7 NOISE

7.1 Introduction

7.1.1 This Chapter of the EIA Report evaluates the effects of the Torrance Wind Farm Extension II (hereafter referred to as the 'Proposed Development') on the acoustic environment of the area around the Proposed Development. This assessment was undertaken by Arcus Consultancy Services Limited (Arcus), part of the ERM Group.

7.1.2 This Chapter is structured as follows:

- Legislation, policy and guidance;
- Scoping responses and consultation;
- Assessment methodology and significance criteria;
- Baseline conditions;
- Assessment of potential effects (including cumulative);
- Mitigation measures;
- Residual effects; and
- Summary.

7.1.3 This Chapter of the EIA Report is supported by the following figures provided in Volume 2: Figures:

- Figure 7.1: Construction Noise Assessment;
- Figure 7.2: Assessed Cumulative Developments; and
- Figure 7.3: Operational Noise Assessment.

7.1.4 This Chapter is supported by the following Technical Appendices provided in Volume 4:

- Appendix 7.1: Cumulative Sound Power Levels;
- Appendix 7.2: Baseline Noise Survey Records; and
- Appendix 7.3: Details of Construction Plant.

7.1.5 The following terms are used within this Chapter to describe the Proposed Development and various associated study areas:

- the Proposed Development: the whole physical process involved in the development of Torrance Wind Farm Extension II, including wind farm construction, operation and decommissioning (i.e. not a piece of land or an area);
- the Site Boundary: the red line or application boundary as shown in **Figures 7.1** and **7.2**;
- the Site: the land within the Site Boundary available for turbine development and associated wind farm infrastructure;
- Cumulative Assessment Study Area: the area defined by the orange shading within the dashed 30 decibel (dB(A)) contour line shown in **Figure 7.3** (See Section 7.4.29 for further details).

7.2 Legislation, Policy and Guidance

Legislation

7.2.1 The following legislation is of relevance to the noise aspects of the Proposed Development:

- The Control of Pollution Act 1974 (CoPA 1974)[1]; and
- The Environmental Protection Act 1990 (EPA 1990)[2].

The Control of Pollution Act 1974

7.2.2 CoPA 1974 provides Local Authorities with powers to control noise and vibration from construction sites.

7.2.3 Section 60 of the CoPA 1974 enables a Local Authority to serve a notice, on persons carrying out construction work, of its requirements for the control of site noise. This may specify plant or machinery that is or is not to be used, the hours during which construction work may be carried out, the level of noise or vibration that bay be emitted, and provide for changes in circumstances. Appeal procedures are available.

7.2.4 Section 61 of the CoPA 1974 allows for those carrying out construction work to apply to the Local Authority in advance for consent to carry out the works. This is not mandatory, but is often advantageous for the developer, as once consent is issued, the Local Authority is no longer able to act under Section 60 of CoPA 1974 or Section 80 of the EPA 1990, provided the works are carried out in accordance with the Section 61 consent. It does not, however, prevent nuisance action under Section 82 of the EPA 1990.

The Environmental Protection Act 1990

7.2.5 The EPA 1990 specifies mandatory powers available to Local Authorities in respect of any noise that either constitutes or is likely to cause a statutory nuisance, which is also defined in the CoPA 1974. A duty is imposed on Local Authorities to carry out inspections to identify statutory nuisances, and to serve abatement notices against these. Procedures are also specified with regards to complaints from persons affected by a statutory nuisance.

Policy and Guidance

7.2.6 The following is a summary of the key policy and guidance of relevance to this Chapter.

Construction Noise

7.2.7 Guidance relevant to the effects of noise and vibration during construction and decommissioning is provided by BS 5228:2009+A1:2014 (BS 5228)[3]. This standard:

- Is published in two parts: Part 1 – Noise; and Part 2 - Vibration;
- Refers to the need for the protection against noise and vibration of persons living and working in the vicinity of, and those working on construction and open sites.
- Recommends procedures for noise and vibration control in respect of construction operations.
- Stresses the importance of community relations, and states that early establishment and maintenance of these relations throughout site operations will go some way towards allaying people's concerns.

[1] UK Government (1974) The control of Pollution Act 1974, available at: http://www.legislation.gov.uk/ukpga/1974/40 (accessed 16/11/2022)
[2] UK Government (1990) The Environmental Protection Act 1990. Available at: http://www.legislation.gov.uk/ukpga/1990/43/contents (accessed 16/11/2022)
[3] BS 5228:2009+A1:2014 Code of Practice for noise and vibration control on construction and open sites – Part 1: Noise and Part 2: Vibration.

- Provides recommendations regarding the supervision, planning, preparation and execution of works, emphasising the need to consider noise at every stage of the operation.
- Describes methods of controlling noise at source and its spread.
- Includes a discussion of noise control targets, and example criteria for the assessment of the significance of noise effects.

Wind Turbine Operational Noise

7.2.8 The following guidance and information sources have been considered in the assessment of operational noise from the wind turbines:

- The Scottish Government's web-based planning information on onshore wind turbines[4].
- Planning Advice Note 1/2011 (PAN 1/2011): Planning and Noise[5].
- ETSU-R-97: The Assessment and Rating of Noise from Wind Farms[6].
- A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise[7].

The Scottish Government's web-based planning information on onshore wind turbines

7.2.9 The Scottish Government's web-based information provides advice to Local Authorities on the planning issues associated with wind farm development. With respect to noise from wind farms, it refers to ETSU-R-97: The Assessment and Rating of Noise from Wind Farm and the Institute of Acoustics' Good Practice Guide ('the GPG').

7.2.10 It goes on to refer to PAN 1/2011 as providing advice on the role of the planning system in helping to prevent and limit the adverse effects of noise, and states that the associated Technical Advice Note (TAN) provides guidance which may assist in the technical evaluation of a noise assessment.

7.2.11 PAN 1/2011 promotes the principles of good acoustic design and the appropriate location of new potentially noisy development. The TAN offers advice on the assessment of noise impact and includes details of the legislation, technical standards and codes of practice appropriate to specific noise issues. Appendix 1 of the TAN: Assessment of Noise describes the use of ETSU-R-97 in the assessment of wind turbine noise.

[4] Scottish Government (2014) Onshore Wind Turbines Planning Advice [Online] Available at: https://www.gov.scot/publications/onshore-wind-turbines-planning-advice/ (accessed 17/11/2022)
[5] The Scottish Government 2011 Planning Advice Note Pan 1/2011 Planning and Noise and accompanying Technical Advice Note, 2011. [Online] Available at: https://www.gov.scot/publications/planning-advice-note-1-2011-planning-noise/ (Accessed 17/11/2022)
[6] ETSU 1996, ETSU-R-97 The Assessment and Rating of Noise from Wind Turbines, ETSU for the DTI, 1996.
[7] A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise, IOA, 2013.

ETSU-R-97

7.2.12 ETSU-R-97 provides a framework for the assessment and rating of noise from wind turbine installations. It is the standard for wind farm developments in the UK, and the methodology has therefore been adopted for the present assessment.

7.2.13 Both background noise and noise from wind turbines typically vary with wind speed. According to ETSU-R-97, wind farm noise assessments should therefore consider the site-specific relationship between wind speed and background noise, along with the particular noise emission characteristics of the proposed wind turbines.

7.2.14 ETSU-R-97 specifies the use of the $L_{A90,10min}$ descriptor for both background and wind turbine noise. Therefore, unless otherwise specified, all references to noise levels within this Chapter relate to this descriptor. Similarly, all wind speeds referred to relate to a height of 10 metres (m) Above Ground Level (AGL) at the location of the Proposed Development, standardised in accordance with current good practice guidance.

7.2.15 The document recommends the application of external noise limits at the nearest noise sensitive properties, to protect outside amenity and prevent sleep disturbance inside dwellings. These limits take the form of a 5 dB margin above the prevailing background noise level, except where background noise levels are lower than certain thresholds, where fixed lower limits apply. Separate limits apply for daytime and night-time periods, as outlined below. The limits apply to the cumulative effects of all wind turbines that affect a particular location.

7.2.16 A 'simplified criterion' is also described which may be applicable where there are large separation distances between the proposed turbines and nearest noise-sensitive receptors. In such cases, a fixed limit of 35 dB, $L_{A90,10min}$ applies, without reference to background noise levels.

7.2.17 During daytime, the guidance specifies limits designed to protect the amenity of residents whilst within the external amenity areas of their properties. The limits are based on the prevailing background noise level for 'lower daytime' periods, defined in ESTU-R-97 as:

- 18:00 – 23:00 every day; plus
- 13:00 – 18:00 on Saturday; and
- 07:00 – 18:00 on Sundays.

7.2.18 ETSU-R-97 recommends that the fixed lower noise limit for daytime should be set within the range 35 to 40 dB, $L_{A90,10min}$, with choice of value dependent on the following factors:

- The number of dwellings in the neighbourhood of the Proposed Development;
- The effect of the noise limits on the number of kilo Watt hours (kWh) generated; and
- The duration and level of exposure.

7.2.19 Different standards apply at night, where potential sleep disturbance is the primary concern rather than the requirement to protect outdoor amenity. Night-time is considered to be all periods between 23:00 and 07:00. A limit of 43 dB(A) is recommended at night at wind speeds or locations where the prevailing wind speed related night-time background noise level is lower than

38 dB(A). At other times, the limit of 5 dB above the prevailing wind speed-related background noise level applies. The value of night-time fixed lower limit was selected in order to ensure that internal noise levels remained below those considered to have the potential to cause sleep disturbance, taking account of the attenuation of noise when passing from outdoors to indoors, and making allowance for the presence of open windows.

7.2.20 Where the occupier of the property has a financial interest in the development (otherwise known as being a Financially Involved property), ETSU-R-97 states that the fixed lower noise limit for both daytime and night-time can be increased to 45 dB(A) and that *"…consideration should be given to increasing the permissible margin above background"*.

The IOA Good Practice Guide

7.2.21 The GPG was published by the Institute of Acoustics (IOA) in May 2013 and has been endorsed by the Scottish Government as current industry good practice. The GPG is supported by a suite of six Supplementary Guidance Notes (SGNs), published in 2014. The guide presents good practice in the application of the ETSU-R-97 assessment methodology at various stages of the assessment process. The recommendations provided in the GPG been followed throughout this assessment.

7.2.22 The GPG provides advice on the assessment of cumulative noise impact, detailing a number of possible cumulative scenarios and recommended approaches. Advice is also provided with regard to the geographical scope of a cumulative noise assessment, to determine the area within which a cumulative noise assessment is necessary.

7.2.23 Where a new noise source is introduced to a given scenario with a noise level which is predicted to be 10 dB or more below the existing level, the increase in the total noise level is considered to be negligible. On this basis, the necessary extents of a cumulative noise assessment can be determined. Paragraph 5.1.4 of the GPG states:

"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".

7.2.24 As noted in ETSU-R-97, noise from existing wind turbines should not form part of the background noise level from which noise limits for new wind energy developments are derived.

Low-Frequency Noise, Infrasound, Amplitude Modulation and Vibration

Low Frequency Noise and Infrasound

7.2.25 A study[8], published in 2006 by acoustic consultants Hayes McKenzie on the behalf of the Department of Trade and Industry (DTI), investigated low frequency noise from wind farms. This study concluded that there is no evidence of health effects arising from either infrasound or low frequency noise generated by wind turbines, but that complaints attributed to low frequency noise were in fact, possibly due to a phenomenon known as Amplitude Modulation (AM).

7.2.26 In February 2013, the Environmental Protection Authority of South Australia published the results of a study into infrasound levels near wind farms[9]. This study measured infrasound levels at urban locations, rural locations with wind turbines close by, and rural locations with no wind turbines in the vicinity. It found that infrasound levels near wind farms are comparable to levels away from wind farms in both urban and rural locations. Infrasound levels were also measured during organised shut downs of the wind farms; the results showed that there was no noticeable difference in infrasound levels whether the turbines were active or inactive.

7.2.27 Bowdler et al. (2009)[10] 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".

Amplitude Modulation

7.2.28 A study[11] was carried out on behalf of the Department for Business, Enterprise and Regulatory Reform (BERR) by the University of Salford, which investigated the incidence of noise complaints associated with wind farms and whether these were associated with AM. This report defined AM as aerodynamic noise from wind turbines with a greater degree of fluctuation than normal at blade passing frequency. Its aims were to ascertain the prevalence of AM on UK wind farm sites, to try to gain a better understanding of the likely causes, and to establish whether further research into AM is required.

7.2.29 The study concluded that AM has occurred at only a small number of wind farms in the UK (4 of 133), and only for between 7% and 15% of the time. It also stated that the causes of AM are not well understood and that prediction of the effect is not currently possible.

7.2.30 This research was updated in 2013 by an in-depth study undertaken by Renewable UK[12], which identified that many of the previously suggested

[8] The measurement of low frequency noise at three UK wind farms, Hayes Mckenzie, The Department for Trade and Industry, URN 06/1412, 2006.
[9] Environment Protection authority (2013) Infrasound levels near wind farms and in other environments [online] Available at: http://www.epa.sa.gov.au/xstd_files/Noise/Report/infrasound.pdf (accessed 16/11/2022).
[10] 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.
[11] Research into aerodynamic modulation of wind turbine noise'. Report by University of Salford, The Department for Business, Enterprise and Regulatory Reform, URN 07/1235, July 2007.
[12] Renewable UK, 2013: Wind Turbine Amplitude Modulation: Research to Improve Understanding as to its Cause and Effects.

causes of AM have little or no association to the occurrence of AM in practice. The generation of AM is based upon the interaction of a number of factors, the combination and contributions of which are unique to each site. With the current knowledge, it is not possible to predict whether any particular site is more or less likely to give rise to AM, and the incidence of AM occurring at any particular site remains low, as identified in the University of Salford study.

7.2.31 In 2016, the IOA proposed a measurement technique[13] to quantify the level of AM present in any particular sample of wind farm noise. This technique is supported by a review commissioned by the Department of Business, Energy & Industrial Strategy (BEIS, formerly The Department of Energy & Climate Change)[14], which follows on from the conclusions of the IOA study in order to define an appropriate assessment method for AM, including a penalty scheme and an outline planning condition. Notwithstanding this, the suggested outline planning condition is as yet unvalidated, remains in a draft form and would require site-specific legal advice on its appropriateness to a specific development.

7.2.32 Section 7.2.1 of the GPG therefore remains current, stating:

"The evidence in relation to 'Excess' or 'Other' Amplitude Modulation (AM) is still developing. At the time of writing, current practice is not to assign a planning condition to deal with AM".

Vibration

7.2.33 Research undertaken by Snow[15] 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.

7.2.34 Ground-borne vibration from wind turbines can be detected using sophisticated instruments several kilometres from the wind farm site as reported by Keele University[16]. This report clearly shows that, although detectable using highly sensitive instruments, the magnitude of the vibration is orders of magnitude below the human level of perception and does not pose any risk to human health.

Conclusion

7.2.35 No specific assessments of low frequency noise, infrasound, AM or vibration from the operation of the turbines are considered necessary and are therefore not considered further.

7.3 Scoping Responses and Consultation

7.3.1 Throughout the scoping exercises, and subsequently during the ongoing EIA process, relevant organisations were contacted with regards to the Proposed Development. Table 7.1 outlines the consultation responses received in relation to noise.

[13] Institute of Acoustics, (2016) A Method for Rating Amplitude Modulation in Wind Turbine Noise.
[14] BEIS, (2016), Review of the evidence on the response to amplitude modulation from wind turbines.
[15] ETSU (1997), Low Frequency Noise and Vibrations Measurement at a Modern Wind Farm, prepared by D J Snow.
[16] Microseismic and infrasound monitoring of low frequency noise and vibrations from wind farms: recommendations on the siting of wind farms in the vicinity of Eskdalemuir, Scotland". Keele University, 2005.

Table 7.1: Scoping Responses and Consultation

Consultee	Details	Response	Where Addressed in EIA Report
North Lanarkshire Council (NLC)	Scoping Response - December 2020	The response noted a general agreement with the proposed assessment methodology and highlighted the choice of appropriate limits for low background noise levels and Cumulative noise and being key issues.	The measured background noise levels and derivation of noise limits are discussed in Section 7.5. Cumulative noise is an inherent part of wind farm operational noise assessment, as discussed in Section 7.6.
	Further Consultation with Environmental Health Officer (EHO) – October 2021 and June 2022	The EHO agreed to the proposed assessment methodology and requested that in addition to the use of assessment locations to represent key properties in populous areas, that all isolated properties within the Study Area should also be assessed.	A full list of the noise assessment locations considered in this assessment can be found in Table 7.13.
West Lothian Council (WLC)	Scoping Response – December 2020	The WLC and NLC Environmental Health authorities should be consulted regarding noise.	Noted.
	Further Consultation with Environmental Health Officer (EHO) – October 2021	No response received.	N/A

7.4 Assessment Methodology and Significance Criteria

Scope of Assessment

Construction Noise and Vibration Assessment Methodology

7.4.1 The assessment of construction noise has been limited to noise-sensitive receptors within 500 m of the construction works, as beyond this distance there is no reasonable prospect of a significant effect. Infrastructure elements within 500 m of noise-sensitive receptors include access tracks, the DNO Switchgear Building, hardstanding (e.g. turbine laydown areas), wind turbine foundations and the wind turbines. The construction noise assessment therefore considers noise generated by these elements, in addition to noise from on-Site haulage.

7.4.2 Haulage traffic movements are based on worst-case figures from Table 9.10 of Chapter 9: Traffic and Transport, which provides peak traffic movement figures during the delivery of aggregates used in the construction of the access tracks and hardstanding, which is a worst-case scenario. At other times noise from haulage is expected to be substantially lower.

Vibration

7.4.3 Ground-borne vibration is rapidly attenuated with distance; given the separation distances from construction activities to receptors (see Table 7.15 for details), there is no reasonable prospect of significant vibration effects from construction activities, and this has not been considered further in this Chapter.

Construction Traffic Noise on Public Roads

7.4.4 Noise from construction traffic on public roads has been assessed on the basis of the change in traffic noise levels due to the addition of traffic associated with construction of the Proposed Development. Projected baseline traffic flows for each location have been sourced from Table 9.8 in Chapter 9: Traffic and Transport. The percentage increases in traffic have then been used together with the number of vehicles, proportion of HGVs and likely speed (based on the type of road) to calculate the likely change in traffic noise level due to construction traffic for each month of the construction programme, using the method described in Calculation of Road Traffic Noise (CRTN)[17].

Construction Noise Significance Criteria

7.4.5 BS 5228 provides several example criteria for the assessment of the significance of noise effects from construction activities. Of those available, *"Example Method 2 – 5 dB(A) Change"* has been selected for the current assessment as it offers a slightly less complex procedure than Example Method 1 and is more in keeping with conventional EIA methodologies for noise than alternative methods provided, which relate to eligibility for noise insulation. Using this method, noise levels generated by construction activities are deemed to be significant if:

- The L_{Aeq} level of construction noise exceeds lower threshold values of 65 dB(A) during daytime (includes 0700 to 1300 Saturday)[18], 55 dB(A) during evenings and weekends[19] or 45 dB(A) at night[20]; and

[17] Calculation of Road Traffic Noise, Department of the Environment, 1988
[18] 0700-1900 weekdays, 0700-1300 Saturdays
[19] 1900-2300 weekdays, 1300-2300 Saturdays and 0700-2300 Sundays
[20] 2300-0700 every day

- The total noise level (pre-construction ambient noise plus construction noise) exceeds the pre-construction ambient noise level by 5 dB(A) or more for a period of one month or more.

7.4.6 Construction noise levels in excess of the threshold values that would occur for a period of one month or more are regarded as significant in terms of the EIA Regulations.

Construction Traffic Noise Significance Criteria

7.4.7 The magnitude of effects, in terms of the predicted change in traffic noise levels on public roads, expressed as $L_{A10,18hour}$ in accordance with CRTN, and based on criteria defined in DMRB[21] are defined as follows:

- Negligible: change of less than 1 dB;
- Minor: change of 1 to 3 dB;
- Moderate: change of 3 to 5 dB; and
- Major: change of 5 dB or more.

7.4.8 Effects of Moderate or Major magnitude are considered to be significant in terms of the EIA Regulations[22]. Effects of Negligible or Minor magnitude are considered to be not significant in terms of the EIA Regulations.

Operational Noise Assessment Methodology

7.4.9 Typically, the operational noise assessment process comprises the following steps:

i) Identification of potential receptors (typically residential dwellings).
ii) Measurement of prevailing, wind speed dependant background noise levels at nearby receptors.
iii) Establishment of limits for acceptable levels of wind turbine noise, based on the measured background noise levels and appropriate fixed lower limits.
iv) Prediction of the likely levels of wind turbine noise received at each receptor.
v) Comparison of the predicted levels with the noise limits.

7.4.10 The method of measuring background noise is described in ETSU-R-97, supported by the GPG. In brief, it involves continuous measurement of both background noise levels at a representative number of receptors, and wind speeds on the development site for a period of at least one week. The resulting data is then sorted into quiet daytime and night-time periods and the relationship between wind speed and background noise established for each location.

Selection of Wind Turbine Fixed Lower Noise Limits

7.4.11 As discussed at Section 7.2.15, the noise limits described in ETSU-R-97 are a combination of a 5 dB margin above the prevailing wind speed-dependent background noise level and fixed lower limits, applicable where background noise levels are low. These limits apply to cumulative effects. The daytime fixed lower noise limit is defined as a value within the range 35 to 40 dB.

7.4.12 With specific regard to this assessment, eight nearby cumulative

[21] Design Manual for Roads and Bridges, Highways Agency / Transport Scotland, Volume II Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 7 HD 213/11 , Noise and Vibration – Revision 1, November 2011, Table 3.1 – Classification of Magnitude of Noise Impacts in the Short Term
[22] Scottish Government (2017) Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 as amended.

developments have been consented with noise limits based on a daytime fixed lower limit of 35 dB (identified in Table 7.2). As a result, the existing cumulative daytime fixed lower limit is already greater than 35 dB at all assessed receptors, which therefore sets a precedent in this regard. For the purposes of this assessment, fixed lower limits of 40 dB, L_{A90} during daytime periods and 43 dB, L_{A90} during night-time periods are therefore considered appropriate for the assessment of cumulative noise levels.

7.4.13 Notwithstanding the above, the daytime apportioned noise limits for the Proposed Development in isolation are based on a fixed lower limit of 35 dB $L_{A90,10min}$, or 5 dB above background (the most stringent under ETSU R-97 methodology). Further detail is provided in Section 7.6.13.

7.4.14 In addition, it should be noted that due to the relatively high levels of background noise measured during the baseline survey, a margin of 5 dB above the prevailing background noise levels results in noise limits in excess of the fixed lower limits suggested in ETSU-R-97 at all locations at all wind speeds (see Table 7.14). The choice of fixed lower daytime limit therefore has no effect upon the noise limits in practice.

7.4.15 For receptors where the occupant is financially involved with the Proposed Development (detailed in Table 7.13), a higher fixed lower limit of 45 dB for daytime and night-time periods applies, in accordance with ETSU-R-97.

Noise Predictions

7.4.16 Noise predictions have been made using SoundPLAN software (v8.2), which implements the ISO 9613-2[23] methodology and takes account of the specific data and parameters recommended in the GPG, as summarised below:

- The turbine sound power levels should be stated and these should include an appropriate allowance for measurement uncertainty. If the data provided contains no allowance for measurement uncertainty, or uncertainties are not stated, an additional 2 dB should be included.
- Atmospheric absorption should be calculated based on conditions of 10°C and 70% relative humidity.
- The ground factor assumed should be G=0.5 (mixed ground) except in urban areas or where noise propagates across large bodies of water, where G=0 (hard ground) should be assumed.
- A receiver height of 4.0 m should be assumed.
- Barrier attenuation should not be included, unless there is no line of sight from the receptor, in which case a 2 dB barrier effect may be included.
- An additional 3 dB should be added to noise immission levels at properties located across a valley or with heavily concave ground between the receptor location and the wind turbine(s)[24].
- The predicted noise levels ($L_{Aeq,t}$) should be converted to the required $L_{A90,10min}$ by subtracting 2 dB.

7.4.17 ISO 9613-2 provides a prediction of noise levels likely to occur under worst-case conditions; those favourable to the propagation of sound, i.e. down-wind or under a moderate, ground-based temperature inversion as often occurs at night (often referred to as stable atmospheric conditions). The specific measures recommended in the GPG have been shown to provide good correlation with levels of wind turbine noise measured at operational

[23] ISO 9613-2:1996 Acoustics — Attenuation of sound during propagation outdoors — Part 2: General method of calculation.
[24] Equation to determine concave ground as presented in Section 4.3.9 of the GPG.

wind farms[25,26].

Cumulative Noise Assessment

7.4.18 ETSU-R-97 states that the assessment should take account of the effect of noise from all wind turbines that may affect a particular receptor. A screening exercise was conducted to identify any wind turbines either operational, consented, or proposed (i.e., the subject of a current planning application), considered to have the potential to result in cumulative noise impacts when assessed in conjunction with the Proposed Development. For the purposes of the noise assessment, cumulative wind developments within 5 km of the Proposed Development have been identified (the distance at which other developments are considered to have the potential to result in cumulative noise impacts). The identified cumulative developments are identified in Table 7.2.

Table 7.2: Cumulative Developments

Development Name	Planning Reference	Status	No. of Turbines
Blairmains Farm 1*	11/00147/FUL	Operational	2
Blairmains Farm 2	13/01820/FUL	Operational	2
Brownhill Farm*	20/00504/FUL	Consented	2
Burnhead Wind Farm*	20/00504/FUL	Operational	13
Cowdenhead	LIVE/0146/FUL/13	Operational	2
Drumduff	0138/FUL/14	Operational	3
Drumelzie	LIVE/0154/FUL/15	Consented	1
Forrestfield	15/01411/FUL	Consented	4
Hill of Harthill*	14/00232/FUL	Operational	1
Knowehead Farm 1*	11/01098/FUL	Operational	1
Knowehead Farm 2	14/00649/FUL	Operational	1
Shotts Golf Club	14/01495/FUL	Operational	1
Southrigg 1	14/02112/FUL	Operational	1
Southrigg 2*	19/00644/FUL	Consented	1
Tippethill Farm	LIVE/0635/FUL/13	Operational	1
Torrance Farm*	10/00973/FUL	Operational	3
Torrance Farm Extension*	12/00284/FUL	Operational	2
West Benhar	13/01377/FUL	Under Construction	8
Wester Hassockrig	11/00741/FUL	Operational	1
*Developments with consented noise limits based on a daytime fixed lower limit of 35 dB.			

7.4.19 The relevant data applied in this assessment for the cumulative wind farms is detailed in Appendix A7.1.

7.4.20 Cumulative noise effects have been addressed through the derivation of apportioned noise limits (see Section 7.6.12). The result is the remaining

[25] Bullmore et al. (2009). Wind Farm Noise Predictions and Comparison with Measurements, Third International Meeting on Wind Turbine Noise, Aalborg, Denmark 17 – 19 June 2009.
[26] Cooper & Evans (2013). Effects of different meteorological conditions on wind turbine noise.

noise budget available to the Proposed Development.

7.4.21 The method of predicting windfarm noise levels is described in the GPG as discussed in Section 7.4.16. This method has been applied to all operational noise predictions within this Chapter of the EIA Report.

Wind Turbine Noise Significance Criteria

7.4.22 The acceptable limits for wind turbine operational noise are clearly defined in ETSU-R-97. Therefore, this assessment determines whether the calculated immission levels at nearby noise sensitive properties lie below the noise limits derived in accordance with ETSU-R-97. Where the noise immission levels at noise-sensitive receptors are shown to be below derived noise limits, the effect is considered to be not significant in terms of The Electricity Works (EIA) (Scotland) Regulations 2017[27].

7.4.23 As such, the approach to assessment followed in other technical chapters within this EIA Report is not applicable to the effects of wind turbine noise, and effects are not considered in terms of their magnitude and the sensitivity of receptors as these factors are implicit in the limits defined by ETSU-R-97.

Decommissioning

7.4.24 Noise produced during decommissioning of the Proposed Development is likely to be of a similar nature to that during construction, although the duration of decommissioning will be shorter than that of construction. It is considered that the conclusions of the construction noise assessment will be relevant to decommissioning noise also, and that a separate assessment is unnecessary. Any legislation, guidance or good practice relevant at the time of decommissioning would be complied with.

Elements Scoped Out of Assessment

7.4.25 The following elements have been scoped out of the assessment for reasons described in previous sections of this Chapter:

- Construction noise due to sources greater than 500 m from receptors;
- Decommissioning noise;
- Low frequency noise;
- Infrasound;
- Amplitude Modulation; and
- Vibration.

Study Area

Construction Noise

7.4.26 The Study Area for the construction noise assessment is 500 m from any development infrastructure.

Operational Noise

7.4.27 The GPG states that cumulative assessment is required in areas where the difference in predicted noise levels between the Proposed Development and other wind energy developments is less than 10 dB.

7.4.28 Based upon the above, it follows that where noise levels from the Proposed

[27] Scottish Government (2017) Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017
available at: https://www.legislation.gov.uk/ssi/2017/101/regulation/1/made (Accessed 16/11/2022)

Development are at least 10 dB below the cumulative noise limits, there is no potential for the cumulative noise limits to be exceeded as a result of the Proposed Development. Therefore, where predicted noise levels for the Proposed Development are at least 10 dB below the cumulative noise limit, there is no potential for the limit to be exceeded as a result of the Proposed Development.

7.4.29 Figure 7.3 shows the area within which the predicted noise from the Proposed Development is 30 dB (10 dB below the lowest cumulative noise limit level of 40 dB) or greater, and where noise from the Proposed Development is predicted to be within 10 dB of the other cumulative wind farms. A cumulative assessment is therefore required for receptors within the regions where these areas overlap (referred to as the Study Area).

7.4.30 Due to the large number of receptors located within the cumulative assessment area, a representative selection of the noise sensitive receptors have been chosen for assessment. These assessment locations are detailed in Table 7.13.

Design Parameters

7.4.31 The GPG notes that most sites at planning stage will not have selected a preferred turbine, therefore a candidate turbine representative of a range of turbines should be selected to provide appropriate source noise levels. Once noise levels have been predicted at the potentially affected properties, compliance with noise limits can be assessed and design advice provided if compliance with the limits is considered unlikely.

7.4.32 The Siemens-Gamesa SG 6.6-170 wind turbine with a hub height of 120.9 m[28] has been selected as the candidate turbine for this assessment. This assessment assumes the turbines operate at full power (mode AM 0) at all times. The manufacturer's data is provided at hub height and has been adjusted to a standardised 10 m height. The manufacturer's data excludes any margin for uncertainty; in line with the GPG, an additional 2 dB has therefore been included in the sound power levels in this assessment, as detailed in Table 7.3.

Table 7.3: Manufacturer's Noise Emission Data[29] – Siemens-Gamesa SG 6.6-170 wind turbine - 120.9 m Hub Height

	Standardised 10 m Wind Speed, ms-[1]								
	4	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
	Sound Power Level, dB(A)								
Sound Power Level, dB LWA, Mode 0	97.9	103.0	105.8	106.0	106.0	106.0	106.0	106.0	106.0
Sound Power Level, dB, LWA, inc. 2 dB allowance for uncertainty	99.9	105.0	107.8	108.0	108.0	108.0	108.0	108.0	108.0

[28] Hub height chosen as a worst-case height for the wind turbine design envelope.
[29] Siemens-Gamesa (2020), SG 6.0-170 Standard Acoustic Emission, Rev. 0, AM0-M7, IEC Ed.3, D2359593/002

7.4.33 The octave-band frequency spectrum at the wind speed for which the maximum sound power level is achieved (8 ms^{-1}) is detailed in Table 7.4.

Table 7.4: Octave-band Spectra[30] – Siemens-Gamesa SG 6.6-170 wind turbine - 120.9 m Hub Height

	Standardised 10 m Wind Speed, ms^{-1}							
	63	125	250	500	1000	2000	4000	8000
	Sound Power Level, dB(A)							
Sound Power Level, dB, LWA, Scaled to 108 dB(A)	89.5	96.3	98.5	99.5	102.7	102.4	97.9	86.1

Assessment Limitations

7.4.34 Baseline noise monitoring locations were selected to provide a conservative representation of the background noise levels in the local area and corrected to account for the influence of existing wind turbines, following advice contained within the GPG.

7.4.35 Background noise measurements were obtained during the baseline noise survey for the full range of wind speeds required by the GPG for both daytime and night-time periods, after exclusions were considered. Wind speeds were measured at a range of heights, including 105 m and 120 m, and standardised from a hub height of 120.9 m to a height of 10 m in accordance with the GPG.

7.4.36 The background noise survey was undertaken in the presence of operational cumulative wind turbines; however, this has been accounted for by undertaking a 'background noise correction' on the measured data (i.e. subtracting predicted operational noise levels from measured noise levels). Information on this is provided in Section 7.5.13.

7.4.37 It is therefore concluded that no significant assessment limitations exist.

Embedded Mitigation

7.4.38 Operational noise was a key factor in the design of the turbine layout. Each layout iteration was modelled to determine its noise impact, and the effects on the energy output of the Proposed Development on any noise mitigation measured that may be required. Through this iterative process, the layout design was optimised to ensure that the Proposed Development could operate efficiently within appropriate noise limits.

7.5 Baseline Conditions

Construction Noise

7.5.1 Figure 7.1 shows the location of potentially noise-sensitive properties in relation to the construction of the Proposed Development. Due to the number of properties within 500 m of the site infrastructure, a number of construction

[30] Siemens-Gamesa (2020), SG 6.0-170 Standard Acoustic Emission, Rev. 0, AM0-M7, IEC Ed.3, D2359593/002

noise receptors have been selected to represent all noise-sensitive receptors located within 500 m of the site infrastructure. These receptors are detailed in Table 7.5.

Table 7.5: Construction Noise Receptors

Property Name	Easting	Northing
Hill of Harthill	289453	665403
Netherton Farm	290745	665303
59 Edinburgh Road	289315	664222
54 Howburn Road	289782	664543
51 Miller Street	290228	664596
64 Westcraigs Road	290624	664754
79 Polkemmet Drive	291185	664805

Operational Noise

Receptor Identification

7.5.2 Potential operational noise-sensitive receptors have been identified using Ordnance Survey (OS) MasterMap AddressBase, a database which combines the locations of buildings and other features from large-scale digital mapping with the Royal Mail's address database, along with aerial photography and site visits. Of the identified receptors located within the study area, a representative selection has been assessed. Providing the assessed receptors are shown to be compliant with the requirements of ETSU-R-97, receptors located further from the Proposed Development would also comply.

Baseline Noise Survey

7.5.3 Six properties were identified for the purposes of baseline noise monitoring (presented in Table 7.6) and agreed in consultation with the North Lanarkshire Council EHO. Background noise monitoring was carried out at these locations, in accordance with ETSU-R-97 and the GPG. The following specific measures ensured this compliance:

- Type 1[31] measuring equipment (Rion NL-52) was used, which was calibrated at the start of the survey and at each site visit. No significant calibration drift occurred (i.e. no more than 0.5 dB);
- Noise monitoring equipment was equipped with specially-designed, dual-layer windshields manufactured by Rion, which have been confirmed by the supplier as being suitable for use in elevated wind speeds and meeting the requirements of the GPG;
- Measurements were performed at a height of 1.4 m AGL, in free-field conditions (i.e. a minimum of 3.5 m from any reflective surface other than the ground);
- Background noise levels were recorded at continuous 10-minute intervals, as $L_{A90,10min}$;
- During the survey, wind speeds were measured using SoDAR remote sensing equipment at a range of heights. Measurements taken at 105 m and 120 m were used to calculate standardised 10 m wind speeds for the worst-case hub height of 120.9 m, following the procedure described in Section 2.6 of the GPG;

[31] As defined in BS EN 06651:1994 Specification for Sound Level Meters

- Logging rain gauges were deployed at Hill Farm, Netherton Farm and 6 Argyll Court;
- Any periods of elevated background noise levels which were not considered representative of the location were identified and excluded from analysis; and
- The GPG recommends at least 200 valid data points in each quiet daytime and night time period for each monitoring location, after exclusions are taken into account. This was exceeded at all monitoring locations.

7.5.4 Noise monitoring commenced at Hill Farm, Craigholm Farm, and Netherton Farm on the 23rd of February 2022, and at 95 Edinburgh Road, 24 Miller Street and 6 Argyll Court on the 24th of February 2022. Noise monitoring concluded at all locations on the 17th of March 2022.

7.5.5 Table 7.6 provides details of the baseline noise monitoring locations. Survey record sheets and calibration certificates for noise and wind monitoring equipment used during the survey are included in Appendix A7.2.

Table 7.6: Baseline Noise Monitoring Locations

Location Name	Easting	Northing	Description of Location
Hill of Harthill Farm	289424	665409	In the garden to the (west) side of the property, shielded from prevailing wind to some extent by trees.
Craigholm Farm	290113	665987	In the garden to the rear (west) of property, on the far side of the property to the operational Torrance turbines.
Netherton Farm	290779	665263	In the garden to the front (south) of the property, screened from operational Torrance turbines by the house.
95 Edinburgh Road	289178	664185	In the garden to the rear (south) of the property, screened from M8 road noise by the houses.
24 Miller Street	290457	664682	In the garden to the rear (north) of the property, towards the M8.
6 Argyll Court	290529	664122	In the garden to the rear (south west) of the property. This location was chosen to represent properties to the south of the Proposed Development located away from the M8 motorway, where noise levels are anticipated to be lower.

7.5.7 The background noise data were analysed according to the following process:

- Synchronisation of measured noise level ($L_{A90,10min}$), 10 m standardised wind speed, wind direction and rainfall data, correcting for differences in the timestamp averaging period (i.e. start or end of the 10-minute period) and daylight savings time (GMT/BST) for each.
- Exclusion of any 10-minute periods where rainfall was recorded, (including the preceding 10-minute period), and any other atypical periods judged to have been affected by rainfall (referred to in Chart 7.1 to Chart 7.12 'additional exclusions').
- Elimination of any periods where the sound level meters recorded 'over-range' measurements as these are likely to be associated with short-duration, high intensity noise events or sources, such as machinery which may not be typical of the background noise environment.
- Exclusion of any data points which were considered 'outliers' relative to the overall dataset, located above the resulting polynomial trendline.
- Sorting of data into 'quiet daytime' and night-time periods, as defined in ETSU-R-97.
- Preparation of an X-Y scatter plot of measured noise levels against standardised 10 m wind speed for quiet daytime and night-time periods.
- Application of a polynomial trendline to the plot, using Microsoft Excel's 'Trendline' function. In all cases, the use of third order polynomial trendlines was considered most appropriate.
- Determination of the prevailing background noise levels from the trendline curves.

Background Noise Levels

7.5.8 Chart 7.1 to Chart 7.12 detail the results of the background noise data analysis for each location, for quiet daytime and night periods, as defined in ETSU-R-97.

7.5.9 At high wind speeds, where insufficient data was available in a wind speed 'bin'[32], the background noise level is set equal to the last value where sufficient valid data was available. At low wind speeds where the trendline values are greater than those at higher wind speeds, the background noise level is set equal to the lowest value on the trendline. In each of these scenarios, the background noise level is 'flat-lined' in order to take a conservative approach by ensuring that background noise levels are not unnecessarily elevated. The 'flat-lined' values are referred to on the following charts as *'Assumed Prevailing Background Noise'*.

[32] Each 1 m/s wind speed bin is equal to the integer value +/- 0.5 dB. For example, the 6 m/s wind speed bin covers the range of 5.50 m/s to 6.49 m/s.

Chart 7.1: Quiet Daytime – Hill of Harthill Farm

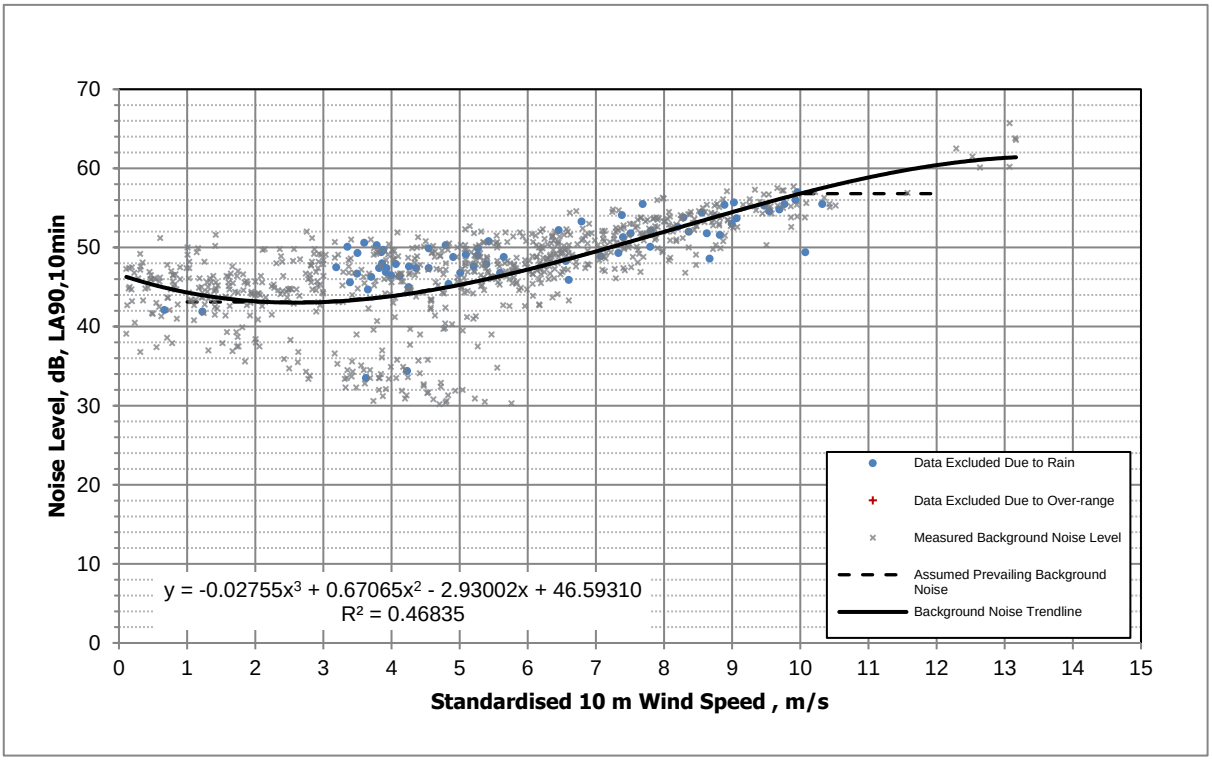


Chart 7.2: Night-time – Hill of Harthill Farm

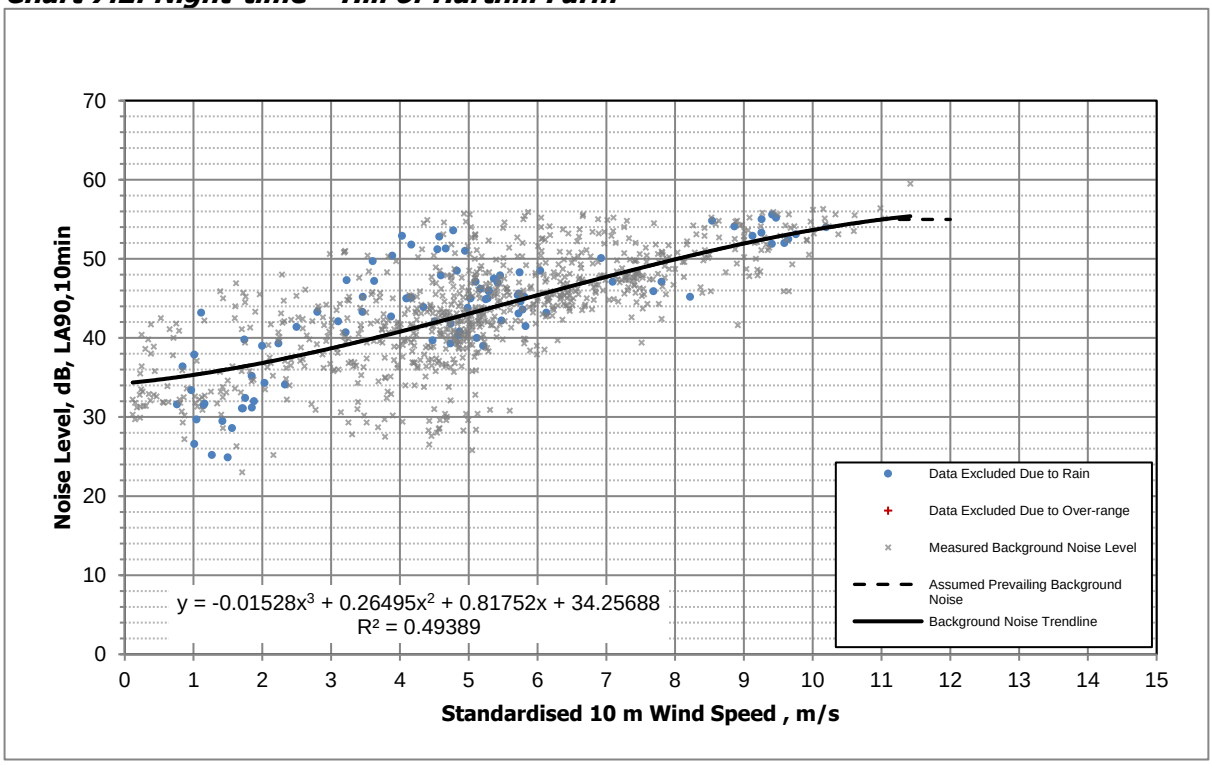


Chart 7.3: Quiet Daytime – Craigholm Farm

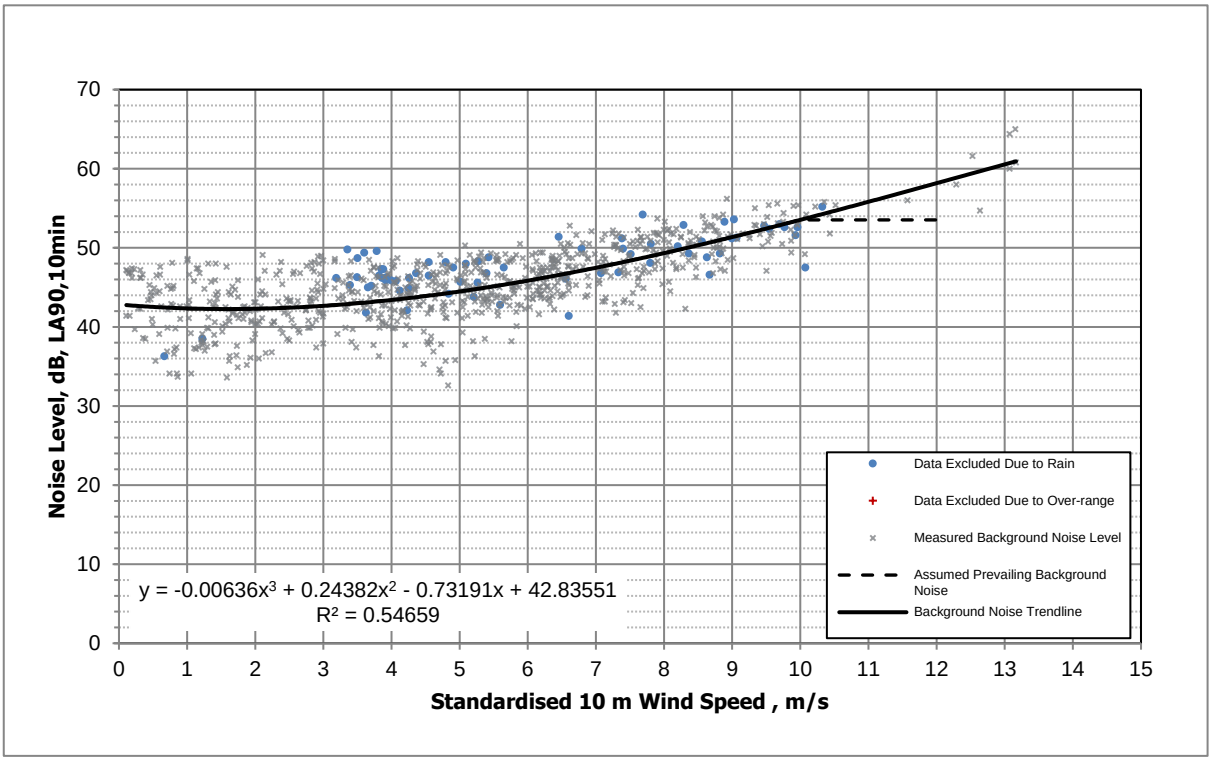


Chart 7.4: Night-time – Craigholm Farm

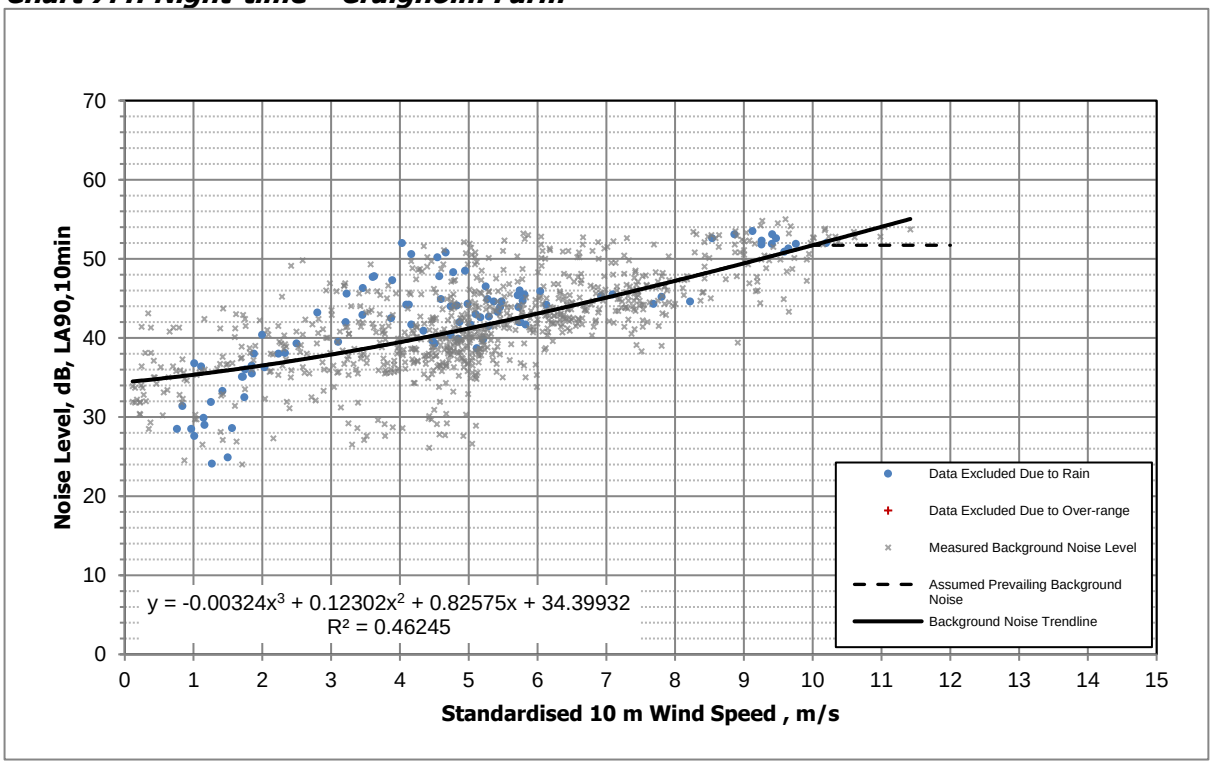


Chart 7.5: Quiet Daytime – Netherton Farm

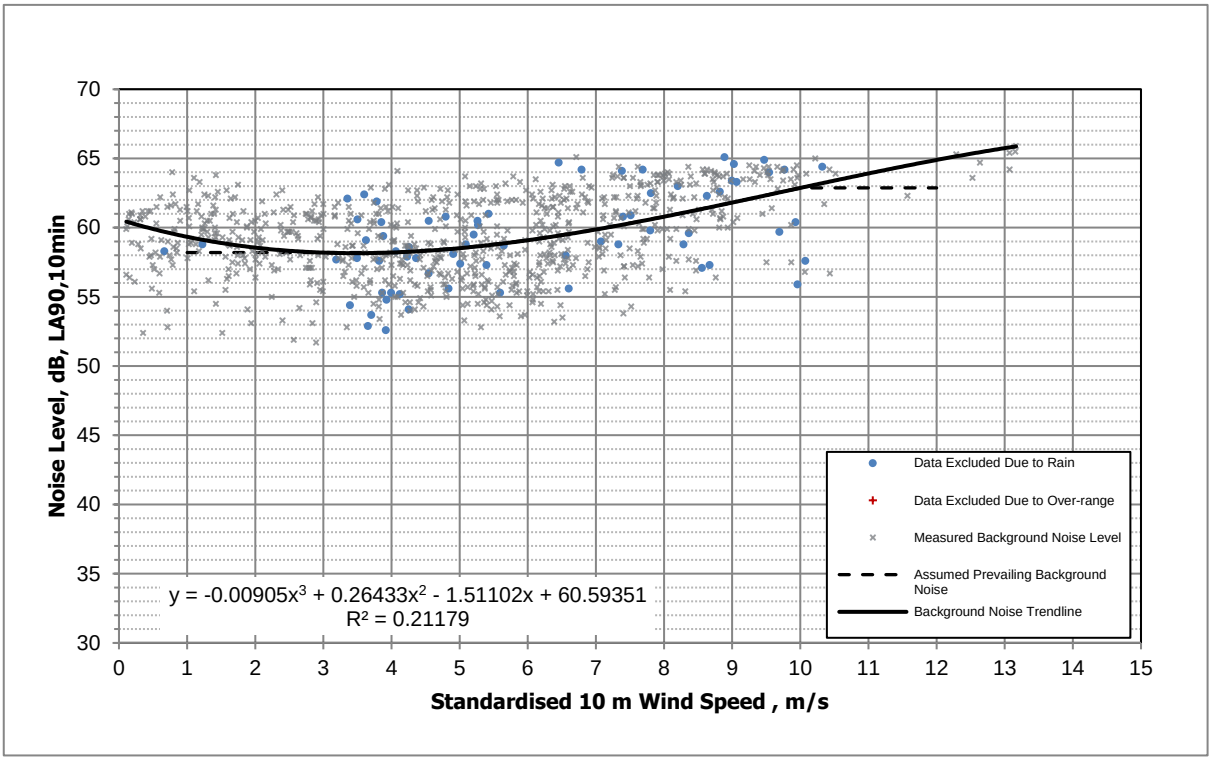


Chart 7.6: Night-time – Netherton Farm

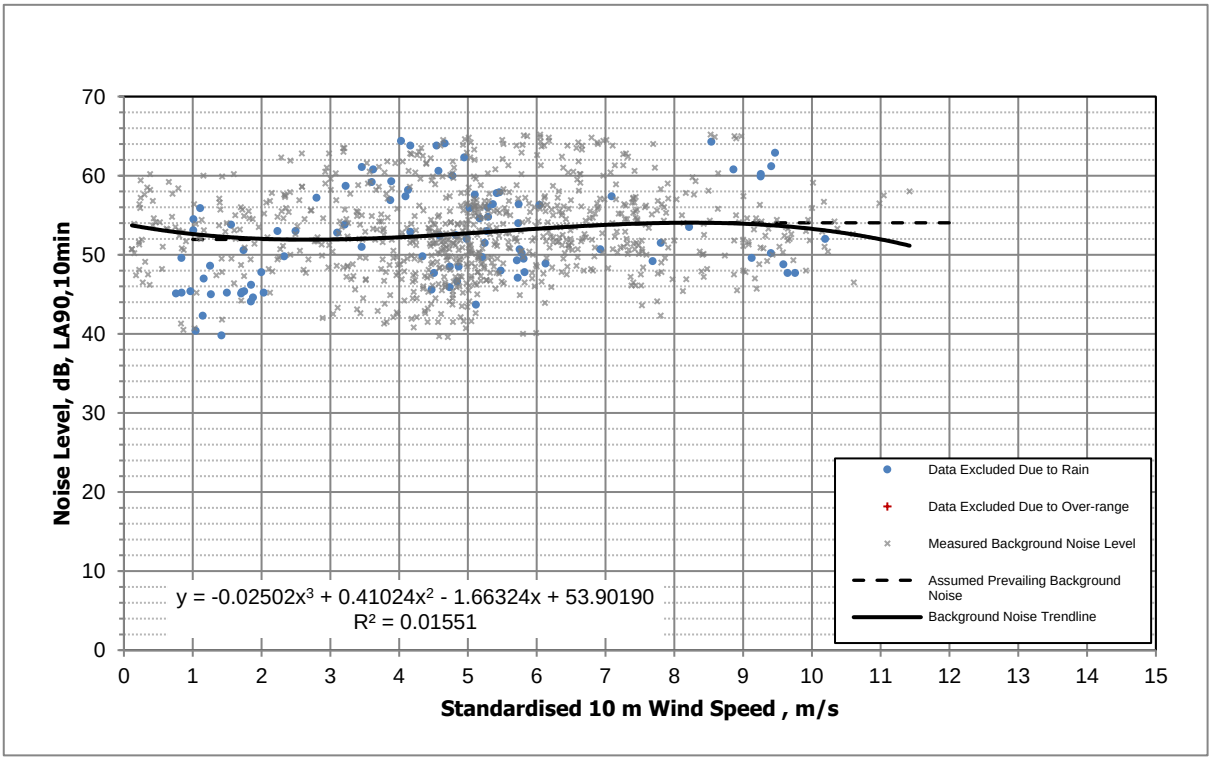


Chart 7.7: Quiet Daytime – 95 Edinburgh Road

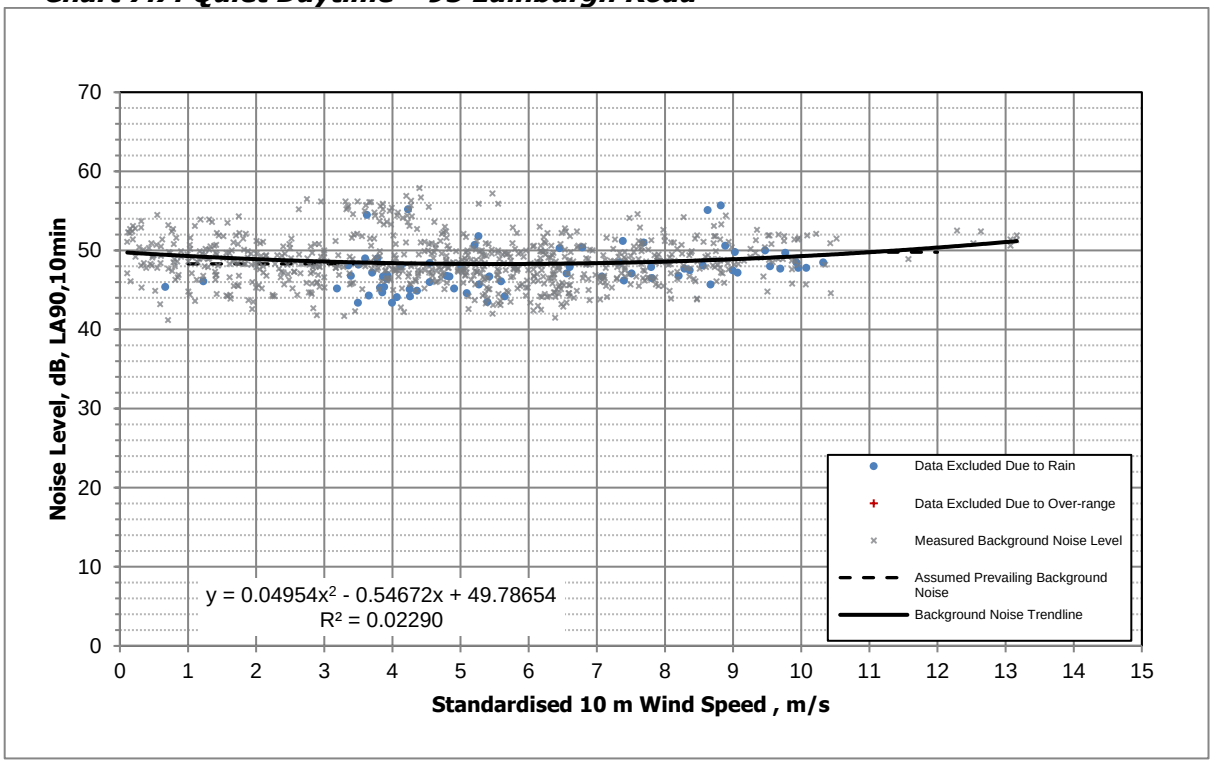


Chart 7.8: Night-time – 95 Edinburgh Road

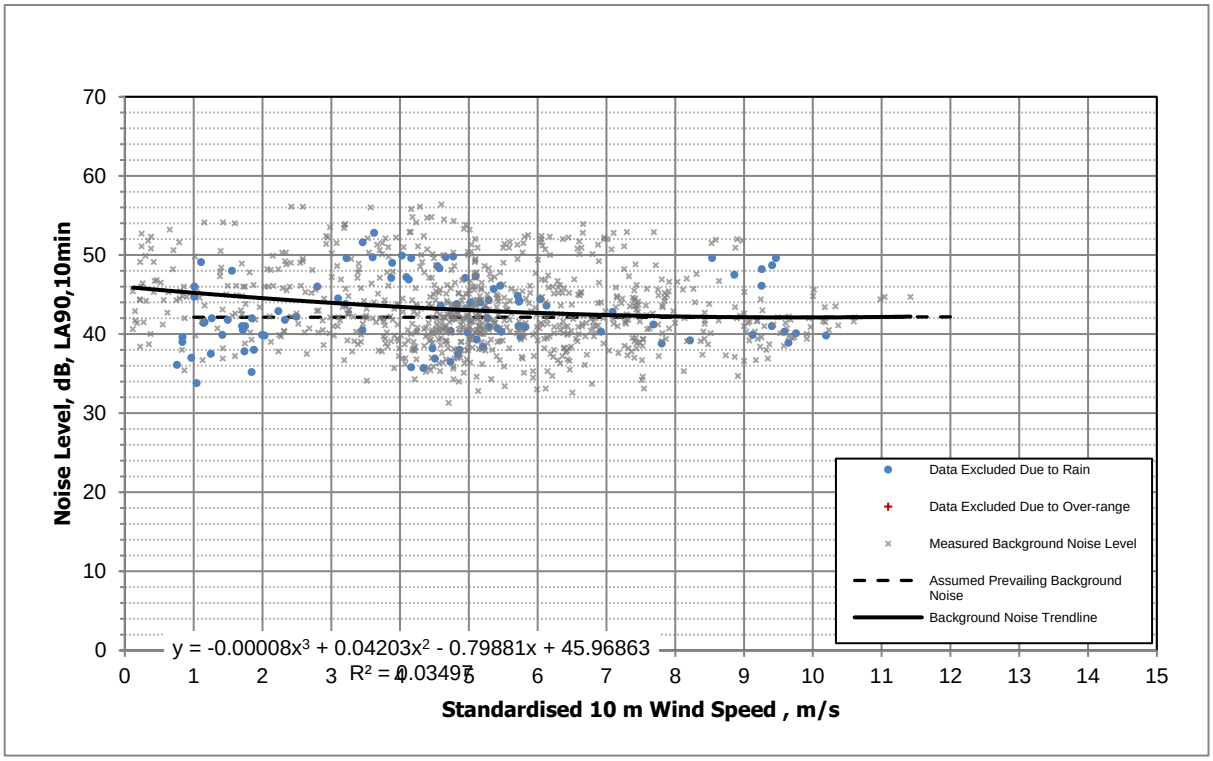


Chart 7.9: Quiet Daytime – 24 Miller Street

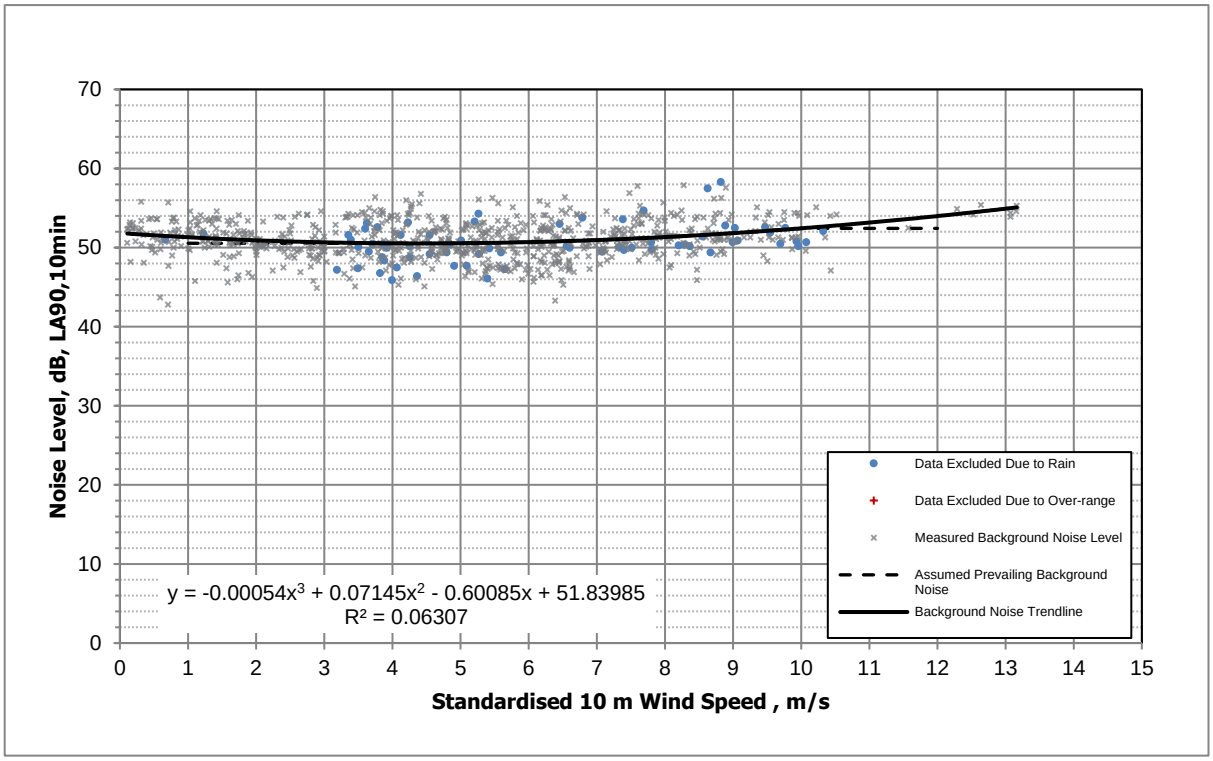


Chart 7.10: Night-time – 24 Miller Street

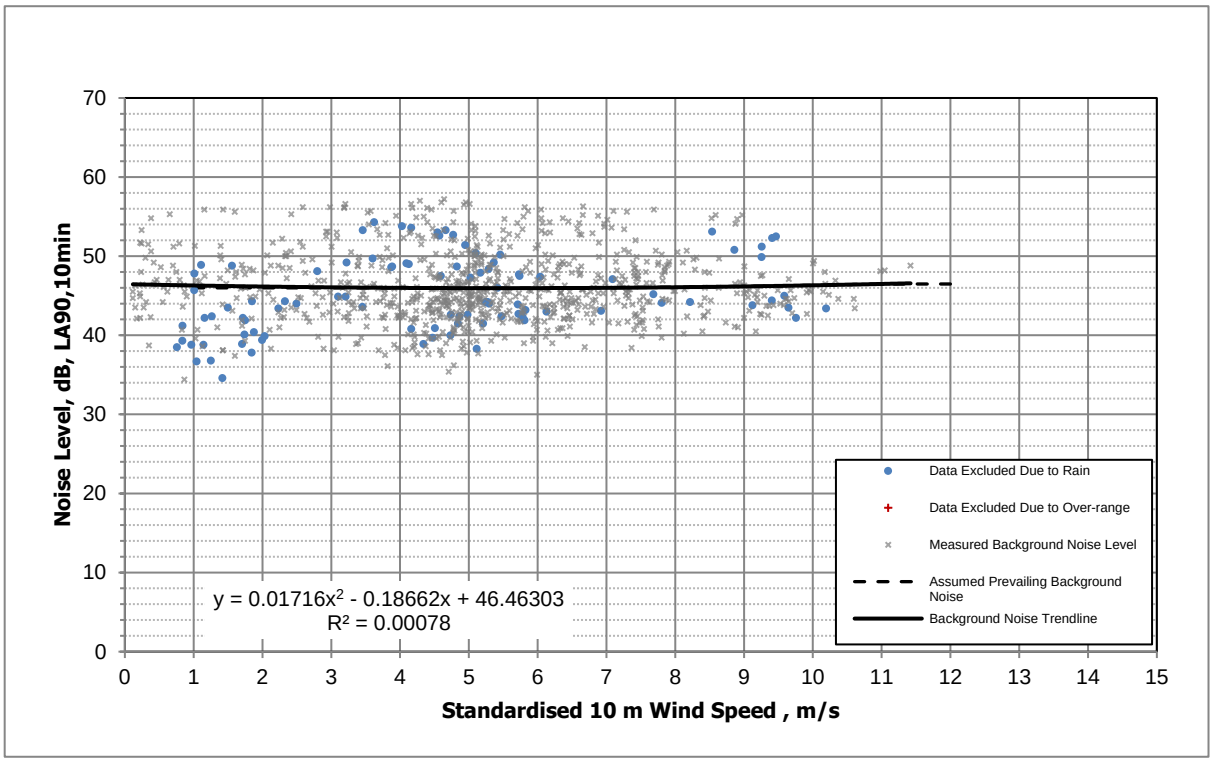


Chart 7.11: Quiet Daytime – 6 Argyll Court

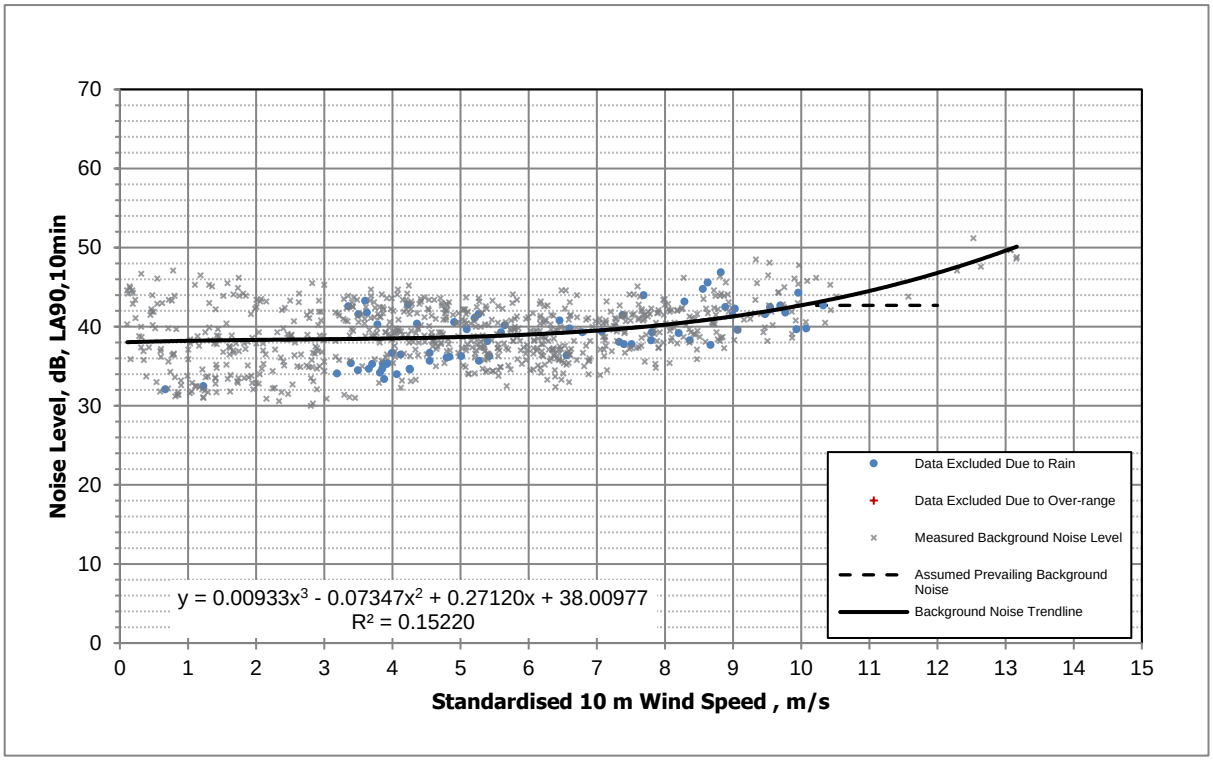
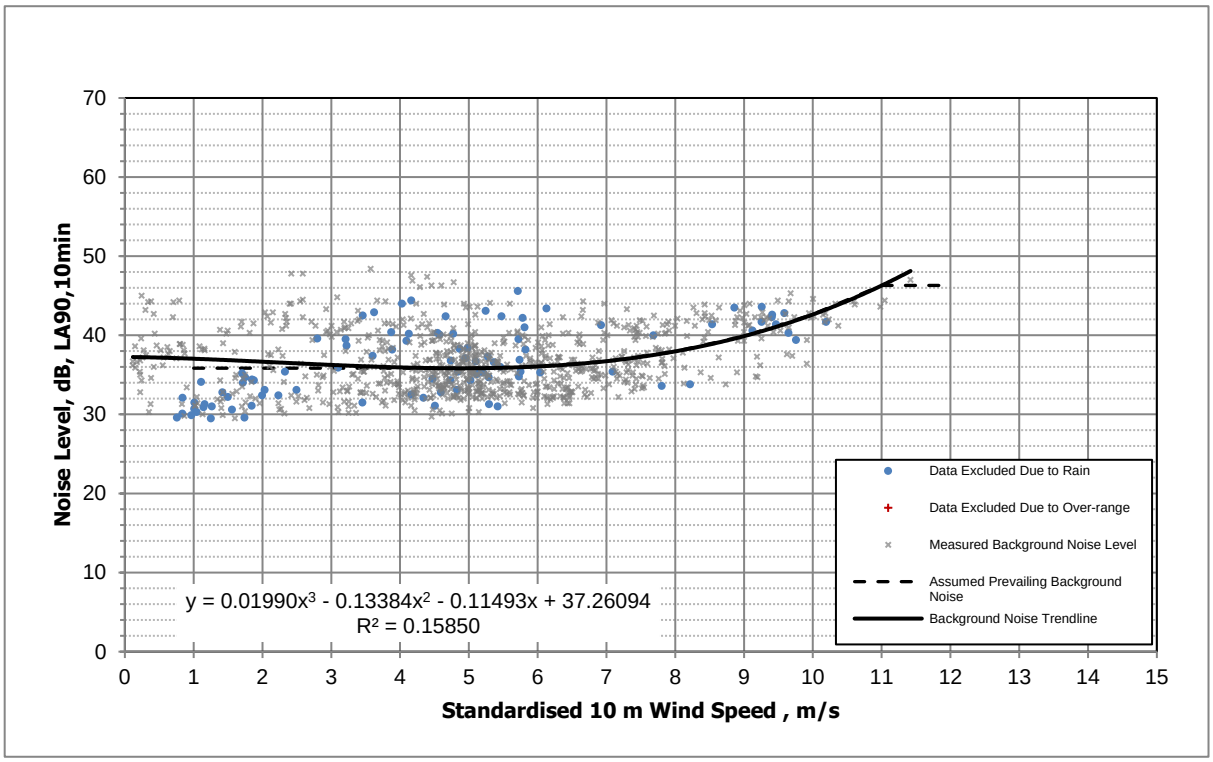


Chart 7.12: Night-time – 6 Argyll Court



7.5.10 Following analysis, the resulting charts were found to show a good correlation between noise level and wind speed at most measurement locations, with the

exception of 95 Edinburgh Road and 24 Miller Street; these receptors are located adjacent to the M8 motorway, with background noise levels dominated by road traffic. However, as road traffic noise is a permanent fixture of the local environment, the measured background noise levels are considered representative.

Correction for Operational Turbines

7.5.11 It is a key principle of the ETSU-R-97 methodology that noise from operational wind turbines should not be regarded as a component of background noise. Therefore, in order to ensure all contributions from existing wind turbines were fully excluded, the existing level of wind turbine noise at each noise monitoring location was predicted through noise modelling and used to correct the measured background levels.

7.5.12 Noise levels due to the existing operational scenario at the time of the baseline monitoring (i.e. noise due to the developments noted as operational in Table 7.2) were calculated in accordance with the GPG, following the procedure described in Section 7.4.16. Details of the noise emission data for the operational wind farms are presented in Appendix A7.1.

7.5.13 The predicted operational cumulative noise levels were then logarithmically subtracted from the measured background noise levels. Table 7.7 to Table 7.12 detail this process for the datasets captured at all six baseline noise monitoring locations, for daytime and night-time periods. The corrected background noise levels, highlighted in bold, were then used to derive the cumulative ETSU-R-97 limits, as presented in Table 7.14.

Table 7.7: Prevailing Background Noise Levels - Hill of Harthill Farm

	Standardised 10 m Wind Speed, ms-^{1}								
	4	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
	Prevailing Background Noise Level, dB, $L_{A90,10min}$								
Quiet Daytime									
Measured Background Level	43.8	45.3	47.2	49.5	52.0	54.5	56.8	56.8	56.8
Existing Turbine Noise Level	24.3	29.6	35.3	37.4	38.1	38.6	39.3	39.3	39.3
Corrected Background Level	**43.8**	**45.1**	**46.9**	**49.2**	**51.8**	**54.3**	**56.7**	**56.7**	**56.7**
Night-time									
Measured Background Level	40.8	43.1	45.4	47.7	49.9	51.9	53.6	55.0	55.0
Existing Turbine Noise Level	24.3	29.6	35.3	37.4	38.1	38.6	39.3	39.3	39.3
Corrected Background Level	**40.7**	**42.9**	**45.0**	**47.3**	**49.6**	**51.7**	**53.5**	**54.9**	**54.9**

Table 7.8: Prevailing Background Noise Levels – Craigholm Farm

	Standardised 10 m Wind Speed, ms-1								
	4	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
	Prevailing Background Noise Level, dB, $L_{A90,10min}$								
Quiet Daytime									
Measured Background Level	43.4	44.5	45.8	47.5	49.3	51.4	53.5	53.5	53.5
Existing Turbine Noise Level	30.5	35.4	40.5	42.7	42.8	42.9	43.0	43.0	43.0
Corrected Background Level	**43.2**	**43.9**	**44.3**	**45.7**	**48.2**	**50.7**	**53.1**	**53.1**	**53.1**
Night-time									
Measured Background Level	39.5	41.2	43.1	45.1	47.2	49.4	51.7	51.7	51.7
Existing Turbine Noise Level	30.5	35.4	40.5	42.7	42.8	42.9	43.0	43.0	43.0
Corrected Background Level	**38.9**	**39.9**	**40.1**	**42.1**	**45.3**	**48.3**	**51.1**	**51.1**	**51.1**

Table 7.9: Prevailing Background Noise Levels – Netherton Farm

	Standardised 10 m Wind Speed, ms-1								
	4	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
	Prevailing Background Noise Level, dB, $L_{A90,10min}$								
Quiet Daytime									
Measured Background Level	58.2	58.5	59.1	59.9	60.8	61.8	62.9	62.9	62.9
Existing Turbine Noise Level	32.3	37.1	42.2	44.4	44.5	44.6	44.7	44.7	44.7
Corrected Background Level	**58.2**	**58.5**	**59.0**	**59.7**	**60.7**	**61.7**	**62.8**	**62.8**	**62.8**
Night-time									
Measured Background Level	52.2	52.7	53.3	53.8	54.0	54.0	54.0	54.0	54.0
Existing Turbine Noise Level	32.3	37.1	42.2	44.4	44.5	44.6	44.7	44.7	44.7
Corrected Background Level	**52.2**	**52.6**	**52.9**	**53.2**	**53.5**	**53.5**	**53.5**	**53.5**	**53.5**

Table 7.10: Prevailing Background Noise Levels – 95 Edinburgh Road

	Standardised 10 m Wind Speed, ms-1								
	4	5	6	7	8	9	10	11	12
	Prevailing Background Noise Level, dB, $L_{A90,10min}$								
Quiet Daytime									
Measured Background Level	48.3	48.3	48.3	48.4	48.6	48.9	49.3	49.8	49.8
Existing Turbine Noise Level	20.1	25.7	32.2	34.4	35.4	36.1	37.0	37.0	37.0
Corrected Background Level	**48.3**	**48.3**	**48.2**	**48.2**	**48.4**	**48.6**	**49.0**	**49.5**	**49.5**
Night-time									
Measured Background Level	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.2	42.2
Existing Turbine Noise Level	20.1	25.7	32.2	34.4	35.4	36.1	37.0	37.0	37.0
Corrected Background Level	**42.1**	**42.0**	**41.7**	**41.3**	**41.1**	**40.9**	**40.5**	**40.6**	**40.6**

Table 7.11: Prevailing Background Noise Levels – 24 Miller Street

	Standardised 10 m Wind Speed, ms-1								
	4	5	6	7	8	9	10	11	12
	Prevailing Background Noise Level, dB, $L_{A90,10min}$								
Quiet Daytime									
Measured Background Level	50.5	50.6	50.7	50.9	51.3	51.8	52.4	52.4	52.4
Existing Turbine Noise Level	26.0	30.9	36.0	38.2	38.4	38.6	38.8	38.8	38.8
Corrected Background Level	**50.5**	**50.5**	**50.5**	**50.7**	**51.1**	**51.6**	**52.2**	**52.2**	**52.2**
Night-time									
Measured Background Level	46.0	46.0	46.0	46.0	46.1	46.2	46.3	46.5	46.5
Existing Turbine Noise Level	26.0	30.9	36.0	38.2	38.4	38.6	38.8	38.8	38.8
Corrected Background Level	**45.9**	**45.8**	**45.5**	**45.2**	**45.3**	**45.3**	**45.5**	**45.7**	**45.7**

Table 7.12: Prevailing Background Noise Levels – 6 Argyll Court

	Standardised 10 m Wind Speed, ms-1								
	4	5	6	7	8	9	10	11	12
	Prevailing Background Noise Level, dB, $L_{A90,10min}$								
Quiet Daytime									
Measured Background Level	38.5	38.7	39.0	39.5	40.3	41.3	42.7	42.7	42.7
Existing Turbine Noise Level	23.1	28.5	33.3	35.5	35.8	36.1	36.3	36.3	36.3
Corrected Background Level	**38.4**	**38.3**	**37.6**	**37.3**	**38.3**	**39.7**	**41.6**	**41.6**	**41.6**
Night-time									
Measured Background Level	35.8	35.8	36.1	36.7	38.0	39.9	42.6	46.3	46.3
Existing Turbine Noise Level	23.1	28.5	33.3	35.5	35.8	36.1	36.3	36.3	36.3
Corrected Background Level	**35.6**	**34.9**	**33.1**	**33.7**	**35.0**	**37.5**	**41.5**	**45.8**	**45.8**

Assessed Receptors

7.5.14 The assessed receptors are a representative selection of those located within the study area identified in Figure 7.2. For each of these receptors, Table 7.13 details the source of the respective background noise levels, from which the cumulative noise limits are derived, along with the Financial Involvement of the receptors.

Table 7.13: Assessed Receptors

Receptor Name	Easting	Northing	Source of Background Noise Data	Financially Involved with the Proposed Development?
54 Howburn Road	289782	664543	95 Edinburgh Road	No
59 Edinburgh Road	289315	664222	95 Edinburgh Road	No
Bankhead Cottage	288628	664176	95 Edinburgh Road	No
Treesbank Farm	288481	664403	95 Edinburgh Road	No
Hill of Harthill Farm	289453	665403	Hill of Harthill Farm	Yes
51 Miller Street	290228	664596	24 Miller Street	No
79 Polkemmet Drive	291185	664805	24 Miller Street	No
64 Westcraigs Road	290624	664754	24 Miller Street	No
6 Argyll Court	290534	664137	6 Argyll Court	No
Craigholm Farm	290166	665992	Craigholm Farm	Yes
Netherton Farm	290745	665303	Netherton Farm	Yes
72 Harthill Road	290034	666292	Craigholm Farm	No
Bogend	288370	666015	Hill of Harthill Farm	No
Forrestburn Cottage	287762	665336	Hill of Harthill Farm	No
16 Hirst Road	288091	663997	95 Edinburgh Road	No

Receptor Name	Easting	Northing	Source of Background Noise Data	Financially Involved with the Proposed Development?
2 Summerlee Cottages	288956	663473	6 Argyll Court	No
13 Station Road	289798	666704	Craigholm Farm	No
5 Bedlormie Drive	289148	666858	Craigholm Farm	No

Cumulative Noise Limits

7.5.15 Table 7.14 details the ETSU-R-97 cumulative noise limits for each assessed receptor. It is from these limits that apportioned noise limits applicable to the Proposed Development are derived.

Table 7.14: Cumulative Noise Limits

Receptor Name	Standardised 10 m Wind Speed, ms-1								
	4	5	6	7	8	9	10	11	12
	Cumulative Noise Limit, dB, $L_{A90,10min}$								
Daytime									
54 Howburn Road	53.3	53.3	53.2	53.2	53.4	53.6	54.0	54.5	54.5
59 Edinburgh Road	53.3	53.3	53.2	53.2	53.4	53.6	54.0	54.5	54.5
Bankhead Cottage	53.3	53.3	53.2	53.2	53.4	53.6	54.0	54.5	54.5
Treesbank Farm	53.3	53.3	53.2	53.2	53.4	53.6	54.0	54.5	54.5
Hill of Harthill Farm	48.8	50.1	51.9	54.2	56.8	59.3	61.7	61.7	61.7
51 Miller Street	55.5	55.5	55.5	55.7	56.1	56.6	57.2	57.2	57.2
79 Polkemmet Drive	55.5	55.5	55.5	55.7	56.1	56.6	57.2	57.2	57.2
64 Westcraigs Road	55.5	55.5	55.5	55.7	56.1	56.6	57.2	57.2	57.2
6 Argyll Court	43.4	43.3	42.6	42.3	43.3	44.7	46.6	46.6	46.6
Craigholm Farm	48.2	48.9	49.3	50.7	53.2	55.7	58.1	58.1	58.1
Netherton Farm	63.2	63.5	64.0	64.7	65.7	66.7	67.8	67.8	67.8
72 Harthill Road	48.2	48.9	49.3	50.7	53.2	55.7	58.1	58.1	58.1
Bogend	48.8	50.1	51.9	54.2	56.8	59.3	61.7	61.7	61.7
Forrestburn Cottage	48.8	50.1	51.9	54.2	56.8	59.3	61.7	61.7	61.7
16 Hirst Road	53.3	53.3	53.2	53.2	53.4	53.6	54.0	54.5	54.5
2 Summerlee Cottages	43.4	43.3	42.6	42.3	43.3	44.7	46.6	46.6	46.6

Receptor Name	Standardised 10 m Wind Speed, ms-1								
	4	5	6	7	8	9	10	11	12
	Cumulative Noise Limit, dB, $L_{A90,10min}$								
13 Station Road	48.2	48.9	49.3	50.7	53.2	55.7	58.1	58.1	58.1
5 Bedlormie Drive	48.2	48.9	49.3	50.7	53.2	55.7	58.1	58.1	58.1
Night-time									
54 Howburn Road	47.1	47.0	46.7	46.3	46.1	45.9	45.5	45.6	45.6
59 Edinburgh Road	47.1	47.0	46.7	46.3	46.1	45.9	45.5	45.6	45.6
Bankhead Cottage	47.1	47.0	46.7	46.3	46.1	45.9	45.5	45.6	45.6
Treesbank Farm	47.1	47.0	46.7	46.3	46.1	45.9	45.5	45.6	45.6
Hill of Harthill Farm	45.7	47.9	50.0	52.3	54.6	56.7	58.5	59.9	59.9
51 Miller Street	50.9	50.8	50.5	50.2	50.3	50.3	50.5	50.7	50.7
79 Polkemmet Drive	50.9	50.8	50.5	50.2	50.3	50.3	50.5	50.7	50.7
64 Westcraigs Road	50.9	50.8	50.5	50.2	50.3	50.3	50.5	50.7	50.7
6 Argyll Court	43.0	43.0	43.0	43.0	43.0	43.0	46.5	50.8	50.8
Craigholm Farm	45.0	45.0	45.1	47.1	50.3	53.3	56.1	56.1	56.1
Netherton Farm	57.2	57.6	57.9	58.2	58.5	58.5	58.5	58.5	58.5
72 Harthill Road	43.9	44.9	45.1	47.1	50.3	53.3	56.1	56.1	56.1
Bogend	45.7	47.9	50.0	52.3	54.6	56.7	58.5	59.9	59.9
Forrestburn Cottage	45.7	47.9	50.0	52.3	54.6	56.7	58.5	59.9	59.9
16 Hirst Road	47.1	47.0	46.7	46.3	46.1	45.9	45.5	45.6	45.6
2 Summerlee Cottages	43.0	43.0	43.0	43.0	43.0	43.0	46.5	50.8	50.8
13 Station Road	43.9	44.9	45.1	47.1	50.3	53.3	56.1	56.1	56.1
5 Bedlormie Drive	43.9	44.9	45.1	47.1	50.3	53.3	56.1	56.1	56.1

7.6 Assessment of Potential Effects

Construction Noise – Site Infrastructure

7.6.1 Table 7.15 details the distance between the closest noise-sensitive receptors and each construction activity occurring within 500 m of the receptor. It should be noted that the majority of receptors are located more than 500 m from works other than access track construction (e.g. turbine foundations and turbine construction); these receptors have therefore been screened out from the assessment of these activities.

Table 7.15: Distance to Construction Activities and Predicted Noise Levels

Receptor Name	Construction Activity		
	Construction of Tracks and/or Hardstanding	Construction of Turbine Foundations	Construction of Turbines
	Distance to Receptor[33], m		
Hill of Harthill	260	280	280
Netherton Farm	115	245	245
59 Edinburgh Road	415	470	470
54 Howburn Road	120	580	580
51 Miller Street	375	590	590
64 Westcraigs Road	335	545	545
79 Polkemmet Drive	490	800	800

7.6.2 Details of the numbers and types of plant and their noise emission levels assumed for each phase of construction based upon experience of similar developments are provided in Appendix A7.3 of this EIA Report together with details of the calculations carried out to predict construction noise levels.

7.6.3 It should be noted that the predicted noise levels are based on worst-case assumptions, including:

- Modelling assumes all plant is located at the closest point to the receptor for each activity.
- Noise due to HGV traffic on haulage routes is included, and assumes worst case traffic movements occurring during concrete pouring (Table 9.12, Chapter 9: Traffic and Transport).
- No reduction from noise as a result of topographical screening.

7.6.4 The results of these calculations are shown in Table 7.16. As noted in Section 7.6.1, construction noise from activities located greater than 500 m from receptors has been screened out, and is represented by a dashed line below.

[33] The distances presented in this Table may differ from distances presented elsewhere in this EIA Report.

Table 7.16: Predicted Construction Noise Levels

Receptor Name	Construction Activity		
	Construction of Tracks and/or Hardstanding	Construction of Turbine Foundations	Construction of Turbines
	Predicted Noise Level, dB, $L_{Aeq,12hr}$ (day)		
Hill of Harthill	52.2	58.0	53.5
Netherton Farm	60.4	59.4	54.7
59 Edinburgh Road	47.9	52.7	49.8
54 Howburn Road	60.0	-	-
51 Miller Street	58.7	-	-
64 Westcraigs Road	49.8	-	-
79 Polkemmet Drive	46.4	-	-

7.6.6 As can be seen from Table 7.16, the predicted levels of construction noise are below the daytime lower threshold of 65 dB(A) at all receptors. As such, construction noise effects are considered to be not significant in terms of the EIA Regulations.

Construction Traffic Noise

7.6.7 Details of the calculation of the change in road traffic noise levels are contained in Appendix A7.3. Table 7.17 provides a summary of the results for the estimated worst-case increase in traffic flows for each location, alone with the resulting magnitude of effect as described in Section 7.4.7.

Table 7.17: Predicted Construction Traffic Noise Effects

Location	Change in Traffic Noise Level, dB	Magnitude of Effect
M8 Motorway	0.0	Negligible
Westcraigs Road	0.6	Negligible
West Main Street	0.7	Negligible

7.6.8 It can be seen from Table 7.17 that the predicted change in the level of road traffic noise during construction of the Proposed Development is less than 3 dB in all cases with effects of negligible or minor significance. As such, construction traffic noise effects are not significant in terms of the EIA Regulations.

Operational Wind Turbine Noise - Calculation of Apportioned Noise Limits

7.6.9 The cumulative developments included in this assessment are detailed in Table 7.2. When assessing cumulative noise levels, consideration should be given to any noise limits or other noise-related planning conditions applicable to each development. Where there is no reasonable prospect of a cumulative development producing noise levels up to its consented (or proposed) limits, the GPG recommends that predicted noise levels should be used along with an additional safety margin. This approach prevents the sterilisation of an area in which existing wind turbine noise levels are substantially lower than

the ETSU-R-97 limits, enabling further appropriate development to be considered. An additional safety margin of 2 dB has therefore been applied to the noise emissions of each cumulative development, on top of the required addition for uncertainty (typically a further 2 dB).

7.6.10 Details of the noise emission data for each cumulative development are presented in Appendix A7.1.

7.6.11 Table 7.18 details the predicted 'adjusted' cumulative noise levels (excluding noise due to the Proposed Development) for each of the assessed receptors identified in Table 7.13. It should be borne in mind that as the noise assessment follows GPG advice with regard to cumulative noise effects, the noise levels presented in Table 7.18 are a theoretical worst case; a number of conservative assumptions have been made as detailed in the previous Sections of this Chapter, such as the assumption that each receptor is directly downwind of all turbines simultaneously, which cannot occur in practice.

Table 7.18: Predicted Cumulative Noise Levels

Receptor	Standardised Wind Speed at 10 m AGL, ms^{-1}								
	4	5	6	7	8	9	10	11	12
	Noise Level, dB, $L_{A90,10min}$								
54 Howburn Road	27.8	32.5	37.1	39.1	39.5	39.7	40.0	40.0	40.0
59 Edinburgh Road	27.5	32.0	36.8	38.7	39.3	39.7	40.3	40.3	40.3
Bankhead Cottage	26.6	30.9	37.3	39.2	40.4	41.0	42.1	42.1	42.1
Treesbank Farm	26.6	30.9	38.7	40.7	42.1	42.9	44.1	44.1	44.1
Hill of Harthill Farm	28.3	33.1	38.3	40.3	40.9	41.3	41.9	41.9	41.9
51 Miller Street	28.9	33.6	38.2	40.3	40.6	40.8	40.9	40.9	40.9
79 Polkemmet Drive	32.2	37.0	41.9	44.2	44.3	44.6	44.6	44.6	44.6
64 Westcraigs Road	30.4	35.2	40.0	42.1	42.3	42.5	42.6	42.6	42.6
6 Argyll Court	28.6	33.4	37.7	39.7	39.9	40.1	40.3	40.3	40.3
Craigholm Farm	33.0	37.8	42.7	44.9	45.0	45.1	45.2	45.2	45.2
Netherton Farm	34.6	39.4	44.5	46.7	46.8	46.9	46.9	46.9	46.9
72 Harthill Road	31.8	36.7	41.6	43.7	43.8	44.0	44.1	44.1	44.1
Bogend	27.8	31.8	36.2	37.9	38.6	39.0	39.6	39.6	39.6
Forrestburn Cottage	29.9	33.1	37.9	39.6	40.5	41.0	41.8	41.8	41.8
16 Hirst Road	27.0	31.0	36.7	38.6	39.7	40.3	41.3	41.3	41.3
2 Summerlee Cottages	29.3	33.9	37.8	39.5	39.8	39.9	40.2	40.2	40.2

13 Station Road	29.7	34.6	39.2	41.2	41.4	41.6	41.8	41.8	41.8
5 Bedlormie Drive	28.2	32.9	37.0	38.8	39.2	39.4	39.8	39.8	39.8

Apportioned Noise Limits

7.6.12 Cumulative noise effects have been addressed through the derivation of apportioned noise limits. Apportioned noise limits are created by logarithmically subtracting the cumulative noise scenario (i.e. excluding noise due to the Proposed Development), from the cumulative noise limits. The result is the remaining noise budget available to the Proposed Development. Should no additional noise budget be available at a given property, limits at that property for noise due to the Proposed Development are set 10 dB below the cumulative noise limit, ensuring that any contribution to cumulative noise due to the Proposed Development is negligible.

7.6.13 As noted in Section 7.4.13, the daytime apportioned noise limits has not been considered to be a simply portion of a cumulative noise limit based upon a daytime fixed lower limit of 40 dB; as such, and as a final step, the daytime apportioned limits were checked to ensure they do not exceed the limit for the Proposed Development in isolation of 35 dB $L_{A90,10min}$, or 5 dB above background (the most stringent under ETSU-R-97 methodology), taking account of the financially involved status of Hill of Harthill Farm, Craigholm Farm and Netherton Farm.

7.6.14 The resulting apportioned limits applicable to the Proposed Development in isolation are presented in Table 7.19. These limits may be presented in the planning conditions of any consent for the Proposed Development and will ensure the Proposed Development's compliance with ETSU-R-97 when considered both individually and cumulatively.

Table 7.19: Noise Limits Applicable to the Proposed Development in Isolation

Receptor	Standardised Wind Speed at 10 m AGL, ms^{-1}								
	4	5	6	7	8	9	10	11	12
	Noise Limit, dB, $L_{A90,10min}$								
Daytime									
54 Howburn Road	53.3	53.2	53.1	53.0	53.2	53.5	53.8	54.4	54.4
59 Edinburgh Road	53.3	53.2	53.1	53.1	53.2	53.5	53.8	54.4	54.4
Bankhead Cottage	53.3	53.2	53.1	53.0	53.1	53.4	53.7	54.3	54.3
Treesbank Farm	53.3	53.2	53.0	53.0	53.0	53.3	53.5	54.1	54.1
Hill of Harthill Farm	48.8	50.1	51.7	54.0	56.7	59.3	61.7	61.7	61.7
51 Miller Street	55.5	55.5	55.5	55.6	56.0	56.5	57.1	57.1	57.1
79 Polkemmet Drive	55.5	55.4	55.3	55.4	55.8	56.3	57.0	57.0	57.0
64 Westcraigs Road	55.5	55.5	55.4	55.5	55.9	56.4	57.1	57.1	57.1
6 Argyll Court	43.2	42.8	41.0	38.9	40.7	42.9	45.4	45.4	45.4
Craigholm Farm	48.0	48.6	48.3	49.4	52.5	55.3	57.9	57.9	57.9
Netherton Farm	63.2	63.5	63.9	64.7	65.6	66.7	67.8	67.8	67.8
72 Harthill Road	48.1	48.6	48.6	49.8	52.7	55.4	58.0	58.0	58.0
Bogend	48.8	50.1	51.8	54.1	56.7	59.3	61.7	61.7	61.7
Forrestburn Cottage	48.7	50.1	51.7	54.1	56.7	59.3	61.7	61.7	61.7
16 Hirst Road	53.3	53.2	53.1	53.1	53.2	53.4	53.8	54.3	54.3
2 Summerlee Cottages	43.2	42.7	40.9	39.1	40.8	43.0	45.4	45.4	45.4
13 Station Road	48.1	48.7	48.9	50.2	52.9	55.5	58.0	58.0	58.0
5 Bedlormie Drive	48.1	48.8	49.1	50.4	53.1	55.6	58.1	58.1	58.1
Night-time									
54 Howburn Road	47.0	46.9	46.2	45.4	45.0	44.7	44.1	44.2	44.2
59 Edinburgh Road	47.1	46.9	46.2	45.5	45.1	44.7	43.9	44.1	44.1
Bankhead Cottage	47.1	46.9	46.1	45.4	44.7	44.2	42.8	43.0	43.0
Treesbank Farm	47.1	46.9	45.9	44.9	43.9	42.8	39.9	40.2	40.2

Receptor	Standardised Wind Speed at 10 m AGL, ms^{-1}								
	4	5	6	7	8	9	10	11	12
	Noise Limit, dB, $L_{A90,10min}$								
Hill of Harthill Farm	45.6	47.7	49.6	52.0	54.4	56.6	58.4	59.8	59.8
51 Miller Street	50.9	50.7	50.2	49.7	49.8	49.8	50.0	50.2	50.2
79 Polkemmet Drive	50.9	50.6	49.9	49.0	49.0	49.0	49.2	49.4	49.4
64 Westcraigs Road	50.9	50.7	50.1	49.5	49.5	49.6	49.7	49.9	49.9
6 Argyll Court	42.8	42.5	41.5	40.3	40.1	39.9	45.3	50.4	50.4
Craigholm Farm	43.9	44.1	41.3	43.1	48.7	52.6	55.7	55.7	55.7
Netherton Farm	57.1	57.5	57.7	57.9	58.2	58.2	58.2	58.2	58.2
72 Harthill Road	43.6	44.2	42.5	44.4	49.2	52.8	55.8	55.8	55.8
Bogend	45.6	47.7	49.8	52.1	54.5	56.7	58.4	59.8	59.8
Forrestburn Cottage	45.6	47.7	49.7	52.1	54.5	56.6	58.4	59.8	59.8
16 Hirst Road	47.1	46.9	46.2	45.5	45.0	44.5	43.4	43.6	43.6
2 Summerlee Cottages	42.8	42.4	41.4	40.4	40.2	40.1	45.3	50.4	50.4
13 Station Road	43.7	44.4	43.8	45.8	49.7	53.0	55.9	55.9	55.9
5 Bedlormie Drive	43.8	44.6	44.3	46.4	49.9	53.2	56.0	56.0	56.0

Predicted Noise Levels due to the Proposed Development

7.6.15 Table 7.20 details the predicted noise immission levels due to the operation of the Proposed Development, following the methodology described in Section 7.4.16, and using the noise emission data presented in Table 7.3 and Table 7.4. As previously noted, predicted noise levels are worst-case, based upon the assumption that each receptor is directly downwind of all Proposed Development turbines simultaneously, which cannot occur in practice.

Table 7.20: Predicted Operational Noise Levels due to the Proposed Development

Receptor	Standardised Wind Speed at 10 m AGL, ms^{-1}								
	4	5	6	7	8	9	10	11	12
	Predicted Noise Level, dB, $L_{A90,10min}$								
54 Howburn Road	33.5	38.5	41.3	41.5	41.5	41.5	41.5	41.5	41.5
59 Edinburgh Road	33.1	38.2	41.0	41.2	41.2	41.2	41.2	41.2	41.2
Bankhead Cottage	28.2	33.2	36.0	36.2	36.2	36.2	36.2	36.2	36.2
Treesbank Farm	28.1	33.1	35.9	36.1	36.1	36.1	36.1	36.1	36.1
Hill of Harthill Farm	38.0	43.0	45.8	46.0	46.0	46.0	46.0	46.0	46.0
51 Miller Street	32.5	37.6	40.3	40.6	40.6	40.6	40.6	40.6	40.6
79 Polkemmet Drive	29.2	34.3	37.1	37.3	37.3	37.3	37.3	37.3	37.3
64 Westcraigs Road	32.8	37.9	40.6	40.9	40.9	40.9	40.9	40.9	40.9
6 Argyll Court	27.2	32.2	35.0	35.2	35.2	35.2	35.2	35.2	35.2
Craigholm Farm	30.8	35.9	38.7	38.9	38.9	38.9	38.9	38.9	38.9
Netherton Farm	39.2	44.3	47.1	47.3	47.3	47.3	47.3	47.3	47.3
72 Harthill Road	27.8	32.8	35.6	35.8	35.8	35.8	35.8	35.8	35.8
Bogend	23.3	28.4	31.2	31.4	31.4	31.4	31.4	31.4	31.4
Forrestburn Cottage	21.8	26.8	29.6	29.9	29.9	29.9	29.9	29.9	29.9
16 Hirst Road	23.0	28.0	30.8	31.0	31.0	31.0	31.0	31.0	31.0
2 Summerlee Cottages	23.9	28.9	31.7	31.9	31.9	31.9	31.9	31.9	31.9
13 Station Road	24.2	29.3	32.1	32.3	32.3	32.3	32.3	32.3	32.3
5 Bedlormie Drive	22.0	27.0	29.8	30.0	30.0	30.0	30.0	30.0	30.0

7.6.17 Table 7.21 details the difference (margin) between predicted noise immission levels (Table 7.20) and the apportioned noise limits (Table 7.19) for the assessed receptors. A negative margin indicates that the predicted noise level is below the derived noise limit.

Table 7.21: Margin between Predicted Proposed Development Turbine Noise and Apportioned Noised Limits

Receptor	Standardised 10 m Wind Speed, ms-[1]								
	4	5	6	7	8	9	10	11	12
	Margin, dB								
Daytime									
54 Howburn Road	-19.8	-14.7	-11.8	-11.5	-11.7	-12.0	-12.3	-12.9	-12.9
59 Edinburgh Road	-20.2	-15.0	-12.1	-11.9	-12.0	-12.3	-12.6	-13.2	-13.2
Bankhead Cottage	-25.1	-20.0	-17.1	-16.8	-16.9	-17.2	-17.5	-18.1	-18.1
Treesbank Farm	-25.2	-20.1	-17.1	-16.9	-16.9	-17.2	-17.4	-18.0	-18.0
Hill of Harthill Farm	-10.8	-7.1	-5.9	-8.0	-10.7	-13.3	-15.7	-15.7	-15.7
51 Miller Street	-23.0	-17.9	-15.2	-15.0	-15.4	-15.9	-16.5	-16.5	-16.5
79 Polkemmet Drive	-26.3	-21.1	-18.2	-18.1	-18.5	-19.0	-19.7	-19.7	-19.7
64 Westcraigs Road	-22.7	-17.6	-14.8	-14.6	-15.0	-15.5	-16.2	-16.2	-16.2
6 Argyll Court	-16.0	-10.6	-6.0	-3.7	-5.5	-7.7	-10.2	-10.2	-10.2
Craigholm Farm	-17.2	-12.7	-9.6	-10.5	-13.6	-16.4	-19.0	-19.0	-19.0
Netherton Farm	-24.0	-19.2	-16.8	-17.4	-18.3	-19.4	-20.5	-20.5	-20.5
72 Harthill Road	-20.3	-15.8	-13.0	-14.0	-16.9	-19.6	-22.2	-22.2	-22.2
Bogend	-25.5	-21.7	-20.6	-22.7	-25.3	-27.9	-30.3	-30.3	-30.3
Forrestburn Cottage	-26.9	-23.3	-22.1	-24.2	-26.8	-29.4	-31.8	-31.8	-31.8
16 Hirst Road	-30.3	-25.2	-22.3	-22.1	-22.2	-22.4	-22.8	-23.3	-23.3
2 Summerlee Cottages	-19.3	-13.8	-9.2	-7.2	-8.9	-11.1	-13.5	-13.5	-13.5
13 Station Road	-23.9	-19.4	-16.8	-17.9	-20.6	-23.2	-25.7	-25.7	-25.7
5 Bedlormie Drive	-26.1	-21.8	-19.3	-20.4	-23.1	-25.6	-28.1	-28.1	-28.1
Night-time									
54 Howburn Road	-13.5	-8.4	-4.9	-3.9	-3.5	-3.2	-2.6	-2.7	-2.7
59 Edinburgh Road	-14.0	-8.7	-5.2	-4.3	-3.9	-3.5	-2.7	-2.9	-2.9
Bankhead Cottage	-18.9	-13.7	-10.1	-9.2	-8.5	-8.0	-6.6	-6.8	-6.8
Treesbank Farm	-19.0	-13.8	-10.0	-8.8	-7.8	-6.7	-3.8	-4.1	-4.1
Hill of Harthill Farm	-7.6	-4.7	-3.8	-6.0	-8.4	-10.6	-12.4	-13.8	-13.8
51 Miller Street	-18.4	-13.1	-9.9	-9.1	-9.2	-9.2	-9.4	-9.6	-9.6
79 Polkemmet Drive	-21.7	-16.3	-12.8	-11.7	-11.7	-11.7	-11.9	-12.1	-12.1
64 Westcraigs Road	-18.1	-12.8	-9.5	-8.6	-8.6	-8.7	-8.8	-9.0	-9.0
6 Argyll Court	-15.6	-10.3	-6.5	-5.1	-4.9	-4.7	-10.1	-15.2	-15.2
Craigholm Farm	-13.9	-8.2	-2.6	-4.2	-9.8	-13.7	-16.8	-16.8	-16.8
Netherton Farm	-17.9	-13.2	-10.6	-10.6	-10.9	-10.9	-10.9	-10.9	-10.9
72 Harthill Road	-15.8	-11.4	-6.9	-8.6	-13.4	-17.0	-20.0	-20.0	-20.0
Bogend	-22.3	-19.3	-18.6	-20.7	-23.1	-25.3	-27.0	-28.4	-28.4
Forrestburn Cottage	-23.8	-20.9	-20.1	-22.2	-24.6	-26.7	-28.5	-29.9	-29.9

Receptor	Standardised 10 m Wind Speed, ms-1								
	4	5	6	7	8	9	10	11	12
	Margin, dB								
16 Hirst Road	-24.1	-18.9	-15.4	-14.5	-14.0	-13.5	-12.4	-12.6	-12.6
2 Summerlee Cottages	-18.9	-13.5	-9.7	-8.5	-8.3	-8.2	-13.4	-18.5	-18.5
13 Station Road	-19.5	-15.1	-11.7	-13.5	-17.4	-20.7	-23.6	-23.6	-23.6
5 Bedlormie Drive	-21.8	-17.6	-14.5	-16.4	-19.9	-23.2	-26.0	-26.0	-26.0

7.6.18 As Table 7.21 shows, worst-case noise levels due to the Proposed Development meet the apportioned noise limits at all assessed receptors, and as such are not significant in terms of the EIA Regulations.

7.7 Mitigation Measures

Construction Noise and Vibration

7.7.1 The good practice measures detailed below will be implemented to manage the effects of noise and vibration during construction operations, and will be required of all contractors:

- Construction operations shall be limited to times agreed with the Council.
- Deliveries of turbine components, plant and materials by HGV to Site shall only take place within times agreed with the Council.
- The site contractors shall be required to employ the best practicable means of reducing noise emissions from plant, machinery, and construction activities, as advocated in BS 5228-1:2009.
- Where practicable, the work programme will be phased, which would help to reduce the combined effects arising from several noisy operations.
- Where necessary and practicable, noise from fixed plant and equipment will be contained within suitable acoustic enclosures or behind acoustic screens.
- All sub-contractors appointed by the main contractor will be formally and legally obliged, and required through contract, to comply with all environmental noise conditions.
- Where practicable, night-time working will not be carried out. Local residents shall be notified in advance of any night-time construction activities likely to generate significant noise levels, e.g. abnormal load movement.
- Any plant and equipment normally required for operation at night (23:00 - 07:00), e.g. generators or dewatering pumps, shall be silenced or suitably shielded to ensure that the night-time lower threshold of 45 dB, $L_{Aeq,night}$ shall not be exceeded at the nearest noise-sensitive receptors.

7.7.2 Application of the above measures to manage construction noise will ensure that effects are minimised as far as is reasonably practicable and that the construction process is operated in compliance with the relevant legislation.

Operational Noise

7.7.3 As demonstrated in Table 7.21, operational wind turbine noise from the proposed development is compliant with the noise limits derived in line with the requirements of ETSU-R-97 and the GPG, therefore no mitigation is

required for operational or cumulative operational noise.

7.8 Residual Effects

7.8.1 Application of the above measures to manage construction noise will ensure that effects are minimised as far as is reasonably practicable and that the construction process is operated in compliance with the relevant legislation.

7.8.2 The residual operational effects are the same as the operational effects identified in this assessment.

7.9 Summary

7.9.1 An assessment of potential noise effects associated with the Proposed Development has been carried out.

7.9.2 Construction noise will be limited in duration and confined to working hours as specified by the Council and therefore can be adequately controlled through the application of good practice measures and secured by planning condition. This will ensure that any noise from during construction will be adequately controlled.

7.9.3 Predicted levels of construction noise are below the daytime lower threshold of 65 dB(A) at all receptors. As such, construction noise effects are considered to be not significant in terms of the EIA Regulations.

7.9.4 Predicted noise levels due to increased traffic movements as a result of the Proposed Development have been assessed. The increase in road traffic noise due to the construction of the Proposed Development has been found to be not significant.

7.9.5 The effect of operational noise has been assessed in accordance with ETSU-R-97 and in line with current best practice (i.e. the GPG). It has been shown that the Proposed Development would comply with the requirements of ETSU-R-97 at all receptor locations. The effect of operational noise is therefore not significant.

7.9.6 The cumulative effects of the Proposed Development in conjunction with nearby wind energy developments either operational, consented or the subject of a current planning application were taken into consideration in the above assessment, in accordance with ETSU-R-97 and the GPG. The effect of cumulative operational noise is therefore not significant.

7.9.7 Noise during decommissioning will be of a similar nature to that of construction and will be managed to ensure compliance with best practice, legislation, and guidelines current at the time in order to ensure that effects are not significant.