11.3.8 Draft Revised Wind Energy Development Guidelines 2019 (Draft DoEHLG 2019 Guidelines)

There have been a number of draft guidelines over the years with the latest one being in December 2019. The Draft DoEHLG 2019 Guidelines are subject to significant public and stakeholder consultation and liable to change, in line with best practice.

A tender has been issued by the Department of Environment, Climate and Communications to review and re-draft the Wind Energy Development Guidelines. This process has yet to be completed.

This assessment is based on the current guidance outlined in Section 10.2.4, Local Council/An Bord Pleanala decisions as per Section 10.2.5 and existing Planning Conditions as per Section 10.2.6.

11.3.9 IOA Good Practice Guide – Supplementary Guidance Note 5 – Post Completion Measurements

The Institute of Acoustics Noise Working Group were tasked with providing a Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise in relation to how noise impacts are considered in relation to wind energy developments. A number of Supplementary Guidance Notes support the Good Practice Guide with SGN 5: 'Post Completion Measurements' providing specific direction on compliance monitoring.

Various aspects of the compliance monitoring were addressed in this document, including:

- Noise Limits in Planning Conditions;
- Measurement of Wind Speed;
- Measurement Locations and Instrumentation;
- Noise Data and Data Processing;
- Outcome of Measurement Exercise.

The requirements of this document were incorporated into the compliance measurement methodology to ensure that the measurement methodology was conducted as per what is considered good practice by Local Authorities.

11.3.10 Amplitude Modulation or Aerodynamic Noise

Aerodynamic noise originates from the flow of air over, under and around the blades and is generally broadband in character. It is directly linked to the movement of the rotors through the air and will occur to varying degrees whenever the turbine blades move. Aerodynamic noise is generally both broadband i.e. it does not contain a distinguishable note or tone, and of random character, although the level is not constant and fluctuates in time with the movement of the blades. The dominant character of such aerodynamic noise is therefore normally a 'swish' type of sound, which is familiar to most people who have stood near to a large wind turbine.

The sound level of aerodynamic noise from wind turbine blades is not completely steady but is modulated (fluctuates) in a cycle of increased and then reduced level, sometimes called "blade swish", typically occurring in step with the angle of rotation of the blades and so being periodic at the rotor's rotational speed – for typical commercial turbines, this is at a rate of around once or twice per second. This phenomenon is known as Amplitude Modulation of Aerodynamic Noise or more succinctly by the acronym AM. In some situations, however, the modulation characteristics can change in character to the point where it can potentially give rise to increased annoyance.

In early wind turbine designs, where the rotor was positioned downwind of the tower, a pronounced 'beat' was audible as each blade passed through the turbulent wake shed from the tower. However, this effect does not exist for the upwind rotor designs found on the majority of modern wind farms where the air flow to the blades is not interrupted by the tower structure. Instead, it seems that aerodynamic modulation is due to fluctuation of the primary mechanisms of aerodynamic noise generation.

The most recent information in relation to assessing AM is presented in the IEC TS 61400-11. The scope of this standard includes an assessment of the sound characteristics of the noise and relies on the Institute of Acoustics Reference Method (IoA RM) to quantify the AM level along with the WSP Phase 2 Report which identified a penalty scheme as presented in Figure 11-1 below.

Figure 11-1 Proposed AM penalty scheme

Current scientific knowledge is such that AM cannot be predicted at the planning stage, but can only be measured once the wind farm becomes operational.

The methodology contained within the IoA RM and IEC 61400 allows quantification of all aspects of AM and the penalty scheme identified above allows quantification of the mitigation required, if any. An appropriate penalty can be added onto the measured L_{A90} noise level, the ensure overall noise levels comply with the applicable noise limit.

Previous monitoring of the Castledockrell Wind Farm by Wexford County Council and presented in report "Castledockrell Wind Farm Noise Monitoring Report" dated 4th November 2019, with respect to AM concluded,

> *"RPS used the IoA methodology to determine AM as it provides a consistent and robust method of determining the extent of the phenomenon. Two hours of worst-case data were isolated and analysed using the IoA methodology. For the data analysed the AM results were found to exceed the 3dB threshold recommended in the UK for new wind farm developments."*

Whilst AM was identified within a worst case two hour period, no further consideration of potential long term consistent AM impacts had been considered. Additional long-term noise level

monitoring specifically considering AM has been undertaken at Castledockrell Wind Farm at three residential locations, this is presented in Appendix 11-12.

11.3.11 Infrasound and Low Frequency Noise and Vibration

There is always low frequency noise (also sometimes referred to as infrasound) present in the ambient quiet background in any setting. It is generated by natural sources such as road traffic, wind effects through air and vegetation, wave motion, water flow in streams and rivers. There are also low frequency emissions from many sources found in modern life, such as household appliances (e.g., washing machines, air conditioners, fridges, heating systems, boilers, burners, heat pumps, extraction systems, electric or battery clocks, sky box, etc.), Other sources include water flowing through pipes within your home and in water flow from municipal water supply. Vibration of elements of structures (low frequency, less than 20Hz)) can be generated by local activity in one's home by way of normal routine activity, like climbing stairs, walking on the floor, closing doors etc. When sitting in a moving vehicle very high levels of low frequency vibration/sound is experienced.

The frequency range of audible noise is in the range of 20 to 20,000Hz and low frequency noise is generally from about 2 to 200Hz with infrasound typically of frequencies below 20Hz. There appears to be little or no agreement about the biological effects of low frequency noise on human health and there is evidence to suggest that there are no serious consequences to people's health from infrasound exposure.

A study of low frequency noise (infrasound) and vibration around a modern wind farm was carried out for ETSU and reported in ETSU W/13/00392/REP – 'Low Frequency Noise and Vibration Measurements at a Modern Wind Farm'[12]. The results showed levels of infrasound to be below accepted thresholds of perception even on the Site. Furthermore, a document prepared for the World Health Organisation, states that "there is no reliable evidence that infrasound below the hearing threshold produce physiological or psychological effects".

The level of ground vibration from the operation of the wind farms is below human threshold of 0.2mm/s[13] at the base of a turbine.

South Australian Environment Protection Authority (EPA) Infrasound Study

A report released in January 2013 by the South Australian EPA[14] found that the level of infrasound from wind turbines is insignificant and no different to any other sources of noise, and that the worst contributors to household infrasound are air-conditioners, traffic and noise generated by people. The study included several houses in rural and urban areas, houses both adjacent to a wind farm and away from turbines and measured the levels of infrasound with the wind farms operating and also switched off. There were no noticeable differences in the level of infrasound under all these different conditions. In fact, the lowest levels of infrasound were recorded at one of the houses closest to a wind farm, whereas the highest levels were found in an urban office building. The South Australian study found: 'the contribution of wind turbines to the measured infrasound levels is insignificant in comparison with the background level of infrasound in the environment'.

---

[12] *ETSU W/13/00392/REP – 'Low Frequency Noise and Vibration Measurements at a Modern Wind Farm'.*

[13] *Wiss, J. F., and Parmelee, R. A.. (1974) Human Perception of Transient Vibrations, "Journal of Structural Division", ASCE, Vol 100, No. S74, PP. 773-787*

[14] *http://www.epa.sa.gov.au/environmental_info/noise/wind_farms*

Massachusetts Institute of Technology (MIT)

A report by an Independent Expert Panel prepared for Massachusetts Department of Health (2012)[15] consisted of a panel that included seven individuals with backgrounds in public health, epidemiology, toxicology, neurology and sleep medicine, neuroscience, and mechanical engineering, all of which were considered independent experts from academic institutions. The report found that "there is insufficient evidence that the noise from wind turbines is directly (i.e., independent from an effect on annoyance or sleep) causing health problems or disease' and 'available evidence shows that infrasound levels near wind turbines cannot impact the vestibular system".

Technical Research Centre of Finland

A long-term study into so-called "wind turbine syndrome"[16] health problems supposedly caused by low-frequency sound from spinning blades has concluded that this "infrasound" has absolutely no physical impact on the human body.

The study conducted by the Technical Research Centre of Finland (VTT) and others, commissioned by the Finnish government, found that infrasound sound waves with frequencies below the range of human hearing cause no measurable changes in the human body, and cannot in any way be detected by the human ear.

Infrasound measurements were taken inside and outside local dwellings near two Finnish wind farms, as well as inside the facilities and beyond them, for 308 days.

Measurements showed that the infrasound levels in rural areas with wind farms were about the same as levels in a regular urban environment. As stated by VTT:

> *"Infrasound samples representing the worst-case scenarios were picked out from the measurement data and used in the listening tests,"*
>
> *"The participants in the listening tests were divided into two groups based on how they reported wind turbine infrasound related symptoms: people who suffered from those and people who never had symptoms."*
>
> *"The participants were unable to make out infrasonic frequencies in wind turbine noise, and the presence of infrasound made no difference to how annoying the participants perceived the noise, and their autonomous nervous system did not respond to it. There were no differences between the results of the two groups."*

German Research

A German report[17], titled "*Low Frequency Noise incl. Infrasound from Wind Turbines and Other Sources*" presents the details of a measurement project which ran from 2013. The report was published by the State Office for the Environment, Measurement and Nature Conservation of the Federal State of Baden-Württemberg in 2016 and concluded the following in relation to infrasound from wind turbines:

---

[15] *Infrasound Does Not Explain Symptoms Related to Wind Turbines, Finnish Government, June 2020, https://www.vttresearch.com/en/news-and-ideas/vtt-studied-health-effects-infrasound-wind-turbine-noise-multidisciplinary*
[16] *Report by Leigh Collins, 21st April 2020 on a study commissioned by the Finnish Government into infrasound and wind turbine syndrome*
[17] *Report available at https://www4.lubw.baden-wuerttemberg.de/servlet/is/262445/low-frequency_noise_incl_infrasound.pdf?command=downloadContent&filename=low-frequency_noise_incl_infrasound.pdf*

"The measured infrasound levels (G levels) at a distance of approx. 150 m from the turbine were between 55 and 80 dB(G) with the turbine running. With the turbine switched off, they were between 50 and 75 dB(G). At distances of 650 to 700 m, the G levels were between 55 and 75 dB(G) with the turbine switched on as well as off."

"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 Draft) [18]"

"The results of this measurement project comply with the results of similar investigations on a national and international level."

There is a significant body of evidence to show that the infrasound associated with wind turbines will be below perceptibility thresholds and typically in line with existing baseline levels of infrasound within the environment.

IEC 61400-11-2

Annex C of IEC61400-11-2 "Low frequency sound evaluation" states:

"Measurement of low frequency sound levels from wind turbines is feasible close to the wind turbine. There is general agreement, however, that direct measurement of low frequency sound at a distance from a wind turbine is difficult. Furthermore, the measurement of low frequency sound indoors can be complicated by room specific conditions such as room dimensions and the sound absorption of the surfaces in the room. This can require multiple microphone positions to be monitored simultaneously. This is a rather intrusive measurement in an inhabited residence. Wind turbine sound measurements shall be taken over long periods as outlined in Clause 11. It is impractical to isolate non-wind turbine low frequency sound over long measurement periods inside a residence. For these reasons a standardised calculation approach is by far the most reliable and reproducible approach."

Annex C describes a preferred calculation methodology to determine low frequency sound levels originating from wind turbines at receptor locations based on manufacturer's sound power levels.

11.4 Wind Turbine Noise Criteria

With respect to the relevant guidance documents outlined in Section 11.3 the following noise criteria have been identified for the noise assessments for this site. The criteria curves have been derived following a detailed review of the background noise data conducted at the nearest noise sensitive locations.

It is proposed to adopt a lower daytime threshold of 40 dB $L_{A90,10\text{-}min}$ for low noise environments where the background noise is less than 30 dB(A). This follows a review of the prevailing background noise levels and is considered appropriate in light of the following:

- The EPA document *'Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)'* proposes a daytime noise criterion of 45 dB(A) in 'areas of low background noise'. The proposed lower threshold here is 5 dB more stringent than this level.
- It is reiterated that the DoEHLG 2006 Guidelines states that *"An appropriate balance must be achieved between power generation and noise impact."* Based on

[18] *DIN 45680:2013-09 – Draft "Measurement and Assessment of Low-frequency Noise Emissions" November 2013*

a review of other national guidance in relation to acceptable noise levels in areas of low background noise it is considered that the criteria adopted as part of this assessment are robust.

Based on the guidance listed above, the proposed operational limits in $L_{A90,10min}$ for the Proposed Development in line with the DoEHLG 2006 Guidelines (reflecting the amendment as per 11.3.5 above) are:

- **40 dB $L_{A90,10min}$ for quiet daytime environments of less than 30 dB $L_{A90,10min}$;**
- **45 dB $L_{A90,10min}$ for daytime environments greater than 30 dB $L_{A90,10min}$ or a maximum increase of 5 dB above background noise (whichever is higher), and;**
- **43 dB $L_{A90,10min}$ or a maximum increase of 5 dB above background noise (whichever is higher) for night time periods**

It is also intended to demonstrate that the existing Proposed Development is compliant with Wexford County Council's recommended Condition 8 of planning permission 20044702, taking into consideration the conversion of L_{Aeq} to L_{A90}:

'Maximum noise levels at the nearest noise sensitive properties shall be:

a) 38dB(A) L_{A90}, at a wind speed of 5 metres per second at hub height of nearest machine

b) 43dB(A) L_{A90}, at a wind speed of 8 metres per second at hub height of nearest machine;

11.5 Baseline Environment

11.5.1 Identification of Receptors

From a desktop review of the locality on the ground, aerial photographs and the Wexford County Council planning register was reviewed to a maximum extent of 2km from the Proposed Development. From that list, four properties were identified which represented all of those properties around the Proposed Development site that can represent both the background noise level and operational noise from the Proposed Development. The 4 no. noise level monitoring locations along with their proximity to the Proposed Development are listed in Table 11-15. 3 no. noise level monitoring locations are within 500m of the Proposed Development, hence they have been considered a worst case scenario are presented in Appendix 11-6. The fourth noise monitoring location was selected as a background noise level monitoring location and hence it was placed further back from the Proposed Development.

The measured noise levels was compared to predicted noise levels and used to calibrate a SoundPlan noise model. Predicted noise levels were then obtained for all houses within 500m of any turbine. These predicted noise levels are presented and compared to the appropriate limit levels.

11.5.2 Acquisition and Analysis of Background and Operational Noise Level Data

The DoEHLG 2006 Guidelines, ETSU-R-97 and the IOA Good Practice Guide recommend the measurement and use of wind speed data, against which background noise measurements are correlated. The IOA Good Practice Guide Supplementary Guidance Note 4[19] (excerpt presented

[19] *IOA, A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise-Supplementary Guidance Note 4: Wind Shear*

in Technical Appendix 10.3) gives the methodology to account for wind shear, calculation to hub height and to standardise 10m height wind speed.

Due to a met mast or LiDAR not being available, wind speeds and directions were measured concurrently with operational noise level measurements, referencing the average hub height wind speeds and directions across all of the existing wind turbines. Such an approach is deemed an acceptable method under the IOA GPG SGN5 and common place across the Island of Ireland. The requirements of Condition 8 of planning permission 20044702 is to reference hub height wind speeds, whilst consideration against IOA GPG background +5dB limits requires standardisation of the hub height wind speeds to 10m height wind speeds as per Annex A of the IOA GPG. This methodology is similar to what is endorsed by the DoEHLG 2006 Guidelines.

The 84.5m hub height wind speed was standardised to 10m height wind speed with the wind speed plotted against the 10-minute background noise data to derive a best fit polynomial curve.

Noise limits as specified within Condition 8/ IOA GPG background +5dB apply to noise associated solely with the operation of the Proposed Development, and not to the total measured noise level around the site, nor noise from any other wind energy developments in the locality.

Total measured noise levels at neighbouring receptors can potentially exceed the noise limits as specified within Condition 8/ IOA GPG background +5dB due to the influence of background noise levels as well as any other wind energy development in the locality. It will therefore be necessary to subtract from the total measured noise level at each wind speed (in the manner specified by ETSU-R-97), the background noise levels as measured in the upwind scenario i.e. noise from the Proposed Development being directed away from the measurement location.

It is also standard practice to consider downwind conditions of the respective neighbouring receptors (which may differ due to their relative location to the wind farm) due to propagation effects i.e. downwind conditions will result in the greatest noise levels at neighbouring receptors.

Paragraph 2.1.7 of SGN5 states:

> *"downwind conditions can generally be defined for each location as conditions in which the angle between the wind direction and the direct line from any wind turbine to the measurement location considered is no greater than 45 degrees."*

11.5.3 Measurement Locations and Instrumentation

Noise level meters were deployed at four monitoring locations in the vicinity of the Proposed Development which were deemed to be representative of the dwellings surrounding the Proposed Development. One of these sites was to provide a representative background noise level, whilst the three remaining sites were used to minimise the influence from background noise levels and maximise operational noise impacts. All noise level meters were fitted with double skin windscreens based on that specified in W/31/00386/REP 'Noise Measurements in Windy Conditions'[20].

Rainfall and wind speed were concurrently measured. Noise level meters were installed on 29 March 2024 and collected 24 April 2024, permitting in the region of 3,750 separate 10-minute measurement periods. Wind speeds and directions were measured concurrently with operational noise level measurements, referencing the average hub height wind speeds and directions across all the 12 no. Castledockrell Wind Farm turbines. Review of the wind speed and direction data noted limited differences across all the existing turbines, providing increased

[20] *W/31/00386/REP 'Noise Measurements in Windy Conditions'.*

certainty in the wind speed data. The wind speed data from the existing turbines was taken from the nacelle mounted anemometer and corrected by the SCADA software using an internal algorithm for the effects of the rotor.

Table 11-2 presents the approximate locations where noise level measurements were undertaken, and details of the meter used.

Table 11-2 Co-ordinates of Noise Monitoring Locations

ID	Equipment	Irish National Grid (ING) Co-ordinates	
		X	Y
NML1 – Property 69	Larson Davis LxTSE	690478	648555
NML2 – Location 23	Larson Davis LxTSE	692776	648989
NML3 – Location 1	Larson Davis LxTSE	691131	649533
NML4 – Location 6	Larson Davis LxTSE HOBO rain gauge	692256	649937

All acoustic instrumentation was calibrated before and after the survey and the drift of calibration was less than 0.1dB, which is within accepted guidelines. Calibration certificates for the meters are presented in Appendix 11-5.

The noise monitoring locations predominantly mirror those as presented within the Wexford County Council – Castledockrell Wind Farm Noise Monitoring Report dated 4th November 2019, which itself represented the noise monitoring locations as presented within the original Environmental Impact Statement dated November 2004.

Hub height wind speed and direction data was provided by the wind farm operator for the above specified time periods, taken from the nacelle mounted anemometers for the existing wind turbines. The following data processing was undertaken:

- The relationship between measured ambient noise levels and wind data was determined.
- Periods of rainfall that may have affected the results was filtered out.
- Only data between 23:00 to 04:00 was considered to reduce the likelihood of extraneous noise sources affecting data (e.g. early morning birdsong and traffic).
- Only data within 45 degrees either side of directly downwind for each monitoring location individually was included, noting that downwind differs for each monitoring location. It should be noted that given the nature of a number of the Noise Monitoring Locations (NML), downwind is present across a number of wind directions, therefore expanding the 'arc' of included data.
- Measurements were corrected for the influence of background noise levels by subtracting the background noise level in the manner prescribed in page 88 of ETSU-R-97.

11.6 Prediction of Wind Turbine Noise Levels at Additional Properties within 500m

The predicted noise levels are based on the methodology given in the IOA Good Practice Guide. Noise level calculations are based on ISO 9613-2 which provides a prediction of noise levels likely to occur under worst-case down-wind conditions.

There are numerous models for predicting noise from a point source and some of these models are specifically used for the prediction of noise from wind farms. SoundPLAN software package was used to calculate the noise level at the receptors. The propagation model calculates the predicted sound pressure levels by taking the source sound power level for each turbine in their respective octave bands (details included in Appendix 11-9) and subtracting a number of attenuation factors according to the following formula:

Predicted Octave Band Noise level = $L_W + D - (A_{geo} + A_{atm} + A_{gr} + A_{br} + A_{mis})$

A_{geo} –Geometric Spreading

Geometric (spherical) spreading from a simple free-field point source results in attenuation over distance according to:

$L_p = L_w - (20 \log R + 11)$

Where:

L_p = sound pressure level

L_w = sound power level

R = distance from the turbine to receiver

D – Directivity Factor

The directivity factor allows for adjustment where the sound radiated in the direction of the receptor is higher than that for which the sound power level is specified. In this case, the sound power levels are predicted as worst case propagation conditions, i.e. all receptors are assumed to be in downwind conditions.

A_{gr} - Ground Effects

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

Ground conditions are described according to a variable defined as G, which varies between 0 for hard ground and 1 for soft ground. Although in reality the ground is predominately porous, it has been modelled as mixed 50% hard and 50% porous corresponding to a ground absorption coefficient of 0.5. Predictions have been carried out using a source height corresponding to the proposed height of the turbine nacelle, a receiver height of 4m and an assumed ground factor of G=0.5 as recommended in the IOA Good Practice Guide.

A_{bar} - Barrier Attenuation

The effect of a barrier (including a natural barrier) between a noise source and receptor is that noise will be reduced according to the path difference (difference between the direct distance between source to receptor and distance between source and receptor over the barrier). The reduction is relative to the frequency spectrum of the sound and may be predicted according to the method given in ISO 9613. In practice, barriers can become less effective in downwind conditions. A barrier can be very effective when it lies within a few metres of the receptor. In the prediction model, zero attenuation is given for barrier effects, which is a worst-case scenario setting.

A_{atm} - Atmospheric Absorption

Sound emergence through the atmosphere is attenuated by conversion of sound energy to heat. This energy is dependent on the temperature and relative humidity of the air, but only weakly on ambient pressure through which the sound is travelling and is frequency dependent, with increasing attenuation towards higher frequencies. The attenuation by atmospheric absorption A_{atm} in decibels during propagation through distance in metres is given by:

$A_{atm} = d \times \alpha$,

α = atmospheric absorption coefficient in dB/mm-1

d = distance from turbine

Values of α from ISO 9613 Part 1, corresponding to a temperature of 100oC and a relative humidity of 70% has been used for these predictions and are given in Table 11-3 below. These values are recommended in the IOA Good Practice Guide.

Table 11-3 Atmospheric Absorption Coefficient

Octave Band Centre Frequency	Atmospheric Absorption Coefficient (dB/m)
63	0.0001
125	0.0004
250	0.001
500	0.0019
1000	0.0037
2000	0.0097
4000	0.0328
8000	0.117

A_{misc} – Miscellaneous Other Effects

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

The ISO 9613-2 standard calculates under downwind propagation conditions and therefore predicts the average downwind sound pressure level at each dwelling. The model assumes that the wind is directly downwind from each turbine to each dwelling. The prediction model is calculated as a worst-case scenario.

The predicted octaves from each of the turbines are summed to give the predicted noise level expressed as L_{Aeq} dB(A).

No allowance has been made for the character of noise emitted by the turbines, however in general the emissions from wind turbines are broadband in nature. In the unlikely event of a turbine exhibiting clearly tonal components at any receptor, the turbine would be turned down or stopped until such tonality is ameliorated.

The predicted noise levels $L_{Aeq,10min}$ are converted to the required $L_{A90,10min}$ by subtracting 2 dB(A).

11.6.1 Calibration to measured operational noise levels

The noise model will be initially run as per the above calculation methodology with the results compared against the measured operational noise levels at the three noise monitoring locations. It is expected that the measured operational noise levels will be lower given the inherent conservatism of the calculation methodology. The difference between the calculated results and the measured operational noise levels will be determined for each noise monitoring location and wind speed. An average of these differences will then be used to calibrate the noise model, to bring it in line with the measured operational noise levels i.e. the noise model results will tally with the measured operational noise levels at the 3 measurement locations, which allows the accurate representation of noise impacts at other properties in the locality.

11.7 Background Noise Levels

NML1 is located furthest from the Proposed Development site and upwind of the wind farm during the predominant wind direction – south-westerly. To ensure no undue influence of background noise levels from the existing operation of existing wind turbines, noise level data was filtered to only include wind directions upwind of the Proposed Development. In addition, noise level data was filtered for night-time only and exclusion of any periods of rainfall. The IOA Good Practice Guide 5.2.3 states:

> *"In the presence of an existing wind farm, suitable background noise levels can be derived by one of the following methods ... accounting for the contribution of the existing wind farm in the measurement data e.g. directional filtering (only including background data when it is not influenced by the existing turbines e.g. upwind of the receptor, but mindful of other extraneous noise sources e.g. motorways) or subtracting a prediction of noise from the existing wind farm from the measured noise levels."*

Given the rural setting of the locality, there are no significant noise sources, such as a motorway, to the southwest of NML1 likely to influence the background noise levels to any significance. The predominant wind direction in Ireland is south-westerly, hence the majority of background noise level assessments are undertaken in a south-westerly wind direction.

During installation and collection of the noise level meter at NML1, noise from existing turbines was not audible. Predicted noise impacts from the Proposed Development during a south-westerly wind direction at NML1 was undertaken to determine any possible influence on the measured background noise levels. It was noted that at all wind speeds the predicted noise impact from Proposed Development at NML1 was at least 10dB(A) under the measured background noise levels. Thus it can be concluded that noise from existing wind turbines had no measurable influence on the presented background noise levels.

NML1 was chosen for the background noise measurements as it was further away from trees (potential increased noise levels during higher wind speeds) than the other sites, which would result in lower recorded noise levels, therefore providing a more robust assessment. The site was also distant from the nearest wind turbine and at an elevation where no turbines were visible. Given the rural setting of the locality and limited differences across the other receptor locations, NML1 was considered representative of the background noise level across the Proposed Development.

Wind speed and direction data was taken from the existing wind turbines, with background noise levels derived for both hub height and 10m standardized height wind speeds.

The measured night-time background noise levels relative to hub height and 10m AGL standardized heights are presented in Table 11-4 below, with graphical representation of the measured data presented in Appendix 11-4.

Table 11-4 Derived Night-Time Background Noise Levels

Wind Speed @ Hub Height (m/s)	Night-time L_{A90},dB	Wind Speed @ 10m AGL (m/s)	Night-time L_{A90},dB
4	30.7	4	31.6
5	31.1	5	33.0
6	31.9	6	35.2
7	33.1	7	37.9
8	34.5	8	40.9
9	36.3	9	43.8
10	38.4	10	46.2
11	40.6	11	47.5
12	42.8	12	46.9

For the purposes of this assessment, the measured background noise levels at hub height have been incorporated into the Condition 8 calculations, whilst the measured background noise levels at 10m standardised height have been incorporated into the DoEHLG 2006 Guidelines assessment in line with the IOA GPG background +5dB calculations.

11.8 Data Processing of Operational Noise Levels

Data analysis was conducted on the noise measurement data:

- Only data where the Proposed Development was fully operational was included
- Only data between the hours of 23:00 and 04:00 was included
- Only data within 45 degrees either side of directly downwind for each monitoring location individually was included, noting that downwind differs for each monitoring location. It should be noted that given the nature of the noise monitoring locations, downwind is present across a number of wind directions, therefore expanding the 'arc' of included data.
- Data was omitted in the case where rainfall was registered

Taking into consideration the above exclusions, this refined the available data set to show the worst-case noise levels as presented in Table 11-5.

Table 11-5 Resultant Data Set

Location	Remaining Data Points	Downwind Direction (Blowing From)
NML1	120	0° to 100°
NML2 – Property 23	306	225° to 45°

Location	Remaining Data Points	Downwind Direction (Blowing From)
NML3 – Property 1	373	45° to 215°
NML4 – Property 6	500	55° to 275°

The resultant data set for the noise monitoring locations where data was available is presented in Sections 11.9.2 to 11.9.5 below.

Where the measured background noise levels were below the total measured noise level, the night-time background noise levels were logarithmically subtracted from the total measured noise levels to determine the operational noise level. The operational noise level was then assessed against the noise limit.

If it was the case that the measured background noise levels were above the total measured noise level, the total measured noise level was directly assessed against the noise limit.

11.9 Assessment of Potential Effects

11.9.1 Operational Noise Levels

The measured total noise levels for each noise monitoring location are presented below, with the calculations carried out in the Figures and Tables as outlined above.

11.9.2 Noise Monitoring Location 1

Figure 11-2 presents measured ambient noise levels at NML1 considering only dry, downwind and night-time (23:00 to 04:00hrs) criteria.

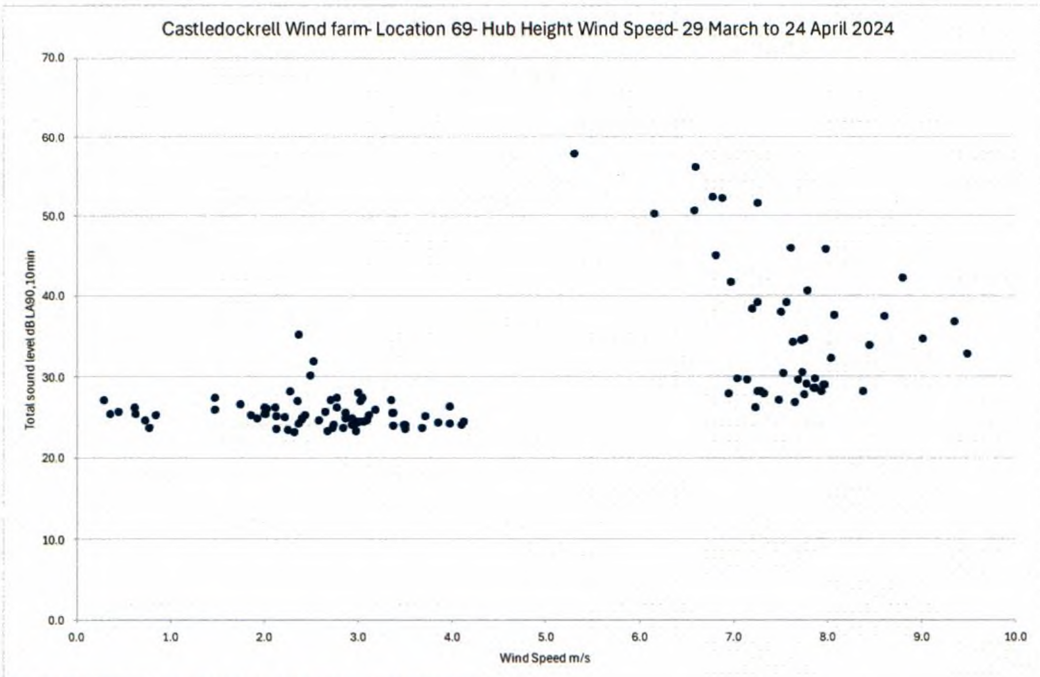

Figure 11-2 Measured Noise Levels NML1 – Hub Height

Given the lack of sufficient data points across the wind speed range, it is not possible to derive any meaningful conclusions and supports the use of NML1 as a background noise level measurement location.

Figure 11-3 presents measured ambient noise levels at NML1 considering only dry, downwind and night-time (23:00 to 04:00hrs) criteria.

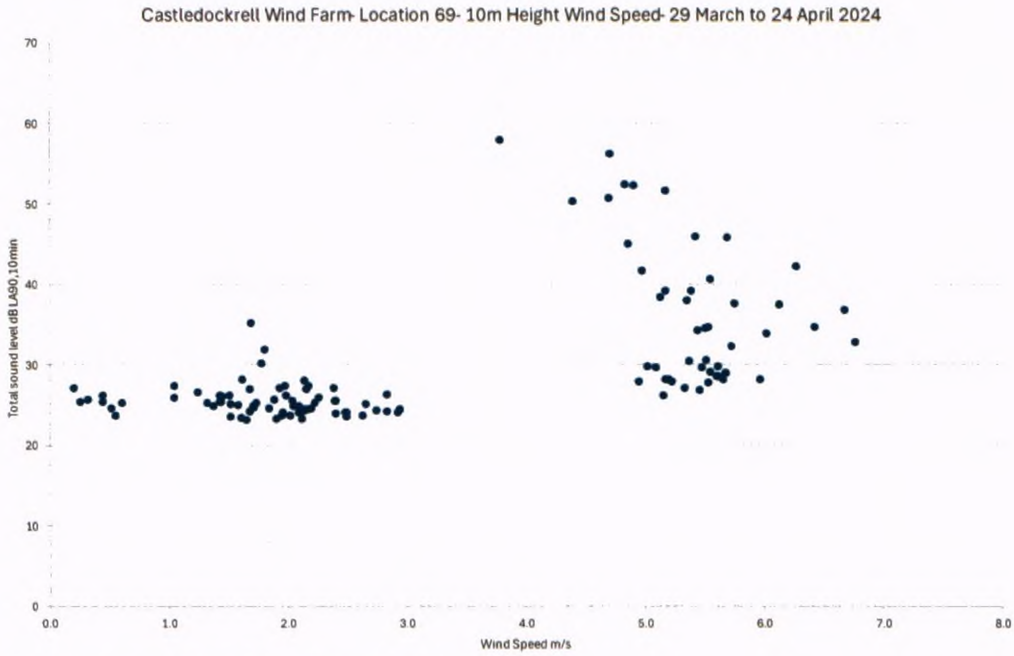

Figure 11-3 Measured Noise Levels NML1 – 10m Height

Given the lack of sufficient data points across the wind speed range, it is not possible to derive any meaningful conclusions and supports the use of NML1 as a background noise level measurement location.

11.9.3 Noise Monitoring Location 2 – Property 23

Figure 11-4 presents measured ambient noise levels at NML2 – Property 23 considering only dry, downwind and night-time (23:00 to 04:00hrs) criteria.

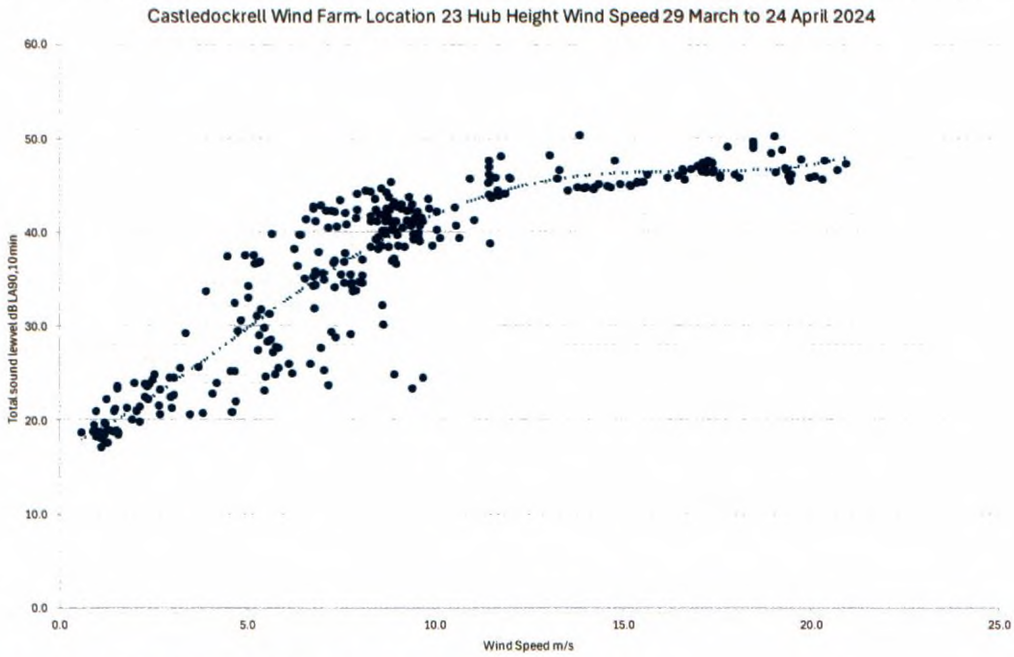

Figure 11-4 Measured Noise Levels NML2 – Property 23 – Hub Height

Table 11-6 NML2 – Property 23 - Measured Noise Levels – Condition 8

Wind Speed m/s (Hub Height)	Total measured noise level L_{A90},dB	Background noise level L_{A90},dB	Calculated operational noise level L_{A90},dB	Noise Limit L_{A90},dB	Difference
4	26.8	30.7	-	-	-
5	29.7	31.1	-	38	- 8.3
6	32.6	31.9	24.0	-	-
7	35.2	33.1	31.2	-	-
8	37.7	34.5	34.8	43	-8.2
9	39.8	36.3	37.2	-	-
10	41.6	38.4	38.7	-	-
11	42.9	40.6	39.1	-	-
12	43.9	42.8	37.4	-	-

It can be seen that the calculated operational/total measured noise levels achieve the Condition 8 noise limits of 38dB at 5m/s and 43dB at 8m/s hub height wind speeds for NML2 – Property 23. In addition, there is a good range of noise data across all wind speeds.

Figure 11-5 presents measured ambient noise levels at NML2 – Property 23 considering only dry, downwind and night-time (23:00 to 04:00hrs) criteria.

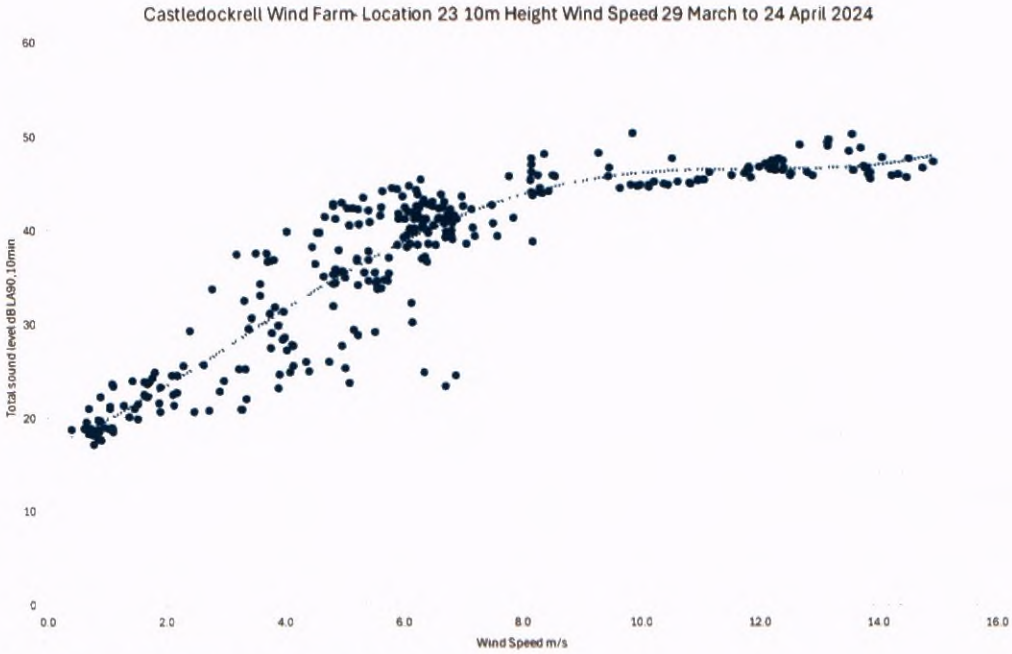

Figure 11-5 Measured Noise Levels NML2 – Property 23 – 10m Height

Table 11-7 NML2 – Property 23 Measured Noise Levels – IOA GPG background +5dB

Wind Speed m/s (10m AGL)	Total measured noise level L_{A90},dB	Backgroun d noise level L_{A90},dB	Calculated operational noise level L_{A90},dB	Noise Limit L_{A90},dB	Differenc e
4	31.5	31.6	-	43	-11.5
5	35.3	33	31.5	43	-11.5
6	38.7	35.2	36.1	43	-6.9
7	41.4	37.9	38.9	43	-4.1
8	43.5	40.9	40.0	45.9	-5.9
9	44.9	43.8	38.2	48.8	-10.6
10	45.6	46.2	-	51.2	-5.6
11	45.7	47.5	-	52.5	-6.8
12	45.5	46.9	-	51.9	-6.4

It can be seen that the calculated operational/total measured noise levels achieve the IOA GPG background +5dB noise limits for NML2 – Property 23 across all wind speeds. In addition, there is a good range of noise data across all wind speeds.

11.9.4 Noise Monitoring Location 3 – Property 1

Figure 11-6 presents measured ambient noise levels at NML3 – Property 1 considering only dry, downwind and night-time (23:00 to 04:00hrs) criteria.

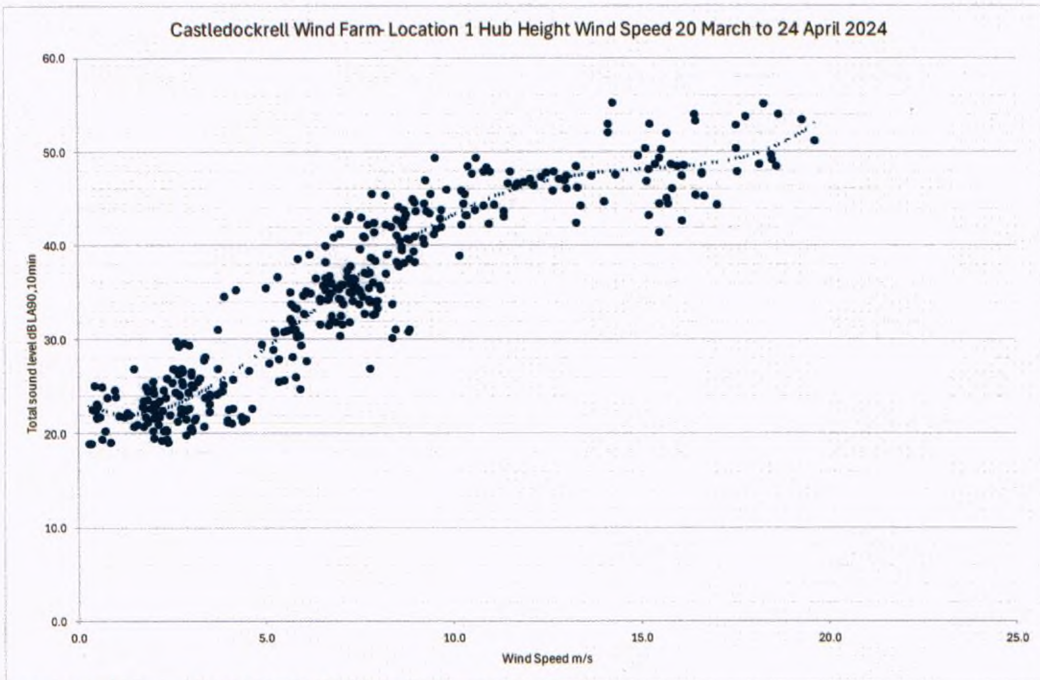

Figure 11-6 Measured Noise Levels NML3 – Property 1 – Hub Height

Table 11-8 NML3 – Property 1 Measured Noise Levels – Condition 8

Wind Speed m/s (HH)	Total measured noise level L_{A90},dB	Background noise level L_{A90},dB	Calculated operational noise level L_{A90},dB	Noise Limit L_{A90},dB	Difference
4	26.2	30.7	-	-	-
5	29.1	31.1	-	38	-8.9
6	32.2	31.9	20.7	-	-
7	35.4	33.1	31.6	-	-
8	38.4	34.5	36.1	43	-6.9
9	41.0	36.3	39.3	-	-
10	43.3	38.4	41.6	-	-
11	45.1	40.6	43.2	-	-
12	46.4	42.8	43.9	-	-

It can be seen that the calculated operational/total measured noise levels achieve the Condition 8 of 38dB at 5m/s and 43dB at 8m/s hub height wind speeds noise limits for NML3 – Property 1. In addition, there is a good range of noise data across all wind speeds.

Figure 11-7 presents measured ambient noise levels at NML3 – Property 1 considering only dry, downwind and night-time (23:00 to 04:00hrs) criteria.

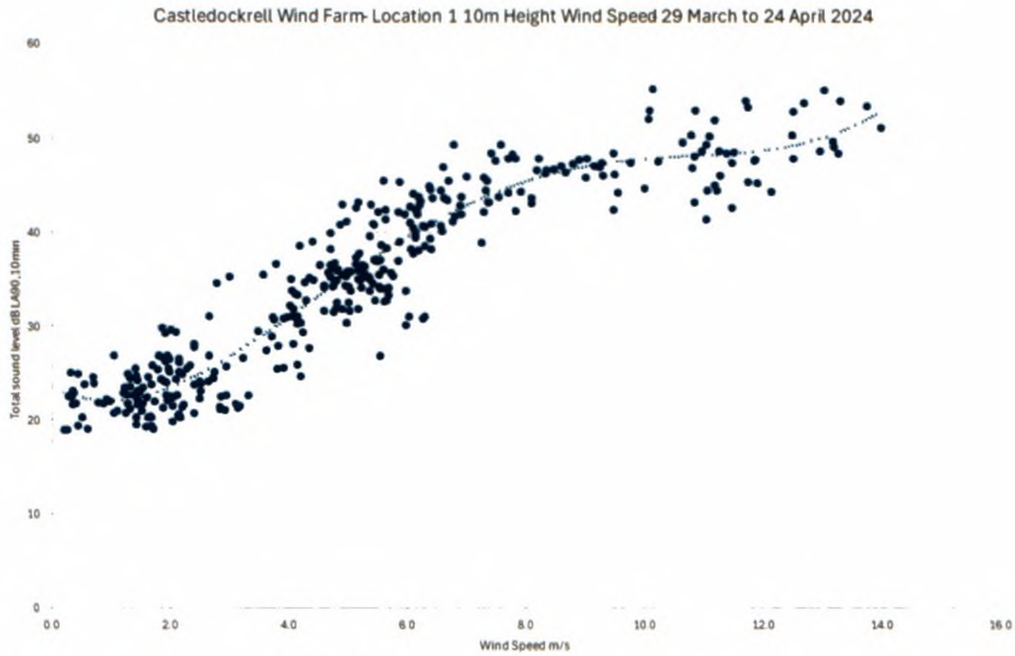

Figure 11-7 Measured Noise Levels NML3 – Property 1 – 10m Height

Table 11-9 NML3 – Property 1 Measured Noise Levels – IOA GPG background +5dB

Wind Speed m/s	Total measured noise level L_{A90},dB	Background noise level L_{A90},dB	Calculated operational noise level L_{A90},dB	Noise Limit L_{A90},dB	Difference
4	31.0	31.6	-	43	-12.0
5	35.5	33	31.8	43	-11.2
6	39.6	35.2	37.6	43	-5.4
7	43.0	37.9	41.4	43	-1.6
8	45.6	40.9	43.7	45.9	-2.2
9	47.2	43.8	44.6	48.8	-4.2
10	48.2	46.2	43.8	51.2	-7.4
11	48.8	47.5	42.7	52.5	-9.8
12	49.5	46.9	46.0	51.9	-5.9

It can be seen that the calculated operational/total measured noise levels achieve the IOA GPG background +5dB noise limits for NML3 – Property 1 across all wind speeds. In addition, there is a good range of noise data across all wind speeds.

11.9.5 Noise Monitoring Location 4 – Property 6

Figure 11-8 presents measured ambient noise levels at NML4 – Property 6 considering only dry, downwind and night-time (23:00 to 04:00hrs) criteria.

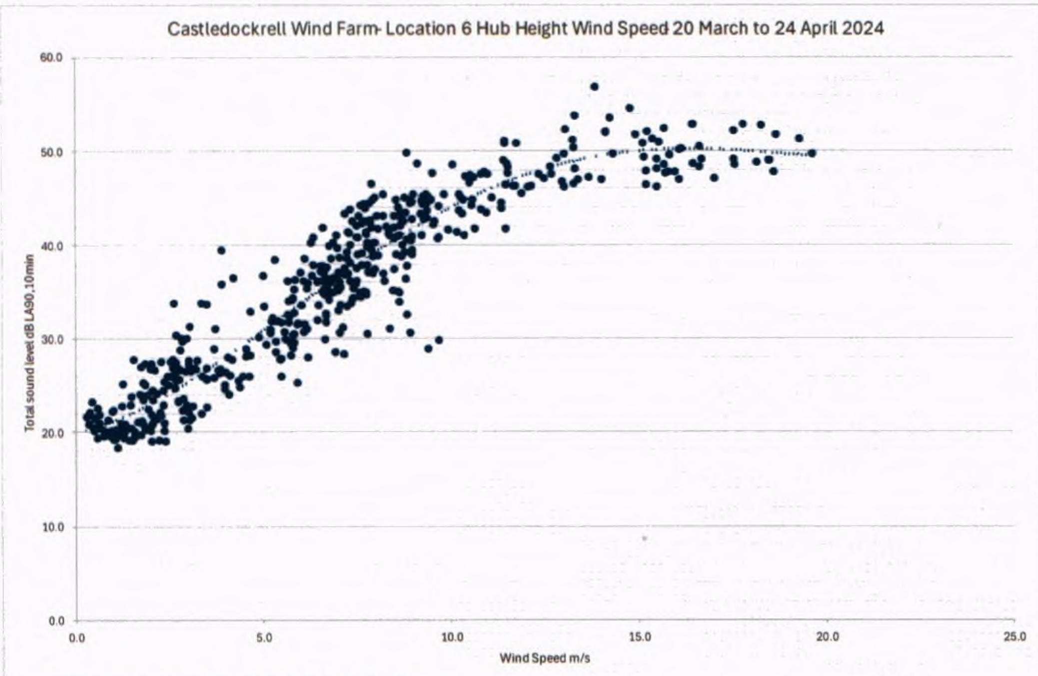

Figure 11-8 Measured Noise Levels NML4 – Property 6 – Hub Height

Table 11-10 NML4 – Property 6 Measured Noise Levels – Condition 8

Wind Speed m/s	Total measured noise level L_{A90},dB	Background noise level L_{A90},dB	Calculated operational noise level L_{A90},dB	Noise Limit L_{A90},dB	Difference
4	28.0	30.7	-	-	-
5	30.9	31.1	-	38	-7.1
6	33.7	31.9	29.0	-	-
7	36.5	33.1	33.8	-	-
8	39.1	34.5	37.2	43	-5.8
9	41.4	36.3	39.8	-	-
10	43.4	38.4	41.8	-	-
11	45.1	40.6	43.1	-	-
12	46.3	42.8	43.7	-	-

It can be seen that the calculated operational/total measured noise levels achieve the Condition 8 noise limits for NML4 – Property 6 at both 5 and 8m/s wind speeds. In addition, there is a good range of noise data across all wind speeds.

Figure 11-9 presents measured ambient noise levels at NML4 – Property 6 considering only dry, downwind and night-time (23:00 to 04:00hrs) criteria.

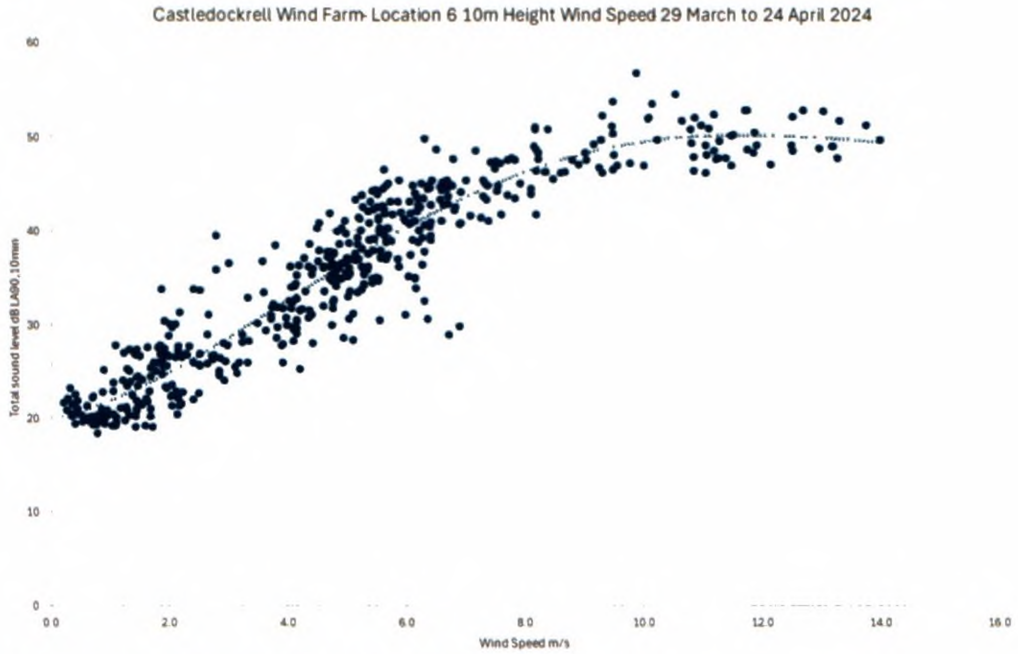

Figure 11-9 Measured Noise Levels NML4 – Property 6 – 10m Height

Table 11-11 NML4 – Property 6 Measured Noise Levels – IOA GPG background +5dB

Wind Speed m/s	Total measured noise level L_{A90},dB	Background noise level L_{A90},dB	Calculated operational noise level L_{A90},dB	Noise Limit L_{A90},dB	Difference
4	32.7	31.6	26.0	43	-17.0
5	36.6	33	34.2	43	-8.8
6	40.3	35.2	38.8	43	-4.2
7	43.6	37.9	42.2	43	-0.8
8	46.2	40.9	44.7	45.9	-1.2
9	48.1	43.8	46.1	48.8	-2.7
10	49.3	46.2	46.4	51.2	-4.8
11	49.9	47.5	46.1	52.5	-6.4
12	49.9	46.9	46.8	51.9	-5.1

It can be seen that the calculated operational/total measured noise levels achieve the IOA GPG background +5dB noise limits for NML4 – Property 6 across all wind speeds. In addition, there is a good range of noise data across all wind speeds.

11.9.6 Additional Receptor Locations

There are an additional twenty five houses within 500m of a Proposed Development turbine, as shown in Appendix 11-7 and Table 11-12 below. This shows the grid reference of each turbine and the houses, along with the distance to the nearest turbine.

Table 11-32 Turbine Coordinates

Name	X-coord	Y-Coord
T1	692507	649745
T2	692212	649592
T3	692501	649395
T4	692194	649264
T5	691950	649084
T6	691633	649030
T7	691319	648993
T8	691548	649338
T9	691922	649431
T10	691236	649288
T11	692763	649572
T12 (permitted under 20080335)	692997	649807

Table 11-43 Distance from nearest turbine to receptors

Location Name	X-coord	Y-Coord	Distance
1 (NML3)	691120	649541	278
2	692233	648896	340
3	690945	649465	340
4	690898	649410	359

Location Name	X-coord	Y-Coord	Distance
5	690973	649540	364
6 (NML4)	692212	649961	366
7	690919	649504	383
8	692717	649063	396
9	690887	649478	397
10	692477	650143	399
11	692693	649028	414
12	692130	648694	429
13	692676	648985	445
14	692655	648976	446
15	692471	650189	446
16	692086	648654	451
18	691313	649745	464
19	691323	649749	468
20	691788	649882	470
21	692873	649103	473
22	692540	648922	475
23 (NML2)	692782	649003	482
24	691367	649787	484
25	692243	650165	496
26	692614	648910	497

Predicted noise levels were compared to the measured operational noise levels at each location to ensure that the predicted levels were in line with the current measured operational level. The measured operational noise levels were on average 3.2dB lower than the predicted noise levels at the relative noise monitoring locations. As per 11.6.1 above, the noise model source inputs were adjusted for this difference to calibrate the noise model to the measured operational noise levels.

***Table** 11-14 Predicted noise levels at receptor locations*

Location	Wind Speed (m/s) (10m AGL)								
	4	5	6	7	8	9	10	11	12
1 (NML3)	29.3	32.6	38.0	39.7	41.7	42.5	42.5	42.5	42.5
2	30.4	33.7	39.1	40.8	42.8	43.6	43.6	43.6	43.6
3	27.7	31.0	36.4	38.1	40.1	40.9	40.9	40.9	40.9
4	27.4	30.7	36.1	37.8	39.8	40.6	40.6	40.6	40.6
5	27.4	30.7	36.1	37.8	39.8	40.6	40.6	40.6	40.6
6 (NML4)	29.9	33.2	38.6	40.3	42.3	43.1	43.1	43.1	43.1
7	27.0	30.3	35.7	37.4	39.4	40.2	40.2	40.2	40.2
8	29.7	33.0	38.4	40.1	42.1	42.9	42.9	42.9	42.9
9	26.7	30.0	35.4	37.1	39.1	39.9	39.9	39.9	39.9
10	28.2	31.5	36.9	38.6	40.6	41.4	41.4	41.4	41.4
11	29.4	32.7	38.1	39.8	41.8	42.6	42.6	42.6	42.6
12	28.2	31.5	36.9	38.6	40.6	41.4	41.4	41.4	41.4
13	28.9	32.2	37.6	39.3	41.3	42.1	42.1	42.1	42.1
14	29.0	32.3	37.7	39.4	41.4	42.2	42.2	42.2	42.2
15	27.5	30.8	36.2	37.9	39.9	40.7	40.7	40.7	40.7
16	27.9	31.2	36.6	38.3	40.3	41.1	41.1	41.1	41.1
18	27.8	31.1	36.5	38.2	40.2	41.0	41.0	41.0	41.0
19	27.8	31.1	36.5	38.2	40.2	41.0	41.0	41.0	41.0
20	28.5	31.8	37.2	38.9	40.9	41.7	41.7	41.7	41.7
21	28.6	31.9	37.3	39.0	41.0	41.8	41.8	41.8	41.8
22	29.0	32.3	37.7	39.4	41.4	42.2	42.2	42.2	42.2
23 (NML2)	28.3	31.6	37.0	38.7	40.7	41.5	41.5	41.5	41.5
24	27.5	30.8	36.2	37.9	39.9	40.7	40.7	40.7	40.7

Location	Wind Speed (m/s) (10m AGL)								
	4	5	6	7	8	9	10	11	12
25	27.3	30.6	36.0	37.7	39.7	40.5	40.5	40.5	40.5
26	28.4	31.7	37.1	38.8	40.8	41.6	41.6	41.6	41.6

As per the results in Table 11-14, all properties (except Property 6 and Property 2) demonstrate compliance with the night-time fixed limit of 43dB. A graphical representation of the results is presented in Appendix 11-8 – it should be highlighted that the graphical representation is based on L_{Aeq} values as opposed to L_{A90} as presented in Table 11-14, with a 2dB conversation factor necessary as per Section 11.6 above. Tables 11-15 and 11-16 below compare the predicted noise levels at these two locations to the nearest derived IOA GPG background +5dB night-time noise limit.

Table 11-15 NML4 – Property 6 Predicted Noise Levels – IOA GPG background +5dB

Wind Speed m/s	Predicted noise level L_{A90},dB	Noise Limit L_{A90},dB	Difference
4	29.9	43	-13.1
5	32.9	43	-10.1
6	38.5	43	-4.5
7	40.4	43	-2.6
8	42.3	45.9	-3.6
9	43.3	48.8	-5.5
10	43.3	51.2	-7.9
11	43.3	52.5	-9.2
12	43.3	51.9	-8.6

Table 11-16 NML4 – Property 2 Predicted Noise Levels – IOA GPG background +5dB

Wind Speed m/s	Predicted noise level L_{A90},dB	Noise Limit L_{A90},dB	Difference
4	30.1	43	-12.9
5	33.1	43	-9.9
6	38.7	43	-4.3
7	40.6	43	-2.4
8	42.5	45.9	-3.4
9	43.5	48.8	-5.3
10	43.5	51.2	-7.7
11	43.5	52.5	-9
12	43.5	51.9	-8.4

It can be seen that the predicted noise levels at all receptor locations (including Property 6 and Property 2) comply with the appropriate daytime and night-time noise limit of background +5dB. Consequently, no mitigation is deemed necessary in demonstrating compliance with the relevant planning condition.

11.9.8 **Potential AM complaints**

There are twenty five properties within 5dB of the 43dB lower fixed limit, when all of the turbines are operating at their maximum noise levels. The turbines installed at the existing Castledockrell Wind Farm are able to operate in various modes. If specific conditions arise that significant and consistent AM is generated, the operator can vary the operating mode to sufficiently mitigate the generation of AM or reduce the overall noise level in comparison to achieve set noise limits. A 'Noise Management Plan' has been included within Technical Appendix 11-11 detailing the measurement methodology to be applied to any justified noise complaints from local residents.

Additional noise level monitoring of Castledockrell Wind Farm specific to AM was undertaken at three residential locations from 3 December 2024 to 13 January 2025, as presented in Appendix 11-12. Low levels of AM was observed at each monitoring location, typical of all wind energy developments and similar to that as presented within the previous monitoring of the Castledockrell Wind Farm by Wexford County Council and presented in report "Castledockrell Wind Farm Noise Monitoring Report" dated 4th November 2019.

With the inclusion of the applicable AM penalties to the measured overall noise levels from Castledockrell Wind Farm, compliance with the DoEHLG 2006 Guidelines with the methodology described in ETSU-R-97 and the IOA Good Practice Guide (i.e. background +5dB) is still demonstrated.

11.10 Mitigation Measures and Residual Effects

11.10.1 **Construction Phase**

As there are no construction activities associated with the Proposed Development, there are no impacts anticipated.

11.10.2 **Operational Noise Mitigation**

The operational noise emissions from the Proposed Development have been demonstrated to comply with both the noise limits as set within the Wexford County Council recommended Condition 8 and the DoEHLG 2006 Guidelines +5dB at night-time. Consequently, no mitigation is currently deemed necessary. However, it is acknowledged that if specific conditions arise that significant and consistent AM is generated, the operator can vary the operating mode of the wind turbines to sufficiently mitigate the generation of AM or reduce the overall noise level in comparison to achieve set noise limits.

11.10.2.1 **Description of Effects – Operational Noise**

The criteria for description of effects for all operational noise activity and the potential worst-case effects, at the nearest receptors is given below.

Table 11-17 Description of Effects – Operational

Quality	Significance	Duration
Negative	Not Significant	Long Term

11.11 Decommissioning Assessment Methodology

11.11.1 Relevant Guidance

There is no published national guidance relating to the maximum permissible noise level that may be generated during the decommissioning phase of a project. However, National Roads Authority (NRA) give limit values which are acceptable (the NRA Guidelines)[21]. Guidance to predict and control noise is also given in BS 5228:2009-1+A12014, Code of Practice for Noise and Vibration Control on Construction and Open Sites (two parts) where Part 1 considers Noise[22].

11.11.1.1 NRA Guidelines for the Treatment of Noise and Vibration in National Road Schemes

The NRA Guidelines provide noise limits which are acceptable and states, where it is deemed necessary to predict noise levels associated with construction noise, that this should be done in accordance with BS 5228.

11.11.1.2 BS5228:2009-1A; 2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites

Part 1 of BS 5228 deals with noise prediction and control. It recommends procedures for noise control in respect of construction and demolition operations. The standard stresses the importance of community relations, and states that early establishment and maintenance of the relations throughout the carrying out of site operations will go some way towards allaying people's concerns. Some of the more relevant factors that are likely to affect the acceptability of construction/decommissioning noise are:

- The attitude of local residents to the Proposed Development
- Site location relevant to noise sensitive receptors
- Duration of site operations
- Hours of work
- The characteristics of the noise produced

Recommendations are made regarding the supervision, planning, preparation and execution of works, emphasising the need to consider noise at every stage of the activity. Measures to control noise are described including:

Control of noise at source by, e.g.

- Substitution of plant or activities for less noisy ones
- Modification of plant or equipment by less noisy ones
- Using noise control enclosures
- Siting of equipment and its method of use
- Maintenance of equipment
- Controlling the spread of noise by increasing distance between plant and receptors, or by the provision of acoustic screening

Example criteria for the assessment of the significance of noise effects are also given, although these are not mandatory.

---

[21] *National Roads Authority, Guidelines for Noise and Vibration in National Road Schemes.*
[22] *BS 5228-1: 2009 Code of Practice for Noise and Vibration Control on Construction and Open Sites: Code of Practice for Basic Information and Procedures for Noise Control.*

Methods of calculating the levels of noise resulting from construction activities are provided, as are updated source levels for various plant, equipment and construction activities.

11.11.2 Decommissioning Noise Assessment Methodology

The NRA guidelines for construction noise, which are considered in the frame of the decommissioning phase for the purpose of this assessment and are considered acceptable are presented in Table 11-18.

Table 11-18 NRA Guidelines – Acceptable noise level limits

Day/Times	Guideline Limits
Monday to Friday 07:00 – 19:00 hrs 19:00 – 22:00 hrs	 70dB $L_{Aeq(1hr)}$ and L_{Amax} 80dB *60dB $L_{Aeq(1hr)}$ and L_{Amax} 65dB
Saturday 08:00 – 16:30 hrs	 65dB $L_{Aeq(1hr)}$ and L_{Amax} 75dB
Sunday and Bank Holidays 08:00 – 16:00 hrs	 *60dB $L_{Aeq(1hr)}$ and L_{Amax} 65dB

*Decommissioning activities at these times, other than required by an emergency works, will normally require explicit permission from the relevant local authority.

Decommissioning Times for the Proposed Development are:

Monday to Friday: 07.00 to 19.00hrs, Saturday 08.00 to 13.00hrs with no work on Sunday, or Bank Holidays. These proposed working hours would be deemed more conservative than those within Table 11-18, focusing on less sensitive time periods.

Part 1 of BS 5228 provides several example criteria for the assessment of the significance of noise effects from construction activities. Noise levels generated by construction activities are considered significant if:

- The L_{Aeq}, period level of construction noise exceeds lower threshold values of 65dB during daytime, 55dB during evenings and weekends or 45dB at night.
- The total noise level (pre-construction ambient noise plus construction noise) exceeds the pre-construction noise level by 5dB or more for a period of one month or more.

Decommissioning noise from wind farm development is not considered an intensive activity. The main noise sources will be associated with removal of the wind turbines and remediation of turbine hardstand areas and turbine foundations, where they will be allowed to regenerate and revegetate. Site access tracks will likely be left in-situ for use by the landowners. Underground internal wind farm cables will be removed, and the ducting left in-situ. Further information on plans for decommissioning is included within Appendix 4-4 Decommissioning Plan.

All workers associated with the decommissioning phase of the Proposed Development will be subject to the Health and Safety Authority Guidance which states that for noise exposure noise levels likely to exceed 80 dBA (expressed as $L_{ep,d}$ 8 hour dBA) there is the potential of risk of

damage to hearing. All workers on site will be given guidance on how to comply with the 'First Action Level'.

11.11.3 Evaluation of Potential Effects

The potential impacts of decommissioning are evaluated by comparing the predicted noise levels against the guideline limits given in Table 11-18: Noise levels that are considered acceptable based on the NRA guidelines, and sample criteria in Part 1 of BS 5228 in Section 10.3.4.

The potential operational impacts are evaluated by comparing the measured noise levels against the noise limits given in Section 11.3. The primary Irish guidance is currently the DoEHLG 2006 Guidelines and this document identifies the assessment methodology within ETSU-R-97 and the associated IOA Guidance. The operational noise levels are calculated according to the IOA Good Practice Guide (GPG) – SGN5 as detailed in Section 11.3.9 and potential impacts are assessed against the noise limits at the nearest receptors.

11.11.4 Decommissioning Noise

As has been previously stated, the decommissioning process associated with wind farms is not considered intensive and is temporary works most of which is carried out a considerable distance from receptors, i.e. at least 250m. The main noise sources will be associated with removal of the wind turbines and remediation of turbine hardstand areas and turbine foundations, where they will be allowed to regenerate and revegetate naturally. Site access tracks will likely be left in-situ for use by the landowners. Underground internal wind farm cables will be removed, and the ducting left in-situ.

The removal of turbines by large trucks travelling at very low speed will generate very low levels of noise at receptors along the haul route.

It is not possible to specify the precise noise levels of emissions from the decommissioning equipment until such time as a contractor is chosen and plant has been selected. However, Table 11-19 indicates typical construction range of noise levels for this type of activity (levels from author's database and BS 5228). Predictions are made for receptors nearest to the turbine bases / hardstands activity and ancillary construction activity.

Table 11-19 Typical noise levels from Construction Works

Activity	L_{Aeq} at 10m
Tracked excavator removing topsoil and subsoil	80- 87dBA
Rock breaker and excavator loading	82-89dBA
Trenching tracked excavator 14t, pneumatic breaker, vibratory roller 71t, tractor	71 dBA
Excavator loading / tipping, excavator and Vibratory roller	80- 87dBA

The difference in noise levels between two locations can be calculated as:

Lp2 - Lp1 = 10 log (R2 / R1)2 - (Aatm +Agr + Abr +Amis)

= 20 log (R2 / R1) - (Aatm +Agr + Abr +Amis)