objective measure to the subjective response to AM noise, ReUK has proposed an AM test[51] for implementation as a planning condition, although this was subject to discussion.

A.81. The Institute of Acoustics (IOA) published in 2016 a standardised methodology[52] for the assessment and rating of AM magnitude. The method provides a decibel level each 10 minute which represents the magnitude of the modulation in the noise, and minimises the influence of sources not related to wind turbines. The proposed method, unlike other methods that have previously been proposed, utilises as the core of its detection capability the fact that AM noise from wind turbines, by definition, exhibits periodicity at a rate that is directly related to the rotational speed of the source wind turbine. The IOA document does not however provide any thresholds or criteria methodology for using the resulting AM values.

A.82. The UK Government (DECC or Department of Energy and Climate Change, now obsolete) commissioned a review focused on the subjective response to AM with a view to recommend how this feature may be controlled. The outcome of this research has been published[53] in October 2016 by the Department for Business, Energy & Industrial Strategy (DBEIS). This report recommends the use of a "character penalty" approach, in which a correction is applied to the overall A-weighted noise level to account for AM in the noise in a manner similar to that used to assess tonality in the noise according to ETSU-R-97. This penalty is based on the above IOA methodology for detecting AM. The researchers make a number of recommendations for local authorities to consider and qualifications for the use of such controls, and note that the current state of knowledge on the subject and the implications of their proposed control is limited and that a period of testing and review over the next few years would be beneficial. The authors were however unable to provide clarity on how exactly the recommendations would operate in practice for any particular wind farm. On publication of the report, DBEIS encouraged local authorities in England to consider the research but provided limited guidance on how the outcomes were to be accounted for within the planning system.

A.83. Subsequently, a report commissioned by the UK Department for Business, Energy & Industrial Strategy was published[54] in February 2023 and concludes that the noise limits in ETSU-R-97 should be reviewed and that updated guidance on amplitude modulation should be included but makes no firm recommendations with regards to any update. Therefore, until the UK or Scottish governments conclude such a review, the ETSU-R-97 methodology continues to be applicable. The UK Government has also confirmed[55] that ETSU-R-97 should continue to apply until the review recommendations are considered in further detail. The UK Government most recently published[56] in July 2025 a draft for consultation of a revision of the ETSU-R-97 guidelines but noted that this draft guidance should not be used until a response to this consultation is published.

51 Template Planning Condition on Amplitude Modulation (guidance notes), RenewableUK, December 2013.
52 Institute of Acoustics (IOA) Amplitude Modulation Working Group, Final Report, A Method for Rating Amplitude Modulation in Wind Turbine Noise, June 2016.
53 Review of the evidence on the response to amplitude modulation from wind turbines, WSP for Department for Business, Energy & Industrial Strategy. https://www.gov.uk/government/publications/review-of-the-evidence-on-the-response-to-amplitude-modulation-from-wind-turbines
54 WSP, A Review of Noise Guidance for Onshore Wind Turbines, report for the UK Department for Business, Energy & Industrial Strategy, October 2022 (published 10 February 2023).
55 Government Response to the House of Lords Science and Technology Committee Report: The neglected pollutants: the effects of artificial light and noise on human health, December 2023. https://committees.parliament.uk/publications/42401/documents/210714/default/ [accessed September 2024]
56 https://www.gov.uk/government/consultations/assessment-and-rating-of-wind-turbine-noise-guidance-proposed-updates [accessed December 2025]

Glossary of Acoustics Terminology

Terminology	Description
A-weighting	A filter that down-weights low frequency and high frequency sound to better represent the frequency response of the human ear when assessing the likely effects of noise on humans
Acoustic character	One or more distinctive features of a sound (e.g. Tones, whines, whistles, impulses) that set it apart from the background noise against which it is being judged, possibly leading to a greater subjective effect than the level of the sound alone might suggest
Acoustic screening	The presence of a solid barrier (natural landform or manmade) between a source of sound and a receiver that interrupts the direct line of sight between the two, thus reducing the sound level at the receiver compared to that in the absence of the barrier
Ambient noise	All-encompassing noise associated with a given environment, usually a composite of sounds from many sources both far and near, often with no particular sound being dominant
Annoyance	A feeling of displeasure in this case evoked by ncise
Attenuation	The reduction in level of a sound between the source and a receiver due to any combination of effects including: distance, atmospheric absorption, acoustic screening, the presence of a building façade, etc.
Audio frequency	Any frequency of a sound wave that lies within the frequency limits of audibility of a healthy human ear, generally accepted as being from 20 Hz To 20,000 Hz
Background noise	The noise level rarely fallen below in any given location over any given time period, often classed according to day time, evening or night time periods (for the majority of the population of the UK the lower limiting noise level is usually controlled by noise emanating from distant road, rail or air traffic)
Db	Abbreviation for 'decibel'
Db(a)	Abbreviation for the decibel level of a sound that has been a-weighted
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
Equivalent continuous sound pressure level	The steady sound level which has the same energy as a time varying sound signal when averaged over the same time interval, t, deroted by $L_{Aeq,t}$
External noise level	The noise level, in decibels, measured outside a building
Filter	A device for separating components of an acoustic signal on the basis of their frequencies
Frequency	The number of acoustic pressure fluctuations per second occurring about the atmospheric mean pressure (also known as the 'pitch' of a sound)
Frequency analysis	The analysis of a sound into its frequency components
Ground effects	The modification of sound at a receiver location due to the interaction of the sound wave with the ground along its propagation path from source to receiver
Hertz	The unit normally employed to measure the frequency of a sound, equal to cycles per second of acoustic pressure fluctuations about the atmospheric mean pressure
Impulsive sound	A sound having all its energy concentrated in a very short time period
Instantaneous sound pressure	At a given point in space and at a given instant in time, the difference between the instantaneous pressure and the mean atmospheric pressure
Internal noise level	The noise level, in decibels, measured inside a building
L_{Aeq}	The abbreviation of the a-weighted equivalent continuous sound pressure level
L_{A10}	The abbreviation of the 10 percentile noise indicator, often used for the measurement of road traffic noise
L_{A90}	The abbreviation of the 90 percentile noise indicator, often used for the measurement of background noise
Level	The general term used to describe a sound once it has been converted into decibels
Loudness	The attribute of human auditory response in which sound may be ordered on a subjective scale that typicaly extends from barely audible to painfully loud
Noise	Physically: a regular and ordered oscillation of air molecules that travels away from the source of vibration and creates fluctuating positive and negative acoustic pressure above and below atmospheric pressure.

Terminology	Description
	Subjectively: sound that evokes a feeling of displeasure in the environment in which it is heard, and is therefore unwelcomed by the receiver
Noise emission	The noise emitted by a source of sound
Noise immission	The noise to which a receiver is exposed
Noise nuisance	An unlawful interference with a person's use or enjoyment of land, or of some right over, or in connection with it
Octave band frequency analysis	A frequency analysis using a filter that is an octave wide (the upper limit of the filter's frequency band is exactly twice that of its lower frequency limit)
Percentile exceeded sound level	The noise level exceeded for n% of the time over a given time period, t, denoted by $L_{An,t}$
Receiver	A person or property exposed to the noise being considered
Residual noise	The ambient noise that remains in the absence of the specific noise whose effects are being assessed
Sound	Physically: a regular and ordered oscillation of air molecules that travels away from the source of vibration and creates fluctuating positive and negative acoustic pressure above and below atmospheric pressure
	Subjectively: the sensation of hearing excited by the acoustic oscillations described above (see also 'noise')
Sound level meter	An instrument for measuring sound pressure level
Sound pressure amplitude	The root mean square of the amplitude of the acoustic pressure fluctuations in a sound wave around the atmospheric mean pressure, usually measured in pascals (Pa)
Sound pressure level	A measure of the sound pressure at a point, in decibels
Sound power level	The total sound power radiated by a source, in decibels
Spectrum	A description of the amplitude of a sound as a function of frequency
Standardised wind speed	Values of wind speed at hub height corrected to a standardised height of ten metres using the same procedure as used in wind turbine emission testing
Threshold of hearing	The lowest amplitude sound capable of evoking the sensation of hearing in the average healthy human ear (0.00002 Pa)
Tone	The concentration of acoustic energy into a very narrow frequency range

Annex B – Location Maps and Turbine Coordinates

Figure B1 - Map showing the layout of the turbines on the proposed Development and the nearby other sites which have been considered in this assessment: Clyde Windfarm, Middle Muir Windfarm, Andershaw Windfarm, and M74 West Renewable Energy Park.

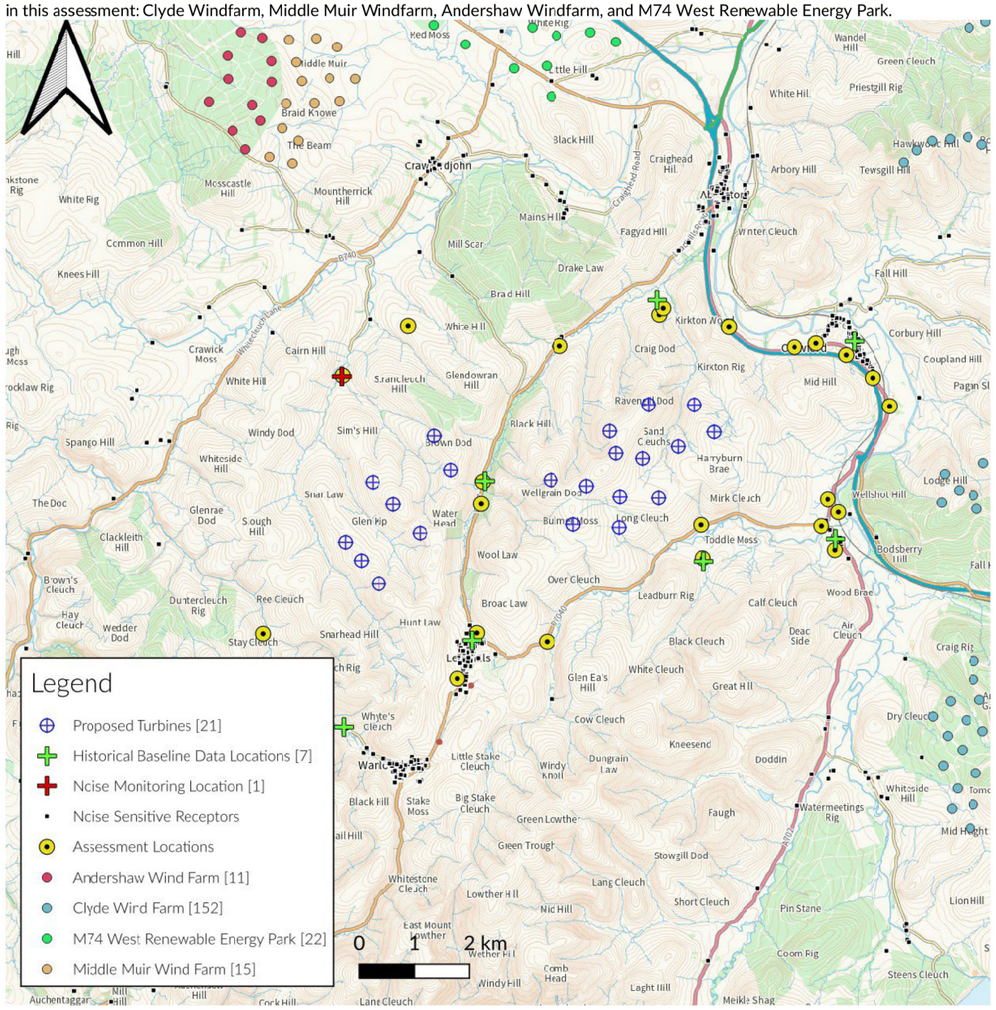
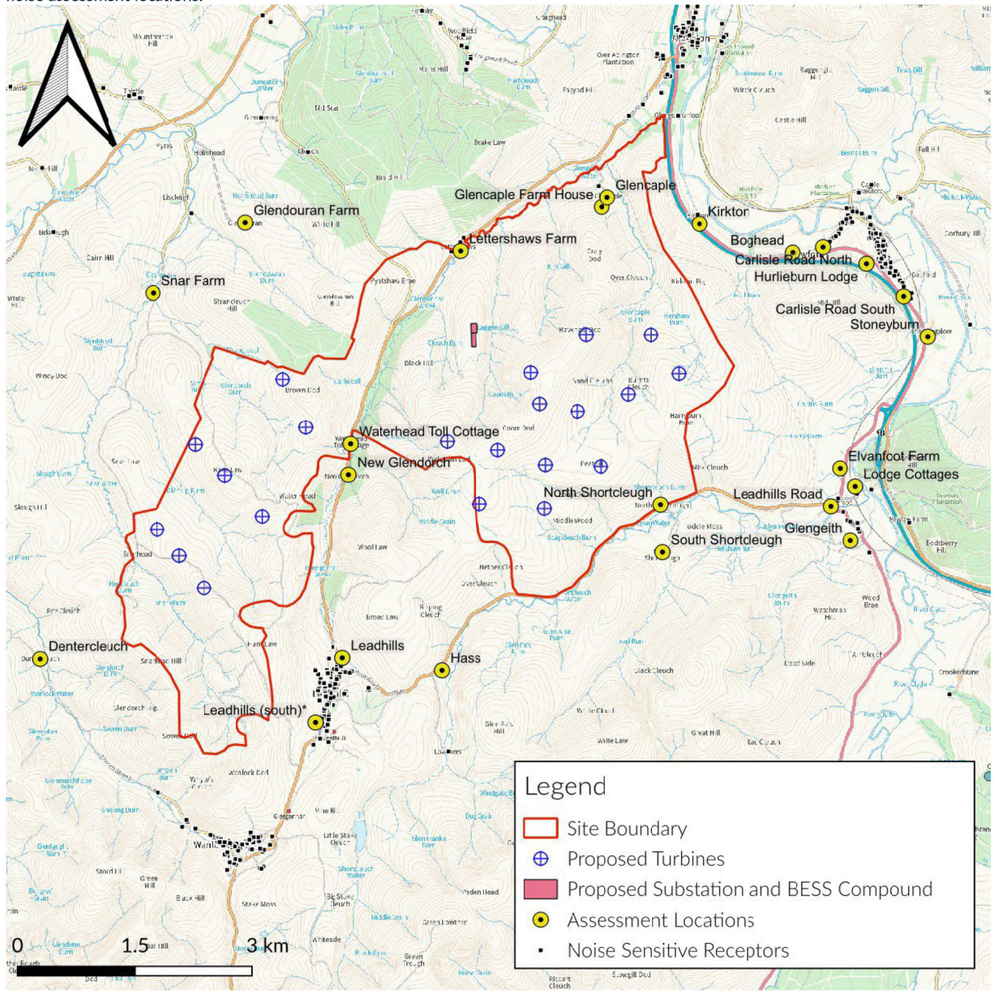


Figure B2 - Map showing the site boundary, layout of the turbines, the noise monitoring location, the historical baseline locations, and the noise assessment locations.



Turbine & Propagation Details: The Proposed Development (Ravengill Energy Park)

Table B1 – Turbine coordinates – the Proposed Development

Turbine	Easting	Northing	Turbine	Easting	Northing
T1	287971	618974	T12	292389	618783
T2	288264	618355	T13	291144	619062
T3	286849	618133	T14	291257	618660
T4	287226	617738	T15	291738	618565
T5	287709	617214	T16	292036	617853
T6	286364	617049	T17	290720	618062
T7	286646	616715	T18	291330	617871
T8	286963	616303	T19	291316	617317
T9	291850	619544	T20	290077	618173
T10	292680	619542	T21	290485	617374
T11	293040	619047			
All turbines modelled using the hub height of 134 m and always operating in unconstrained mode (PO7200 with Serrated Trailing Edges).					

Table B2 - Propagation attenuation effects due to terrain (dB) – the proposed Development – Positive numbers are due to terrain shielding barrier effects (e.g. 2 dB), representing a decrease in noise levels, and negative numbers (e.g. -3 dB) represent an increase in predicted noise levels due to concave ground effects. Where there is a zero shown, neither terrain shielding nor concave ground were found.

Turbine	Property											
	Lettershaws Farm	Leadhills Road	North Shortcleugh	South Shortcleugh	Hass	Waterhead Toll Cottage	New Glendorch	Glencaple Farmhouse	Glencaple	Leadhills	Dentercleuch	Snar Farm
T1	0	2	2	2	2	0	0	2	2	0	2	0
T2	0	2	2	2	2	0	0	2	2	0	2	0
T3	2	2	2	2	2	2	2	2	2	0	2	0
T4	0	0	2	2	2	2	2	2	2	0	2	0
T5	0	0	2	2	2	0	0	2	2	0	2	0
T6	2	2	2	2	2	2	2	2	2	2	0	0
T7	0	2	2	2	2	2	2	2	2	2	0	2
T8	0	0	2	2	2	2	2	2	2	0	0	2
T9	0	0	0	0	0	2	2	0	0	2	2	2
T10	2	0	2	0	0	2	2	0	0	2	2	2
T11	2	0	0	0	0	2	2	0	0	2	2	2
T12	2	0	0	0	0	2	2	2	0	2	2	2
T13	0	0	2	0	0	2	2	2	2	2	2	2
T14	0	0	0	0	0	2	0	2	2	2	2	2