provided by the manufacturer (Document ref: D0820814-1 / DA). The sound power levels are presented in Table 7.13 and octave band data in dB(A) at Standardised 10m height wind speed of 8.5 m/s is presented in Table 7.14

Table 7.13: Wind Turbine (Enercon E-136 EP5 / 4650 kW with TES) Sound Power Levels, dB L_{WA}

Turbine	Standardised 10 m Height Wind Speed (m/s)						
	3	4	5	6	7	8	9 to cut-out
Enercon E136 TES (Normal Operation)	90.1	97.5	102.9	105.3	106	106	106.1

Table 7.14: Wind Turbine (Enercon E-136 EP5 / 4650 kW with TES) Octave Band Noise Levels, dB(A) for a Standardised 10 m Height Wind Speeds of 8.5 m/s

10 m Standardised wind speed (m/s)	Octave Band Level Centre Frequency in Hz								
	31.5	63	125	250	500	1000	2000	4000	8000
8.5	75.1	84.9	92.7	98.7	100.8	100.4	97.7	92.4	84.7

The IoA GPG states that it should be ensured that a margin of uncertainty is included within source wind turbine noise data used in noise predictions. A 2 dB correction is added to the sound power level to account for a margin of uncertainty.

It is possible to run all turbine models in noise reduced modes of operation (NROs) whereby the noise level is lessened by reducing the rotational speed of the turbines, with a resultant loss of electrical energy production.

7.5.3.2 Potential Operational Impact – Substations Transformers and Battery Storage

The cumulative assessment of all noise sources from the proposed development was assessed against the noise limits. In additional to the noise from wind turbines, noise will be produced by the transformers located in the substations. The noise level is likely to depend on the load on the transformer which is dependent on the wind speed (as the wind turbines producing more energy in high wind speeds).

Predictions have been carried out based on an example transformer; the Siemens TLPN7747 40000 / 50000 kVA. The sound power level for the transformer is 93 dB(A). The octave band profile for the transformer has been sourced from 'An Introduction to Sound Level Data for Mechanical and Electrical Equipment' published by CED Engineering. The A-weighted octave band data is presented in Table 7.15.

There will also be battery storage adjacent to the Lackendarragh North substation. The battery storage containers will have two HVACs per container to regulate the temperature in the storage containers. Predictions have been carried out based on an example HVAC unit; Mitsubishi PUHY-P200YKB-A1 (-BS). The sound power level for the HVAC unit is 78 dB and the A-weighted octave band data is presented in Table 7.15.

Table 7.15: Octave Band Sound Power Level Data

Equipment	A-weighted Octave Band Centre Frequency (Hz)									Overall L_{WA}
	31.5	63	125	250	500	1k	2k	4k	8k	
Transformer Ω	81.0	87.0	89.0	84.0	84.0	78.0	73.0	68.0	61.0	93.0
HVAC	-	66.9	68.0	72.5	72.9	69.6	66.3	60.6	53.0	78.0

Ω - Manufacturer's datasheet provided information on overall sound power levels. Octave band data was sourced from 'An Introduction to Sound Level Data for Mechanical and Electrical Equipment' CED Engineering

Noise predictions have also been carried out using International Standard ISO 9613, *Acoustics – Attenuation of Sound during Propagation Outdoors*. A worst case with plant producing their highest noise emissions has been assumed. Wind turbine noise is predicted in terms of the L_{A90} noise indicator. However, the other noise sources from the proposed development are typically assessed in terms of the L_{Aeq} noise indicator. Furthermore, the proposed noise limits are in terms of L_{A90}. For the purpose of assessing the cumulative impact from all noise sources on site, it has been assumed that noise from other noise sources is a constant level and the L_{Aeq} noise level is equal to the L_{A90} noise level. This is a conservative approach but it facilitates the calculation of cumulative noise. Predicted results are presented in the next section.

7.5.3.3 Potential Operational Impact – Predicted Noise Levels

Noise predictions were performed for the 22-wind turbine layout modelling Enercon E-136 EP5 / 4650 kW with TES wind turbines for a range of standardised 10m height wind speeds from 3 m/s up to 9 m/s (to cut-out[18]). Receptors within the 35 dB L_{A90} noise contour of the turbines were modelled. Several receptors were identified as farm buildings or unoccupied derelict buildings and these have not been considered as part of the impact assessment and were not assessed against the derived daytime and night-time noise levels. Predicted noise levels from other on-site noise sources were also modelled and cumulative noise from all on-site noise sources from the proposed development are assessed against the Wind Energy Development Guidelines 2006

Table 7.16 presents predicted noise levels adjacent to the 18 noise monitoring locations. The locations presented represent the dwellings with the highest noise levels for each of the 18 monitoring locations. The predicted noise levels at all receptor locations are presented in Appendix 7.6. Note: the predicted noise levels are for a worst-case scenario with noise sensitive receptors downwind of the proposed wind farm.

[18] Noise emissions from the wind turbines plateau at wind speeds above 9 m/s

In practice, receptor locations will not be downwind of all noise sources and the actual noise levels will be lower than those presented in Table 7.16 and Appendix 7.6.

Table 7.16 also presents derived daytime and night-time noise limits at each of these locations. The predicted noise levels exceed the daytime and night-time noise levels with the level of exceedance dependent on the receptor locations. New sources of noise will be introduced into the soundscape and it is expected that there will be a long-term moderate significance of impact on the closest dwellings to the proposed wind farm.

In order to demonstrate compliance, mitigation measures need to be employed. Section 7.6.2 presents mitigation measures required to meet the daytime and night-time noise limits.

The predicted noise levels are also assessed against the '2019 Draft Guidelines' noise limits and this is presented in Appendix 7.7

Table 7.16: Assessment of Predicted L_{A90} Noise Levels for Coom Green Energy Park Operation against Daytime and Night-time Noise Limits

Receptor ID	Description	Predicted L_{A90} Sound Pressure Level at 10m Standardised Wind Speed, dB									
		3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
R10	Predicted Level	25.2	32.5	37.8	40.2	40.9	40.9	41.0	41.0	41.0	41.0
	Daytime limit	37.5	45.0	45.0	45.0	45.0	45.0	45.0	46.8	46.8	46.8
	Daytime Excess	-	-	-	-	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-
R20	Predicted Level	24.1	31.2	36.5	38.9	39.6	39.6	39.7	39.7	39.7	39.7
	Daytime limit	37.5	37.5	37.5	45.0	45.0	45.0	45.0	45.0	45.0	45.0
	Daytime Excess	-	-	-	-	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-
R27	Predicted Level	26.5	33.3	38.6	41.0	41.7	41.7	41.8	41.8	41.8	41.8
	Daytime limit	37.5	37.5	45.0	45.0	45.0	45.0	45.8	48.0	48.0	48.0
	Daytime Excess	-	-	-	-	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-
R36	Predicted Level	22.8	30.0	35.4	37.8	38.5	38.5	38.6	38.6	38.6	38.6
	Daytime limit	37.5	37.5	37.5	45.0	45.0	45.0	46.2	48.8	48.8	48.8
	Daytime Excess	-	-	-	-	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-
R40	Predicted Level	24.1	30.0	35.1	37.5	38.2	38.2	38.3	38.3	38.3	38.3
	Daytime limit	37.5	37.5	37.5	45.0	45.0	45.1	49.9	55.0	55.0	55.0
	Daytime Excess	-	-	-	-	-	-	-	-	-	-

Receptor ID	Description	Predicted L_{A90} Sound Pressure Level at 10m Standardised Wind Speed, dB									
		3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-
R52	Predicted Level	25.7	31.4	36.5	38.8	39.5	39.5	39.6	39.6	39.6	39.6
	Daytime limit	37.5	37.5	37.5	45.0	45.0	45.0	47.8	53.9	53.9	53.9
	Daytime Excess	-	-	-	-	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-
R55	Predicted Level	25.4	32.4	37.8	40.2	40.9	40.9	41.0	41.0	41.0	41.0
	Daytime limit	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
	Daytime Excess	-	-	-	-	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-
R56	Predicted Level	24.2	31.2	36.5	38.9	39.6	39.6	39.7	39.7	39.7	39.7
	Daytime limit	37.5	37.5	37.5	37.5	45.0	45.0	45.0	46.7	46.7	46.7
	Daytime Excess	-	-	-	**1.4**	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-
R60	Predicted Level	22.9	30.1	35.5	37.9	38.6	38.6	38.7	38.7	38.7	38.7
	Daytime limit	37.5	37.5	37.5	37.5	45.0	45.0	45.2	51.1	51.1	51.1
	Daytime Excess	-	-	-	**0.4**	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-
R71	Predicted Level	24.0	31.0	36.3	38.7	39.4	39.4	39.5	39.5	39.5	39.5
	Daytime limit	35.0	35.0	45.0	45.0	45.0	45.0	45.4	48.5	48.5	48.5
	Daytime Excess	-	-	-	-	-	-	-	-	-	-

Receptor ID	Description	Predicted L_{A90} Sound Pressure Level at 10m Standardised Wind Speed, dB									
		3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-
R77	Predicted Level	23.1	30.1	35.4	37.8	38.5	38.5	38.6	38.6	38.6	38.6
	Daytime limit	37.5	37.5	37.5	37.5	37.5	45.0	45.0	45.0	45.0	45.0
	Daytime Excess	-	-	-	**0.3**	**1.0**	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-
R101	Predicted Level	25.2	32.2	37.5	39.9	40.6	40.6	40.7	40.7	40.7	40.7
	Daytime limit	37.5	37.5	37.5	45.0	45.0	45.0	45.0	45.0	45.0	45.8
	Daytime Excess	-	-	-	-	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-
R105	Predicted Level	23.0	30.2	35.5	37.9	38.6	38.7	38.7	38.7	38.7	38.7
	Daytime limit	37.5	37.5	37.5	37.5	45.0	45.0	45.0	45.0	45.0	47.0
	Daytime Excess	-	-	-	**0.4**	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-
R107	Predicted Level	26.0	33.2	38.5	40.9	41.6	41.6	41.7	41.7	41.7	41.7
	Daytime limit	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	47.2	49.2
	Daytime Excess	-	-	-	-	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-
R118	Predicted Level	23.7	30.8	36.1	38.5	39.2	39.2	39.3	39.3	39.3	39.3
	Daytime limit	37.5	37.5	37.5	37.5	45.0	45.0	45.0	45.0	46.0	48.0
	Daytime Excess	-	-	-	**1.0**	-	-	-	-	-	-

Receptor ID	Description	Predicted L_{A90} Sound Pressure Level at 10m Standardised Wind Speed, dB									
		3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-
R121	Predicted Level	26.4	33.5	38.8	41.2	41.9	41.9	42.0	42.0	42.0	42.0
	Daytime limit	37.5	37.5	37.5	45.0	45.0	45.0	45.0	47.9	50.7	52.9
	Daytime Excess	-	-	**1.3**	-	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-
R122	Predicted Level	24.6	31.2	36.5	38.8	39.5	39.5	39.6	39.6	39.6	39.6
	Daytime limit	37.5	37.5	37.5	37.5	37.5	45.0	45.0	45.0	45.3	47.2
	Daytime Excess	-	-	-	**1.3**	**2.0**	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-
R154	Predicted Level	22.4	29.7	35.1	37.5	38.2	38.2	38.3	38.3	38.3	38.3
	Daytime limit	37.5	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
	Daytime Excess	-	-	-	-	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-

7.5.4 Potential Impacts during Decommissioning

Upon decommissioning of the proposed wind farm, the wind turbines would be disassembled in reverse order to how they were erected. All above ground turbine components would be separated and removed off-site for recycling. Turbine foundations would remain in place underground and would be covered with earth and reseeded as appropriate. These activities would be undertaken during daytime hours, and noise, which would be of a lesser impact than for construction, will be controlled through the relevant guidance and standards in place at the time of decommissioning.

Site access tracks could be in use for purposes other than the operation of the wind farm by the time the decommissioning of the project is to be considered, and therefore it may be more appropriate to leave the site access tracks in situ for future use. If the roads were not required in the future for any other useful purpose, they could be removed where required. This would involve removing hard core material and placement of topsoil. The impact is expected to be less than that during the construction stage.

It is proposed that the underground cable will be cut back and it will remain in-situ. The works associated with the cutting back of the underground cable will have a negligible impact.

7.5.5 Potential Cumulative Impacts

7.5.5.1 Construction Phase

In terms of cumulative impacts with other projects, there is potential for the proposed project to produce a cumulative impact if the Bottlehill Landfill site becomes operational during the construction or operation of the Coom Green Energy Park project. Bottlehill landfill finished construction in May 2006. However, it is not currently operational and therefore there is no operational noise data from the facility. In order to determine cumulative impacts, noise predictions from the Bottlehill Landfill EIS were used.

The predicted noise levels from onsite construction activity from CGEP is significantly below the construction noise limits of 65 dB $L_{Aeq,1hr}$. Bottlehill landfill has the potential to generate noise. However, the landfill is a licenced facility and must comply with the conditions and emission limits set out in the waste licence (W161-1). Schedule C of the licence sets noise emission limits of 55 dB L_{Aeq}(30 minutes) and 45 L_{Aeq}(30 minutes) for daytime and night-time periods, respectively.

The EIS submitted as part of the planning application for Bottlehill Landfill provides details on calculated noise levels at the nearest house and presents the 'worst-case impact of the individual sources on the nearest house'. It was stated that… 'The likely impact of three items of plant or equipment operating at the extremities of the Landfill's Activity Boundary will be 43 dBA at the nearest house. During the normal operation of the landfill the impact will be substantially lower than this.'

Assuming that the likely noise level of 43 dBA at the nearest noise sensitive location occurs, the cumulative noise levels will be below the construction noise limit of 65 dB $L_{Aeq,1hr}$. If the construction noise level at a noise sensitive location is 10 dB above the noise from the likely noise level of 43 dBA from the landfill, there will be a negligible cumulative effect. If the construction noise level at a noise sensitive location is similar to the likely noise level of 43 dBA from the landfill, there will be a slight cumulative effect.

There is also a potential for cumulative noise impacts due to increased traffic on local roads. The Bottlehill Landfill EIS predicts noise levels between 62 and 63 dBA $L_{Aeq,12hr}$ at 10m away from the road during the operation of the landfill.

The cumulative impacts of Bottlehill Landfill and CGEP construction could result in an increase in noise levels of at least 3 dB which could result in potential exceedance of the 65 dB $L_{Aeq,1hr}$ construction noise limit. However, this will depend on the construction phase. A traffic impact assessment is included as part of Chapter 13 – Traffic and Transportation of this EIAR. A Traffic Management Plan is included in the outline CEMP. In the event An Bord Pleanála (the Board) decides to grant approval for the proposed development, the final Traffic Management Plan (TMP) will address the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned by the Board.

7.5.5.2 Operational Phase

There is existing planning consent for a single wind turbine 1 km from the site near Glannasack (planning ref. 11/06168). However, it is unknown if it will be developed but for completeness it has been included as part of the cumulative assessment. There is also a consented single turbine at Kepak (Cork) Limited in Watergrasshill, Co. Cork and it is located 7 km from the site. There are no other neighbouring operational or consented wind farm developments within 12.5 km of the proposed Coom Green Energy Park (see Section 3.2.1 in Chapter 3 for further details). The nearest wind farms were assessed and the single turbine near Glannsack is assessed cumulatively. The other wind farms are sufficiently distant such that there are no cumulative impacts.

As noted above, Bottlehill Landfill is not currently operational. In the event that it does become operational, there is potential for cumulative impacts. The noise emissions and limits for the wind farm are different to the other noise sources as the noise limit can vary with wind speed. To further complicate the issue, the noise limits for wind farm developments are typically presented in terms of L_{A90} noise indicator, whereas the noise limits for Bottlehill Landfill is fixed for daytime and night-time periods and the limits are typically in terms of L_{Aeq}. Bottlehill Landfill is a licenced facility and Schedule C of the licence sets noise emission limits of 55 dB $L_{Aeq(30\ minutes)}$ and 45 $L_{Aeq(30\ minutes)}$ for daytime and night-time periods, respectively. The EPAs 'Guidance Note on Noise Assessment of Wind Turbine Operations at EPA Licensed Sites (NG3)' was published to assist waste licensed and integrated pollution prevention and control (IPPC) licensed sites in assessing the suitability of their sites for wind energy development. For the purpose of assessing the cumulative impact of the proposed and consented wind farms and Bottlehill Landfill, compliance was assessed against the noise limits in Bottlehill Landfills licence.

The L_{A90} wind farm noise levels were converted to L_{Aeq} noise levels for the purpose of cumulative assessment. The L_{A90} noise level were converted to L_{Aeq} by adding 2 dB[19]. Given the variability in the wind turbine noise as a function of wind speed, wind speeds from 3 m/s to 10 m/s were assessed.

[19] The ETSU workgroup stated…" $L_{A90,10min}$ of the wind farm is likely to be about 1.5-2.5dB(A) less than the L_{Aeq} measured over the same period." By subtracting 2 dB from L_{Aeq} noise level, it is possible to estimate the L_{A90} noise level. This correction was sourced from the IoA's "A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and rating of wind turbine noise" However, the 2 dB subtraction is usually applied to noise predictions where noise under consideration is turbine only noise. For assessing compliance with wind farm developments, it is recommended that L_{A90} noise level is measured. The rational for this is described in the next paragraph.

L_{Aeq} noise indicator is susceptible to short transitory noise events and these events can significantly change L_{Aeq} noise indicator level. These events may not be related to noise emitted by the wind farm and can be sources such as bird song, animal noises, cars etc.. L_{A90} noise indicator is generally used for background noise and research by ETSU noise working group suggest this to be the most appropriate noise indicator to use for measuring noise from a wind farm. The noise working group state *"Measurements performed in rural areas indicate that the ambient L_{Aeq} noise levels may be 5 - 25dB(A) above the L_{A90} background noise level due to these transitory events. Therefore, when performing noise measurements for the assessment of compliance with planning conditions or obligations, confusion can occur due to the L_{Aeq} being significantly higher than the L_{A90} background noise level due to noise sources not associated with the wind farm. This might unfairly indicate that the condition is being failed if the condition is related to a L_{Aeq} exceedance above the background L_{A90}."*

The cumulative assessment includes all on-site noise sources from the proposed development, Moneygorm single wind turbine and Bottlehill Landfill.

The EIS for Bottlehill Landfill includes a drawing (Drawing No. 0013011/01/505) identifying the noise sensitive locations in the vicinity of the site. There are no IDs in the drawings but the nearest house is approximately north-west of the landfill and the likely operational noise is 43 dBA. It is highly likely that receptor referred to in the Bottlehill Landfill EIS is R9 in this EIAR. There are no other predicted noise levels at other receptors identified in the Bottlehill Landfill EIS. Using the information available, the cumulative impact at receptor R9 was assessed. Table 7.17 presents the predicted cumulative L_{Aeq} noise levels at receptor R9.

Table 7.17: Predicted Cumulative Noise Level at Receptor R9

Wind Speed	Proposed Development		Bottlehill Landfill		Moneygorm	Cumulative	
	Daytime (LAeq)	Night-time (LAeq)	Day (LAeq)	Night (LAeq)	LAeq	Day (LAeq)	Night (LAeq)
3 m/s	26.7	26.7	43	25*	-2.2	43.1	29.4
4 m/s	33.9	33.9	43	25*	-2.2	43.5	35.1
5 m/s	39.3	39.3	43	25*	-2.2	44.5	36.6
6 m/s	41.7	41.7	43	25*	0.4	45.4	36.6
7 m/s	42.4	42.4	43	25*	3.8	45.7	38.5
8 m/s	42.4	42.4	43	25*	4.4	45.7	40.9
9 m/s	42.5	42.5	43	25*	5.2	45.8	43.3
10 m/s	42.5	42.5	43	25*	3.3	45.8	43.3
* - Noise at night from ground flare unit							

The predicted cumulative noise levels are dominated by noise from Bottlehill Landfill at low wind speeds and the noise levels from Bottlehill Landfill and the proposed development are similar at higher wind speeds. The noise from Moneygorm single wind turbine is very low and has a negligible impact at this receptor location.

Receptor R9 assessed above is approximately 8 km from Moneygorm single turbine. Therefore, a further cumulative assessment at receptor locations adjacent to Moneygorm single turbine was also undertaken. Four receptors locations (R121, R122, R125 and R142) are potentially impacted by Moneygorm single turbine. If Moneygorm was operational there would be a negligible increase in noise levels at receptor R121. However, the greatest potential impact is on receptors R125 and R142 which are the closest dwelling to Moneygorm and R122 to a lesser extent. Table 7.18 present the predicted cumulative noise levels at the most exposed noise sensitive locations (R122, R125, R142). The predicted cumulative noise levels from the proposed development and other adjacent wind energy developments are presented in Appendix 7.8.

Table 7.18: Predicted Cumulative Noise Level at Receptors R122, R125 and R142

Wind Speed	Proposed Development			Moneygorm			Cumulative			Noise Limit	
	R122	R125	R142	R122	R125	R142	R122	R125	R142	Daytime	Night-time
3m/s	24.6	26.3	28.8	20.8	28.7	24.5	26.1	30.7	30.1	37.5	43.0
4m/s	31.2	31.0	29.7	20.8	28.7	24.5	31.6	33.0	30.9	37.5	43.0

Wind Speed	Proposed Development			Moneygorm			Cumulative			Noise Limit	
	R122	R125	R142	R122	R125	R142	R122	R125	R142	Daytime	Night-time
5m/s	36.5	35.8	31.8	20.8	28.7	24.5	36.6	36.5	32.5	37.5	43.0
6m/s	38.8	38.0	33.2	24.4	32.3	28.1	**39.0**	**39.1**	34.4	37.5	43.0
7m/s	39.5	38.7	33.7	27.4	35.3	31.1	**39.8**	**40.3**	35.6	37.5	43.0
8m/s	39.5	38.7	33.7	28.9	36.8	32.6	39.9	40.9	36.2	45.0	43.0
9m/s	39.6	38.8	33.8	29.3	37.2	33	40.0	41.1	36.4	45.0	43.0
10m/s	39.6	38.8	33.8	29.2	37.3	33.1	40.0	41.1	36.5	45.0	43.0

The predicted cumulative impact is below the noise limit of 43 dB(A) L90,10min or 5 dB(A) above existing background noise levels conditioned[20] for Moneygorm and the night-time noise limit for the proposed development. However, the predicted cumulative downwind noise levels are above the daytime noise limits at receptors R122 and R125 at standardised 10m height wind speeds of 6 and 7 m/s. The noise model assumes that the receptor locations are downwind of all wind turbines, and in practice that is not physically possible as Moneygorm is located to the east of these receptors whilst the dominant turbines (i.e. turbines closest to receptor locations) from the proposed development are located to the west. When directionality is considered the predicted noise levels at receptors will be lower than those presented in Table 7.18. Nonetheless, a mitigation strategy has been developed to ensure compliance with the daytime noise limit. Details of the mitigation strategy are presented in Section 7.6.2.

7.6 Mitigation Measures

7.6.1 Mitigation Measures during Construction

The predicted noise levels from onsite activity from the proposed development are generally below the noise limits in BS 5228-1. Nonetheless, several mitigation measures will be employed to minimise any potential impacts from the proposed development.

The noise impact for construction works traffic will be mitigated by generally restricting movements along access routes to the standard working hours and exclude Sundays, unless specifically agreed otherwise. For example, during turbine erection, an extension to the working day may be required, i.e. 05:00 to 21:00, but this would be necessary only on a relatively small number of occasions. If turbine deliveries are required at night it will be ensured that vehicles on local roads do not wait outside residential properties with their engines idling, and that the local residents will be informed of any activities likely to occur outside of normal working hours.

[20] Condition 12 of planning reference PL04 .241037 states…

Noise levels arising from the operation of the turbine (corrected for any tonal or impulsive components) shall not exceed 43 dB(A) L90,10min or 5 dB(A) above existing background noise levels, whichever is the greater, at existing habitable houses. All noise measurements shall be carried out in accordance with ISO Recommendation R 1996/ 1 and 2 "Acoustics – Description and Measurement of Environmental noise". Prior to commencement of development, the developer shall submit to, and agree in writing with, the planning authority a noise compliance monitoring programme for the operational turbine.

Consultation with the local community is important in minimising the impacts and therefore construction will be undertaken in consultation with the local authority as well as the residents being informed of construction activities through the Community Liaison Officer.

The construction works on site will be carried out in accordance with the guidance set out in BS 5228:2009+A1:2014, and the noise control measures set out in the Construction Environmental Management Plan (CEMP). Proper maintenance of plant will be employed to minimise the noise produced by any 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 project. Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use.

The hours of construction activity will be limited to avoid unsociable hours where possible. Construction operations shall generally be restricted to between 07:00 - 19:00 hours Monday to Friday and 07:00 - 13:00 hours on Saturdays. However, to ensure that optimal use is made of fair-weather windows, or at critical periods within the programme, it could occasionally be necessary to work outside these hours. Any such out of hours working would be agreed in advance with the local planning authority.

With mitigation measures, the construction and decommissioning noise levels are likely to be below the relevant noise limit of 65 dB $L_{Aeq,1hr}$ for operations exceeding one month, and therefore construction noise impacts are not considered to be significant. However, there is potential for temporary elevated noise levels due to the grid connection works. However, the impact of these works at any particular receptor will be for a short duration (i.e. typically less than 3 days). where the works at elevated noise levels are required over an extended period at a given location, a temporary barrier or screen will be used to reduce noise levels below the noise limit where required. The noise impact will also be minimised by limiting the number of plant items operating simultaneously where reasonable practicable.

7.6.2 Mitigation Measures during Wind Farm Operation

The results of the noise predictions presented in Section 7.5.3 show that operational noise levels are above the derived daytime and night-time noise limits at several noise sensitive locations at a range of wind speeds. In order to ensure the proposed wind farm is compliant with the noise limits, some of the turbines may need to be operated in noise reduced modes of operation[21]. Table 7.19 presents the sound power levels for the Enercon E-136 EP5 / 4650 kW with TES for noise reduced modes of operation and a range of standardised 10m height wind speeds. Several turbine options were considered which meet the wind turbine dimensional envelope and the Enercon E-136 EP5 was a worst-case from a noise perspective. The actual turbines to be installed at the proposed wind farm will be the subject of a competitive tender process and may include turbines not amongst the turbine models currently available. Regardless of the make or model of the turbine eventually selected for installation on site, the noise it will give rise to will be of no greater significance than that used for the purposes of this assessment to ensure that the findings remain valid.

[21] It is possible to run the turbines in noise reduced modes of operation (NROs) whereby the noise level is lessened by reducing the rotational speed of the turbines, with a resultant loss of electrical energy production. NRO1 refers to a noise reduced mode with a sound power of 105.2 dB rather than 106.1 dB when the turbine operates in normal mode of operation.

Table 7.19: Enercon E136 – Sound Power Levels for a range of Noise Reduced Modes of Operation

Turbine	Standardised 10 m Height Wind Speed (m/s)						
	3	4	5	6	7	8	9 to cut-out
Normal Operation (NO)	90.1	97.5	102.9	105.3	106	106	106.1
Operating Mode 105.2 (NRO1)	90.1	97.5	102.9	104.2	104.9	105	105.1
Operating Mode 104.3 NRO2	90.1	97.5	102.1	103.3	103.9	103.9	104.2
Operating Mode 103.4 NRO3	90.1	97.5	101.4	102.5	102.8	103	103.3
Operating Mode 102.4 NRO4	90.1	97.5	100.6	101.6	101.8	102.1	102.4
Operating Mode 101.4 NRO5	90.1	97.5	99.8	100.6	100.7	101.1	101.4
Operating Mode 100.5 NRO6	90.1	97.5	98.9	99.6	99.8	100.2	100.5
Operating Mode 98.4 NRO7	90.1	96.2	97.1	97.5	97.9	98.3	98.4
Operating Mode 95.5 NRO8	90.1	93.8	94.4	94.8	95.3	95.5	95.5

A range of mitigation strategies can be developed to ensure compliance with the daytime noise limit. Table 7.20 present mitigation measures to ensure compliance with the derived noise limits. It should be noted that the proposed curtailment strategies are not exhaustive; there may be several other configurations/alternatives that would allow noise limits to be met and that an appropriate mitigation strategy may be specified for the procured turbine model prior to construction of the wind farm. The operational noise resulting from the proposed development will meet the noise limits set out in Table 7.5.

Table 7.20: Required Turbine Curtailment/Mitigation to Meet Daytime Noise Limits

Turbine ID	Required Noise Reduced Modes to meet Daytime Noise Limit L_{A90} Standardised 10m Height Wind Speeds (m/s)		
	5	6	7
T2	NRO	NRO	NRO
T3	NRO	NRO	NRO
T4	NRO	NRO	NRO
T5	NRO	NRO	NRO
T6	NRO	NRO4	NRO
T7	NRO	NRO	NRO
T8	NRO	NRO	NRO
T9	NRO	NRO	NRO
T10	NRO	NRO5	NRO

Turbine ID	Required Noise Reduced Modes to meet Daytime Noise Limit L_{A90} Standardised 10m Height Wind Speeds (m/s)		
	5	6	7
T11	NRO	NRO	NRO
T12	NRO	NRO	NRO
T13	NRO	NRO	NRO
T14	NRO	NRO1	NRO3
T15	NRO	NRO	NRO
T16	NRO	NRO	NRO6
T17	NRO	NRO2	NRO
T18	NRO4	NRO2	NRO3
T19	NRO4	NRO3	NRO2
T20	NRO	NRO	NRO1
T21	NRO	NRO	NRO
T22	NRO5	NRO2	NRO4
T23	NRO	NRO2	NRO4

The predicted noise levels with mitigation measures are presented in Appendix 7.9. With mitigation, new sources of noise will be introduced into the soundscape and it is expected that there will be a long-term slight to moderate significance of impact for dwellings within the 35 dB L_{A90} study area with a moderate significance of impact on the closest dwellings to the proposed wind farm.

Mitigation measures to ensure compliance with the Draft Revised Wind Energy Development Guidelines are presented in Appendix 7.9. The predicted noise levels with mitigation measures are also presented in Appendix 7.9.

As discussed previously, the operational noise predictions have been carried out for a candidate turbine to ensure a worst case scenario has been assessed and, therefore, the proposed mitigation measures only apply to the assumed turbine considered in this assessment. It may be the case that mitigation would not be required for the turbine that is selected for the site.

It should be noted that the proposed curtailment strategies are not exhaustive; there may be several other configurations/alternatives that would allow noise limits to be met and that an appropriate mitigation strategy may be specified for the procured turbine model prior to construction of the wind farm. The finalised mitigation measures to be implemented at the site will be chosen to ensure that the noise limits are met. In the event An Bord Pleanála (the Board) decides to grant permission for the proposed development, the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned by the Board will be met.

As discussed in section 7.3.3.2, Draft Revised Wind Energy Development Guidelines (December 2019) published by the Department of Housing, Planning and Local Government proposes amendments to the Wind Energy Development Guidelines 2006 and ‘2019 Draft Guidelines’ were out to public consultation until the 19th February 2020 and may be subject to further revision. The Wind Energy Development Guidelines (2006) are current. For completeness, the proposed development has been assessed against the 2006 Guidelines and the ‘2019 Draft Guidelines’.

The noise modelling undertaken assesses a worst case scenario with all noise sensitive locations downwind of all wind turbines.

In practice, it is expected that the actual noise levels from the proposed development will be less than those predicted and hence, the extent of the mitigation will also be reduced. Ultimately, the derived noise limits will guide the turbine selection and operation and will be complied with.

Should the development be granted permission, an operational noise survey will be undertaken to ensure the development complies with the noise limits. If an exceedance in the noise limit occurs, mitigation measures will be refined to ensure compliance with the noise limits is achieved at all noise sensitive locations.

7.6.3 Mitigation Measures during Decommissioning

The noise impact for construction works traffic will be mitigated by generally restricting movements along access routes to the standard working hours and exclude working on Sundays, unless specifically agreed otherwise with the local authority.

The decommissioning works, which will be of a lower impact than construction works, will be carried out in accordance with the policies and guidance required at the time of the works, and restricted to normal working hours, typically 07:00-19:00 hours Monday to Friday and 07:00 -13:00 on Saturdays.

7.7 Residual Impacts

Construction and decommissioning activities with a duration longer than one month are expected to be below the construction noise limit of 65 dB $L_{Aeq,1hr}$ at residential properties. As a result, residual construction impacts are not considered to be significant when assessed under this criterion.

There is potential for temporary elevated noise levels due to the grid connection works. However, these works will be for a short duration at a particular property (i.e. typically less than 3 days at any particular receptor) and where the works are to occur over an extended period at a given location, a temporary barrier or screen will be used to reduce noise level below the noise limit and reduce any potential.

With mitigation measures, operational wind farm noise levels meet the derived noise limits at all noise sensitive locations surrounding the wind farm which is not considered to be a significant impact. However, new sources of noise will be introduced into the soundscape and it is expected that there will be a slight to moderate significance of impact depending on the dwelling location.

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