17 OTHER ISSUES

17.1 Introduction

17.1.1 This Chapter of the EIA Report evaluates the effects of the Proposed Development on any remaining topics within the scope of the EIA.

17.1.2 The topics included within this Chapter include:

- Shadow Flicker;
- Aviation;
- Telecommunications and Utilities; and
- Health and Safety (including Ice Throw).

17.1.3 This Chapter is structured as follows for each topic:

- Legislation, policy and guidance;
- Assessment methodology and significance criteria;
- Scoping Responses and Consultation;
- Baseline conditions;
- Assessment of potential effects;
- Assessment of cumulative effects;
- Mitigation measures;
- Residual effects; and
- Summary.

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

- Figure 17.1 – Shadow Flicker Assessment
- Figure 17.2 – Cumulative Shadow Flicker Assessment

17.1.5 This Chapter is supported by the following Technical Appendix documents provided in Volume 4 Appendices:

- Appendix 17.1 – Shadow flicker receptors
- Appendix 17.2 – Aviation risk assessment

17.2 Shadow Flicker

Introduction

17.2.1 This Section of the EIA Report evaluates the effects of shadow flicker from the Proposed Development on nearby receptors.

17.2.2 Under certain combinations of geographical position and time of day and year, the sun may pass behind the rotors of a wind turbine and cast a shadow over neighbouring properties. Shadow flicker is an effect that can occur when the shadow of a blade passes over a small opening (such as window), briefly reducing the intensity of light within the room, and causing a flickering to be perceived. The likelihood and duration of the effects depends on a range of factors, discussed in detail in Paragraph 17.2.17 of this Chapter.

Legislation, Policy and Guidance

17.2.3 The following guidance and information sources have been considered in carrying out the shadow flicker assessment:

- Online Planning Guidance for Renewables and Low Carbon Energy[1];
- Supplementary Guidance: Wind Energy Development[2]
- Review of Light and Shadow Effects from Wind Turbines in Scotland[3]; and
- Planning Policy Statement (PPS) 18 'Renewable Energy'[4].

Online Planning Guidance for Renewables and Low Carbon Energy

17.2.4 Online Planning Guidance for Renewables and Low Carbon Energy provides information for consideration surrounding shadow flicker. This is the most current guidance available in terms of shadow flicker; therefore, this guidance has been used to inform the assessment methodology for this assessment. It states:

"…where separation is provided between wind turbines and nearby dwellings (as a general rule 10 rotor diameters), 'shadow flicker' should not be a problem".

Supplementary Guidance: Wind Energy Development

17.2.5 West Lothian Council's Supplementary Guidance for Wind Energy Development forms part of the West Lothian Local Development Plan, and sets out West Lothian Council's approach to wind energy development and details the criteria against which wind energy will be assessed. With regards to shadow flicker, it states:

"In certain circumstances shadow flicker from turbines can cause a nuisance for neighbouring properties and a separation distance of 10 rotor diameters is usually recommended. Shadow flicker is the flickering effect caused when rotating wind turbine blades periodically cast shadows through constrained openings such as the windows of neighbouring properties."

[1] Scottish Government. (2014). Onshore wind turbines: planning advice. [Online] Available at: https://www.gov.scot/publications/onshore-wind-turbines-planning-advice/. (Accessed 12/10/22)
[2] West Lothian Council. (2021). Supplementary Guidance: Wind Energy Development. [Online] Available at: https://www.westlothian.gov.uk/media/49451/SG-Supplementary-Guidance-Wind-Energy-Development-Adopted-June-2021/pdf/SG_-_Wind_Energy_Development_-_Adopted_-_Word_Version_-_25_June.pdf (Accessed 12/10/22)
[3] LUC. (2017). Review of Light and Shadow Effects from Wind Turbines in Scotland. [Online] Available at: https://www.climatexchange.org.uk/research/projects/review-of-light-and-shadow-effects-from-wind-turbines-in-scotland/. (Accessed 12/10/22)
[4] Department for Infrastructure. (2019). Best Practice Guidance to PPS 18 'Renewable Energy'. [Online] Available at: https://www.infrastructure-ni.gov.uk/publications/best-practice-guidance-pps-18-renewable-energy. (Accessed 12/10/22)

Review of Light and Shadow Flicker Effects from Wind Turbines in Scotland

17.2.6 A review of light and shadow effects from wind turbines was commissioned by ClimateXChange to review how light and shadow flicker effects are considered in the development planning process in Scotland.

17.2.7 This document includes a review of current UK guidance, along with a review of how the current guidance is applied through the selection and review of case studies.

17.2.8 The review highlights that there is a need for guidance on the thresholds of exposure to shadow flicker in Scotland.

17.2.9 It should be noted that since the publication of this review (2017), shadow flicker guidance in Scotland has not changed, and as such, the guidance in the Online Planning Guidance for Renewables and Low Carbon Energy remains extant.

Planning Policy Statement 18 'Renewable Energy'

17.2.10 No formal guidance is available regarding what levels of shadow flicker may be considered acceptable across the UK. The Northern Ireland Department of the Environment published the Best Practice Guidance to Northern Ireland Planning Policy Statement (PPS) 18: Renewable Energy which states:

"Problems caused by shadow flicker are rare. At distances greater than 10 rotor diameters from a turbine, the potential for shadow flicker is very low. The seasonal duration of this effect can be calculated from the geometry of the machine and the latitude of the site. Where shadow flicker could be a problem, developers should provide calculations to quantify the effect and where appropriate take measures to prevent or ameliorate the potential effect, such as by turning off a particular turbine at certain times.

Careful site selection, design and planning, and good use of relevant software, can help avoid the possibility of shadow flicker in the first instance. It is recommended that shadow flicker at neighbouring offices and dwellings within 500 m should not exceed 30 hours per year or 30 minutes per day."

Assessment Methodology and Significance Criteria

Study Area

17.2.11 The Study Area considers a maximum distance of 1,700 m (ten times the rotor diameter of 170 m) from the turbines; however, shadows will not be cast over this entire area. At the latitude of the Proposed Development, the relative path of the sun through the sky throughout the year means that shadows are cast predominantly to the west and east, with shadows to the south and (to a lesser extent) the north being reduced in comparison.

17.2.12 To ensure that this assessment considers only receptors which may experience shadow flicker effects, the Study Area is defined as the calculated area over which shadows from the wind turbines may be cast (see Paragraph 17.2.11), limited to a distance of 1,700 m (ten times the rotor diameter of 170 m) from the turbines, in line with current guidance. The Study Area is shown in **Figure 17.1**. The Study Area covers areas of both North Lanarkshire and West Lothian Councils' administrative boundaries.

Survey Methodology

17.2.13 The assessment of shadow flicker is a desk-based assessment, and as such, no onsite survey specific to shadow flicker has been undertaken.

17.2.14 The desk-based assessment was undertaken using Ordnance Survey AddressBase Plus data, verified against freely available online aerial imagery, to confirm the locations and names of permanent dwellings within the study area.

Assessment Methodology

17.2.15 A recognised computer software package[5] was used to calculate theoretical times and durations of shadow flicker effects for each receptor within 1,700 m from the turbines. This software creates a mathematical model of the Proposed Development and its surroundings, based on:

- Turbine locations, hub height and rotor diameter;
- Topography (using Ordnance Survey Terrain 5 elevation data); and
- Latitude and longitude of the Proposed Development site (used in calculating the position of the sun in relation to time of day and year).

17.2.16 A cut-off distance of 1,700 m (ten times the maximum rotor diameter of 170 m) from each turbine was employed during this calculation as described in Paragraph 17.4.1.

17.2.17 Certain worst-case assumptions are made in the calculation, including:

- All receptors have windows facing towards the turbines.
- All windows have been assumed to measure 1 m by 1 m, to be situated at a height of 2 m above ground level, to the window's centre.
- Windows facing towards each of the cardinal compass point directions (North, South, East, and West) have been modelled in order to identify effects from all possible directions. In practice, not all of these directions face the Proposed Development, and the buildings may not have windows on each facade.
- There will be no intervening structures or vegetation (other than topography) that may restrict the visibility of a turbine, preventing or reducing the effect.
- Weather conditions are such that strong shadows are always cast during times when shadow flicker may occur.
- The wind direction will be such that the turbine rotor will always be facing directly towards each property, maximising the size of the shadow and hence the frequency and duration of the effect.
- The wind speed will be such that the turbine blades will always be rotating.

[5] Resoft WindFarm 4.2.1.7

17.2.18 The shadow flicker calculations are intended to indicate a theoretical maximum potential duration of effects and to provide an approximation of the times of day and year that these would occur, rather than provide a prediction of the level of effects that is likely to occur.

17.2.19 In reality, varying weather conditions (including wind speed, wind direction, and cloud cover) would result in worst-case conditions occurring less frequently than the modelling assumes, and as a result of this precise predictions of actual shadow flicker occurrence are not possible to make in advance. However, a correction to the theoretical maximum potential effects based on measured average weather conditions can provide a more realistic prediction of the level of shadow flicker effects which may occur in practice.

17.2.20 At the Blackburn S Wks climate station[6] (the nearest Met Office long term climate station to the Proposed Development), average recorded sunshine levels for the period 1991 – 2020 totalled 1,335.85 hours per year. This figure represents approximately 30% of the total daylight hours experienced per year, based on a total of 4,496 annual daylight hours[7] experienced at the location of the Proposed Development.

17.2.21 This assessment therefore considers a predicted annual shadow flicker duration based on 30% of the theoretical maximum potential annual effects at each receptor. However, predicted maximum daily levels have not been corrected in order to ensure a worst-case scenario. In practice, for shadow flicker to occur, periods of bright sunshine would have to coincide with the calculated times when shadow flicker may occur, so it is likely that shadow flicker will occur less frequently than the predicted levels indicate.

17.2.22 The likelihood of shadow flicker occurrence is also likely to be further reduced as a result of other factors, such as wind speed, wind direction, screening (from buildings or vegetation) and the actual locations and orientation of windows at the receptors.

Significance Criteria

17.2.23 As no formal guidance is available regarding what levels of shadow flicker may be considered acceptable in the UK, the thresholds suggested in the Northern Irish guidance document PPS18 (a maximum of 30 minutes / 0.5 hours per day and 30 hours per year) have been adopted for this assessment.

Assessment Limitations

17.2.24 The assumptions made in the assessment process, as outlined in this Paragraph 17.2.17, are considered to be conservative and likely to overestimate the effect of shadow flicker in practice.

[6] Met Office. (2022). Blackburn N Wks long term climate averages 1991 – 2020. [Online] Available at: https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages/gcvmy75y3. (Accessed 29/11/22)
[7] Timeanddate.com. (2022). Sunrise, Sunset, and Daylength at 55°52'01.1"N, 3°45'24.2"W. [Online] Available at: https://www.timeanddate.com/sun/@55.86700,-3.75674. (Accessed 30/11/22)

Scoping Responses and Consultation

17.2.25 Throughout the scoping exercises, and subsequently during the ongoing EIA process, relevant organisations were contacted with regards to the Development. **Error! Reference source not found.** outlines the consultation responses received in relation to shadow flicker.

Table 17.1: Consultation Responses

Consultee	Details	Response	Where addressed in EIA Report
North Lanarkshire Council	Scoping Opinion	Shadow flicker should be assessed as part of the EIA. An assessment methodology was proposed, but was not acknowledged.	Chapter 17 – Other Issues
West Lothian Council	Scoping Opinion	No specific response was received in relation to shadow flicker.	N/A

Baseline Conditions

17.2.26 Due to the proximity of the Proposed Development to the residential areas of Eastfield, Harthill, and Greenrigg (to the south), and Blackridge (to the north), a large number of potential shadow flicker receptors (2,041) are located within a distance of ten times the rotor diameter from the turbines.

17.2.27 As stated in Paragraph 17.2.11, the Study Area is based on the calculated area over which shadows may be cast, in order to ensure that this assessment considers only receptors where shadow flicker effects may occur. There are 1,588 receptors located within the Study Area. These properties are shown on **Figure 17.1**, and a full list of these receptors is detailed in Technical Appendix 17.1.

Assessment of Potential Effects

Construction/Decommissioning Phase

17.2.28 Shadow flicker is a phenomenon that only occurs once the turbines are installed and operational, and thus no shadow flicker effects are anticipated during the construction or decommissioning phases of the Proposed Development.

Operational Phase

17.2.29 **Error! Reference source not found.** details the number of receptors which are calculated to exceed the daily and annual threshold levels outlined in 'PPS18' (described in Paragraph 17.2.10), considering both the theoretical maximum hours of shadow flicker per annum, based on the worst-case assumptions discussed in Paragraph 17.2.17. It also shows the calculation of the predicted number of hours of shadow flicker per annum, as described in Paragraph 17.2.21.

Table 17.2: Shadow Flicker Threshold Levels

Receptors	Receptors Calculated to Receive Shadow Flicker Effects >30 Minutes per Day	Receptors Calculated to Receive Shadow Flicker Effects >30 Hours per Year	
		Theoretical Maximum Levels	Predicted Levels
Number of Receptors (of 1,588 total)	1,328	1,085	33

17.2.30 Table 17.3 details the calculated shadow flicker levels at a sample of the most-affected receptors. Due to the large number of assessed receptors, the calculated shadow flicker levels for each receptor are not presented in this Chapter, however they are detailed in full in Technical Appendix 17.1.

Table 17.3: Shadow Flicker Maximum and Average Levels

Receptors	Days per Year on which Shadow Flicker may occur	Maximum Daily Duration of Shadow Flicker Effects (Hours)	Theoretical Maximum Shadow Flicker Effects per Year (Hours)	Predicted Shadow Flicker Effects Per Year[8] (Hours)
Hill of Harthill Farm (289453, 665403)	233	2.9	447.7	133.0
Netherton Farm (290745, 665303)	137	1.7	143.9	42.8
54 Howburn Road (289782, 664543)	143	1.17	130.7	38.8
Treesbank Farm (288481, 664403)	122	1.26	121.2	36.0
31 Netherton Street (289807, 664498)	132	1.11	121	35.9

[8] Considering average annual hours of sunshine (required for shadow flicker to occur) of approximately 30%.

Receptors	Days per Year on which Shadow Flicker may occur	Maximum Daily Duration of Shadow Flicker Effects (Hours)	Theoretical Maximum Shadow Flicker Effects per Year (Hours)	Predicted Shadow Flicker Effects Per Year[8] (Hours)
Craigholm Farm (290166, 665992)	145	1.38	119.6	35.5
19 Netherton Street (289843, 664455)	125	1.05	108.8	32.3
39 Howburn Road (289843, 664519)	141	1.07	108.2	32.1
16 Netherton Street (289855, 664489)	135	1.04	106.8	31.7

17.2.31 As previously discussed in Section 17.2.17, this assessment includes a number of worst-case assumptions in terms of environmental factors (such as wind conditions and screening), and the receptors themselves (in terms of window locations), which could reduce or eliminate shadow flicker in practice.

17.2.32 As can be seen from Table 17.3, the predicted levels of shadow flicker at the most-affected receptor, Hill of Harthill Farm, are 133 hours per year with a maximum of 2.9 hours per day. At the next most-affected receptor, Netherton Farm, predicted levels of shadow flicker are considerably lower at 42.8 hours per year with a maximum of 1.7 hours per day.

17.2.33 While these receptors are the most-affected of the receptors considered within this assessment, the average levels of shadow flicker when considering all 1,588 receptors is 13.6 hours per year with a maximum of 0.6 hours per day.

17.2.34 A number of receptors are predicted to experience levels of shadow flicker above the thresholds of 30 minutes (0.5 hours) per day and 30 hours per year. As such, shadow flicker due to the Proposed Development, without appropriate mitigation is considered to be **significant** as per the EIA Regulations.

Assessment of Cumulative Effects

17.2.35 In order for cumulative shadow flicker effects to occur, shadow flicker sensitive receptors must receive shadow flicker from more than one wind farm/turbine development (including the Proposed Development)

17.2.36 A screening exercise was undertaken to identify any cumulative developments which have the potential to result in cumulative shadow flicker effects. All cumulative developments (either operational, consented or in planning) located within ten rotor diameters[9] of the Study Area are identified in Table 17.3 and shown on **Figure 17.2**. Cumulative developments located more than ten rotor diameters from the Study Area have no prospect of causing cumulative shadow flicker effects, and have not been considered further.

Table 17.3: Cumulative Wind Developments

Cumulative Development	Rotor Diameter (m)	10 Rotor Diameter Buffer Distance (m)	Distance to nearest receptor[10] (m)
Hill of Harthill Farm	20.7	207	587
Knowehead Farm 1	19.2	192	226
Knowehead Farm 2	19	190	182
Southrigg 1	48	480	857
Southrigg 2	48	480	738
Torrance Farm Wind Farm	101	1,010	188
Torrance Farm Wind Farm Extension	101	1,010	602

17.2.37 Of the 1,588 receptors located within the Study Area of the Proposed Development, there are 100 receptors which may experience cumulative shadow flicker effects. The cumulative shadow flicker predictions for each receptor are included in **Technical Appendix 17.1**.

17.2.38 Of the identified receptors, Table 17.4 details the number which may experience cumulative shadow flicker effects exceeding the relevant threshold levels.

Table 17.4: Cumulative Shadow Flicker Threshold Levels

	Receptors Calculated to Receive Shadow Flicker Effects >30 Minutes per Day	Receptors Calculated to Receive Shadow Flicker Effects >30 Hours per Year	
		Theoretical Maximum Levels	Predicted Levels
Cumulative developments only (without the Proposed Development)	6	7	1

[9] Rotor diameters are specific to the turbines used for each cumulative development.
[10] Receptors located within the Study Area of the Proposed Development.

	Receptors Calculated to Receive Shadow Flicker Effects >30 Minutes per Day	Receptors Calculated to Receive Shadow Flicker Effects >30 Hours per Year	
		Theoretical Maximum Levels	Predicted Levels
Proposed Development only	63	58	2
Total Cumulative (including the Proposed Development)	67	88	3

17.2.39 As can be seen from Table 17.4, 67 receptors are predicted to experience maximum daily cumulative shadow flicker effects in excess of 30 minutes (0.5 hours) per day and three receptors are predicted to experience annual cumulative shadow flicker effects in excess of 30 hours per year.

17.2.40 As such, cumulative shadow flicker, without appropriate mitigation, is considered to be **significant** as per the EIA Regulations.

Mitigation Measures

17.2.41 A range of mitigation measures are available to control the effects of shadow flicker, including:

- Control at Property: the provision of blinds, shutters, or curtains to affected properties.
- Control on Pathway: for example, screening via planting close to an affected property; and
- Control at Source: for example, shutdown of turbines at times when effects occur.

17.2.42 Control at property and control on pathway mitigation measures can be limited in effectiveness (as they mask rather than remove the effects), and can take time to become effective (as in the case of screening through planting).

17.2.43 Control at source is the most immediate and effective method for mitigating shadow flicker effects. This involves shutting turbines down during specific times when shadow flicker is likely to occur; the times are pre-calculated and programmed into the shutdown calendar of the Development's SCADA system (Supervisory Control and Data Acquisition system, which is the central computerised monitoring system), although this does not take account of weather conditions occurring at specific times, resulting in excessive shutdowns. Photocells can be installed that determine whether ambient light levels are sufficient for distinct shadows (and therefore shadow flicker) to be generated to prevent unnecessary shutdowns.

17.2.44 Alternatively, a shadow flicker protection system can be incorporated into the SCADA system. This calculates the locations of shadows in real time, determines whether these coincide with the pre-programmed locations and takes into account ambient lighting before triggering shutdowns. These systems provide greater flexibility than shutdown calendars as it allows for new receptor locations to be programmed, for example if complaints are received from a property not already included in an existing mitigation scheme.

17.2.45 Shadow flicker will be controlled at source using one of the systems outlined above, in order to ensure that the operation of the Proposed Development does not directly result in shadow flicker levels exceeding 30 hours per year or 30 minutes per day at any property, or contribute to cumulative shadow flicker levels exceeding 30 hours per year or 30 minutes per day at any property.

17.2.46 Shadow flicker effects are typically controlled through the use of a planning condition. The following is a suggested shadow flicker planning condition:

> 'Prior to operation of the development hereby approved, a scheme detailing the protocol for the assessment of any complaints of shadow flicker resulting from the development on residential properties existing at the date of the grant of planning permission, including remedial measures, should be submitted to and approved in writing by the Planning Authority. Operation of the turbines shall take place in accordance with the approved protocol.'

Residual Effects

17.2.47 Shadow flicker is a phenomenon that only occurs once the turbines are installed and operational, therefore there will be no effects as a result of shadow flicker during the construction or decommissioning phases of the Proposed Development.

17.2.48 With appropriate mitigation applied, operational residual effects from shadow flicker would be **not significant** as per the EIA Regulations, either due to the Proposed Development in isolation, or cumulatively.

Summary

17.2.49 An assessment of potential shadow flicker effects associated with the Proposed Development has been carried out in line with guidance and best practice used in the UK.

17.2.50 Predictions of shadow flicker have been calculated for receptors located within a Study Area based on the calculated area over which shadows from the turbines may be cast, limited to a distance of 1,700 m (10 x the rotor diameter) from each turbine. It has been found that there are 1,588 receptors within the shadow flicker study area with the potential to experience shadow flicker.

17.2.51 An assessment of effects from the Proposed Development alone has found that 1,328 receptors are expected to experience a maximum daily level of shadow flicker in excess of 30 minutes per day, and that 33 receptors are predicted to experience in excess of 30 hours of shadow flicker per year based on a likely worst-case scenario. Implementation of appropriate mitigation will ensure that shadow flicker levels remain below the recommended threshold at all neighbouring properties, such that shadow flicker effects due to the operation of the Proposed Development are **not significant** as per the EIA Regulations.

17.2.52 An assessment of cumulative effects has identified that of the 1,588 receptors located within the Study Area, 100 receptors may also experience cumulative shadow flicker effects from other wind turbine developments. Of these 100 receptors which may experience cumulative effects, 67 receptors are expected to experience a maximum daily level of shadow flicker in excess of 30 minutes per day, and that 3 receptors are predicted to experience in excess of 30 hours of shadow flicker per year based on a worst case scenario. Implementation of appropriate mitigation will ensure that shadow flicker levels remain below the recommended threshold at all neighbouring properties, such that cumulative shadow flicker effects are **not significant** as per the EIA Regulations.

17.2.53 No shadow flicker effects will occur during construction or decommissioning, and as such shadow flicker due to construction or decommissioning of the Proposed Development is **not significant** as per the EIA Regulations.

17.3 Aviation

17.3.1 Wind turbines have the ability to reflect radio waves and therefore have the potential to interfere with radar systems. In addition, wind turbines can present a physical obstruction at, or close to, an aerodrome or other aviation activity site, such as areas of low flying.

17.3.2 The general approach to wind farm development is to avoid adverse effects on aviation infrastructure where possible, and to find appropriate technical mitigation solutions where this cannot be achieved. Policy guidance and extant regulations in respect of the potential interference effects of wind turbines on air traffic control (ATC) radars are highlighted in civil and military publications. Furthermore, there are airfield physical safeguarding and telecommunication and navigational infrastructure safeguarding requirements.

Legislation, Policy and Guidance

17.3.3 There are a number of aviation publications relevant to the interaction of wind turbines and aviation containing guidance and legislation, which cover the complete spectrum of aviation activity in the UK as shown below:

- Civil Aviation Publication (CAP) 764 Civil Aviation Authority (CAA) Policy and Guidance on Wind Turbines Version 6, Feb 2016 (CAA, 2016)[11];
- CAP 168 Licensing of Aerodromes, Version 11 March 2019 (CAA 2019)[12];

[11] Civil Aviation Publication (2016) CAP 764: CAA Policy and Guidelines on Wind Turbines [Online] Available at: https://publicapps.caa.co.uk/docs/33/CAP764%20Issue6%20FINAL%20Feb.pdf (Accessed 30/11/22)
[12] Civil Aviation Publication (2019) CAP 168: Licensing of Aerodromes [Online] Available at: https://publicapps.caa.co.uk/docs/33/CAP%20168%20Issue11_Licensing%20of%20Aerodromes%2013032019.pdf (Accessed 30/11/22)

- CAP 670 ATS Safety Requirements Version 3 June 2019 (CAA 2019)[13];
- CAP 774 UK Flight Information Services, Ed 4 December 2021 (CAA 2021)[14];
- CAP 493 Manual of Air Traffic Services Part 1 Version 9 April 2021 (CAA 2021[15]);
- CAP 393 Regulations made under powers in the Civil Aviation Act 1982 and the Air Navigation Order 2016 Version 6 February 2021(CAA 2021)[16];
- CAP 660 Parachuting Ed 5 March 2020 (CAA 2020)[17];
- Military Aviation Authority Regulatory Article 2330 (Low Flying) (MOD MAA 2021)[18];
- UK Aeronautical Information Publications (AIP) (NATS 2021)[19];
- CAA Policy Statement: Lighting of Onshore Wind Turbine Generators in the United Kingdom with a maximum blade tip height at or in excess of 150m Above Ground Level[20];
- CAA Policy Statement: Lighting of En-Route Obstacles and Onshore Wind Turbines 01 April 2010 (CAA 2010)[21]; and
- Wind Energy and Aviation Interests Interim Guidelines[22].
- CAP 738 Safeguarding of Aerodromes Version 3 Dec 2006 (CAA 2020)[23]; and
- CAP 793 Safe Operating Practices at Unlicensed Aerodromes Ed 1 July 2010 (CAA 2010)[24].

[13] Civil Aviation Publication (2019) CAP 670: Air Traffic Services Safety Requirements [Online] Available at: https://publicapps.caa.co.uk/docs/33/CAP670%20Issue3%20Am%201%202019(p).pdf (Accessed 30/11/22)

[14] Civil Aviation Publication (2021) CAP 774: UK Flight Information Services [Online] Available at: https://publicapps.caa.co.uk/docs/33/CAP774_UK%20FIS_Edition%204.pdf (Accessed 30/11/22)

[15] Civil Aviation Publication (2021) CAP 493: Manual of Air Traffic Services – Part 1 [Online] Available at: https://publicapps.caa.co.uk/docs/33/CAP493%20Edition%209%20Corrigendum%20%20(May%202021).pdf (Accessed 30/11/22)

[16] Civil Aviation Publication (2021) CAP 393: Regulations made under powers in the Civil Aviation Act 1982 and the Air Navigation Order 2016 [Online] Available at: https://publicapps.caa.co.uk/docs/33/CAP393%20Regulations%20made%20under%20powers%20in%20the%20Civil%20Aviation%20Act%201982%20and%20the%20Air%20Navigation%20Order%202016.pdf (Accessed 30/11/22)

[17] Civil Aviation Publication (2020) CAP 660: Parachuting [Online] Available at: https://publicapps.caa.co.uk/docs/33/CAP%20660%20Parachuting%20March%202020.pdf (Accessed 30/11/22)

[18] Military Aviation Authority (2021) RA 2330 - Low Flying [Online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/996200/RA2330_Issue_5.pdf (Accessed 30/11/22)

[19] NATS (2021) Aeronautical Information Publication [Online] Available at: https://nats-uk.ead-it.com/cms-nats/opencms/en/Publications/AIP/ (Accessed 30/11/22)

[20] Civil Aviation Publication (2017) Policy Statement: Lighting of Onshore Wind Turbine Generators in the United Kingdom with a maximum blade tip height at or in excess of 150m Above Ground Level [Online] Available at: https://publicapps.caa.co.uk/docs/33/DAP01062017_LightingWindTurbinesOnshoreAbove150mAGL.pdf (Accessed 30/11/22)

[21] Civil Aviation Publication (2010) Policy Statement: Lighting of En-Route Obstacles and Onshore Wind Turbines [Online] Available at: https://publicapps.caa.co.uk/docs/33/DAP_LightingEnRouteObstaclesAndWindTurbines.pdf (Accessed 30/11/22)

[22] Wind Energy, Defence and Civil Aviation Interests Working Group (2002) Wind Energy and Aviation Interests Interim Guidelines [Online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/48101/file17828.pdf (Accessed 30/11/22)

[23] Civil Aviation Publication (2020) CAP 738: Safeguarding of Aerodromes [Online] Available at: https://publicapps.caa.co.uk/docs/33/CAP738%20Issue%203.pdf (Accessed 30/11/22)

[24] Civil Aviation Publication (2010) CAP 793: Safe Operating Practices at Unlicensed Aerodromes [Online] Available at: https://publicapps.caa.co.uk/docs/33/CAP793.pdf (Accessed 30/11/22)

17.3.4 The proposed turbines, at 200 m to blade tip, would require lighting under Article 222 of the Air Navigation Order (ANO, 2016), which requires that 'en-route obstacles' at or above 150 m above ground level are lit with visible lighting to assist their detection by aircraft. This would likely constitute 2000 candela (cd) lighting on the highest practical point e.g. the turbine nacelle.

17.3.5 Air Navigation Order 2016 (CAP393) Article 223 (8) states that *"If visibility in all directions from every wind turbine generator in a group is more than 5 km the light intensity for any light required by this article to be fitted to any generator in the group and displayed may be reduced to not less than 10% of the minimum peak intensity specified for a light of this type."* This allows the minimum intensities identified above to be dimmed to 10% of their values if meteorological conditions permit. For example, the 2,000 cd minimum intensity may be dimmed to 10%, or 200 cd, if visibility is greater than 5 km, in moderate to excellent or 'clear' visibility.

17.3.6 In addition, the CAA requires low intensity lights to be fitted at the intermediate level on the turbine tower (CAA, 2017).

Assessment Methodology and Significance Criteria

17.3.7 The search for aviation assets included all assets across Scotland to ensure all potentially affected assets are identified. If the Proposed Development is found to have any adverse impacts on stakeholders' operations, for example the safeguarding of a civilian airport, or if the Proposed Development is found to be located within an area of high priority military aviation activities, this would be considered a significant effect and mitigation would be required.

Overview and Study Area

17.3.8 The assessment of effects of the Proposed Development is based upon the guidance laid down in CAA Publication CAP 764 Policy and Guidelines on Wind Turbines Version 6 (dated February 2016) with the consultation criteria for aviation stakeholders defined in Chapter 4 of CAP 764.

17.3.9 CAP 764 states the distances from various types of airfields where consultation should take place. These distances include:

- Airfield with a surveillance radar – 30 km;
- Non-radar licensed aerodrome with a runway of more than 1,100 m – 17 km;
- Non-radar licensed aerodrome with a runway of less than 1,100 m – 5 km;
- Licensed aerodromes where the turbines would lie within airspace coincidental with any published Instrument Flight Procedure (IFP);
- Unlicensed aerodromes with runways of more than 800 metres – 4 km;
- Unlicensed aerodromes with runways of less than 800 metres – 3 km;
- Gliding sites – 10 km; and
- Other aviation activity such as parachute sites and microlight sites within 3 km – in such instances developers are referred to appropriate organisations.

17.3.10 CAP 764 goes on to state 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. These ranges are intended as a prompt for further discussion between developers and aviation stakeholders which may result in a study area being modified as required based on specific airspace and operational considerations.

17.3.11 The assessment considers effects on both civil and military aviation receptors.

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

Significance Criteria

17.3.13 Should the construction and operation of the Proposed Development materially cause disturbance to any aviation users or affect the operation of any of the various radar systems, such as through degradation of signal quality to the extent that it warrants an objection from the radar operator, this would be considered a significant effect for the purposes of the EIA Regulations.

Scoping Responses and Consultation

17.3.14 Consultation with relevant aviation stakeholders is a routine part of wind farm development and the consultation process that is required to be undertaken is also laid down in CAP 764 (for civil aviation issues) and the Wind Energy and Aviation Interests Interim Guidelines (for both civil and military consultation).

17.3.15 Consultation for this EIA Report topic was undertaken with the organisations shown in Table 17.6.

Table 17.6: Aviation Consultee Responses

Consultee	Details	Response	Where addressed in EIA Report
NATS Safeguarding	2020 Scoping Opinion 2022 Re-consultation	Stated proposed development conflicts with safeguarding criteria and therefore NATS objected to the proposal.	Chapter 17: Other Issues
Edinburgh Airport	2020 Scoping Opinion 2022 Re-consultation	Stated proposed development conflicted with safeguarding criteria, and impacted their radar, and therefore Edinburgh Airport objected to the proposal.	Chapter 17: Other Issues
Ministry of Defence (MoD)	2020 Scoping Opinion	MoD stated they had concerns regarding the	Chapter 17: Other Issues

	2022 Re-consultation	proposal due to potential impacts on a military low flying training area, and accredited aviation safety lighting should be used in the development.	
Glasgow Airport	Consulted during EIA process	Stated they were unlikely to object to the proposal, but this position would be confirmed once turbine details were finalised and they were consulted on the full planning application.	Chapter 17: Other Issues

Baseline Conditions

17.3.16 The closest radar equipped civilian airport to the Site is Edinburgh Airport, approximately 27 km to the northeast of the Site and is also the closest licensed aerodrome. Glasgow Prestwick Airport is located approximately 66 km to the southwest. Glasgow Airport is located approximately 42 km to the west.

17.3.17 The Proposed Development is located in an area relatively remote from military aviation infrastructure. There are no military airfields in the region, the closest is Prestwick located 66.5 km southwest. The former RAF Leuchars, now an army base, is located 79 km northeast in which the MOD continue to safeguard radar there.

17.3.18 The Proposed Development is located within the 'Blue' level priority zone[25], which is a low priorty military low flying zone where the MOD is less likely to raise concerns.

17.3.19 The Proposed Development is located within Tactical Training Area (TTA) 20T. This area covers the south of Scotland, including South Lanarkshire, Scottish Borders and Dumfries and Galloway amongst others. TTA 20T is an area where military fixed wing aircraft can engage in operation low flying training down to 45.7 m above terrain features, and therefore the MoD requests that accredited aviation safety lighting is employed on developments in this area.

17.3.20 The NATS online self-assessment maps[26] indicate that the Site is within an area where turbines may interfere with the primary surveillance radar of NERL which covers heights of 20 m to 200 m. The closest NERL facility to the Development is NATS Glasgow with the closest turbine located approximately 41 km to the west of the facility.

[25] Low Flying Areas identified using Aviation Datasets on ArcGIS Pro.

[26] NATS Self-assessment maps [online] Available at: https://www.nats.aero/services/information/wind-farms/self-assessment-maps/ (Accessed 30/11/22)

17.3.21 The Eskdalemuir Seismic Array is located approximately 70 km southeast of the Proposed Development; therefore, the Proposed Development does not fall within the 50 km consultation zone.

17.3.22 The Met Office safeguards its network of radars using a European methodology known as OPERA (Operational Programme on the Exchange of Radar data). In general, they will object to any turbine within 5 km in line of sight and will examine the impact of any turbines within 20 km. Where a site is within 20 km, the Met Office will undertake an operational assessment based on three main criteria, having determined if there is a technical effect on the radar. In this case the closest Met Office radar is at Holehead, 32 km to the northwest of the Proposed Development and therefore beyond the 20 km area of concern. Given this distance, no impacts are expected and impacts on Met Office Radars have been scoped out of further assessment.

17.3.23 An online search for private airfields has been conducted and none were identified within consultation distance. The closest identified is Cumbernauld Airport[27], approximately 18 km to the northwest of the Proposed Development. This has an 820 m x 23 m asphalt runway, but as the airstrip is greater than 4 km from the Proposed Development, consultation is not required. Not all private strips are listed in publications or marked on charts.

Assessment of Potential Effects

17.3.24 The assessment of potential effects has been completed by Pager Power, and has involved in-depth consultation with relevant consultees (**Technical Appendix 17.2**). These conversations are ongoing through the planning process, particularly where appropriate mitigation is being discussed and agreed.

Licensed Aerodromes

Glasgow Airport

17.3.25 Given the location of the turbines within Edinburgh airspace, it is determined that it is unlikely the Proposed Development would receive a safeguarding objection from Glasgow Airport on radar grounds. It is therefore assumed that the Proposed Development will have no significant impact on aviation receptors at Glasgow Airport. At the time of writing Pager Power have not received any comment on the Proposed Development. The position of Glasgow Airport is therefore expected to be confirmed during the determination of the full planning application.

[27] Cumbernauld - UK Airfield Guide and https://www.cumbernauldairport.org/

Edinburgh Airport

17.3.26 Based on technical assessments completed by Pager Power, the Proposed Development was determined to not be visible to Edinburgh Airport (**Technical Appendix 17.2**). Nonetheless, following consultation with Edinburgh Airport they have determined that the Proposed Development is in the line of sight of the radar system, and mitigation will be required. Pager Power have since requested additional evidence to demonstrate this outcome, however, Edinburgh Airport have declined to provide this to date (February 2023). It is therefore expected that additional information will be provided during the determination of the full planning application.

17.3.27 Should signifcant impacts on Edinburgh Airport radar be anticipated, appropriate mitigation will be agreed between the Applican and Edinburgh Airport.

NATS

17.3.28 Significant impacts were anticipated in relation to Cumbernauld and Kincardine radar. Following further consultation, the Applicant has received confirmation from NATS that a mitigation solution is achievable.

Ministry of Defence

17.3.29 Military low flying can take place throughout the UK. The MOD has published a map indicating areas within the UK where military low flying activities are the most likely to cause an objection. The map is colour coded as follows:

- Green – Area with no military low flying concerns;
- Blue – Low priority military low flying areas less likely to raise concerns;
- Amber – Regular military low flying area where mitigation may be necessary to resolve concerns;
- Red – High priority military low flying area likely to raise considerable and significant concerns.

17.3.30 The location of the wind turbines relative to the military low flying zones are all located within the 'blue' zone, which is a low priority military low flying zone where the MOD is less likely to raise concerns.

17.3.31 Nevertheless, it is likely that the MOD will request the turbines be fitted with MOD accredited aviation lighting in accordance with the requirements of the Civil Aviation Authority, Air Navigation Order 2016.

Assessment of Cumulative Effects

Airport and Airport Radar

17.3.32 Based on previous radar line-of-sight analysis completed by Pager Power, Torrance Farm and Torrance Farm Extension are not predicted to be detectable by the PSRs at Orchardton (Cumbernauld), Kincardine, Edinburgh Airport, or Glasgow Airport.

17.3.33 No cumulative impacts upon airport radar are therefore predicted.

NATS – NATS En Route

17.3.34 Following implementation of the technical mitigation solution, in agreement with NATS, no impacts from the proposed development upon Lowther Hill are predicted.

17.3.35 No cumulative impacts upon NATS En Route radar are therefore predicted.

Ministry of Defence

17.3.36 Torrance Farm and Torrance Farm Extension are also located within the same 'blue' low flying zone as the proposed development. It is therefore predicted the proposed development will be subject to the same MOD lighting requirements as the operational wind developments.

17.3.37 No cumulative effects are anticipated in the context of low flying constraints.

Mitigation Measures

Airport and Airport Radar

17.3.38 A range of mitigation options are available to mitigate impacts on PSR if necessary. These are described in detail in section 5.1 of Technical Appendix 17.2, and include;

- Layout Revisions
- Radar Blanking
- Radar In-Fill
- Replacement Wind Farm Tolerant Radar

NATS – NATS En Route

17.3.39 The proposed development is predicted to have a significant technical impact upon the PSR at Lowther Hill due to the high likelihood that the turbines will cause false returns to appear on the radar display.

17.3.40 NATS has confirmed mitigation is required, and consultation regarding the implementation of a mitigation solution is ongoing.

17.3.41 As discussed in paragraphs 17.3.27 and 17.3.26, suitable mitigation measures have been agreed with NATS, and discussions are ongoing with Edinburgh Airport to determine suitable mitigation.

Visible Aviation Lighting Assessment

17.3.42 As the Proposed Development turbines exceed 150 m in height, there is a statutory requirement for aviation obstruction lighting. The MoD, through the auspices of the Defence Infrastructure Organisation, has requested aviation safety lighting in accordance with the requirements of the Air Navigation Order 2016. This is the civil requirement as determined by the CAA and approved by the CAA. The MOD requirement will thus be met in meeting the requirements of the CAA.

Lighting Specification

- Medium intensity steady red (2000 candela) lights on the nacelles of all turbines;

- a second 2000 candela light on the nacelles of all turbines, to act as alternates in the event of a failure of the main light;
- lights should be operated so they will be turned on whenever illuminance reaching a vertical surface falls below 500 LUX; and
- the lights to be capable of being dimmed to 10% of peak intensity when the visibility as measured at the wind farm exceeds 5 km.

Residual Effects

17.3.43 Following the implementation of mitigation measures for NATS, Edinburgh Airport, and military low flying exercise areas, Therefore there will be no significant effects on aviation receptors as a result of the Proposed Development.

Summary

17.3.44 The primary risk to the proposed development is the objection sustained by Edinburgh Airport. Following undertaking its own assessment and reviewing the third-party assessment, it is concluded that the proposed development will not affect the Edinburgh radar due to terrain between the radar antenna and the wind turbine blades. Pager Power is willing to provide further evidence and assurances to Edinburgh Airport that the Primary Surveillance Radar (PSR) will not be affected.

17.3.45 Discussions with NATS to implement a technical mitigation prior to construction of the proposed development for the impacts upon the PSRs at Orchardton (Cumbernauld), Kincardine, and Lowther Hill are progressing.

17.3.46 An objection from Glasgow Airport is not predicted following consideration of the potential impacts upon their PSR in an operational context and their consultation response. They will provide their official position following submission of the planning application.

17.3.47 Visible aviation lighting will be required for all turbines, infrared lighting is also likely to be requested by the Ministry of Defence (MOD).

17.4 Telecommunications and Utilities

17.4.1 Due to the size and nature of wind turbines, they have the potential to interfere with electromagnetic signals passing above ground during operation. Infrastructure affected can include telecommunication links, microwave links, and television reception.

17.4.2 In particular, the tower and rotating blades of wind turbines have the most potential for interference with electromagnetic signals. The degree and nature of the interference will depend on:

- The location of the wind turbines with respect to the receiver and the transmitter;
- Characteristics of the rotor blades (including size, shape and composition);
- Signal frequency;
- Screening obstacles between turbine and respective receivers and transmitters, including terrain; and
- The radio wave propagation in the local atmosphere.

17.4.3 In addition, other infrastructure such as buried utilities may be affected by the construction of the Proposed Development.

17.4.4 This section of the EIA Report details the relevant guidance, consultation that has been undertaken with infrastructure operators, the existing baseline for these elements as relevant to the Proposed Development, and an assessment of the likely effects as a result of the Proposed Development.

Legislation, Policy and Guidance

17.4.5 There are a number of documents which provide guidance on telecommunications considerations for wind energy developments. The guidance considered in this assessment are:

- British Wind Energy Association - Best Practice Guidelines of Wind Energy Developments[28];
- The Scottish Government - Onshore Wind Turbine: Planning Advice[29];
- Ofcom – Tall Structures and Their Impact on Broadcast and Other Wireless Service[30]; and
- Ofcom (2003) Guidelines for Improving Digital Television and Radio Reception.

17.4.6 The potential effects as a result of the Proposed Development have been assessed with reference to the above documents.

Assessment Methodology and Significance Criteria

Scope of assessment

17.4.1 The search for existing telecommunication, television and microwave links, and utilities was undertaken within an approximate 1 km radius of the Site Boundary, which covers all turbine locations and beyond the boundary of the Site. This ensures all telecommunication and microwave links potentially affected are identified.

17.4.2 A high-level utilities search was also undertaken covering the extent of the Site, identifying any existing utilities with the potential to be affected by the Proposed Development.

Assessment Methodology

17.4.3 The potential effects assessed in this Chapter have been identified through consultation and desk-based assessment. Effects during the construction and decommissioning phases are classed as temporary, short-term effects. Potential effects which are associated with the 40-year operational phase of the Proposed Development are classified as long-term effects.

[28] BWEA (1994) Best Practice Guidelines of Wind Energy Developments [Online] Available at: https://www.thenbs.com/PublicationIndex/documents/details?Pub=BWEA&DocID=258180 (Accessed 30/11/22)
[29] Scottish Government (2014) Onshore wind turbines: planning advice [Online] Available at: https://www.gov.scot/publications/onshore-wind-turbines-planning-advice/ (Accessed 30/11/22)
[30] Ofcom (2009) Tall Structures and Their Impact on Broadcast and Other Wireless Service [Online] Available at: https://www.ofcom.org.uk/__data/assets/pdf_file/0026/63494/tall_structures.pdf (Accessed 30/11/22)

17.4.4 It is industry practice not to assess the short-term effects on television reception and telecommunications from wind farms during the construction and decommissioning phases; previous engagement with infrastructure operator consultees has indicated that any effects will only occur as a result of the presence and operation of the wind turbines themselves. Consequently, this assessment does not consider effects associated with construction and decommissioning activities on these receptors.

Significance Criteria

17.4.5 Effects on telecommunications receptors are of a technical nature, and where unacceptable effects are predicted to occur, a technical solution must be sought with the owner/operator of the infrastructure to ensure the continued acceptable technical operation of the infrastructure.

17.4.6 Following this approach, it is inappropriate to assess the level of significance of these effects in relation to the EIA Regulations in the same way as for other receptors; therefore, any potential effect that materially affects the operation of telecommunication links, such as through degradation of signal quality to the extent that it warrants an objection from the link operator, is considered significant. Where a potential significant effect has been identified, appropriate mitigation that could be implemented to reduce or remove the effect are described in this Chapter. Mitigation is generally available either through rerouting of any affected links or upgrades to the transmitting and / or receiving apparatus.

Scoping Responses and Consultation

17.4.7 Telecommunication operators were consulted throughout the EIA process. Relevant consultees were contacted to provide information relating to utilities and telecommunication links which may be affected due to the Proposed Development. Turbine co-ordinates and dimensions of the layout was provided to telecommunications consultees. Table 17.7 provides a summary of the consultation undertaken.

Table 17.7: Consultation Responses

Consultee	Summary of Response	Response to Consultee
Mobile Broadband Network Limited (MBNL)	Objection.	MBNL is being consulted to find a suitable mitigation option. Costings for a technical solution have been issued to the Applicant. Agreements will be put in place prior to the construction of the Proposed Development.
Virgin Media O2	No objections to the Proposed Development.	N/A
Vodafone	Objection based on Turbine 4 infringement.	Vodafone is being consulted and discussions are ongoing to find a mitigation option. Agreements will be put in place prior to the

Consultee	Summary of Response	Response to Consultee
		construction of the Proposed Development.
BT	No objections to the Proposed Development.	N/A
Atkins	No objections to the Proposed Development.	N/A
Arqiva	No objections to the Proposed Development.	N/A
JRC	No objections to the Proposed Development.	N/A
Airwave	Objection based on Turbine 4 coordinates	Turbine 4 was relocated to address consultee objection
	No objection with new turbine 4 coordinates.	N/A

Baseline Conditions

Telecommunications

17.4.8 Consultation with the relevant organisations was initiated during the EIA process to identify any potential microwave or telecommunication links that could be affected by the Proposed Development.

Television Reception

17.4.9 Digital television signals are rarely affected by the operation of wind turbines; however, in some cases interference can be caused by blocking or reflections. A minimum signal strength is required for digital television to operate effectively; if a property already receiving a weak digital signal experiences additional blocking or reflections from wind turbines, the signal level may drop, causing the television to pixelate or cut-out intermittently. Reflections and blocking from other objects (such as trees) close to a receptor can cause similar effects. Simple measures to boost the signal through an improved receiver or roof antenna are usually sufficient to correct the issue.

17.4.10 The area surrounding the Site receives television signals that are exclusively digital, and hence no analogue television signals are broadcast in the area. As a result, and considering the intervening distance between wind turbines and property, television reception received by the nearest properties to the Site will not be affected, and no effects are predicted to occur.

17.4.11 Notwithstanding this, in the event that interference which is directly attributable to the Proposed Development is suspected, the Applicant will implement an investigation in line with an agreed protocol that would be secured by planning condition to establish whether or not the Proposed Development is responsible. Should it be found that the Proposed Development is responsible, appropriate solutions will be investigated and implemented as necessary. Examples of such solutions are similar to those discussed in Section 17.4.10 and include: changing the receptor height, re-orientating the receptor to receive signals from an alternative transmitter, upgrading the receptor system or installation of satellite television. Any interference experienced before the Proposed Development is operational is unlikely to relate to it.

Utilities

17.4.12 Other below-ground infrastructure such as utilities, could be affected during construction; however, implementation of best practice would ensure that these are not adversely affected during construction.

17.4.13 During construction, there may be construction traffic passing beneath overhead transmission lines along the transportation route. Although it is very unlikely that any damage to this infrastructure will occur, appropriate management measures will be put in place to ensure that electricity lines are not affected by the Proposed Development, and that the Proposed Development is constructed in accordance with relevant health and safety legislation as appropriate. Following the implementation of such measures, if necessary, there will be no effect on either underground or overhead utility infrastructure, and it is not considered further.

Assumption and Limitations

17.4.14 The assessment is based on desk-based research, assisted by an extensive consultation process. No limitations or data gaps have been identified.

Assessment of Potential Effects

Telecommunications

17.4.15 Consultation with the relevant organisations was initiated during the EIA Scoping stage to identify any potential microwave or telecommunication links that could be affected by the Proposed Development. Ofcom monitors the fixed microwave links throughout the UK, whereas JRC manages the radio spectrum used by the UK Fuel and Power Industry. Atkins undertakes a similar role for the water industry. Arqiva operates the Freeview terrestrial transmission network including BBC and ITV.

17.4.16 Virgin Media O2, BT, Atkins, Arqiva and JRC identified no links that might be impacted by the Proposed Development and have raised no objection to the Proposed Development. Airwave had originally objected based on the coordinates of Turbine 4, as the original position would have an impact on the Tetra mobile radio coverage and the operational zones of Airwave MW Radio links, and was too close to the direct line of sight of the Airwave radio link**.** Following consideration of Airwave's response, T4 was relocated 45 m northwest and Airwave subsequently removed their objection.

17.4.17 Both MBNL and Vodafone have objections to the Proposed Development. As stated in Paragraph 17.4.6 any potential effect that materially affects the operation of telecommunication links, such as through degradation of signal quality to the extent that it warrants an objection from the link operator, is considered significant.

17.4.18 Thus, given the current objections from these telecommunications providers, impacts on telecommunication due to the Proposed Development, without appropriate mitigation is considered to be significant as per the EIA Regulations. Mitigation is generally available either through rerouting of any affected links or upgrades to the transmitting and / or receiving apparatus.

Television Reception

17.4.19 As detailed in Paragraph 17.4.1217.4.9, the area surrounding the site receives television signals which are exclusively digital, and hence no analogue signals are broadcast in the area. As a result, it is considered that the television reception received by any properties will not be affected, and no effects will occur. However, once operational, in the event that interference which is directly attributable to the Proposed Development is experienced, the operator will implement a suitable mitigation solution. The precise solution would be identified in accordance with an agreed investigative protocol, including consultation with the relevant stakeholders, that would be secured by planning conditions.

Utilities

17.4.20 Other below ground infrastructure, such as utilities, could be affected during construction; however, implementation of best practice would ensure that these are not adversely affected during construction or operation.

Mitigation and Residual Effects

17.4.21 Consultation with MBNL and Vodafone has flagged that the Proposed Development will have significant impacts on their services. Discussions are ongoing with MBNL and Vodafone who are both being consulted to find suitable mitigation options. Construction of the Proposed Development will not begin until agreements / appropriate mitigation have been put in place to ensure the Proposed Development will not interfere with telecommunications signals. Following the implementation of agreed mitigation, there will be no significant effects on Telecommunication.

17.4.22 No adverse effects on television reception and utilities are anticipated and therefore no specific mitigation measures are proposed.

Summary

17.4.23 Consultation undertaken with telecommunications consultees has confirmed that there are fixed communication links operating across proposed wind turbine locations. Discussions are ongoing with MBNL and Vodafone who are both being consulted to find a suitable mitigation option. Construction of the Proposed Development will not begin until agreements / appropriate mitigation have been put in place to ensure the Proposed Development will not interfere with telecommunications signals, and thus there will be no significant effects on Telecommunication.

17.4.24 Effects on television reception are assessed as unlikely, and technical solutions are readily available as suitable mitigation measures should unexpected adverse effects arise. Adverse effects on utilities infrastructure would be avoided through appropriate safe systems of work.

17.4.25 Therefore, no significant effects upon telecommunications and utilities are anticipated as a result of the Proposed Development

17.5 Human Health and Safety

17.5.1 The EIA Regulations state than an EIA must identify, describe and assess in an appropriate manner, the expected effects deriving from the vulnerability of the Proposed Development to Major Accidents and Disasters (MADS) that are relevant to the Proposed Development, as well as upon human health and safety.

Legislation, Policy and Guidance

17.5.2 Effects upon health and safety are managed through risk assessments, pursuant to legislation of the United Kingdom such as the Control of Major Accident Hazards Regulations 2015[31] (as amended by the Health and Safety (Amendment) (EU Exit) Regulations 2018[32]) and the Planning (Hazardous Substances) Regulations 2015[33].

17.5.3 The aforementioned legislation lays down rules for the prevention of major accidents which might result from certain industrial activities and the limitation of their consequences for human health and the environment. The legislation requires the preparation of emergency plans and response measures which will be covered under equivalent documents relevant to the nature of the Proposed Development.

17.5.4 The Construction (Design and Management) Regulations 2015[34] (CDM Regulations) are intended to ensure that health and safety issues are properly considered during development to reduce the risk of harm. In accordance with the CDM Regulations, a Principal Designer and Principal Contractor would be appointed.

17.5.5 The Principal Designer would have responsibility for coordination of health and safety during the pre-construction phase. Guidance published by the Health and Safety Executive in January 2015, defines principal designers as *"…designers appointed by the client in projects involving more than one contractor. They can be an organisation or an individual with sufficient knowledge, experience and ability to carry out the role."*

[31] The Control of Major Accident Hazards Regulations 2015 [Online] Available at: https://www.legislation.gov.uk/uksi/2015/483/contents/made (Accessed 06/02/2023)
[32] The Health and Safety (Amendment) (EU Exit) Regulations 2018 [Online] Available at: https://www.legislation.gov.uk/uksi/2018/1370/contents/made (Accessed 06/02/2023)
[33] The Planning (Hazardous Substances) Regulations 2015 [Online] Available at: https://www.legislation.gov.uk/uksi/2015/627/contents/made (Accessed 06/02/2023)
[34] The Construction (Design and Management) regulations 2015 (2015) [Online] Available at: https://www.legislation.gov.uk/uksi/2015/51/contents/made (Accessed 06/02/2023)

17.5.6 Principal contractors are defined in the 2015 CDM Regulations as "contractors appointed by the client to coordinate the construction phase of a project where it involves more than one contractor …They … must possess the skills, knowledge, and experience, and (if an organisation) the organisational capability necessary to carry out their role effectively given the scale and complexity of the project and the nature of the health and safety risks involved."

17.5.7 Throughout all phases of the Proposed Development, cognisance would be made of the following guidance documents produced by RenewableUK, and updated by SafetyOn:

- Wind Turbine Safety Rules Third Edition[35]; and
- Guidance & Supporting Procedures on the Application of Wind Turbine Safety Rules Third Edition[36].

Assessment Methodology and Significance Criteria

17.5.8 In identifying relevant major accidents or disasters, the following definitions are used to guide this assessment which are informed by the Institute of Environmental Management and Assessment (IEMA) EIA Quality Mark Article "What is this MADness"[37]:

- Major Accident – uncontrolled occurrence in the course of the construction or operation of the Proposed Development, leading to serious danger to the environment, which may be either immediate or delayed;
- Disaster - An event not directly caused by the Proposed Development, leading to serious danger to the environment, which may be either immediate or delayed. It may result from natural sources, such as flooding, adverse weather, ground movement, or from man-made sources (e.g., escalation of a fire from an adjacent facility); and
- Relevance – a relevant major accident or disaster is defined as follows:
  - Caused by the Proposed Development;
  - Having the potential to impact upon the Proposed Development; and
  - Would be exacerbated or mitigated by the Proposed Development.

Scoping Responses and Consultation

17.5.9 Throughout the scoping exercises, and subsequently during the ongoing EIA process, relevant organisations were contacted with regards to the Proposed Development. No consultation responses were received in relation to Human Health and Safety.

[35] SafetyOn (2019) Wind Turbine Safety Rules, Third Edition - Issue 2 [Online] Available at: https://safetyon.com/__data/assets/pdf_file/0005/662729/Wind-Turbine-Safety-Rules-Edition-3-2015-Issue-2-December-2019.pdf (Accessed 06/02/2023)
[36] SafetyOn (2019) Guidance on the Application of Wind Turbine Safety Rules, Third Edition – Issue 3 [Online] Available at: https://safetyon.com/__data/assets/pdf_file/0006/662730/Wind-Turbine-Safety-Rules-Guidance-Edition-3-2015-Issue-3-Dec-2019.pdf (Accessed 06/02/2023)
[37] IEMA (2017) What is this MADness? [Online] Available at: https://www.iema.net/assets/uploads/EIA%20Articles/AMEC%20What%20is%20this%20MADness.pdf (Accessed 06/02/2023)

Assessment of Potential Effects

Vulnerability of the Development to Disasters

17.5.10 The Site is not located within an area known for natural disasters such as floods, hurricanes, tornadoes, volcanic eruptions, earthquakes or tsunamis.

17.5.11 As stated in **Chapter 16** of this EIA Report, none of the identified climate change trends listed will affect the Proposed Development with the exception of increased high wind speed conditions. Due to the exposed nature of wind farm sites, wind turbines are designed to withstand extreme weather conditions. Brake mechanisms installed on turbines allow them to be operated only under specific wind speeds and, should severe wind speeds be experienced, then the turbines would be shut down. Although an unlikely event for Scotland, the brake mechanism could also apply to a hurricane scenario.

17.5.12 Other disasters (natural or manmade) that could affect the Proposed Development may include forest fires and floods. Wildfires within forests form a small proportion of "outdoor fires" in Scotland[38] and are uncommon[39], and the risk of a forest fire affecting the Proposed Development is therefore low. In the rare event that one does occur, standard operating procedures for emergency operations at wind turbine sites would be followed.

17.5.13 Flooding is the most probable natural disaster that could affect the Proposed Development. The Proposed Development has been designed to minimise the impact of flooding, however emergency response plans appropriate for the individual phases of the Proposed Development would be in place and implemented to deal with any occurrences. These would ensure the health and safety of employees and the protection of critical infrastructure. Flood risk is assessed within **Chapter 14**. The Proposed Development has been designed to minimise the impact of flooding by incorporating a 50 m buffer zone between watercourses and infrastructure (with the exception of watercourse crossings).

17.5.14 No other natural or man-made disasters are considered to have the realistic potential to occur and therefore are not considered further within this Chapter.

17.5.15 Where the Proposed Development has the potential to exacerbate or mitigate effects of disasters this is assessed in other chapters within the EIA Report as relevant, particularly within the hydrological assessment, **Chapter 14** of this EIA Report (in relation to flooding), and in relation to offsetting of greenhouse gas emissions and related climate change impacts in **Chapter 16.**

[38] The Scottish Government (2014). Fire and Rescue Statistics, Scotland. [Online] Available at: http://www.gov.scot/Resource/0046/00466202.pdf (Accessed 06/02/2023).

[39] Davies, G. and Legg, C. (2016). Regional variation in fire weather controls the reported occurrence of Scottish wildfires. PeerJ, 4, p.e2649.

Potential for the Development to Cause Major Accidents

17.5.16 The risk of environmental accidents is covered, where relevant, in individual technical chapters. For example, the potential for accidents, like spillages, are considered in **Chapter 14** of this EIA Report. Other general construction health and safety measures would be implemented by the development contractor in line with best practice prior to the commencement of construction, as discussed in the Construction Phase section below.

17.5.17 The introduction of the Proposed Development, namely the turbines and associated electrical infrastructure, introduces the potential for fire events to occur. It should be noted that the risk of turbines setting on fire is very low, with worst-case estimations having 1 turbine in 2,000 setting on fire in any given year. Other estimations put this figure at 1 in 10,000, with the risk of catastrophic fires that completely destroy the turbine being 1 in 15,000[40].

17.5.18 No other major accidents are considered likely to occur as a result of the Proposed Development. On-site accidents during construction and operation are assessed in the following subsections of this Chapter.

Construction Phase

17.5.19 The risk of construction accidents as they relate to human health and safety would be covered in Construction Method Statements (CMS), a CEMP, and specific risk assessment method statements, prepared in response to conditions attached to the deemed planning permission; such conditions would not be a requirement of the consent. These would include identifying site-specific risks and preparing assessments to minimise and manage the risk such as equipment safe handling, and personal protection equipment, amongst others.

17.5.20 The Proposed Development will require approximately 6.65 hectares (ha) of felling to accommodate the new and upgraded access tracks, Temporary Construction Compound (TCC), Substation Compound, turbines and Crane Hardstandings, as well as all buffer areas. This felling will take place within a managed forest which is periodically felled and replanted as part of its normal management. Felling makes use of high-powered machinery which carries a risk of accidents occurring. The risk of forestry fires and felling accidents would be reduced through adhering to health and safety measures which would be implemented in line with best practice.

17.5.21 In addition to the above measures outlined on health and safety, the risk of fires during the construction phase of the Proposed Development is further reduced through there being no brash and other flammable materials left in an uncontrolled manner. Machinery used during the construction which may, during operation of such machinery, carry risk of fire would be operated in line with health and safety guidance and best practice. Activities during construction relating to the felling of trees will also be conducted in line with standard operating procedures and in compliance with health and safety measures and regulations outlined above.

17.5.22 As a result of the above measures, which reduce the likelihood and severity of construction accidents, construction accidents are not considered further within this Chapter.

Operational Phase

17.5.23 Electrical infrastructure will be required in the form of an electrical substation, cabling and associated infrastructure which will be subject to routine maintenance such that it is not considered to pose a significant risk of creating an accident, such as fires.

17.5.24 Additionally, a felling buffer has been applied to all infrastructure, further reducing the risk of fire spreading into forestry during the operation of the Proposed Development. Elements of the Proposed Development which may pose a risk of catching fire will be regularly inspected by wind farm management and maintained by specialist teams, further reducing the risk of fire incidents. Additionally, effects upon population and human health are unlikely due to the separation of the Proposed Development from residential areas, and adherence to required safety clearances around turbines.

17.5.25 A possible but rare source of danger to human or animal life from a wind turbine would be the loss of a piece of the blade or, in the most exceptional circumstances, of the whole blade from an operational turbine. Many blades are composite structures with no bolts or other separate components. Even for blades with separate control surfaces on or comprising the tips of the blade, separation is highly unlikely. Wind turbines have an exemplary safety record with no recorded instances of fatalities to any member of the public anywhere in the world. The turbines are also designed to shut down automatically during high wind speed conditions, typically in excess of 60 miles per hour (mph).

Ice Throw

17.5.26 There is a risk of ice accumulation on turbine blades, nacelles and towers under certain conditions such as periods of very cold weather with high humidity. In those instances, where icing of blades occurs, fragments of ice might be released from blades, particularly when the machine is started. The wind turbines would be fitted with vibration sensors to detect any imbalance which might be caused by icing of the blades. This enables the operation of machines with iced blades to be inhibited to eliminate the risk of ice throw.

17.5.27 The Siemens Gamesa SG170 candidate turbine is able to be adapted with Siemens Gamesa Renewable Energy's Ice detection and Operation with Ice system technology, which extends the range of wind turbine operation in icy conditions. With the Proposed Development, it is likely that an external sensor option would be utilised.

17.5.28 The external sensor would communicate with the Supervisory Control and Data Acquisition (SCADA) system of the turbines, and would be able to stop them in icy conditions. They are intended for use on wind turbines located in areas where there is a risk that ice can build up on the turbine nacelle or blades and there are personal safety concerns that requires the turbine to stop instantly when ice is detected.

17.5.29 The sensor would allow the turbines to be stopped when ice accumulation is detected, therefore mitigating the risk of ice throw.

[40] Fire Trace International (2020) In the Line of Fire [Online] Available at: https://www.firetrace.com/hubfs/_img/reports/Firetrace-Report-In-The-Line-Of-Fire.pdf (Accessed 06/02/2023)

Lightning Strike

17.5.30 The possibility of attracting lightning strikes applies to all tall structures, and wind turbines are no different. Appropriate lightning protection measures are incorporated in wind turbines to ensure that lightning is conducted harmlessly past the sensitive parts of the nacelle and down into the ground.

17.5.31 The Scottish Government Online Advice (2014) states "although wind turbines erected in accordance with best engineering practice should be stable structures, it may be advisable to achieve a set-back from roads and railways of at least the height of the turbine proposed, to assure safety", and this has been incorporated into the design of the Proposed Development.

Summary

17.5.32 Due to its location, the Site is not prone to natural disasters. Whilst adverse weather conditions, most notably high wind speed events, ice producing conditions and lightning strikes, do occur within Scotland, wind turbines are designed to withstand extreme weather conditions. Brake mechanisms, vibration sensors and lightning protection measures are installed on turbines allowing them to be operated under optimal conditions and inhibited during extreme weather events.

17.5.33 The risk of construction accidents as they relate to human health and safety are detailed and managed through the CDM Regulations and in an oCEMP through specific construction risk assessment method statements, which will be prepared in accordance with conditions attached to any consent of the Proposed Development.

17.5.34 Therefore, the overall risk of health and safety including major accidents and disasters is considered negligible and not significant in terms of the EIA Regulations.