ScottishPower Renewables

Harestanes West Windfarm

Environmental Impact Assessment Report

Volume 2

Chapter 14: Other Issues

December 2024

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Figures

Abbreviations

AD	Air Defence
amsl	above mean sea level
AIP	Aeronautical Information Publication
ANO	Air Navigation Order
ATC	Air Traffic Control
ATS	Air Traffic Services
BT	British Telecom
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
CEMP	Construction Environmental Management Plan
CNS	Communication, Navigation and Surveillance
CTA	Control Area
DAP	Directorate of Airspace Policy
DME	Distance Measuring Equipment
EIA	Environmental Impact Assessment
FL	Flight Level
ft	feet
GIS	Geographic Information System
HGV	Heavy Goods Vehicle
IFP	Instrument Flight Procedure
ITU	International Telecommunications Union
JRC	Joint Radio Company
LDP2	Local Development Plan 2

MOD	Ministry of Defence
OWPS	Onshore Wind Policy Statement
OS	Ordnance Survey
MBNL	Mobile Broadband Network Limited
NERL	NATS (En Route) plc
NGR	National Grid Reference
nm	nautical miles
NPF4	National Planning Framework 4
NSL	NATS (Services) Limited
Ofcom	Office of Communications
PSR	Primary Surveillance Radar
RAF	Royal Air Force
RLoS	Radar Line of Sight
SIP	Spectrum Information Portal
SSR	Secondary Surveillance Radar
TOPA	Technical and Operational Assessment
UHF	Ultra High Frequency

14. Other Issues

14.1. Executive Summary

1. This Chapter outlines the potential for effects relating to the Applicant's Harestanes West Windfarm (the 'proposed Development') on or from nearby infrastructure, telecommunications and TV, shadow flicker, aviation, climate and carbon balance, air quality, aviation, population and human health, risks of disasters and waste management. The findings of these studies are summarised here.

2. Infrastructure: This study identifies that there is limited existing infrastructure on the Site which includes an access from the adjacent A701 road; access via the existing timber haulage road through the operational Harestanes Windfarm overlapping with the Romans and Reivers Trail, and commercial forestry.

3. Forestry As a result of the proposed Development, based on the parameters adopted up to 199.19 Ha of forestry would require to be felled, and require compensatory planting. Of this 72.53 Ha to be kept clear of forestry during the operational phase of the proposed Development, 31.12 Ha will be set aside for habitat improvements. These include a further area of new native woodland creation on shallow peat/ mineral soils of approximately 15 Ha and an area of riparian woodland planting of 13.3 Ha also committed to in the outline Habitat Management Plan included in **Technical Appendix 8.9.**

4. There will be a requirement for 72.53 ha of compensatory planting to be agreed with Scottish Forestry.

5. Telecommunications and Television: As part of the Environmental Impact Assessment (EIA) process, an assessment of the proposed Development was undertaken against existing baseline information and consultation with telecommunications assets stakeholders. No impacts on existing assets are predicted.

6. Shadow Flicker: Shadow flicker guidance indicates that shadow flicker can occur at properties within 10 rotor diameters of wind turbines, located 130 degrees either side of north. Based on the 'realistic worst-case scenario' approach and assessment (taking into consideration and applying climatic data variables to theoretical results), the shadow flicker effects anticipated as a result of the proposed Development are '**Not Significant**'. Therefore, no mitigation is required.

7. Climate and Carbon: The calculations of total carbon dioxide emission savings and payback time for the proposed Development indicates the overall payback period of a development with 12 turbines with an average (expected) installed capacity of around 7 MW each would be approximately 2.2 years, when compared to the fossil fuel mix of electricity generation (see **Section 7** below). This means that the proposed Development is expected to take around 26 months to repay the carbon exchange to the atmosphere (the CO_2 debt). Through construction of the proposed Development, the proposed Development would in effect be in a net gain situation following this time period and would contribute to national carbon reduction objectives.

8. **Air Quality**: While there are no properties within close proximity to the Site, effects associated with dust or vehicle emissions are possible, but these potential effects would be managed through good practice construction measures which would form part of the Outline Construction Environmental Management Plan (CEMP) (**Technical Appendix 3.1**).

9. **Aviation and Radar**: Radar modelling shows that some of the proposed wind turbines would be in Radar Line of Sight (RLoS) of the NATS (En Route) plc (NERL) radars at Lowther Hill and Great Dun Fell, and the Ministry of Defence (MOD) radar at Deadwater Fell. The Lowther Hill radar is capable of filtering out wind turbine generated radar clutter and mitigation in the form of an alternative radar providing infill coverage is also available. NERL has not raised any concerns regarding Great Dun Fell radar, but similar mitigation is available if required. The MOD has not raised concerns regarding potential impacts on any of its radar facilities, and the proposed Development location would likely not be in an operationally significant area in terms of required Deadwater Fell radar coverage. The Site is within a military low flying area. Notification of obstacle locations and heights before construction, and MOD accredited aviation lighting fitted to the wind turbines would address MOD concerns regarding military low flying aircraft.

10. **Seismic Array**: The Eskdalemuir Seismic Array is a piece of infrastructure that is the responsibility of the Ministry of Defence (MOD). Vibration caused by onshore wind turbines located within 50 km of the Array is a consideration for the MOD. The Applicant is confident that the ongoing efforts of the Eskdalemuir Working Group will result in the release sufficient budget to allow the proposed Development to be constructed. However, the Applicant is acknowledges that the seismic noise budget for Eskdalemuir is finite and needs to be managed to maximise wind deployment opportunities within the 50 km consultation zone in order to enable Scotland to meet its legislated Net Zero 2045 targets.

11. **Population and Human Health**: Further to the consideration of human health impacts throughout the Environmental Impact Assessment (EIA) Report, it is not expected that there would be any effects from the proposed Development which would have significant effects on population and human health.

12. **Risks of Accidents and Other Disasters**: The vulnerability of the proposed Development to major accidents and natural disasters, such as flooding, sea level rise, or earthquakes, is considered low due to its geographical location. In addition, the nature of the proposal and remoteness of the Site means there would be negligible risks on the surrounding environment. Road safety is addressed in **Chapter 12: Traffic and Transport**.

13. **Waste and Environmental Management**: The Outline Construction Environmental Management Plan (CEMP) (**Technical Appendix 3.1**) provides a general overview on how waste and other environmental issues would be managed during the construction phase. The Outline Peat Management Plan (**Technical Appendix 10.2**) also details how excavated peat is controlled, stored, re-used and disposed of during the construction phase of the proposed Development.

14. It is expected that a site-specific waste management plan for the control and disposal of waste generated onsite would be required by condition, should the proposed Development receive consent.

14.2. Introduction

15. This Chapter assesses the potential effects of the construction and operation of the proposed Development on the following issues:

- infrastructure;
- forestry;
- telecommunications;
- television reception;
- shadow flicker;
- climate and carbon balance;
- aviation;
- seismic Array;

16. A separate Technical Appendix considers the impacts of the proposed Development on:

- Forestry (see Technical Appendix 14.1);
- Carbon Calculator (see Technical Appendix 14.2);
- Indicative Aviation Lighting Landscape and Visual Mitigation Plan (see Technical Appendix 14.3), and
- Aviation Impact Assessment (see Technical Appendix 14.4)

14.3. Infrastructure

17. The A701 is the main road leading from the A74(M) Junction 15 near Beattock east of the Site to Dumfries and the A75 to the south of the Site. The A701 is a trunk road that provides access to the Site.

18. The access track to the turbine area leads from the A701, 4.6 km east of the village of Ae, largely following a network of existing access tracks built for the operational Harestanes Windfarm and forestry tracks forming part of the Forestry and Land Scotland estate. It follows the 'Romans and Reivers Route', one of 'Scotland's Great Trails', for a distance of 5.2 km, partly through the operational Harestanes Windfarm before crossing the Water of Ae.

19. Within the Site, the 'Romans and Reivers Route' is already used as a timber haulage road and for the operation and maintenance of the existing Harestanes Windfarm. Sections of the 'Romans and Reivers Route', where it is already a timber haulage road or windfarm access track, will be used for the proposed Development and are shown on **Figure 3.1** of **Chapter 3: Proposed Development**.

20. There are two unnamed public roads close to the turbine area (the portion of the Site within the Application Boundary in which the proposed Development turbines are located). An unnamed public road runs broadly southwest to northeast from Croalchapel to Hyslop, passing Loch Ettrick. This road forms the north-western boundary of the Site. A second unnamed public road leads from the village of Ae broadly north-north-westwards parallel

to the Windyhill Burn. This enters the Site at approximately National Grid Reference (NGR) 296536, 592576, crosses the site and joins the first unnamed road east of Loch Ettrick at approximately NGR 294928, 593866.

21. The Application Boundary overlaps with infrastructure forming part of the operational Harestanes Windfarm along the access track to the turbine area. There are eight operational wind turbines located within the Application Boundary, as well as a network of connecting buried cables and access tracks. These have been factored into the design of the upgrade to the existing networks of access tracks necessary for the proposed Development.

22. The proposed Development's access track passes the Garrel Cemetery (approximate NGR 304130, 590308). According to the Dumfries and Galloway Family History Society, the cemetery is closed (i.e. not open to new burials). No direct physical impacts are predicted on the cemetery. It is recorded as a listed building under the name of Garvald Churchyard and assessed in **Chapter 11: Archaeology and Cultural Heritage**.

23. Effects are predicted to be '**Not Significant'** on any existing infrastructure as a result of the construction or operation of the proposed Development.

14.4. Forestry

24. A detailed forestry technical appendix (**Technical Appendix 14.1: Forestry**) has been prepared to accompany the EIA Report and application for consent documentation for the proposed Harestanes West Windfarm.

25. **Technical Appendix 14.1** provides all the forestry information required for the Environmental Impact Assessment (EIA) Report, including:

- a baseline forestry assessment;
- the effect of the proposed Development on the forestry plantations;
- full information on the areas to be felled and the timber volumes to be removed;
- how the waste will be dealt with to minimise its effect on the environment; and
- mitigation measures in place including Compensatory Planting.

26. **Technical Appendix 14.1** has been prepared on the basis of minimising to a practicable level the amount of forestry felling required to accommodate the proposed Development infrastructure, focusing on the proposed new access tracks, access tracks to be upgraded, proposed turbines, substation and construction compounds.

27. As a result of the proposed Development, based on the parameters adopted up to 199.19 Ha of forestry would require to be felled. Of this 72.53 Ha to be kept clear of forestry during the operational phase of the proposed Development and require compensatory planting, 31.12 Ha will be set aside for habitat improvements. These include a further area of new native woodland creation on shallow peat/ mineral soils of approximately 15 Ha and an area of riparian woodland planting of 13.3 Ha also committed to in the outline Habitat Management Plan included in **Technical Appendix 8.9.**

28. There will be a requirement for 72.53 ha of compensatory planting to be agreed with Scottish Forestry.

14.5. Telecommunications

29. This section describes the existing environment with respect to telecommunications for point-to-point microwave or UHF links, and the potential impacts to their operations as a result of construction and operation of the proposed Development. Where required, the associated impact significance is provided, and the appropriate mitigation options are presented.

14.5.1. Introduction

30. Any wind development has the potential to cause a variety of effects on telecommunications infrastructure by introducing new physical structures (turbines) causing interference between the fixed link path. Large structures can affect this infrastructure in predominantly two ways, these are:

- blocking of radio signals from telecommunications infrastructure; and
- reflection of radio signals from telecommunications infrastructure.

14.5.2. Legislation and Policy Context

31. There is no legislation or formal policy with comprehensive or quantitative methodologies for the management of telecommunications issues. The documents below represent the guidance and industry best-practice for the topic in respect of wind energy developments:

- International Telecommunications Union (ITU) (1992), Assessment of impairment caused to television reception by a wind turbine, Recommendation ITU-R BT805;
- ITU (2010), ITU-R BT.2142-1;
- Bacon (2002), A proposed method for establishing an exclusion zone around a terrestrial fixed radio link outside of which a wind turbine will cause negligible degradation of the radio link performance; and
- Joint Radio Company (JRC) (2014): Calculation of Wind Turbine clearance zones for JRC Ultra High Frequency (UHF) (460 MHz) Telemetry Systems when turbine sizes and locations are accurately known – Issue 4.2.

14.5.3. Consultation

32. Consultation was undertaken with the relevant telecommunication link operators to inform the telecommunications links within the vicinity of the Site and to advise their position with respect to the proposed Development. The proposed Development details such as turbine coordinates, hub heights and tip heights were provided to the stakeholders, who then identify the telecommunications infrastructure such as masts and links that could be potentially impacted.

Table 14.1 Summary of telecommunications consultation

Consultee	Response	Result
Airwave (Motorola Solutions)	Confirmed no objection	No further action
Arqiva	Confirmed no objection	No further action
Atkins	Confirmed no objection	No further action

Consultee	Response	Result
British Telecom (BT)	Confirmed no objection	No further action
The Joint Radio Company (JRC)	Confirmed no objection	No further action
Mobile Broadband Network Limited (MBNL)	Confirmed no objection	No further action
Virgin Media O2	Confirmed no objection	No further action
Vodafone	Potential impact identified	Identified infrastructure assessed showing turbine is clear of the link exclusion zone based on Fresnel zone calculations (Ofcom recommended methodology) and a 25 m-buffer

33. Telecommunications infrastructure information supplied by the link operators directly will be the most accurate data source.

34. Airwave (Motorola Solutions) do not share the details of their link infrastructure, and instead undertake their own technical assessment. A technical assessment for the proposed Development had been progressed to confirm their position.

35. The Ofcom Spectrum Information Portal (SIP) was also reviewed to identify any other telecommunications infrastructure within vicinity of the proposed Development with potential for impacts.

14.5.4. Assessment Methodology

36. The exclusion zones associated with the identified links have been calculated based on the telecommunications data provided. Further two-dimensional clearance calculations have then been undertaken to determine the extent of any clearance or infringement of the proposed development.

37. A Fresnel Zone takes the form of an ellipsoid surrounding a link path and represents the area in which obstructions should not be sited in order to avoid diffraction losses. The width of the zone at any point along the link path is determined by the Fresnel Zone number, the frequency of the link and the distance from each link end. The width of the zone is maximal at the midpoint of the link path.

38. Obstructions such as wind developments which are sited in between two microwave link antennae can partially block the radio signal passing between them, thereby reducing the functionality of the link. This can occur even if the obstruction is not directly between the antennae but close to the link boresight[1]. This kind of blocking is called 'diffraction'. There are various approaches to safeguarding microwave links against from obstruction via wind developments. The most common approaches are:

- Implementation of a fixed stand-off distance around the link boresight; and
- Safeguarding the relevant Fresnel Zone (discussed below).

39. The first approach is used by many operators who request a set buffer distance. Set stand offs are occasionally conservative and produce a large exclusion zone distance. The

[1] *This is the straight line between the two antennae.*

second approach is to assess an obstruction on a case-by-case basis to calculate the most accurate exclusion zone. Pager Power considers the Second Fresnel zone when assessing the effect of a turbine/wind development upon microwave links, and 60% of the First Fresnel zone when assessing UHF links.

40. The exclusion zone for each communications link is defined by the Fresnel zone radius, rotor radius, and an additional 25-metre buffer. A 250-metre exclusion zone is applied to microwave link masts and a 500-metre exclusion zone is applied to UHF link masts.

41. The 3D exclusion zone is determined by taking into account the height of the turbine hub height relative to the link boresight altitude in addition to the calculations used to define the 2D exclusion zone for a communications link.

42. The turbines are then assessed against the exclusions zones to determine the clearances and infringements as required.

14.5.5. Impact Assessment Criteria

43. The definitions are based on industry best practice and experience.

14.5.6. Magnitude of Impact

44. Each effect is assessed based on its magnitude and the sensitivity of the affected receptor. The magnitude of impacts is presented in the table below.

Table 14.2 Telecommunications magnitude of impact criteria

Magnitude of Impact	Criteria
High	Total loss or substantial alteration to key features of the baseline conditions such that receptor attributes will be fundamentally changed.
Moderate	Loss or alteration to one or more key features of the baseline conditions such that receptor attributes will be materially changed.
Low	A minor shift away from baseline conditions. Change arising from the alteration will be discernible but not material. The underlying attributes of the baseline condition will be largely unchanged.
Negligible	Very little change from baseline conditions. Change barely distinguishable, approximating to a ‘no change’ situation.

14.5.7. Sensitivity of Receptor

45. The sensitivity of the receptor is presented in the table below.

Table 14.2 Telecommunications receptor sensitivity criteria

Sensitivity	Definition
High	The receptor has little ability to absorb change without fundamentally altering its present character or is of international or national importance.
Medium	The receptor has moderate capacity to absorb change without significantly altering its present character or is of high importance.
Low	The receptor is tolerant of change without detriment to its character or is of low or local importance.
Negligible	The receptor is of negligible importance.

14.5.8. Significance of Effect

46. The significance of effect is presented in the matrix below. An effect of 'minor adverse' and greater would result in a significant effect.

Table 14.3 Telecommunications significance of effect matrix

Magnitude	Sensitivity			
Negligible	Negligible	Low	Medium	High
Low	Negligible	Negligible	Negligible	Negligible
Medium	Negligible	Minor Adverse	**Minor Adverse**	**Moderate Adverse**
High	Negligible	**Minor Adverse**	**Moderate Adverse**	**Major Adverse**

47. The potential effect of wind turbines on telecommunication links is the partial or complete loss of information transferred electromagnetic waves which are interfered with by wind turbines, be it the static structure or rotating blade. The effect is dependent on numerous factors including the relative location of the links ends to the wind turbines, the level of visibility between link ends and wind turbines, the link's frequency and the number of wind turbines in proximity to a link path. Therefore, the resulting effect on individual point-to point links will vary.

48. A 'Medium' or greater magnitude of effect to telecommunications systems would be result in a significant effect. This is where a loss or alteration to the baseline conditions would materially change the receptor attributes i.e. telecommunications systems were significantly affected such that there was a loss in the data being transmitted.

49. With regard to receptor sensitivity, any location where telecommunications systems are significantly affected beyond baseline conditions (such that a point-to-point link was rendered ineffective), a significant effect would occur. This could be for multiple point-to-point links, where mitigation would be required for all. Therefore, any permanent legal receptor where telecommunications systems previously operated effectively is considered to be of 'Medium' sensitivity.

50. The Significance of Effect, which would be considered 'Significant' is 'Minor Adverse' and mitigation would be required.

14.5.9. Baseline Conditions and Cumulative Impacts

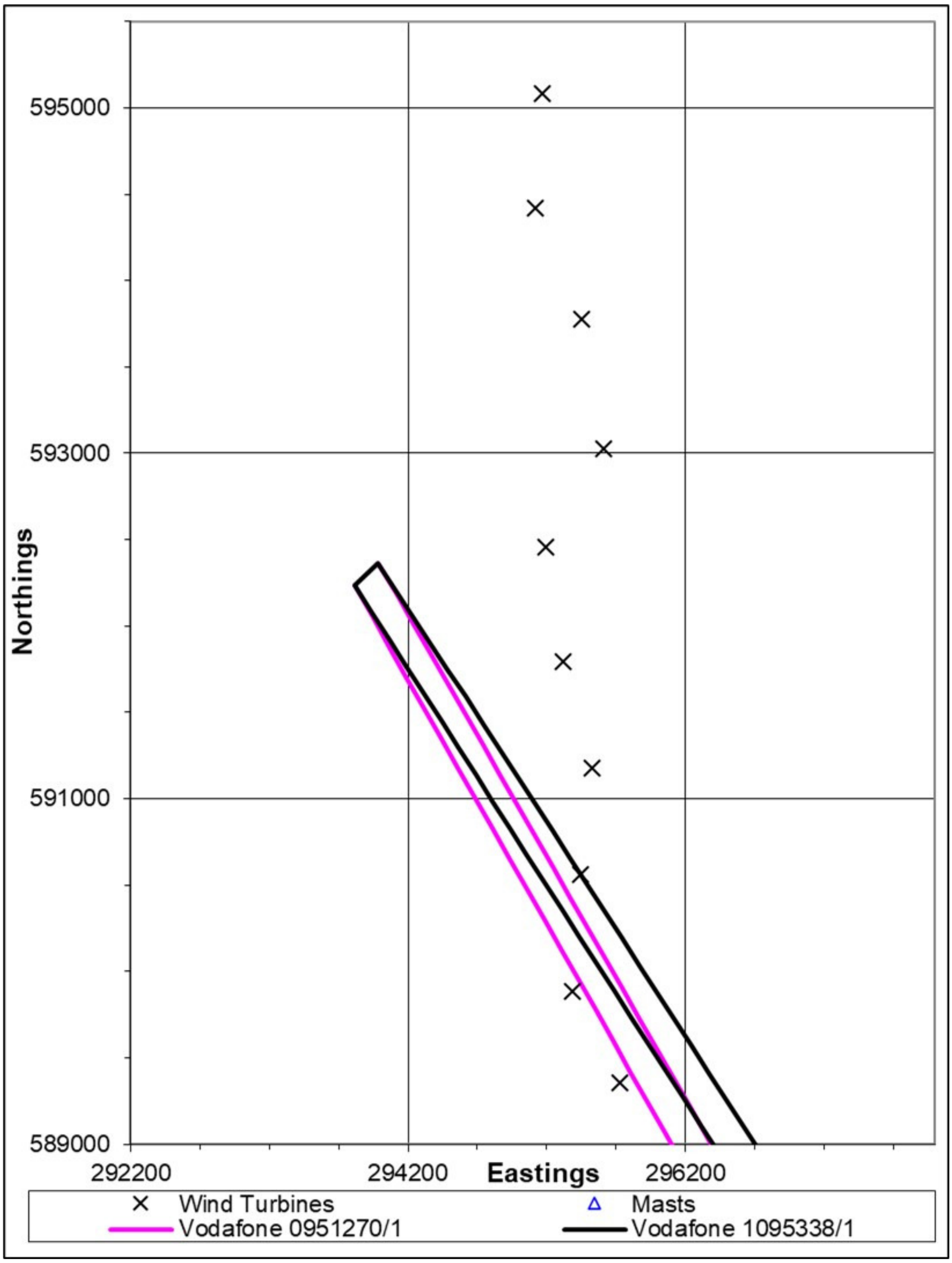
51. Telecommunications infrastructure was identified through consultation with the relevant telecommunications stakeholders, as presented in **Table 14.1**. The search radius was therefore informed by the safeguarding criteria applied by each stakeholder.

52. The existing Dalswinton Wind Farm is located immediately southwest of the proposed Development and therefore would be considered significant (within 1 km of the proposed Development) with respect to telecommunications safeguarding.

53. Cumulative impacts are considered by telecommunications stakeholders when consulted. The communication link details provided, in respect of the Site and its vicinity, are summarised below:

- Two microwave links '0951270/1' and '1095338/1' as part of Vodafone's telecommunication infrastructure.

54. The link plotted in relation to the Site are illustrated in **Figure 14.3** below.



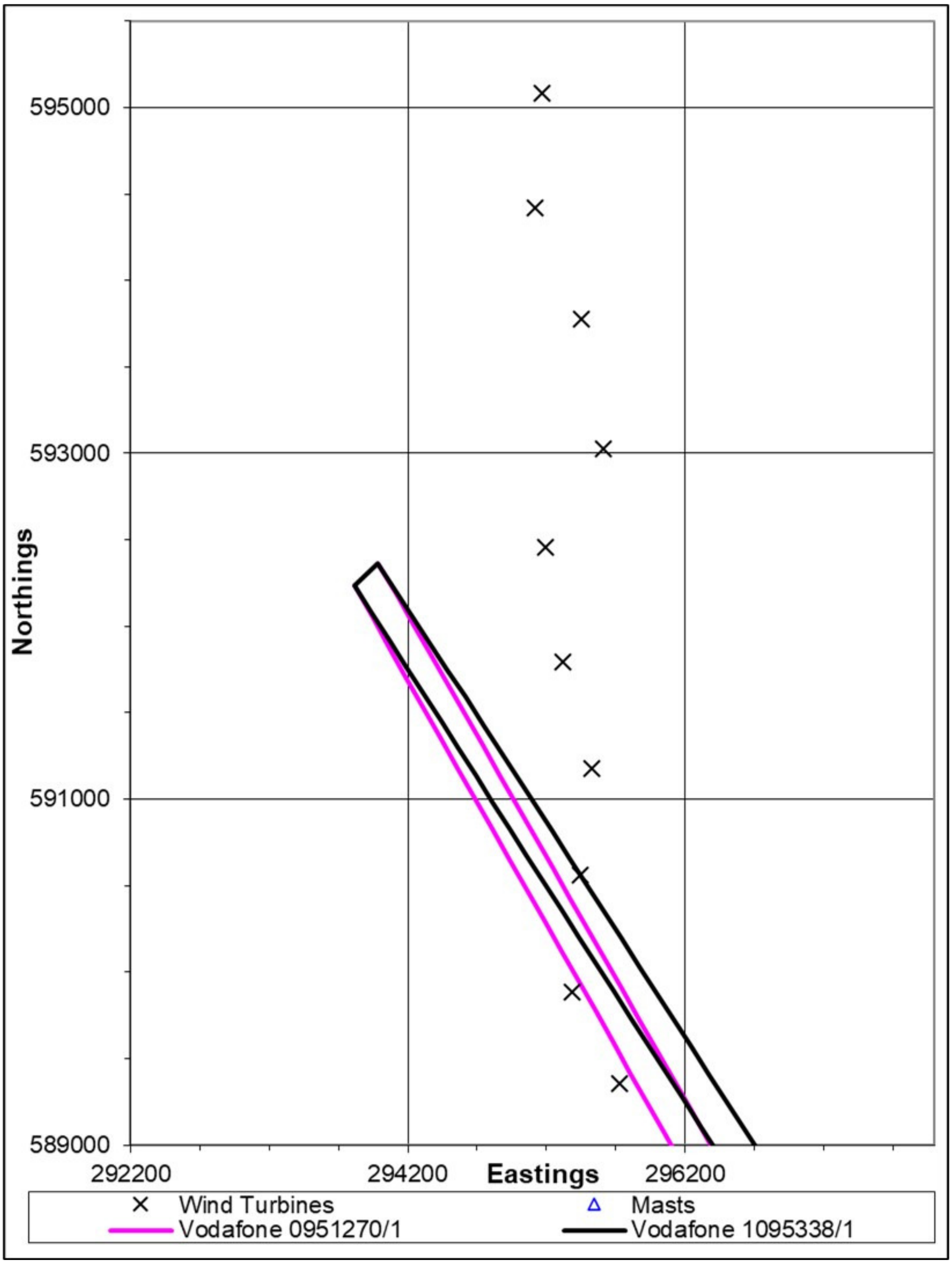


Figure 14.3 Vodafone links near the Site

14.5.10. Identification and Evaluation of Effects

55. All link operators, except Vodafone, have confirmed their telecommunication infrastructure does not operate within vicinity of the proposed Development and is therefore not predicted to be impacted.

56. Airwave (Motorola Solutions) have also confirmed their telecommunication infrastructure does not operate within vicinity of the proposed Development and is therefore not predicted to be impacted, as per their technical assessment.

57. Vodafone have provided the details of two links within close vicinity of the Site with potential to be impacted. Further analysis has confirmed that the proposed Development infrastructure is outwith the exclusion zones (the Fresnel Zone of the link and an additional buffer) and therefore not predicted to impact their link infrastructure.

14.5.11. Residual Effects and Mitigation

58. As no impacts are predicted, there is no mitigation required, and therefore no residual effects.

14.5.12. Summary

59. The effects of the proposed Development on existing telecommunication infrastructure for Arqiva, Atkins, British Telecom (BT), the Joint Radio Company (JRC), Mobile Broadband Network Limited (MBNL) and Virgin Media 02 is predicted to be '**Not Significant'.**

60. The proposed Development's impact on the existing telecommunication infrastructure for Airwave (Motorola Solutions) is predicted to be '**Not Significant**' as confirmed by their own technical assessment.

61. The proposed Development is clear of the existing telecommunication infrastructure and exclusion zone for Vodafone. Mitigation is not expected to be required as impacts are predicted to be '**Not Significant**'.

14.6. Television Reception

14.6.1. Introduction

62. This section presents the findings and conclusions of the technical analysis for television reception issues associated with the proposed Development.

63. Wind turbines have the potential to adversely affect analogue television reception through either physical blocking of the transmitted signal or, more commonly, by introducing multi-path interference where some of the signal is reflected through different routes. The proposed Development is located in an area now served by a digital transmitter.

14.6.2. Methodology

64. Currently there is no widely accepted method of determining the potential effects of wind turbines on digital television reception; however digital television signals are better at coping with signal reflections, and do not suffer from ghosting that may occur with analogue signals.

14.6.3. Baseline Conditions

65. The closest television transmitter is over 5 km from the turbine area. Television transmitters in the area have switched to digital transmission only.

14.6.4. Identification and Evaluation of Effects

66. As stated above, the proposed Development is located in an area now served by a digital transmitter. Therefore, television reception not predicted to be affected by the proposed Development as digital signals are rarely affected.

14.6.5. Residual Effects and Mitigation

67. In the unlikely event that television signals are affected by the proposed Development, reasonable mitigation measures would be considered by the Applicant.

14.6.6. Summary

68. The effects to television reception is predicted to be '**Not Significant**'.

14.7. Shadow Flicker

14.7.1. Introduction

69. Shadow flicker may occur under certain combinations of geographical position and time of day, when the sun passes behind the rotors of a wind turbine and casts a shadow over neighbouring properties. As the blades rotate, the shadow flicks on and off, an effect known as shadow flicker. The effect can only occur inside buildings, where the flicker appears through a window opening.

70. The likelihood and duration of the effect depends upon:

- direction and aspect of the property relative to the turbine(s): in the UK, only properties within 130 degrees either side of north, relative to the turbines, can be affected, as turbines do not cast long shadows on their southern side;
- distance from turbine(s): the further the building is from the turbine, the less pronounced the effect would be, given the shadow fades with distance. Flicker effects are known to be strongest and most likely to have the potential to cause significant effects within ten rotor diameters of a turbine;
- turbine height and rotor diameter;
- topography between the turbine and receptor;
- time of year and day;
- wind direction and orientation of the turbine blades in relation to the receptor; and
- weather conditions (i.e. cloudy days reduce the likelihood of effects occurring).

71. If significant effects due to shadow flicker cannot be avoided through embedded mitigation, then technical mitigation solutions are available, such as temporarily shutting down those turbines(s) which cause the effect during specific intervals where certain contributory conditions occur.

72. Shadow flicker effects are only considered during the operational phase of the wind farm.

14.7.2. Legislation and Policy Context

73. There is no legislation that deals directly with shadow flicker. There is no formal limit on the amount of shadow flicker that is considered acceptable within the UK.

74. Chapter 4 of the EIA Report sets out the planning policy framework that is relevant to the EIA. At a national level, of particular relevance is Policy 11 of National Planning Framework 4 (NPF4). This identifies that schemes should take account of various considerations, including the impact of a proposed scheme on communities or individual dwellings including residential amenity, visual impact, noise, and shadow flicker.

75. For Dumfries and Galloway Council, Local Development Plan 2 Policy IN1: Renewable Energy and IN2: Wind Energy are relevant. These request that applicants consider impact on local communities and individual dwellings, including shadow flicker (among other matters), and consider the environmental impact of the proposals. Dumfries and Galloway Council's "Wind Energy Development: Development Management Considerations Supplementary Guidance (2020)" requests that developers consider shadow flicker as part of their proposals.

76. Planning guidance in the UK directs developers to consider the impact of shadow flicker. This guidance does not specify how to assess the impact, or how to assess the significance of the impact. In Scotland current guidance is available in the Scottish Government's 'Onshore Wind Turbines: Planning Advice' document (last updated May 2014).

14.7.3. Methodology

14.7.3.1.Consultation

77. Consultation was undertaken with a range of consultees, as outlined in **Technical Appendix 6.1**. An approach to how shadow flicker would be assessed was included in the EIA Scoping Report for the project (March 2023). The Energy Consents Unit's EIA Scoping Opinion did not include Shadow Flicker in its contents, and no consultee response to the EIA scoping or subsequent consultations undertaken raised it as a matter for consideration in the EIA Report.

14.7.3.2. Study Area

78. The shadow flicker Study Area considers all residential properties within ten rotor diameters and 130 degrees either side of north of the finalised turbine locations. The rotor diameter of the proposed turbines is anticipated to be up to 162 m. A further 50 m buffer is added to the 10-rotor diameter distance in order to account for micrositing, should the proposed Development receive consent.

79. Operational wind turbines located in the vicinity of the proposed Development were also taken into consideration and reviewed for potential cumulative effects. Nevertheless, on this occasion, during the review process it was confirmed that there are no residential properties within overlapping areas with the potential of shadow flicker (within 10-rotor diameter distance between proposed and existing turbines), and therefore cumulative effects have been scoped out of further assessment.

80. The maximum Study Area for the proposed Development was mapped using Geographic Information System ('GIS') software. This was then refined to include only the areas within 130 degrees of north of proposed wind turbine locations. Properties within 10 rotor diameters (1,620 m) plus 50 m for the reasons outlined above (1,670 m) and the 130° area were identified from OS AddressBase data.

14.7.3.3. Assessment

81. As noted in Section 14.7.2, there is no formal guidance on the amount of shadow flicker that is considered acceptable within the UK. European countries do have guidance on shadow flicker; however, these vary from one country to another. Guidance which has been utilised in Northern Ireland (Northern Ireland Department for the Environment, 2009), Germany (Nordrhein-Westfalen 2002) and Belgium, suggests shadow flicker does not exceed 30 hours per year with a maximum of 30 minutes per day. For the purposes of this assessment, exceedance of 30 hours per year or a maximum of 30 minutes per day is considered to result in a 'significant effect' which may require mitigation.

82. As noted in **Section 6**, of **Chapter 2**, the locations of the proposed turbines have been carefully considered with respect to distance from residential properties.

83. To undertake a shadow flicker assessment, information on the proposed Development, the location of potential residential receptors, digital terrain model data and site-related geographic parameters are included in a computer model in order to predict and quantify the impact shadow flicker may have on receptors within the vicinity of the proposed Development. The assessment identifies whether shadow flicker would be likely to occur at properties neighbouring, and if so the predicted times of year, and the time and duration of these potential effects.

84. Shadow flicker is calculated based on the theoretical condition assuming the sun is always shining, there are no screening features such as trees, no accounting for periods of turbine shut down, and also the wind is always blowing at sufficient velocity to spin the blades and in a direction which results in the blades being perpendicular to the property (maximum shadow flicker or theoretical). The locations of residential receptors and the locations and maximum dimensions of turbines comprising the proposed Development have been input into a model run on industry standard ReSoft WindFarm Release 5 software. For the properties identified within the shadow flicker study area, a window centred at 2 m from ground level with 1 m x 1 m dimensions facing directly towards the proposed Development has been assumed for 'theoretical' scenario results. A minimum sun elevation of 2 degrees has been considered. The model also assumes that:

- The sun is shining from sunrise to sunset (cloudless sky);
- The turbine blades are turning 100% of the time;
- The turbine rotor is oriented directly between the sun and the sensitive receptor; and
- There is no screening between the turbine and the receptor (excluding topography).

85. The inclusion of the above factors results in a 'theoretical' scenario being reported in this assessment. As quoted from guidance above, for shadow flicker to occur, all of the above listed conditions must be met at any one time. In real life conditions, therefore, the actual shadow flicker durations, if shadow flicker occurs at all, will be less than the theoretical predicted levels from the model.

86. Shadow flicker can only occur when the sun is shining. Historical weather data was therefore used to provide a more realistic prediction of potential annual shadow flicker duration when accounting for the frequency of clear skies, when shadows may be cast. This is reported in this assessment as the 'realistic worst-case' scenario for shadow flicker.

87. The average monthly sunshine hours were divided by the corresponding monthly daylight hours to obtain an estimate of the percentage average sunshine hours each month. These were used to calculate an annual average sunshine hours percentage of 22.6 %, as shown in **Table 14.5.** Based on this, a correction factor of 22.6 % can be applied to the annual total theoretical predicted levels of shadow flicker to provide an estimate of the amount of time when the correct meteorological conditions would be present for shadow flicker to occur. These shadow flicker durations however are still likely to be conservative as no account is taken of when turbine blades are not turning, orientation of the turbine rotor, or the presence of screening between the receptor and turbine.

14.7.3.4. Baseline Conditions

88. Whilst examining the established shadow flicker Study Area (as shown in **Figure 14.1**), the potential receptors listed in **Table 14.4** were identified for further assessment.

Table 14.4 Identified Potential Receptors

ID	Description / Address	Current Status	OS Easting	OS Northing	Distance from nearest turbine (m)
1	Knockenshang, DG1 1RL	Uninhabited	297089	593527	934
2	Windyhill, DG1 1RL	Inhabited	296676	592436	1,148

ID	Description / Address	Current Status	OS Easting	OS Northing	Distance from nearest turbine (m)
3	Mews Flat / Shepherds Cottage / The Stockmans Flat, DG1 1RL	Inhabited	297212	592211	1,379
4	Gubhill Farm / Hay Loft, DG1 1RL	Inhabited	297233	592181	1,379
5	Glenview, DG1 1RL	Inhabited	297212	591637	1,093
6	Larchview Cottage, DG1 1RL	Inhabited	297208	591578	1,072
7	Burnfoot, DG1 1RL	Inhabited	297259	591490	1,104
8	3 Gubhill (April Cottage), DG1 1RL	Inhabited	297257	591462	1,097
9	4 Gubhill (Pine Cottage), DG1 1RL	Inhabited	297262	591450	1,101
10	Glenbrae, DG1 1RF	Inhabited	297741	589233	1,538
11	Glenmaid, DG1 1RF	Inhabited	297633	589129	1,475
12	Whitestanes, DG1 1RF	Inhabited	297626	588720	1,577

89. Average monthly sunshine data was obtained from the Met Office's weather station nearest the proposed Development at Eskdalemuir[2]. Data from 1994 to August 2024 was used to determine the average monthly sunshine for Dumfries and Galloway. Monthly daylight hours for 2024 were calculated from the National Oceanic and Atmospheric Administration's (NOAA) solar calculator[3]. The data provided by the NOAA was for the T01 of the proposed Development (NX 2122865201). The values for average daylight and average sunshine are presented in **Table 14.5.**

Table 14.5: Average daylight and sunshine statistics for the Site

Month	Mean Daylight (hours)	Mean Daily Sunshine (hours)	Percentage of Sunshine (%)
January	7.53	1.25	16.54
February	9.42	1.93	20.50
March	11.55	2.66	23.05
April	14.1	4.69	33.23

[2] *Met Office Historic Station Data – Eskdalemuir: https://www.metoffice.gov.uk/research/climate/maps-and-data/historic-station-data*
[3] *NOAA Solar calculator: https://gml.noaa.gov/grad/solcalc/*

Month	Mean Daylight (hours)	Mean Daily Sunshine (hours)	Percentage of Sunshine (%)
May	16.11	4.74	29.44
June	17.15	4.42	25.78
July	16.41	3.97	24.21
August	14.51	3.26	22.49
September	12.4	2.80	22.59
October	10.26	2.01	19.59
November	8.23	1.61	19.55
December	7.17	1.06	14.76
Average	**12.07**	**2.87**	**22.64**

14.7.4. Identification and Evaluation of Effects

90. The results of the shadow flicker assessment, as a 'theoretical' scenario, are shown in Table 14.6.

Table 14.6 Shadow flicker assessment results – theoretical scenario

ID	Days of Shadow Flicker/ Year	Maximum Hours /Day	Mean Hours/Day	Total Hours/Year
1	95	0.72	0.48	45.7
2	100	0.56	0.37	37.2
3	76	0.49	0.36	27.2
4	112	0.49	0.38	43
5	88	0.59	0.44	38.7
6	79	0.60	0.45	35.8
7	74	0.59	0.45	33.6
8	72	0.59	0.46	32.8
9	71	0.59	0.46	32.7
10	65	0.45	0.34	22.1
11	69	0.43	0.29	19.8
12	36	0.44	0.34	12.3

91. There is no formal limit on the amount of shadow flicker that is considered acceptable within the UK. For reference, a typical limit, which has been utilised in Northern Ireland, Republic of Ireland, Germany and Belgium, is 30 hours per year with a maximum of 30 minutes per day. For the purposes of this assessment, these limits are considered to be the criteria for a significant effect.

92. Prior to mitigation and based on the conservative theoretical scenario approach adopted by the model, receptors 1, 2, and 4-9 would experience '**significant**' shadow flicker effects (i.e., an exceedance of 30 hours per year and/or a maximum of 0.5 hours or 30 minutes, per day). However, this approach does not factor in wind direction, wind speed, cloud coverage, whether the turbines are turning, and the presence of obstacles; variables which have the potential to reduce the likelihood and duration of shadow flicker effects. The

shadow area coverage from the proposed turbines is illustrated in **Figure 14.2**, in hours per year.

93. A 'realistic worst-case' shadow flicker scenario incorporates weather data from the Met Office and NOAA which has been collated, averaged and applied to the 'theoretical scenario' results from **Table 14.6.**

94. Following the application of the climatic conditions and parameters shown in **Table 14.5,** the assessment for a 'realistic worst-case' scenario provided the results for Receptors 1, 2, and 4-9 in **Table 14.7**.

Table 14.7: Shadow flicker assessment results – realistic worst-case scenario

ID	'Realistic' mean Hours /Day	'Realistic' Total Hours /Year
1	0.11	10.33
2	0.08	8.41
4	0.09	9.72
5	0.10	8.75
6	0.10	8.09
7	0.10	7.59
8	0.10	7.41
9	0.10	7.39

95. The results of the analysis for the 'realistic worst-case' scenario show that of the 8 receptors within the Study Area which were likely to experience shadow flicker effects approaching or exceeding the referenced limits, none would experience shadow flicker exceeding the thresholds of 30 hours per year or 30 minutes (0.5 hours) per day.

14.7.5. Limitations to Assessment

96. Sunlight and wind data have not been correlated for the purposes of this assessment, and specific window type (i.e., the use and level of occupation for each room) has not been incorporated into the model. For the properties identified within the shadow flicker study area, a window centred at 2 m from ground level with 1 m x 1 m dimensions facing directly towards the proposed Development has been assumed for 'theoretical' scenario results.

97. The 'realistic worst-case' scenario results do not take into consideration that there will be periods in the year when turbine blades are not rotating due to low wind speeds, maintenance activities, or when the turbine rotor won't be facing the sensitive receptors. Furthermore, the results do not take into account screening objects (such as vegetation, or other structures) which may reduce the line of between the turbines and the windows at the sensitive receptor.

14.7.6. Residual Effects and Mitigation

98. Based on the 'realistic worst-case' scenario, the shadow flicker effects expected as a result of the proposed Development are '**Not Significant'**. Therefore, no mitigation is required.

14.7.7. Summary of Effects

99. Following the climatic conditions being taken into account, shadow flicker impacts arising from the proposed Development are anticipated to be '**Not Significant'**.

14.8. Climate and Carbon Balance

14.8.1. Introduction

100. Wind turbines provide an important mechanism for the reduction of carbon dioxide (CO_2), and other greenhouse gas (GHG) emissions into the atmosphere by reducing the consumption of fossil fuel generated mains electricity. However, during their manufacture, construction and decommissioning, wind farms can themselves result in GHG emissions, particularly in such instances as where natural carbon stores, such as peat, are present and potentially impacted by the development.

101. For this reason, this section provides an estimation of:

- the GHG emissions associated with the manufacture, construction, and decommissioning of the proposed Development; and
- the contribution which the proposed Development would make towards the reduction of emissions, which would otherwise be produced by fossil fuel power generation.

102. Taken together, these two elements indicate the whole-life 'carbon balance' of the proposed Development, together with an understanding of the 'emissions payback' period. Once emissions resulting from the manufacture, construction and decommissioning of the proposed Development have been 'paid back' (offset) by the wind farm, all subsequent wind-generated electricity would displace a similar amount of conventionally generated electricity, thereby contributing to an overall GHG reduction.

103. Although often colloquially termed 'carbon balance', the assessment includes all GHGs, not just carbon dioxide. The results are presented in tonnes of carbon dioxide equivalent (tCO_2e), where equivalence means having the same warming effect as CO_2 over 100 years.

14.8.2. Legislation and Policy Context

104. Planning and energy policy, including national and local policy objectives and requirements of legislation in relation to climate change, are summarised in **Chapter 4** of the EIA Report. Both national and local policy recognise that planning should consider the contributions a proposed Development makes towards achieving the climate change targets. Guidance and legislation relating specifically to carbon and GHG emissions are listed below.

105. Relevant legislation and guidance documents have been reviewed and taken into account as part of this assessment. Of particular relevance are:

- The 2015 Paris Agreement;
- The Electricity Works (Environmental Impact Assessment) (Scotland) (Regulations 2017 (as amended) (EIA Regulations); and
- The Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 and the legally binding net zero target for 2045 and interim targets for 2030 and 2040.
- The Climate Change (Emissions Reduction Targets) (Scotland) Bill 2024 has been passed and awaits royal assent. It should be noted that this bill will change the system of targets and replace interim and annual targets with targets based on carbon budgets.

106. The following national policy documents are most relevant to this factor:

- National Planning Framework 4 (NPF4);
- The Scottish Energy Strategy (December 2017);
- The Scottish Government's declaration of a Climate Emergency (April 2019);
- The Scottish Climate Change Plan Update (December 2020);
- The Scottish Government's 'Programme for Government' (September 2022);
- The Onshore Wind Policy Statement (December 2022); and
- The Draft Energy Strategy and Just Transition Plan (January 2023).

107. For Dumfries and Galloway Council, Local Development Plan 2 (2019) Policy IN1: Renewable Energy is the only relevant local policy. This requests that applicants describe the scale of contribution to renewable energy generation targets and the development's anticipated effect on greenhouse gas emissions. Furthermore, Dumfries and Galloway Council's 'Wind Energy Development: Development Management Considerations Supplementary Guidance (2020)' states that "*The extent to which development proposals help to achieve these targets is a material consideration in the determination of applications. Therefore, a statement should be submitted with applications indicating the potential output of the development, and the contribution this would make to the overall targets*."

108. Recognisance has been taken of the following best practice guidelines / guidance etc:

- Institute of Environmental Management and Assessment (IEMA) Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance (2022); and
- Good Practice During Wind Farm Construction, NatureScot et al. (2019).

109. The SNH, now NatureScot, 'Good Practice During Wind Farm Construction' guidance recognises that one of the key aims of wind farm development is to reduce carbon emissions. However, wind farm developments, through the materials used, during the construction processes employed and the potential emissions from disturbed soils and habitats, do result in carbon emissions.

110. The guidance recognises that, in some circumstances, the carbon payback of wind farm developments could be significantly affected by the construction methods used and the degree of restoration of the site. The guidance, therefore, seeks to ensure that good practice is adopted to reduce the carbon emissions associated with wind farm development.

14.8.3. Methodology

14.8.3.1. Consultation

111. Throughout the consultation process, climate and carbon balance was not raised as a topic by the consultees.

14.8.3.2. Assessment

112. Whilst the proposed Development is expected to deliver GHG savings over its lifetime, it could also cause GHG emissions through:

- disturbance of peatland;
- felling of forestry; and
- lifecycle emissions from turbines and other infrastructure.

113. The GHG assessment of the proposed Development has been undertaken using version 2.14.1 of the Scottish Government's Carbon Calculator Tool, which is the standard way of assessing GHG emissions and savings from onshore windfarm developments. The latest version of the Scottish Government Carbon Calculator Tool (V1.8.1) was unavailable during the course of this assessment while undergoing maintenance and a server upgrade. Version 2.14.1 of the Calculator was provided by the relevant case officer as a suitable alternative. A detailed explanation of the Scottish Government's Carbon Calculator Tool methodology is found within **Technical Appendix 14.2**. In brief, the calculator uses project-specific data from the construction of the proposed Development (**Chapter 3: Project Description**) and the receiving environment (**Chapters 7 to 14**), particularly with regards to peat disturbance and the felling of forestry. This allows GHG emissions and avoidance to be quantified across the project lifecycle stages (construction, operation, and decommissioning/site restoration). Specific information concerning the embodied emissions of materials, which would account for turbine manufacture and delivery, is assumed directly through the Carbon Calculator.

114. Calculations are provided for minimum, maximum and expected scenarios, whereby the minimum scenario assumes the lowest energy output and the lowest carbon losses from the proposed Development, and the maximum assumes highest energy output and highest carbon losses. The expected scenario is based on 12 turbines with an anticipated installed capacity of up to 84 MW.

115. The GHG emissions and savings are combined to establish the overall (net) GHG effect of the proposed Development, as well as its carbon payback period.

116. Results from this assessment are reported below in accordance with IEMA's Environmental Impact Assessment Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance (2022).

117. The assessment of the carbon balance of the proposed Development is based upon a detailed baseline description of the proposed Development and its location. All calculations are premised upon site-specific data, where available. Where site-specific data is not available, national/regional information has been used (e.g., from the Met Office and the Department for Business, Energy and Industrial Strategy etc.).

118. The methodology used to calculate CO_2 emissions which would result from the proposed Development is based upon 'Calculating Carbon Savings from Windfarms on Scottish Peatlands – A New Approach' (Nayak *et al.*, 2008 and 2010, Smith *et al.*, 2011). These documents are incorporated into the latest version (V1.8.1) of the Scottish Government's Carbon Calculator Tool. This tool enables carbon losses and carbon savings to be quantified across the project lifecycle stages (construction, operation and decommissioning/site restoration), and these losses and savings are combined to

establish the overall (net) carbon effect of the proposed Development, as well as its 'carbon payback period'.

119. The proposed Development is seeking consent for an operational lifetime of 40 years, and this has been adopted for the purposes of the Carbon Calculator (**Technical Appendix 14.2**).

14.8.4. Data Sources

120. All baseline surveys and data collection were carried out by the respective discipline teams, primarily the teams responsible for collecting data relating to peat disturbance and the felling of forestry.

14.8.4.1. Assumption/Limitations

121. As water table depth was not measured on the Site, values relating to water table depth were taken from Allott *et al*. (2009), who identified general site water table depths ranging from 26 to 451 mm, associating the variation with site erosion status. Allot *et al*. (2009) is a reference provided directly within the user guidance of the Scottish Government Carbon Calculator tool, to be used in situations where primary data is unavailable. This range was used as the minimum and maximum values for all water table depth inputs prior to any improvement (with the expected value being the average between the two values).

122. Based upon experience of previous projects, values following improvement were conservatively assumed to range between a minimum of 0 mm, and a maximum of 26 mm (the minimum value identified prior to any improvement) with the expected value being the average between the two values.

123. Any further assumptions and limitations would relate to the data collection process carried out by the discipline teams, which will be expanded upon in the respective chapters.

14.8.4.2. Mitigation Measures and Identification of Residual Effects

124. It has been assumed that all activities during construction, operation and decommissioning would be conducted in accordance with good practice guidance, as outlined in the CEMP (**Technical Appendix 3.1**), and this EIA Report (see **Chapter 15: Schedule of Commitments**).

125. Further examples of relevant guidance can be found in **Section 8.2: Legislation and Policy Context.**

126. All plantation felling occurring during the construction of the proposed Development will be compensated for in line with the Control of Woodland Removal Policy. The impact on GHG emissions from compensatory planting is not considered by the Carbon Calculator, making this a more conservative estimate. These will be monitored based on the principles set out in the monitoring section in **Technical Appendix 8.9 Outline Habitat Management Plan**.

14.8.4.3. Impact Assessment Criteria

127. Given the international urgency of climate change, the sensitivity of the receptor (i.e., the global climate) to fluctuations in GHG emissions is considered 'Very High'. Thus, the level of the significance of effects is determined by the magnitude, and timing, of GHG emissions and the likelihood of avoiding severe climate change. As the proposed Development will contribute significantly to the avoidance of GHG emissions in the short term, it will be

greatly beneficial towards relevant United Kingdom and Scottish Government renewable energy targets.

128. Aligned with IEMA's Guidance to Assessing GHG Significance (2022), any project that causes GHG emissions to be avoided or removed from the atmosphere has a beneficial effect that is always significant. In such a scenario, the project substantially exceeds the national net zero requirements and is thus aligned with the goal of the Paris Agreement to limit temperature rise to well below 2°C, aiming for 1.5°C. Scotland's legally binding net zero targets (see **Chapter 4: Planning**) are also aligned with the Paris Agreement. **Table 14.8** below presents the significance criteria used for the assessment.

Table 14.8 IEMA's Guidance to Assessing GHG Significance (2022) Framework for assessment of significant effects

Significance	Level	Criteria
Significant	Major adverse	Project adopts a business-as-usual approach, not compatible with the national Net Zero trajectory, or aligned with the goals of the Paris Agreement (i.e., a science-based 1.5°C trajectory). GHG impacts are not mitigated or reduced in line with local or national policy for projects of this type.
	Moderate adverse	Project's GHG impacts are partially mitigated, and may partially meet up-to-date policy; however, emissions are still not compatible with the national Net Zero trajectory, or aligned with the goals of the Paris Agreement.
Not Significant	Minor adverse	Project may have residual emissions, but the project is compatible with the goals of the Paris Agreement, complying with up-to-date policy and good practice.
	Negligible	Project has minimal residual emissions and goes substantially beyond the goals of the Paris Agreement, complying with up-to-date policy and best practice.
Significant	Beneficial	Project causes GHG emissions to be avoided or removed from the atmosphere, substantially exceeding the goals of the Paris Agreement with a positive climate impact.

14.8.4.4. Baseline Conditions

129. The baseline conditions in relation to potential climate change impacts from the proposed Development include existing carbon stored in the Site (such as peat and forestry) that could be impacted by the proposed Development resulting in CO_2 and other GHG emissions.

130. The Site is predominantly comprised of forestry, forming part of the Forest of Ae forestry parcel.

14.8.4.5. Carbon and Peatland

131. Renewable energy developments in upland areas are often sited on areas of peatland which hold stocks of poorly protected carbon. If disturbed, these stocks have the potential to release carbon into the atmosphere in the form of CO_2.

132. Scotland hosts the majority of peat soils in the UK. Therefore, it has a responsibility to maintain and enhance the quality and stability of its peat soils; partly by ensuring that developments do not cause a significant loss of these carbon reservoirs. Part of the proposed Development is sited on peaty soils which has been negatively impacted by extensive commercial forestry planting thereby limiting their capacity to sequester and

store carbon. Specifically, the peat located on the Site is not considered pristine as a result of its disturbance due to planting and harvesting activities, which are likely to have resulted in the release of CO_2 into the atmosphere and the limitation of their ability to sequester carbon.

133. The disturbance of peat has been considered during the design process which has avoided areas of deep peat. The design process is described in **Chapter 2,** whilst specific details relating to peat depth are included in the Peat Slide Risk Assessment, in **Technical Appendix 10.1**.

14.8.4.6. Characteristics of Peatland

134. The loss of carbon from the carbon fixing (sequestering) potential of vegetation on peatland is small but is calculated for the area from which peat is removed and the area affected by drainage. The carbon stored in the peat itself represents a much larger potential source of carbon loss.

135. When flooded, peat soils emit less CO_2 but more methane (CH_4) than when drained. In flooded soils, CO_2 emissions are usually exceeded by plant fixation (sequestration), so the net exchange of carbon within the atmosphere is negative and soil stocks increase. When soils are aerated, CO_2 emissions usually exceed plant fixation, so the net exchange of carbon within the atmosphere is positive.

136. To calculate the CO_2 emissions attributable to the removal or drainage of the peat, emissions occurring if the soil had remained *in situ* and undrained are subtracted from the emissions occurring after removal or drainage.

137. The indirect loss of CO_2 fixation by plants originally on the surface of the site but eliminated by construction activities, including the destruction of active bog plants and felling, is calculated using site-specific data collected as part of the EIA process and based upon blanket bog. Further information on peat is provided in **Chapter 10**, with information on habitats in **Chapter 8**.

138. Emissions due to the indirect, long-term liberation of CO_2 from carbon stored in peat due to drying and oxidation processes caused by on-site construction can also be calculated from site-specific data for the proposed Development. The resultant figure is a reasonable theoretical scenario, as peat would be reused onsite to minimise carbon losses for restoration of the proposed Development, and for habitat restoration including ditch blocking. See the Outline Habitat Management Plan (**Technical Appendix 8.9**) for further information.

14.8.4.7. Characteristics of Forestry

139. The Site is currently an actively managed commercial coniferous forestry plantation. Such plantation, if removed as part of a development, has the potential to lead to a loss in the CO_2 sequestration potential of the land.

140. The amount of carbon released into the atmosphere as a result of felling is dependent upon the type of tree being felled, the age of the crop, the use of the timber and how quickly the stored carbon is released into the atmosphere. Cannell (1999, in Nayak *et al.*, 2008) provides estimates for the amounts of carbon sequestered by fast-growing trees (such as poplar), medium (such as Sitka spruce) and slow-growth (such as beech) trees, as outlined in **Table 14.9**.

Table 14.9 Carbon Sequestration Potential of Fast, Medium and Slow-Growing Tree Species (Cannel, 1999)

	Poplar	Sitka	Beech
Yield Class (m^3 ha^1 yr^1)	12	16	6
Carbon sequestered, G forest (tCO_2 ha^{-1} yr^{-1})	276	13	99
Crop rotation, t forest (years)	26	55	92
CO_2 sequestered per crop rotation (tCO_2 ha^{-1})	6955	7255	8099

14.8.5. Identification and Evaluation of Effects

14.8.5.1. Assessment of Effects

141. The Carbon Calculator has assumed a projected operational life of 40 years. On this basis, its total GHG savings are expected to be 3,224,531531tCO_2e, inclusive of construction, operation and decommissioning emissions.

142. GHG emissions are inherently cumulative, as all emissions have the same impact on the same ultimate receptor (i.e. the global climate). Most developments result in the release of GHGs, and consequently have the potential to result in a cumulative effect. Conversely, renewable energy developments such as this have a net beneficial effect, in that they cause the reduction of GHG emissions. As the receptor is not geographically constrained it is not appropriate to undertake a conventional cumulative effects assessment.

14.8.5.2. Potential Effects – "Do-Nothing" Scenario

143. Under a "do-nothing" scenario, no change would be expected concerning GHG emissions within the Site when compared to the baseline. On a national level, in a scenario where the proposed Development does not take place, the proportion of Scotland and the United Kingdom's electricity mix contributed through fossil fuel electricity generation would be higher than a scenario with the proposed Development, which may jeopardise these countries' ability to meet their long-term emissions reduction targets.

144. The results of the carbon balance assessment carried out for the proposed Development are presented below for each project stage. The project-specific input and output data is contained within **Technical Appendix 14.2**, alongside the detailed methodology of the calculator.

14.8.6. Potential Effects – Construction and Decommissioning

145. **Table 14.10** presents the results of the GHG assessment for the manufacture, construction, and decommissioning stages of the proposed Development. Significant GHG emissions are predicted from soil organic matter, as well as some emissions from the felling of forestry. Total projected emissions are 266,549 tCO_2e.

Table 14.10 Predicted GHG emissions from wind farm manufacture, construction and decommissioning

Source of GHG Emissions/Savings	Estimated GHG emissions (tCO_2e)	% of total
Losses due to turbine manufacture, construction, and decommissioning	73,745	28

Losses due to back-up power generation	68,193	26
Losses due to reduced carbon fixing potential	1,119	0
Losses from soil organic matter	18,309	7
Losses due to Dissolved Oxygen Content and Portable Oxygen Content	0	0
Losses due to forestry felling	105,182	39
Total	266,549	**100**

146. Any post-decommissioning site restoration and enhancement work, such as blocking drainage ditches to promote re-wetting, would be aligned with the Outline Habitat Management Plan (see **Technical Appendix 8.9**) and the Outline Peat Management Plan (**Technical Appendix 10.2**). Such activities can incur GHG savings by promoting growth of peat or other natural carbon stores.

147. **Table 14.11** shows the total CO_2 gains due to site improvement during post-decommissioning (tCO_2e).

Table 14.11 Estimated CO_2 savings due to Improvement of the Site (tCO_2e)

Improvement	GHG Emissions (tCO_2e)	% of Total
Change in emissions due to improvement of degraded bogs	0	0
Change in emissions due to improvement of felled forestry	0	0
Change in emissions due to restoration of peat from borrow pits	0	0
Change in emissions due to removal of drainage from foundations and hardstanding	0	0
Total change in emissions due to improvements	0	0

148. Taking into account the predicted GHG emissions from wind turbine manufacture, construction and decommissioning alongside those savings from the improvement of the site, the total net GHG emissions from the proposedp Development are expected to be 266,549 tCO_2e (**Table 14.12**).

Table 14.12 Estimated annual emissions savings against fossil fuel and grid electricity generation mix

Source of GHG Emissions/Savings	GHG savings	GHG Emissions (tCO_2e)
Predicted GHG emissions from wind turbine manufacture, construction, and decommissioning	0	266,549
Total CO_2 gains/savings due to improvement of the Site	0	0

Total net GHG emissions from wind farm manufacture, construction, decommissioning, and improvement of the Site S	0	266,549

14.8.6.1. Potential Effects - Operation

149. The operational stage of the proposed Development has the greatest potential for GHG savings. At this stage, GHG emissions from construction activities will have ceased and operation of the turbines would generate zero-carbon electricity for the remainder of their lifespan. Table 14.13 presents projected annual emissions savings as measured against the grid-mix and fossil fuel-mix of electricity.

Table 14.13 Estimated annual emissions savings against fossil fuel and grid electricity generation mix

GHG Savings*	GHG savings (tCO2e)		
	Expected Value	Minimum Value	Maximum Value
Grid mix electricity generation			
GHG savings per year	87,277	74,809	99,745
Lifetime GHG savings*	3,491,080	2,992,360	3,989,800
Fossil fuel mix electricity generation			
GHG savings per year	119,339	102,290	136,387
Lifetime GHG savings*	4,773,560	4,091,600	5,455,480
***Operational GHG savings based over a lifetime of 40 years**			

14.8.6.2. Emissions Payback Period

150. The emissions payback time can be calculated by dividing the total expected emissions caused by the proposed Development (266,549 tCO_2e: **Table 14.11**) by expected annual savings from operation (87,277 tCO_2e: **Table 14.12**). This gives a predicted emissions payback of 3.11 years against a representative grid mix (electricity of which the main sources of energy are identical to those used for the National Grid; this could include fossil fuels, renewable energy, nuclear, etc), and 2.22 years against a fossil-fuel mix electricity generation (electricity that is sourced through the combustion of fossil fuels alone).

Table 14.14 Estimated carbon payback period of the proposed Development for a range of capacity factors.

	Carbon payback time (years)		
	Expected Value	Minimum Value	Maximum Value
Grid mix electricity generation	3.1	2.4	4.0
Fossil fuel mix electricity generation	2.2	1.7	3.0

14.8.6.3. Net GHG Effect

151. Assuming an operational life of 40 years, its total GHG savings are expected to be 3,224,531 tCO_2e, inclusive of construction, operation and decommissioning emissions against grid mix electricity generation.

14.8.6.4. Residual Effects and Mitigation

152. As no adverse effects are predicted, no additional mitigation measures are proposed.

14.8.6.5. Summary of Effects

153. GHG emissions will arise from the manufacture, construction and decommissioning activities, including the loss of peat and forestry, from the construction of turbines and associated infrastructure.

154. These emissions are projected to be offset 2.22 years after the proposed Development becomes operational against a fossil fuel mix of electricity, or 3.1 years against a grid-mix of electricity. The proposed Development is predicted to deliver total emissions savings of 4,507,011 tCO_2e over a modelled 40-year operational lifetime, against a fossil fuel mix electricity generation, and 3,224,531 tCO_2e against grid mix electricity generation. The results show that the proposed Development will lead to emission savings through the displacement of higher carbon electricity generation. It should also be noted that this represents a reasonable worst case, given the assessment uses a conservative approach.

155. The overall impact is considered to represent a '**Significant' and Beneficial effect**, and contribute to long-term climate change mitigation. Consequently, the proposed Development contributes towards Scotland's emissions reduction targets as set out in the Climate Change (Emissions Reductions Targets) (Scotland) Act 2019, together with its renewable energy obligations as set out in the Scottish Climate Change Plan.

14.9. Aviation and Radar

14.9.1. Introduction

156. This section considers the potential effects of the construction and operation of the proposed Development on aviation and radar interests, including those of the United Kingdom (UK) Civil Aviation Authority (CAA), Ministry of Defence (MOD), NATS (comprising NATS (En Route) plc (NERL) and NATS (Services) Limited (NSL)), the Met Office, regional airports, local aerodromes, and other UK aviation stakeholders.

157. The potential impacts of wind turbines on aviation interests have been widely publicised and are outlined below:

- Physical obstruction: Turbines can present a physical obstruction at, or close to, an aerodrome or other aviation activity site such as a military low flying area;
- Primary Surveillance Radar (PSR): Turbines can produce spurious/false returns known as "clutter". Turbine clutter appearing on a radar display can affect the safe and efficient provision of Air Traffic Services (ATS) as it can mask unidentified aircraft from the air traffic controller and/or prevent them from accurately identifying aircraft under their control and/or cause the track of the aircraft under control to be incorrectly reported. In some cases, radar reflections from the turbines can affect the performance of the radar itself;
- Secondary Surveillance Radar (SSR): Turbine towers can obstruct and diffract SSR signals, but these effects are typically only considered when turbines are within 10 km of the facility. At greater ranges, SSR signals reflected from wind turbines can result in the

radar generating a false target in a direction that is different to where the intended aircraft target is. Guidance on safeguarding distances varies with CAA recommending 10 km and NATS recommending 28 km (15 nautical miles (nm)); and

- Turbines can cause adverse effects on the overall performance of other Communication, Navigation and Surveillance (CNS) equipment.

14.9.2. Legislation and Policy Context

14.9.2.1. Legislation

158. The Air Navigation Order (ANO) 2016/765 (CAA 2022) implements the UK's obligations under the Chicago Convention on International Civil Aviation and regulates aspects of aviation safety. It provides regulatory and enforcement powers for the CAA needed in respect of retained safety legislation. ANO Article 222 details the requirements for the lighting of enroute obstacles that are 150 m or more above ground level. Article 225A details the requirements for notifying the CAA of any planned works to erect new enroute obstacles that are 100 m or more above ground level.

14.9.2.2. Planning Policy

159. National Planning Framework 4 (Scottish Government 2023) sets out the national spatial strategy for Scotland. The Energy policy (Policy 11) states that project design and mitigation will demonstrate how impacts on aviation and defence interests are addressed.

160. Onshore Wind Policy Statement 2022 (Scottish Government 2022) acknowledges the potential impact of wind turbines on aviation operations. In response to consultation, the Onshore Wind Aviation Radar Delivery 2030 group has been formed to build on the co-existence between the onshore wind and aviation sectors through policy delivery and the implementation of technical solutions.

161. Civil Aviation Publication (CAP) 764: Policy and Guidelines on Wind Turbines (CAA 2016) details the CAA policy and guidelines associated with wind turbine impacts on aviation that aviation stakeholders and wind energy developers need to consider when assessing a development's viability.

14.9.2.3. Local Policy

162. Local Development Plan 2 (Dumfries and Galloway Council 2019), Policy IN2: Wind Energy states that the acceptability of windfarm proposals will be assessed, inter alia, against the impact on aviation and defence interests, including the Eskdalemuir Safeguard Area.

163. Wind Energy Development: Development Management Considerations Supplementary Guidance (Dumfries and Galloway Council 2020) provides further detail in support of aviation and defence interests considerations.

14.9.2.4. Guidance

164. There are several documents which provide relevant guidance for assessing the impact of wind turbines on aviation and radar and these are listed below:

- CAP 032: UK Aeronautical Information Publication (AIP) (CAA 2024);
- CAP 168: Licensing of Aerodromes (CAA 2022);
- CAP 670: Air Traffic Services Safety Requirements (CAA 2019);
- CAP 738: Safeguarding of Aerodromes (CAA 2020);

- CAP 764: Policy and Guidelines on Wind Turbines (CAA 2016);
- CAP 774: UK Flight Information Services (CAA 2021);
- ANO 2016/765 (CAA 2022);
- Directorate of Airspace Policy (DAP) Policy 124: Lighting of Onshore Wind Turbine Generators in the United Kingdom with a maximum blade tip height at or in excess of 150 m Above Ground Level (CAA 2017);
- UK Military AIP (MOD 2024); and
- MOD Obstruction Lighting Guidance (MOD 2020).

14.9.3. Methodology

14.9.3.1. Consultation

165. The relevant aviation stakeholders were consulted regarding the potential effects of the proposed Development as part of the scoping exercise. A summary of consultation is provided in **Table 14.15**.

Table 14.15 – Consultation responses

Consultee	Summary of Consultation
Glasgow Airport 18 April 2023	Glasgow Airport had no comment to make as the proposed Development would lie outside its consultation zone
Prestwick Airport 28 March 2023	Prestwick Airport stated that its PSRs would not be affected by the proposed turbines due to terrain shielding, and that the proposed Development location is clear of Prestwick's Instrument Flight Procedure routings and the Instrument Landing System safeguarding area.
Met Office 29 March 2023	The Met Office confirmed that the proposed Development would be beyond the 20 km consultation zone of any Met Office radar and that they did not need further consultation.
MOD 05 May 2023	The MOD noted that the proposed Development would lie within Tactical Training Area 20T, a military low flying area, and that turbines have the potential to create a physical obstruction to low flying. The MOD would require consent conditions requiring the fitting of MOD accredited aviation safety lighting, together with sufficient data submitted to the MOD to ensure accurate charting of obstructions. The MOD also stated that it must object due to the unacceptable impact the turbines would have on the seismological recording station at Eskdalemuir.
NERL 12 April 2023	NERL indicated it objects to the proposal and provided a Technical and Operational Assessment (TOPA) which predicted that ten of the proposed turbines would be likely to cause false primary plots to be generated by Lowther Hill radar and that this anticipated impact would be unacceptable to Prestwick Centre Air Traffic Control operations.

14.9.3.2. Assessment

166. The assessment comprises a desk-based review of the location, technical characteristics and operational activities of aviation interests and operations in the vicinity of the Site using relevant data sources. The effects of the proposed Development have been assessed by modelling whether any of the wind turbines would be in the line of sight of any aviation radar facilities, and whether the Site is in an area of operational importance to those radars. Evaluation of these effects also considered the response of radar operators

to pre-application consultation. Full details of the assessment methodology and radar modelling are provided in **Technical Appendix 14.4: Aviation Impact Assessment**.

14.9.3.3. Study Area(s)

167. In considering the spatial coverage of the aviation study area, the overriding factor is the potential for turbines to have an impact on civil and military PSRs, taking into account required radar operational ranges. In general, PSRs installed at civil and military airfields have an operational range of between 40 nm and 60 nm. All radar equipped airfields within 60 nm (111 km) of the proposed Development are therefore included in the study area. Enroute radars operated by NERL, and military Air Defence (AD) radars are required to provide coverage at ranges in excess of 60 nm and so all such radars with potential Radar Line of Sight (RLoS) of the proposed Development turbines are also included in the study area.

168. Potential receptors considered within the study area are outlined below.

Civil Aerodromes

169. The CAA publication CAP 764: Policy and Guidance on Wind Turbines (CAA 2016) states the distances from various types of aerodromes where consultation should take place. These distances include:

- Aerodromes with a surveillance radar – 30 km;
- Licensed aerodromes where the wind turbines will lie within airspace coincidental with any published Instrument Flight Procedures (IFPs);
- Non-radar equipped licensed aerodromes with a runway of more than 1,100 m – 17 km;
- Non-radar equipped licensed aerodromes with a runway of less than 1,100 m – 5 km;
- Non-radar equipped unlicensed aerodromes with a runway of more than 800 m – 4 km;
- Non-radar equipped unlicensed aerodromes with a runway of less than 800 m – 3 km;
- Gliding sites – 10 km; and
- Other non-aerodrome aviation activity such as parachute sites and microlight sites –– 3 km.

170. CAP 764 advises that these distances are for guidance purposes only and do not represent ranges beyond which all wind turbine developments will be approved or within which they will always be objected to. For example, aerodromes may utilise their radars at ranges considerably in excess of 30 km.

171. As well as examining the technical impact of turbines on CNS facilities, it is also necessary to consider the physical safeguarding of Air Traffic Control (ATC) operations using the criteria laid down in the CAA publication CAP 168: Licensing of Aerodromes (CAA 2022) to determine whether wind turbines will breach obstacle clearance criteria.

Ministry of Defence

172. Ministry of Defence (MOD) receptors under consideration within the study area include:

- MOD airfields, both radar and non-radar equipped;

- MOD AD radars; and
- Military aircraft engaged in low flying activities.

NERL Facilities

173. It is necessary to consider the possible effects of wind turbines upon NERL's UK-wide network of PSR and SSR facilities which provides enroute information for both civil and military aircraft.

Meteorological Radio Facilities

174. Wind turbines have the potential to adversely impact meteorological radio facilities such as weather radar. The Met Office must be consulted by developers of wind turbine proposals within a 20 km radius zone of any of their UK weather radar sites.

14.9.3.4. Data Sources

175. The primary sources of aviation related data used for the desktop study are the UK civil and military AIPs. The AIPs contain details on airspace and enroute procedures as well as charts and other air navigation information.

14.9.3.5. Impact Assessment Criteria

176. For the purposes of this assessment no detailed grading has been made of the magnitude of the impact or sensitivity of the receptor on the basis that any potential impact on aviation stakeholders that restricts operations is considered to be of significance.

14.9.4. Baseline Conditions

14.9.4.1. Airspace

177. The airspace surrounding the proposed Development is fully described in **Technical Appendix 14.4: Aviation Impact Assessment.** As noted by the MOD in their consultation response, the proposed Development is located within a military low flying area known as Tactical Training Area 20T (Area 2B at night). Within Area 20T military aircraft may conduct low flying training down to 100 ft above the ground.

14.9.4.2. Aerodromes

178. The nearest radar equipped aerodromes to the proposed Development are Prestwick Airport, 66 km to the northwest, Glasgow Airport, 87 km to the north, northwest, and Edinburgh Airport, 81 km to the north, northeast.

179. The nearest non-radar equipped licensed aerodrome to the proposed Development is Carlisle Lake District Airport, 58 km to the southeast, while the nearest minor aerodrome identified is the private airstrip at Glenswinton, 29 km to the southwest. The closest known glider airfield is at Falgunzeon, 27 km south, southwest of the proposed Development.

180. MOD West Freugh is the closest military radar equipped airfield to the proposed Development, 90 km to the west, southwest.

14.9.4.3. En Route Radars and Navigation Aids

181. The closest NERL operated radars to the proposed Development are the combined PSR/SSR facilities at Lowther Hill (17 km north) and Great Dun Fell (93 km southeast), and the PSR only facilities at Cumbernauld (83 km north) and Kincardine (93 km north).

182. The closest NERL enroute navigation aid to the proposed Development is the Green Lowther Distance Measuring Equipment (DME) facility, 18 km to the north.

183. Royal Air Force (RAF) Spadeadam is an Electronic Warfare Tactics facility approximately 40 km east of the proposed Development. Spadeadam Range is supported by a PSR at Deadwater Fell (65 km east) and the Berry Hill PSR/SSR (69 km east, southeast).

184. The closest MOD AD radar is at Brizlee Wood, 118 km east of the proposed Development.

14.9.4.4. Met Office Weather Radars

185. The closest Met Office weather radars to the proposed Development are located at Holehead in Stirlingshire, 94 km to the north, northwest, and at Munduff Hill in Perth and Kinross, 110 km to the north, northeast.

14.9.5. Identification and Evaluation of Effects

14.9.5.1. Effects Scoped Out

186. Wind turbine effects on any civil and military PSRs during the construction phase are scoped out. To discriminate wanted aircraft targets from unwanted clutter, PSRs ignore static objects and only display moving targets. PSRs that can see the rotating blades of wind turbines can mistake them for aircraft and so present them on the radar display as clutter. Until turbine blades in RLoS are allowed to rotate, they will not generate PSR clutter.

187. The proposed Development would be beyond the 20 km consultation zone radius of any weather radar sites, as confirmed by the Met Office, therefore effects on meteorological radio facilities are scoped out.

188. The closest SSR to the Site is the NERL facility at Lowther Hill. The proposed Development would be within the NATS recommended safeguarding distance; however, NERL has not raised any concerns regarding SSR impacts and so effects on SSR are scoped out.

189. The proposed Development would not be within airspace coincidental with licensed aerodrome published IFPs, and would be beyond the CAA stated consultation ranges for unlicensed aerodromes and glider sites. Effects on aerodromes and glider sites are therefore scoped out.

190. Radar modelling indicates that the proposed wind turbines would not be in RLoS of the PSR facilities at Prestwick, Glasgow and Edinburgh Airports, or the NERL enroute PSRs at Cumbernauld and Kincardine. Similarly, the proposed turbines would not be in RLoS of the military PSRs at MOD West Freugh, Berry Hill and Brizlee Wood. Effects on these PSRs are scoped out as they would not detect the proposed wind turbines.

14.9.5.2. Effects Scoped In

191. Radar modelling indicates that 11 of the 12 proposed wind turbines would be in RLoS of Lowther Hill PSR. It is likely that Lowther Hill PSR would detect at least 11 of the proposed turbines.

192. Radar modelling indicates that two of the 12 proposed wind turbines would be in RLoS of Great Dun Fell PSR. It is likely that Great Dun Fell PSR would detect at least two of the proposed turbines.

193. Radar modelling indicates that seven of the 12 proposed wind turbines would be in RLoS of RAF Spadeadam's Deadwater Fell PSR. It is likely that Deadwater Fell PSR would detect at least seven of the proposed turbines.

194. The proposed Development would be located in a military low flying area and the addition of wind turbines would introduce a physical obstruction military aircraft engaged in low flying training.

14.9.5.3. Mitigation Measures and Residual Effects

195. The PSR facility at Lowther Hill was replaced in September 2022 with a 3D PSR system with the capability to mitigate the impact of wind turbines by better filtering out the clutter the turbines generate. Optimisation of the Lowther Hill PSR to mitigate the impact of the proposed Development may be a feasible option. A potential further mitigation option would be to blank the area of clutter and use an infill radar feed that does not have RLoS of the proposed turbines. A suitable infill candidate would be Cumbernauld PSR which has minimum infill coverage of 4,000 ft amsl and is integrated into NERL's Multi-Radar Tracking infrastructure. Application of suitable technical mitigation measures would mean a residual effect of **'Not Significant'**.

196. The NERL TOPA does not predict any impact on Great Dun Fell PSR from the proposed Development. However, should NERL change their stance then mitigation may be required. This could be achieved by applying small area blanking over the two wind turbines that are in RLoS (T11 and T12). With technical mitigation in place, should it be required, the residual effect is considered **'Not Significant'**.

197. Spadeadam Range, where Deadwater Fell PSR is used to control aircraft engaged in electronic warfare exercises, is approximately 40 km to the east of the Site. The distance from the range boundary suggests that the proposed Development location is not in an operationally significant area in terms of required Deadwater Fell PSR coverage for ATC purposes. The MOD has not raised any concerns regarding potential impacts on its radar facilities, so the residual effect is considered **'Not Significant'**.

198. Wind turbines exceeding 150 m in height are required to have suitable aviation lighting installed in accordance with Article 222 of the ANO 2016/765 (CAA 2022) and DAP Policy 124 (CAA 2017). Visible lighting may be supplemented by infra-red lighting, as directed by the MOD. The CAA must be notified in writing of any enroute obstacle exceeding 100 m in height at least eight weeks prior to construction, in accordance with Article 225A of the ANO. The obstacle information is shared with NATS Aeronautical Information Services for publication of obstacles in the AIP and the MOD Defence Geographic Centre for inclusion on military aeronautical charts. The lighting and notification of the proposed wind turbine obstacles would mean a residual effect on military low flying aircraft of **'Not Significant'**.

14.10. Seismic Stations

14.10.1. Introduction

199. Eskdalemuir Seismic Array is a seismological monitoring station in the Scottish Borders which forms part of the UK's obligations under the Comprehensive Test Ban Treaty. The Array is the responsibility of the MOD, who require consultation to ensure appropriate safeguarding from excessive seismic noise generated by wind turbines operating in the vicinity. As a result, an exclusion zone of 10 km has been created around the Array, with

wind turbine developments in the 10-50 km zone (the 'Consultation Zone') around the Array being subject to allocation of seismic budget.

14.10.2. Baseline Conditions

200. At present, all developed and proposed turbines within the 50 km consultation zone are contributing to the budget on a theoretical hypothetical turbine model. When using this model, the vibration budget of 0.336 nm has been reached, resulting in no possibility for further turbine development in the consultation zone using the current model. All applications within the 10-50 km consultation zone since 2018 have been added to a list for MOD approval.

14.10.3. Identification and Evaluation of Effects

201. The Scottish Government and the UK Wind Industry are actively supporting an Eskdalemuir Working Group. The group, alongside leading seismologists, have established that the current algorithm for calculating noise vastly overestimates predicted seismological impact. This fact is further reflected in the Scottish Government's Onshore Wind Policy Statement (2022) which identified that the algorithm used by the MoD to calculate the budget takes a conservative approach and, by design, over-estimates the seismic contribution of each wind turbine.

14.10.4. Residual Effects and Mitigation

202. The Scottish Government, the UK Onshore Wind Taskforce and the wind industry are now actively engaging with the MOD to approve the findings of technical reports demonstrating the overestimation and to secure the introduction of a new policy for budget allocation. Given the Array is 32.3 km from the proposed Development's closest turbine, the seismic footprint would be comfortably accommodated in any new budget without the need for seismic mitigation.

14.10.5. Summary

203. The Applicant is confident that the ongoing work of the Eskdalemuir Working Group will result in the release of a sufficient seismic noise budget to facilitate the construction of the proposed Development. However, the Applicant acknowledges that the seismic noise budget for Eskdalemuir is finite and requires careful management to maximise wind energy deployment within the 50 km Consultation Zone. This strategic management is essential to enable Scotland to meet its legislated Net Zero 2045 targets, in line with the Scottish Government's Onshore Wind Policy Statement (2022)..

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