REPORT

Trinity Consultants

awnconsulting

# Background Noise Survey

Project Title: Ballyfasy Wind Farm

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| Tobin | 227501.0493NT03 | 7 July 2025 |

# DOCUMENT CONTROL SHEET

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| **Signature** | | |
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| **Date** | 7 July 2025 | |

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# 1. INTRODUCTION

AWN Consulting, A trinity Consultants Company, have been appointed to prepare the noise and vibration EIAR chapter and assessment for the Ballyfasy Wind Farm Co. Kilkenny. This note has been prepared to provide details and methodology of the background noise survey undertaken and confirm the derived background noise levels the various Noise Monitoring Locations (NMLs).

# 2. BACKGROUND NOISE SURVEY METHODOLOGY

The noise survey and subsequent data analysis was carried out in accordance with best practice following the guidance contained in the Institute of Acoustics publication *A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise* (May 2013), (IOA GPG).

## 2.1 Measurement Locations

The background noise survey was conducted through installing unattended sound level meters at 6 no. representative locations in the surrounding area. The co-ordinates for selected locations for the noise monitoring locations are outlined in Table 2-1 and identified on a map in Figure 2-1.

**Table 2-1 Coordinates of Noise Monitoring Equipment**

| Location | Coordinates (ITM) | |
|---|---|---|
| | Easting | Northing |
| A (H177) | 660,042 | 624,364 |
| B (H346) | 663,827 | 627,125 |
| C (H555) | 662,424 | 625,138 |
| D (H357) | 663,258 | 626,079 |
| E (H618) | 662,435 | 623,080 |
| F (H262) | 658,987 | 626,062 |

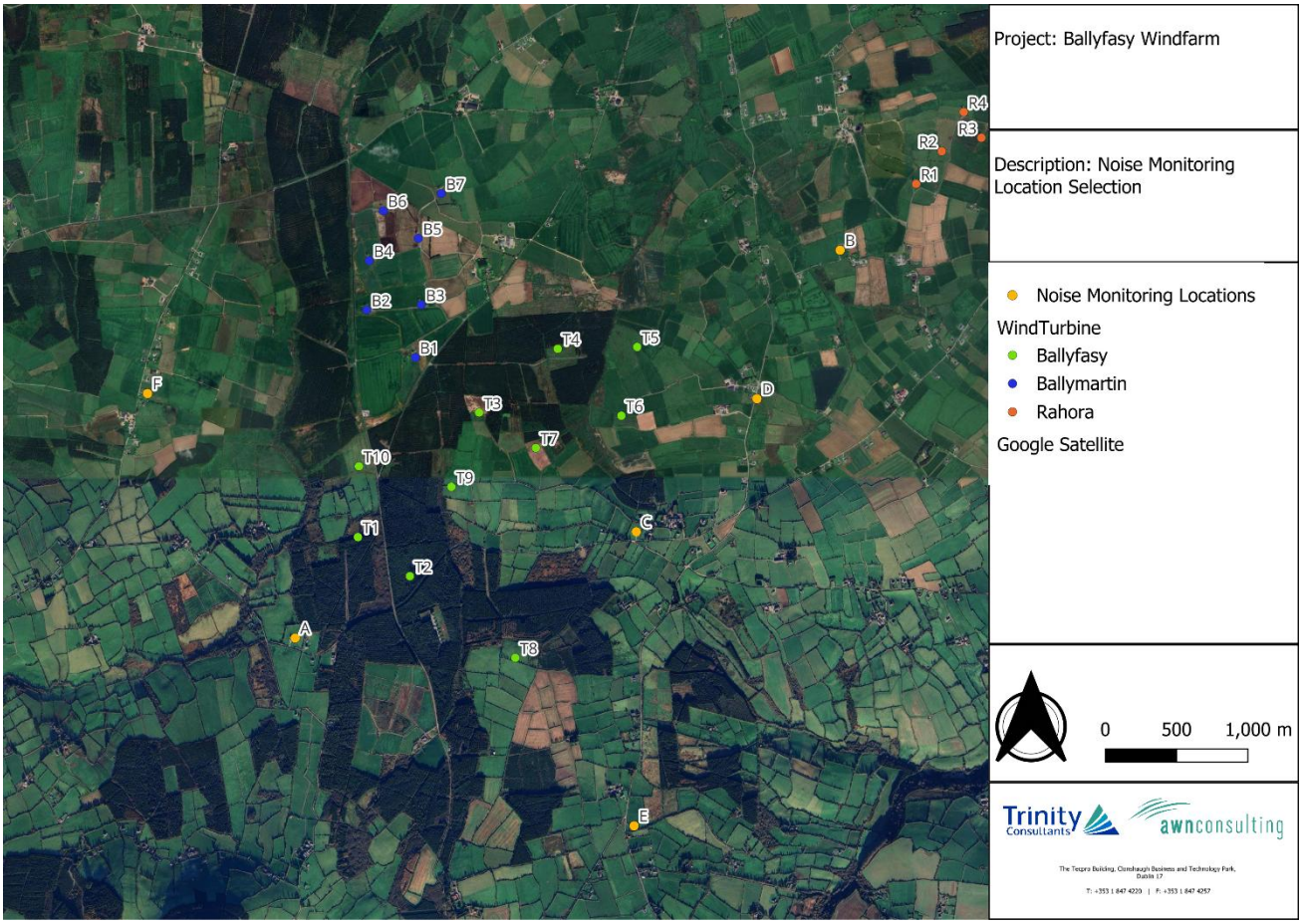
Site visits by survey personnel were carried out during morning and afternoon periods; during these visits, primary noise sources contributing to noise build-up were noted. In respect of night-time periods, when noise due to traffic on local roads, agricultural activities and other sources tend to reduce, there was no indication of any significant local night-time sources of noise at any location. No sources of vibration were noted at any of the survey locations.

In general, the significant noise sources in the area were noted to be local and distant traffic movements, activity in and around the residences, wind generated noise from local foliage and other typical anthropogenic sources typically found in such rural settings.

At some locations noise from the operation of existing turbines located at Ballymartin Smithstown, and Rahora Wind Farms were noted to be audible to varying degrees during site visits. It should be noted that the level of wind turbine noise is variable, it is dependent on the operational condition of the turbine, wind speed and direction, distance from the turbines, and the levels of background noise at the location.

Any noise from the existing wind turbines in the area should not form part of the background noise environment at noise sensitive locations. In contrast, the terms 'baseline noise level' or the 'existing noise levels' environment, incorporate current noise contributions from the operation of the existing turbines.

**Figure 2-1 Noise Monitoring Location Selection**




## 2.2 Measurement Periods

The periods of noise measurements used in the background noise monitoring assessment are outlined in Table 2-2. The survey was deemed completed when an adequate number of datasets had been measured as recommended in the IOA GPG to determine a suitable representation of the typical background noise.

**Table 2-2 Measurement periods of Noise Monitoring Equipment**

| Location Reference | Survey Period | |
|---|---|---|
| | Start Date | End Date |
| A (H177) | 12 July 2023 | 22 August 2023 |
| B (H346) | 12 July 2023 | 17 August 2023 |
| C (H555) | 12 July 2023 | 22 August 2023 |
| D (H357) | 12 July 2023 | 18 August 2023 |
| E (H618) | 12 July 2023 | 22 August 2023 |
| F (H262) | 12 July 2023 | 22 August 2023 |

Before and after the survey the measurement apparatus was check calibrated using a Brüel & Kjær type 4231 Sound Level Calibrator where appropriate. Instruments were calibrated on each interim visit and any drift noted. All calibration drifts were less than ±0.2 dB and within acceptable tolerances outlined in the IOA GPG.

## 2.3 Measurement Procedure

Measurements were conducted at all locations over the survey periods outlined in Table 2-2. Data samples for all measurements (noise, rainfall, and wind) were logged continuously at 10-minute interval periods for the duration of the survey. The $L_{Aeq,10min}$ and $L_{A90,10min}$ noise parameters were measured in this instance and the results were saved to the instrument memory for later analysis.

Survey personnel noted potential primary noise sources contributing to noise build-up during the installation and removal of the sound level meters from site.

## 2.4 Instrumentation

Table 2-3 confirms the details of the noise monitoring instrumentation installed at each location.

**Table 2-3 Details of Noise Measurement Instrumentation**

| Location Reference | Equipment Make and Model | Serial Number |
|---|---|---|
| A (H177) | Rion NL-52 | 164426 |
| B (H346) | Rion NL-52 | 998413 |
| C (H555) | Rion NL-52 | 764925 |
| D (H357) | Rion NL-52 | 186669 |
| E (H618) | Rion NL-52 | 998410 |
| F (H262) | Rion NL-52 | 164427 |

Before, after and during each survey period, the measurement instrument was checked and calibrated using a Brüel & Kjær type 4231 Sound Level Calibrator. All calibration drifts were less than +/- 0.5 dB. Copies of the relevant calibration certificates are included in Appendix 10-2 of the EIAR Chapter.

## 2.5 Rainfall Data

Rainfall was monitored and logged using two Texas Instruments TR-525 data loggers that were installed at Locations A and B over the duration of the survey.

## 2.6 Wind Data

Average wind speed and direction was measured in 10-minute intervals at an on-site met mast and provided to AWN. Wind speed measurements were taken at anemometers situated at 80 m and 60 m. The coordinates of the met mast are provided in Table 2-4. A copy of the met mast installation report is included in Appendix 12.7 of the EIAR Chapter.

**Table 2-4 Met Mast Location**

| Met Mast Reference | Co-ordinates (ITM) | |
|---|---|---|
| | Easting | Easting |
| Ballyfasy Upper, Co. Kilkenny | 661,369 | 625,723 |

### 2.6.2 Wind Shear

Wind speed measurements made at 80 m and 60 m were used to correct the wind speed up to an assessment hub height (HH) at 105.5 m, as per the methodology outlined in the IOA GPG.

The calculated HH wind speeds were then corrected to the 'standardised' 10 m height wind speed in accordance with the IOA GPG. The 'standardised' wind speed is the industry standard for referencing wind speeds with respect to wind turbines.

The calculated hub height wind speeds have been corrected standardised to 10 m height using a fixed correction. The standardised is a wind speed measured at a height different than 10 m (generally measured at the turbine hub height) which is expressed to a reference height of 10 m using a roughness length of 0.05 for standardisation purpose in accordance with the IEC 61400-11 standard:

Roughness Length Shear Profile: $U1 = U2 \times [(\ln(H1/z))/ (\ln(H2/z))]$

Where:

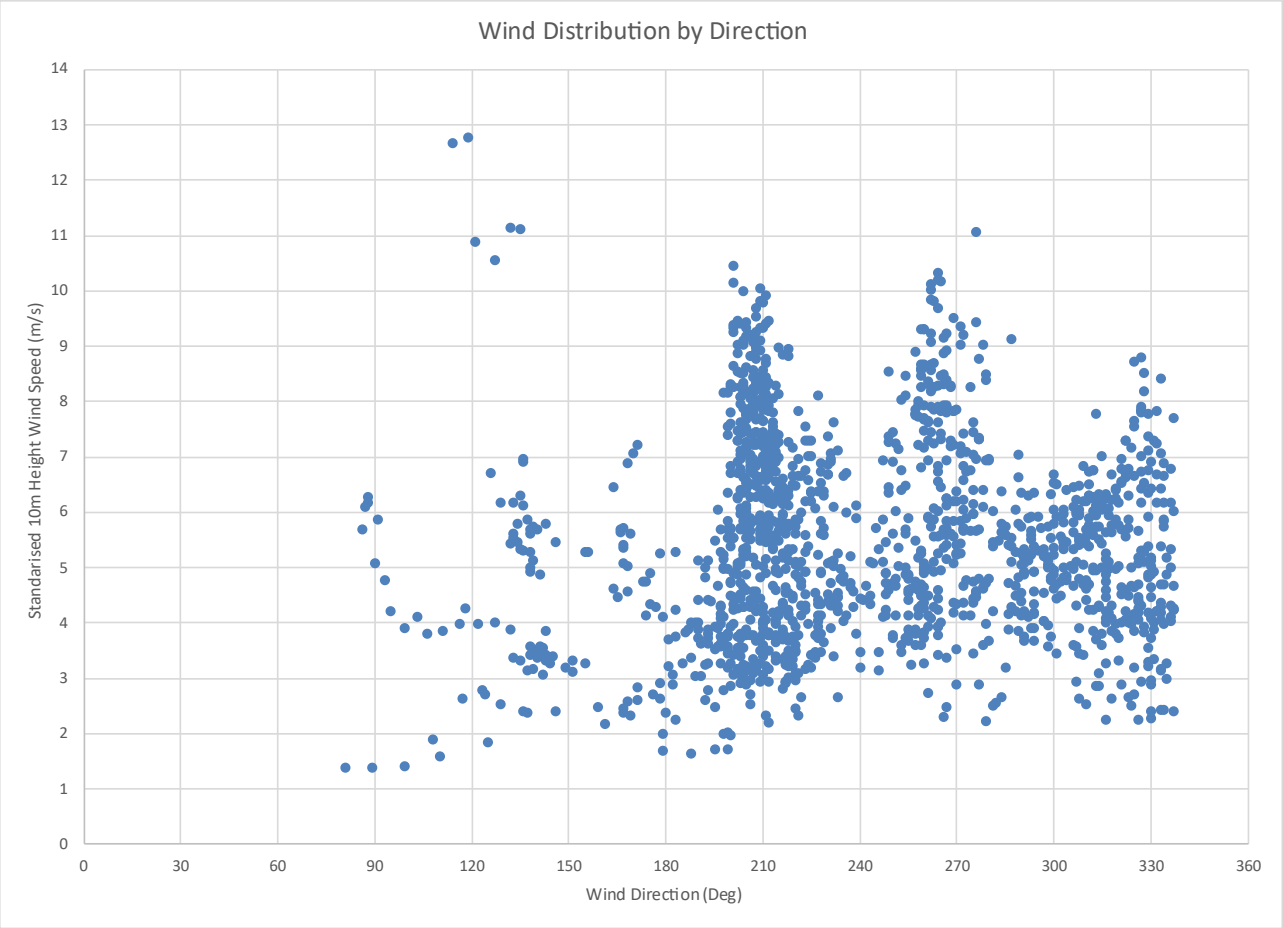
| | |
|---|---|
| $H_1$ | The height of the wind speed to be calculated (10m) |
| $H_2$ | The height of the measured or calculated HH wind speed. |
| $U_1$ | The wind speed to be calculated. |
| $U_2$ | The measured or calculated HH wind speed. |
| Z | The roughness length. |

Note: A roughness length of 0.05m is used to standardise hub height wind speeds to 10m height in the IEC 61400-11:2003 standard, regardless of what the actual roughness length seen on a site may have been. This 'normalisation' procedure was adopted for comparability between test results for different turbines.

Any reference to wind speed in this chapter should be understood to be the standardised 10 m height wind speed unless otherwise stated.

Figure 2-2 presents the distributions of the measured wind speed and wind direction over the survey period.

**Figure 2-2 Distributions of Wind Speeds and Directions Over the Survey Period**




## 2.7 Selection of Measurement Locations

The purpose of the noise survey is to determine the background noise at representative noise sensitive locations (NSLs) within the receiving environment surrounding the proposed development.

As the wind farm was operational the survey locations were identified with consideration of the potential turbine noise contribution from the existing Ballymartin, Castlebanny and Rahora wind farm assessed using noise prediction modelling and supported by reviewing aerial images and street side images where available on website e.g., Google Earth and Bing Maps. The suitability of any location to be representative of, or a 'proxy' for, other locations, is determined through on-site observations and review of the measured background noise data.

The assessment methodology in the EIAR will be in accordance with the Institute of Acoustics document A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise (2013) hereafter referred to as the IOA GPG.

The following text summaries the guidance from the IOA GPG for the selection of background noise survey locations:

- The selection of suitable noise monitoring locations for background noise surveys is not straightforward and only general guidance can be given as it is not possible to be prescriptive.

- Often there are practical constraints on where equipment can be placed, and a considerable degree of experience-based judgement is required when selecting these positions.
- Any contribution to background noise levels of noise from an existing wind farm must be excluded when assigning background noise and setting noise limits for a new development.

A robust assessment of the noise impacts of the wind farm necessitates a detailed survey of the background noise at houses in the vicinity of the wind farm.

## 2.8 Data Analysis

The following sections present a summary of the statistical analysis carried out on the noise monitoring data to derive the background noise curves at each NML.

Background noise data sets can be re-analysed for various scenarios should this be required, for instance, if the proposed HH changes or alternative hub heights are considered.

### 2.8.1 Assessment Periods

The results presented in the following sections refer to the noise data collated during 'quiet periods' of the day and night as defined in the IOA GPG. These periods are defined in Table 2-5.

**Table 2-5 Daytime and Night Periods**

| Period Description | Period Definition |
|---|---|
| Daytime (Amenity Hours) | ETSU-R-97 defines the amenity hours as:<br>18.00 to 23.00 Monday to Friday.<br>13.00 to 23.00 on Saturdays; and,<br>07.00 to 23.00 on Sundays. |
| Night | ETSU-R-97 defines the night-time hours as 23.00 to 07.00 every day |

The data sets have been assessed separately for both daytime and night-time periods as outlined in Table 3 and analysed with respect to the methods outlined in the IOA GPG.

### 2.8.2 Noise from Existing Turbines

Two existing operational wind farms (Ballymartin and Rahora) are in the surrounding environment and have the potential to influence the measured noise data. To derive background noise levels in the presence of exiting turbine noise, the methodology from the IOA GPG has been applied to the assessment.

Section 2.2.2 of the IOA GPG states: '*Any contribution to background noise levels of noise from an existing wind farm must be excluded when assigning background noise and setting noise limits for a new development.*'

There are a number of ways of achieving this, as described in section 5.2 of IOA GPG:

> *5.2.2 Where a new wind farm is proposed and a receptor is also within the area acoustically affected by an already operational wind farm, then noise from the existing wind farm must*

*not be allowed to influence the background noise measurements for the proposed development.*

*5.2.3 In the presence of an existing wind farm, suitable background noise levels can be derived by one of the following methods:*

1. *switching off the existing wind farm during the background noise level survey (with associated significant cost implications);*
2. *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.*
3. *utilising an agreed proxy location removed from the area acoustically affected by the existing wind farm/s; or*
4. *utilising background noise level data as presented within the Environmental Statement/s for the original wind farm/s (the suitability of the background noise level data should be established).*

The other wind farms are outside the control of the applicant. Considering the distance from the NMLs to the existing operational turbines, it is not necessary to switch off turbines. In this instance, the selected NMLs were at sufficient distances from the existing turbines such that the application of option 2 (directional filtering) was sufficient to remove significant contributions of noise from existing turbines.

The locations were selected to provide an opportunity to determine the background noise levels through directional filtering in so far as practicable upwind from all operational turbines.

Where required the data has been analysed to remove contributions from existing wind turbine noise. This was achieved through directional filtering upwind of the receptor from the existing wind farm. The following table summarises key information relevant to this aspect of the methodology.

**Table 2-6 Location-specific methodology details**

| Location | Nearest existing turbine to measurement location | Analysis details |
|---|---|---|
| Loc A (H177) | Ballymartin WF, B1 – 2,130 m | Directional filtering applied. Wind direction sectors North and Northeast removed. |
| Loc B (H346) | Rahora WF, R1 – 709 m<br>Ballymartin WF, B5 – 2,800 m | Directional filtering applied. Wind direction sectors North, Northeast, East, West and Northwest removed. |
| Loc C (H555) | Ballymartin WF, B1 – 1,970 m | Directional filtering applied. Wind direction sectors North, Northeast and Northwest removed. |
| Loc D (H357) | Ballymartin WF, B2 – 2,430 m<br>Rahora WF, R1 – 1,860 m | Directional filtering applied. Wind direction sectors North, Northeast, East, West and Northwest removed. |
| Loc E (H618) | Ballymartin WF, B1 – 3,600 m | Directional filtering not required at this location |
| Loc F (H262) | Ballymartin WF, B2 – 1,660 m | Directional filtering applied. Wind direction sectors North and Northeast removed. |

### 2.8.3 Atypical Noise Data

The data sets have been filtered to remove issues such as the dawn chorus and the influence of other atypical noise sources. An example of atypical sources would be short, isolated periods of raised noise levels attributable to local sources, vehicles, agricultural activity, boiler flues, operation of gardening equipment etc. In addition, sample periods affected by rainfall or when rainfall resulted in prolonged periods of atypical noise levels have also been removed from the data sets. This approach is in line with the guidance contained in the IOA GPG.

# 3. RESULTS

## 3.1 Derived Background Noise Levels

The derived background noise levels dB $L_{A90,10min}$ for daytime and nighttime are presented in Table 3-1 and Table 3-2 respectively. These levels have been derived using regression analysis carried out on the data sets measured in line with best practice guidance contained in the IOA GPG and its SGN No. 2 Data Collection; Appendix C presents the regression analysis charts for daytime and night-time periods from each NML.

These background noise levels will be used to determine the appropriate turbine noise limits in accordance with the adopted turbine noise criteria as set out in the Noise and Vibration Chapter for the proposed development.

**Table 3-1 Derived Background Noise Levels at Assessment Hub Height - Daytime**

| Locations | Period | Background Noise Levels dB $L_{A90}$ at standardised 10m height wind speed m/s for 105.5 m Hub Height | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| A (H177) | Day | 28.1 | 28.8 | 29.8 | 31.0 | 32.6 | 34.4 | 36.5 | 38.9 |
| B (H346) | Day | 28.2 | 30.0 | 30.9 | 32.5 | 35.3 | 39.0 | 42.6 | - |
| C (H555) | Day | 26.9 | 28.4 | 30.1 | 32.2 | 34.5 | 37.0 | 39.9 | 43.0 |
| D (H357) | Day | 25.2 | 26.8 | 28.4 | 30.2 | 32.1 | 34.1 | 36.3 | - |
| E (H618) | Day | 26.5 | 26.9 | 28.4 | 30.6 | 33.4 | 36.4 | 39.3 | 41.8 |
| F (H262) | Day | 28.1 | 28.0 | 29.0 | 30.8 | 33.1 | 35.5 | 37.7 | 39.3 |

**Table 3-2 Derived Background Noise Levels at Assessment Hub Height – Night-time**

| Locations | Period | Background Noise Levels dB $L_{A90}$ at standardised 10m height wind speed m/s for 105.5 m Hub Height | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| A (H177) | Night | 26.7 | 26.7 | 26.9 | 27.6 | 28.5 | 29.8 | 31.4 | 33.4 |
| B (H346) | Night | 22.1 | 24.8 | 26.8 | 29.1 | 32.3 | 36.3 | 40.8 | 37.8 |
| C (H555) | Night | 20.1 | 21.3 | 23.2 | 25.7 | 28.8 | 32.3 | 36.1 | 40.0 |
| D (H357) | Night | 18.6 | 19.9 | 21.7 | 24.1 | 27.0 | 30.5 | 34.6 | - |
| E (H618) | Night | 19.9 | 20.4 | 21.9 | 24.2 | 27.2 | 30.6 | 34.3 | 38.1 |
| F (H262) | Night | 23.0 | 24.3 | 25.0 | 25.9 | 27.6 | 30.8 | 36.0 | - |

# APPENDIX A. GLOSSARY OF TERMINOLOGY

| | |
|---|---|
| **Background noise** | The noise level rarely fallen below in any given location over any given time period, often classed according to daytime, evening or night-time periods. |
| **dB** | Abbreviation for 'decibel'. |
| **dB(A)** | Abbreviation for the decibel level of a sound that has been A-weighted. |
| **Dawn Chorus** | Noise due to birds which can occur at sunrise. |
| **Decibel** | The unit normally employed to measure the magnitude of sound. |
| **Directivity** | The property of a sound source that causes more sound to be radiated in one direction than another. |
| **$L_{A90}$** | The noise level exceeded 90% of the time during a measurement period, often used for the measurement of background noise. |
| **Level** | The general term used to describe a sound once it has been converted into decibels. |
| **Sound level meter** | An instrument for measuring sound pressure level. |

# APPENDIX B. PHOTOGRAPHS OF INSTALLATIONS

## INSTALLATION PHOTOGRAPHS

**Figure 3-1 Location A Installation Photo**

**Figure 3-2 Location B Installation Photo**

**Figure 3-3 Location C Installation Photo**

**Figure 3-4 Location D Installation Photo**

**Figure 3-5 Location E Installation Photo**

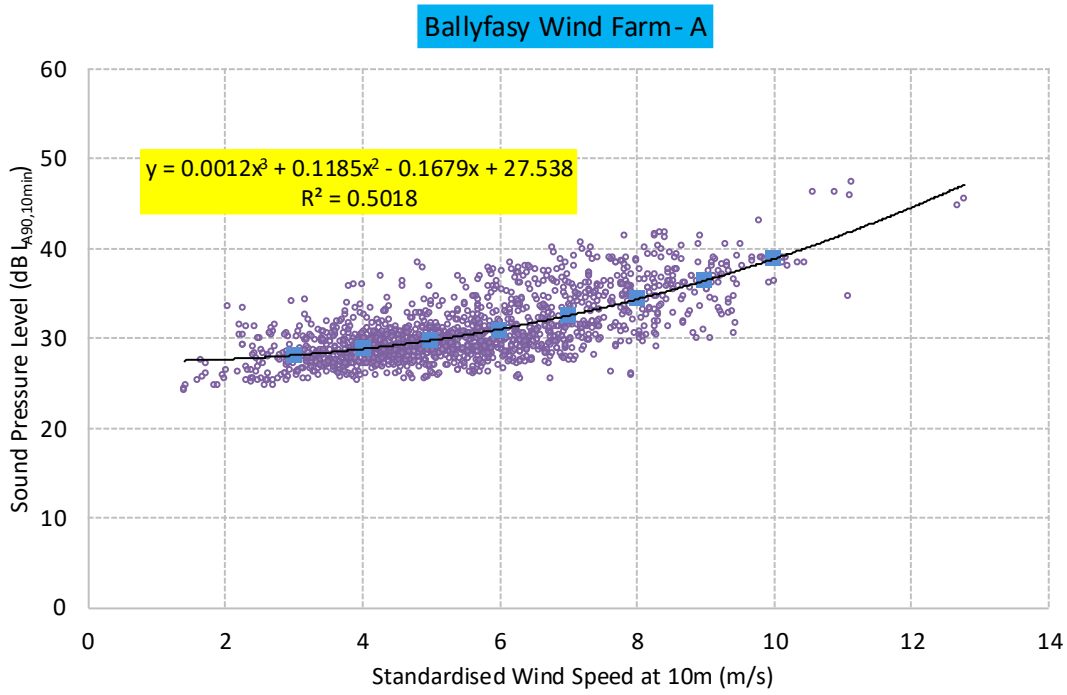
**Figure 3-6 Location F Installation Photo**

# APPENDIX C. REGRESSION ANALYSIS GRAPHS

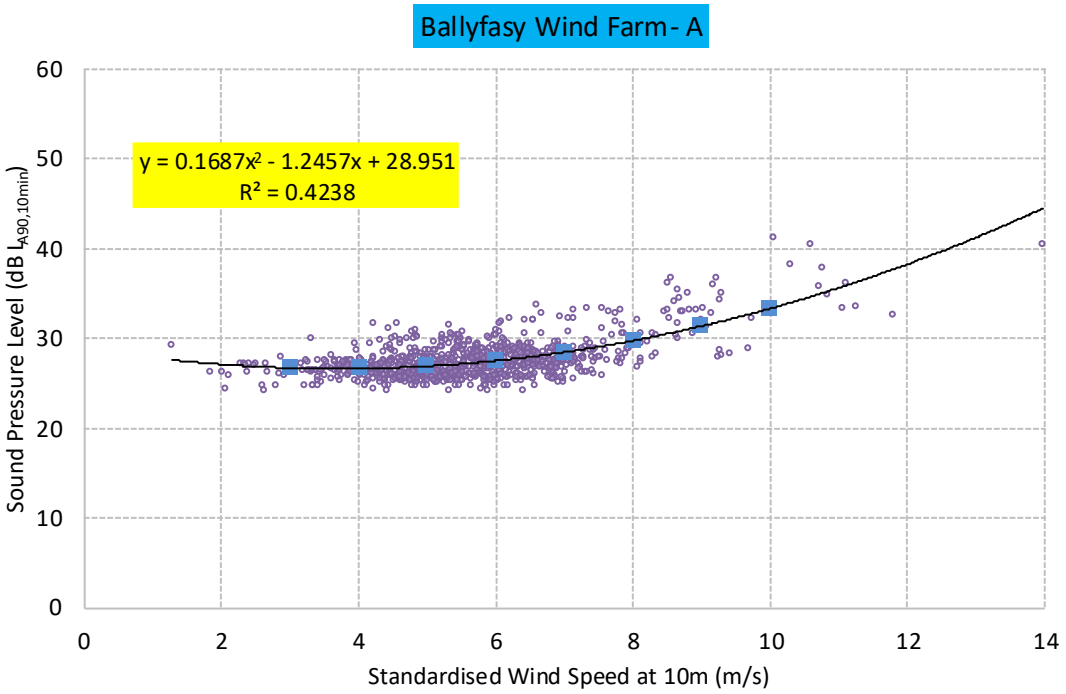
## REGRESSION ANALYSIS ON DATA SETS

The following graphs present the data sets for each location. In each case, the daytime data is presented first and the night-time data below.

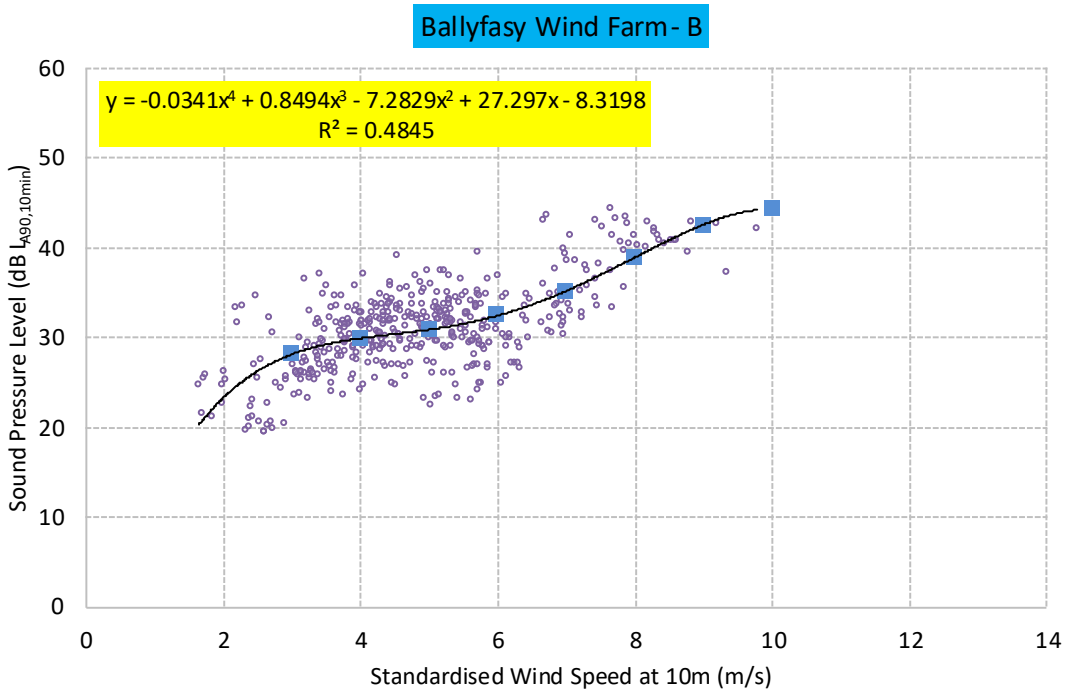
### Loc A Daytime



## Loc A Night




## Loc B Day



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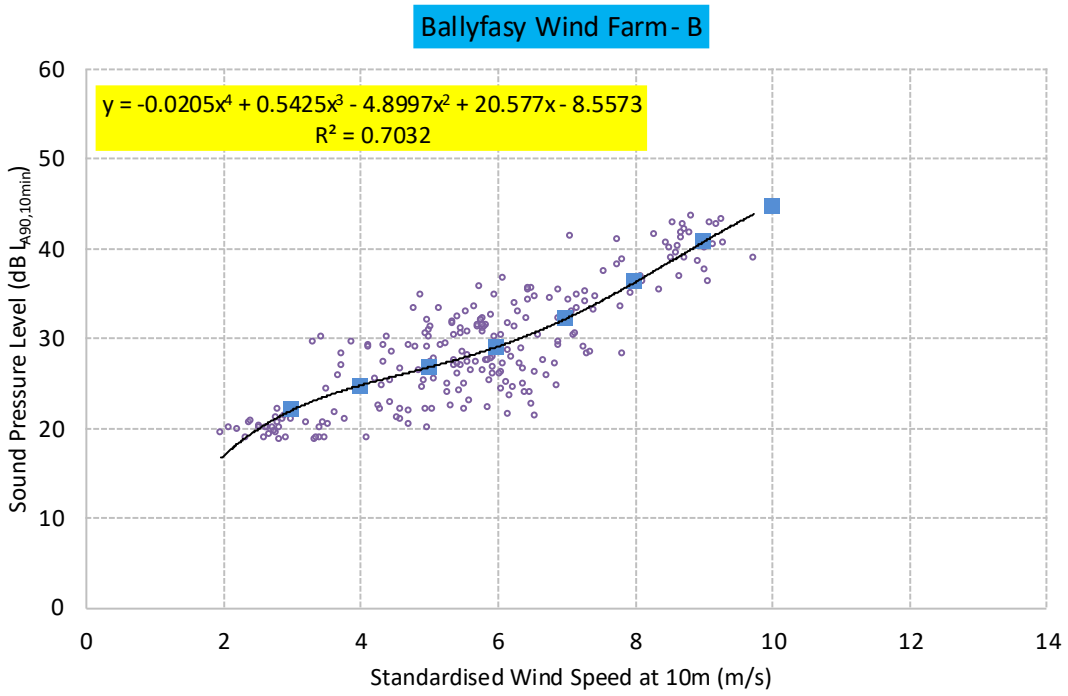
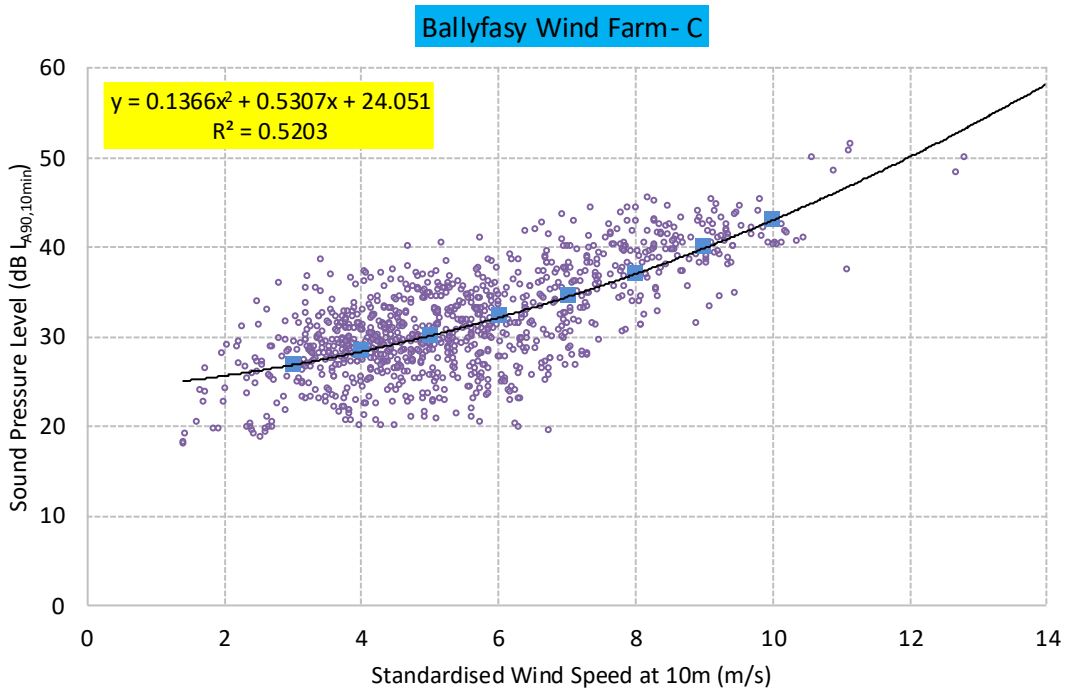
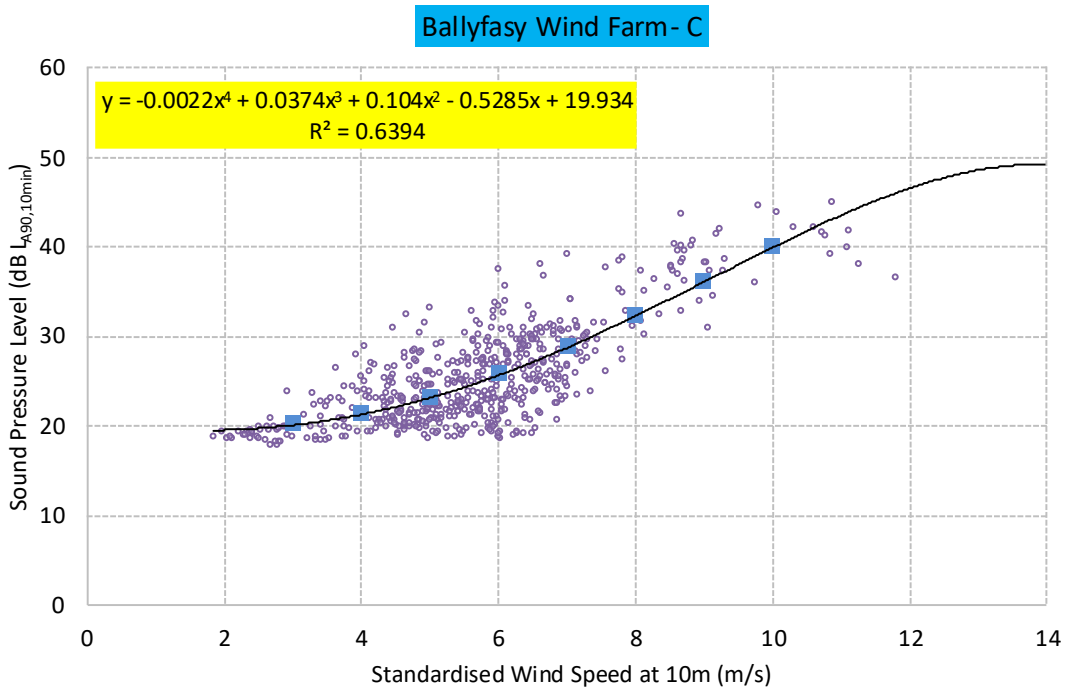


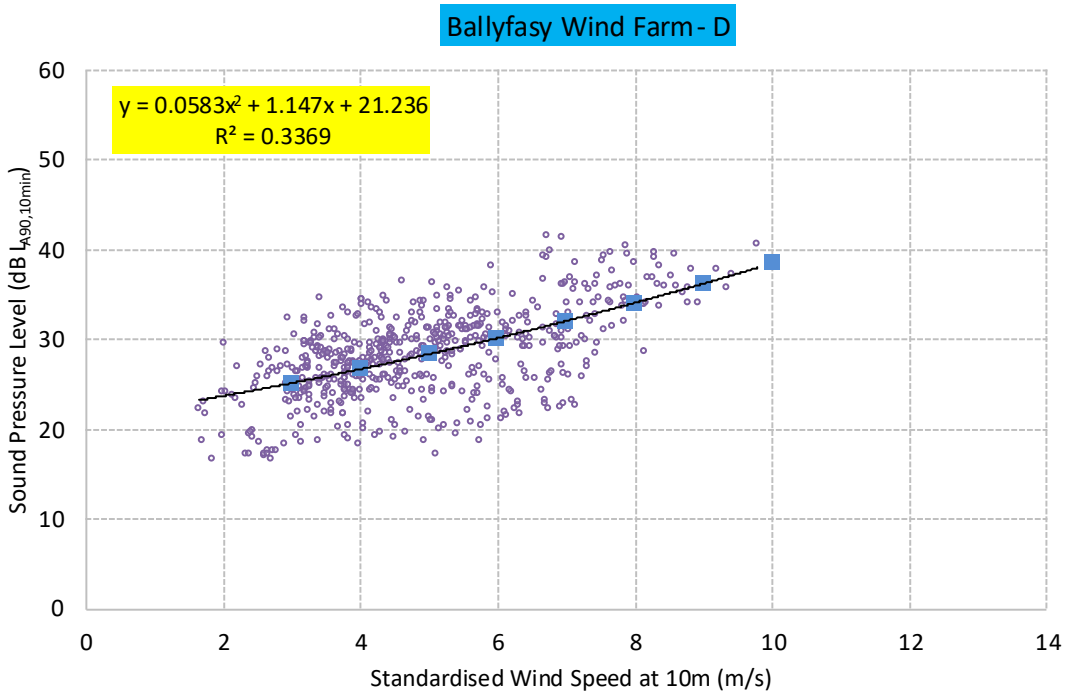

## Loc C Day



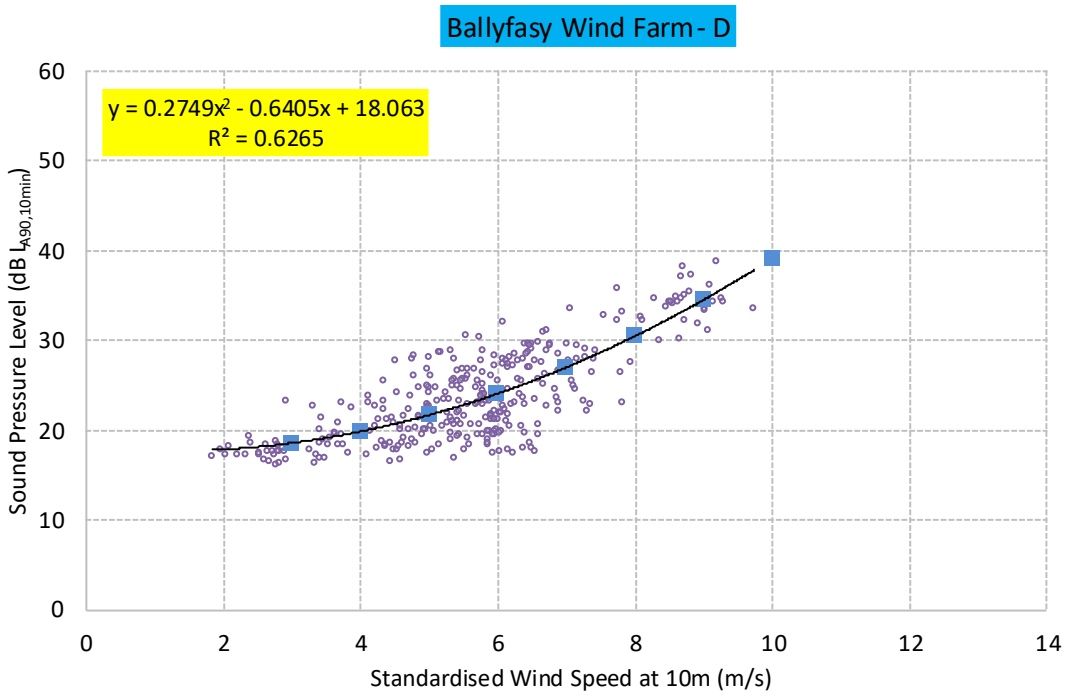
## Loc C Night



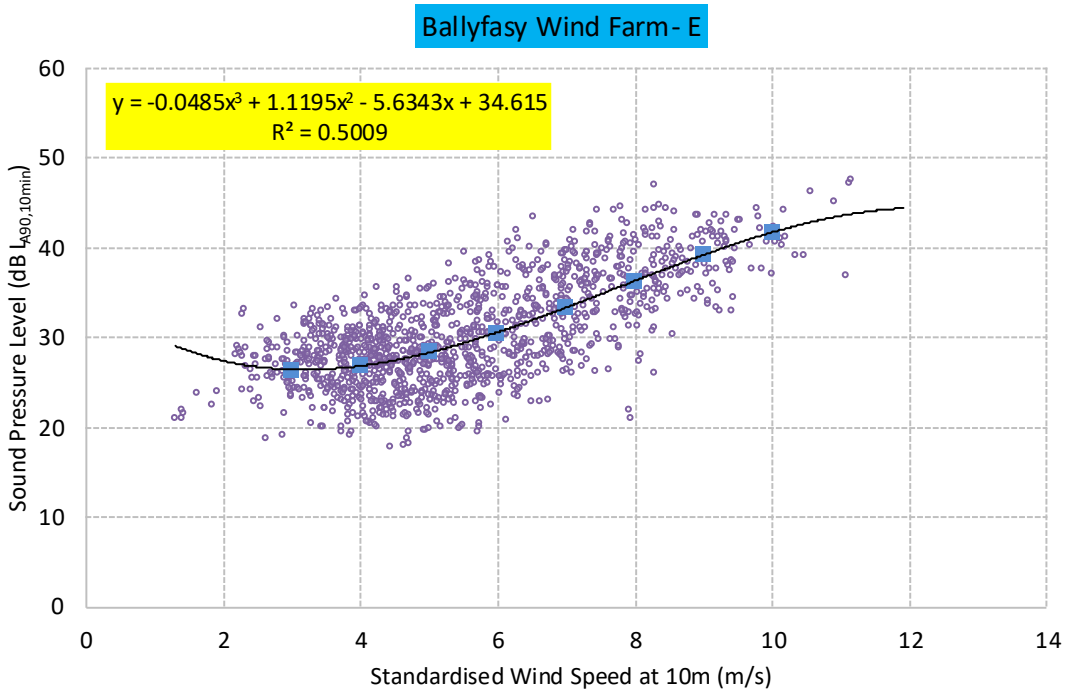

## Loc D Day



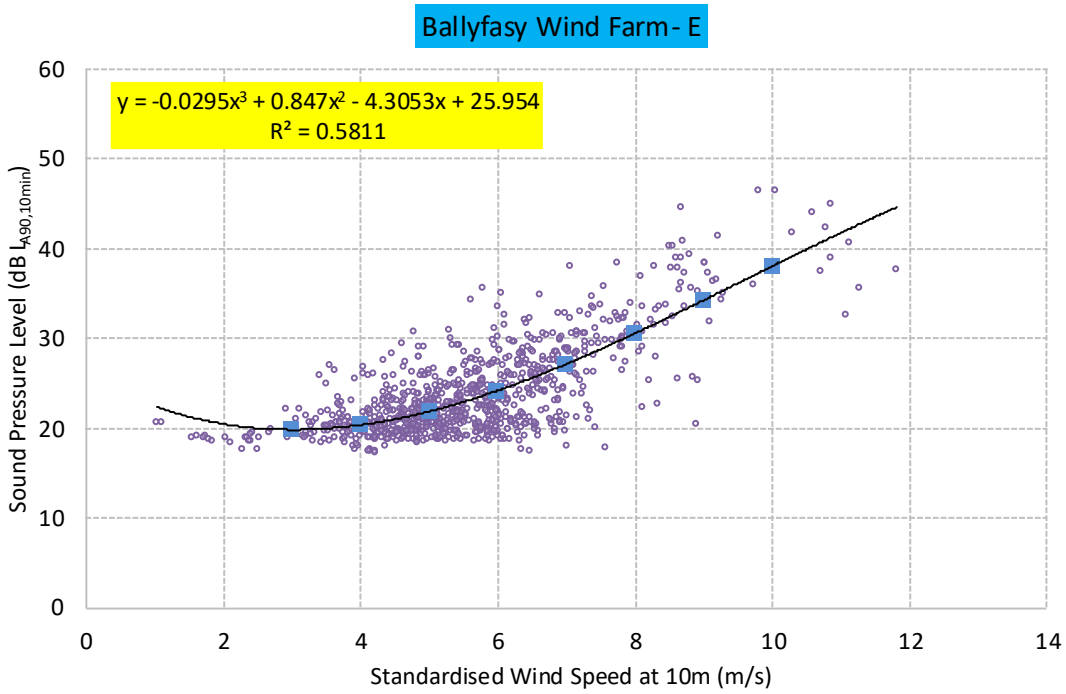
## Loc D Night



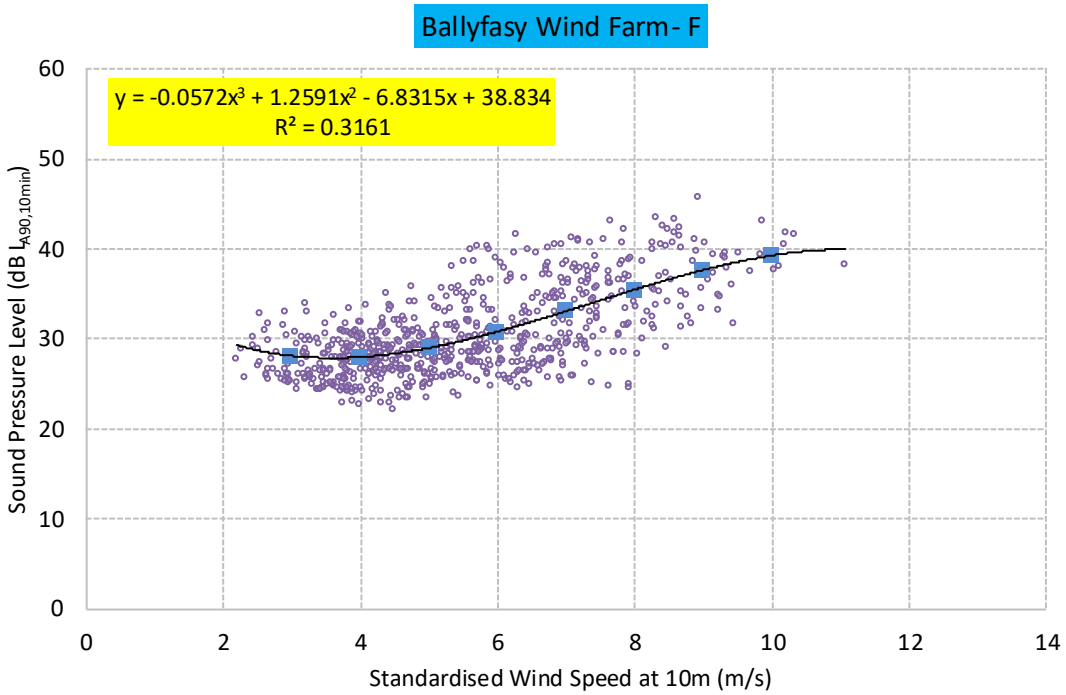

## Loc E Day



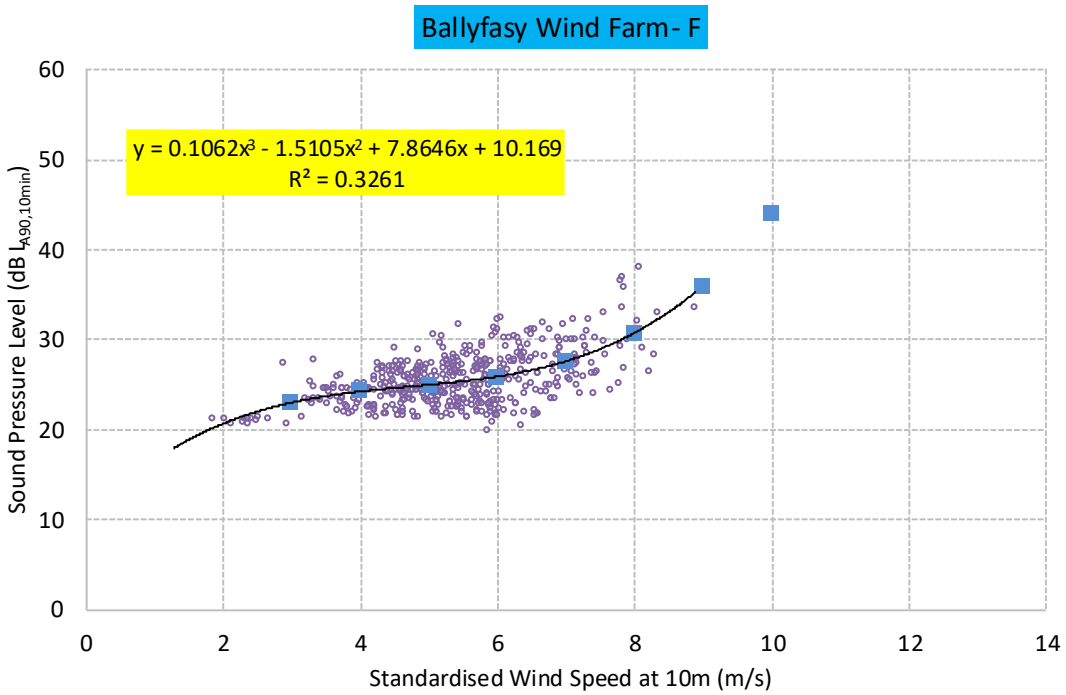
## Loc E Night




## Loc F Day



## Loc F Night


Ballyfasy Wind Farm- F
y = 0.1062x³ - 1.5105x² + 7.8646x + 10.169
R² = 0.3261
Sound Pressure Level (dB LA90,10min)
Standardised Wind Speed at 10m (m/s)
0
10
20
30
40
50
60
0
2
4
6
8
10
12
14