



Vale of Leven Wind Farm Limited

Vale of Leven Wind Farm

Environmental Impact Assessment Report (Volume 1)

Chapter 13 – Aviation and Radar

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13 AVIATION AND RADAR

13.1 Introduction

- 13.1.1 Wind turbines have the potential to affect the performance of radars used for air traffic control, air defence and meteorological forecasting. They can also present an obstacle hazard to aircraft flying at low altitude and may affect the specified minimum altitudes for aircraft flying instrument approach procedures at airports.
- 13.1.2 This chapter considers the likely significant effects on aviation receptors associated with the construction, operation and decommissioning of the Proposed Development.

13.2 Scope and Methodology

- 13.2.1 This chapter sets out:
- consultations undertaken with aviation stakeholders;
 - the aviation baseline;
 - the assessment methodology and significance criteria used in completing the impact assessment;
 - the potential effects, including direct, indirect and cumulative effects;
 - the mitigation measures proposed to address likely significant effects; and
 - the residual effects remaining following the implementation of mitigation.
- 13.2.2 The assessment has been carried out by Aviatica, a specialist aviation consultancy with 27 years' experience of providing aviation advice to the wind energy industry.
- 13.2.3 No difficulties were encountered in conducting the assessment for this chapter. The future aviation environment will be subject to technological and regulatory change. The assessment in this chapter assumes that:
- primary surveillance radar (PSR) continues to be required for air traffic management provision;
 - controlled airspace boundaries and classifications remain as extant in 2023; and
 - relevant UK air law and ICAO Standards and Recommended Practices remain as extant in 2023.

Study Area

- 13.2.4 The study areas for the aviation assessment were selected using the recommended distances set out in Civil Aviation Authority (CAA) guidance CAP 764 (CAA, 2016), modified to ensure that all radars with the range to detect the wind turbines as part of the Proposed Development are included. The distances used are radii from the centre of the Site, as follows:
- 150 km for air traffic control and air defence primary surveillance radars;
 - 30 km for Meteorological Office rainfall radars;
 - 20 km for secondary surveillance radars and aeronautical radio navigation aids;
 - 30 km for licensed, certificated and Government aerodromes;
 - 60 km for instrument flight procedures; and

- 10 km for unlicensed aerodromes, airstrips and gliding sites.

Desk Study

13.2.5 The aviation baseline assessment was carried out by consulting the UK Aeronautical Information Publication (AIP) (NATS, 2023), the UK Military AIP (MoD, 2023), civil and military aeronautical charts and Aviatica in-house databases of aviation infrastructure and assets. The determination of the aviation baseline has also been informed by consultation responses from aviation stakeholders.

Assessment of Potential Effect Significance

13.2.6 Significance criteria for assessment of impacts on aviation, unlike those for environmental effects, are not based on the sensitivity of the receptor. Further, while magnitude of change can be determined in some circumstances, it typically does not provide a standardised metric on which to measure the significance of any effects. In this context, the significance of effects on aviation has been determined in this chapter by application of professional judgement, underpinned by consideration of the magnitude of change (where measurable); the regulations and procedures in place for ensuring that aviation infrastructure meets required performance standards; the safeguarding policies and practices in use by specific aviation stakeholders; and the consultation responses from those stakeholders.

Assessment of Residual Effect Significance

13.2.7 Residual adverse effects of the Proposed Development on aviation are described as either none, negligible, minor, moderate or major. None, negligible or minor effects are categorised as not significant. Moderate or major effects are categorised as significant. The criteria applied to define each of the significance categories in this chapter are set out in **Table 13.1**.

Table 13.1: Significance Criteria

Significance	Description
Major	Regular, frequent or permanent effects which require changes to existing operational and/ or technical practice in order to mitigate adequately, or which are not capable of being mitigated adequately.
Moderate	Periodic effects experienced which may require alterations to existing operational practice.
Minor	Occasional effects experienced which do not require any alteration of existing operational and technical practice.
Negligible	Normally no measurable change from baseline conditions; occasional, fleeting or very short-term effects experienced which do not require any alteration of existing operational and technical practice.
None	No measurable change from baseline conditions.

13.3 Consultation Undertaken

13.3.1 Consultations were undertaken with all relevant aviation stakeholders at scoping stage. Their responses are summarised in **Table 13.2**.

Table 13.2: Summary of Scoping Responses

Consultee	Date	Response	Applicant Response
NATS En Route plc (NERL)	4 May 2022	The Proposed Development has been examined by our technical safeguarding teams and conflicts with our safeguarding criteria. Accordingly, NATS (En Route) plc objects to the proposal.	The impact of the Proposed Development on NATS primary radar is assessed in this chapter.
Glasgow Airport	23 May 2022	The site is located within the safeguarding area for Glasgow Airport beneath our protected Outer Horizontal Surface. Any structures exceeding 156.34 m AOD would penetrate this surface and may raise safeguarding concerns. It is within the wind farm consultation area for Glasgow Airport and may impact upon primary surveillance radar or other navigation aids. Any impact upon primary radar would require mitigation. There is also potential for the development to impact instrument flight procedures which may raise a safeguarding objection.	The applicant is in discussion with Glasgow Airport. The applicant's approach to mitigation is set out in this chapter.
Glasgow Prestwick Airport (GPA)	23 May 2022	The turbines may be visible to GPA's primary radars and generate clutter that would require to be mitigated. An assessment is required to determine if the turbine structures have any impact on the performance of GPA's VHF Ground to Air Communication equipment. Should the final aviation lighting scheme consider the use of Aircraft Detection Lighting System (ADLS) dependent upon Electronic Conspicuity (EC) Equipment(s) and be part of any alternate proposed lighting scheme, GPA respectfully request to be consulted with.	Assessment of impacts on GPA radars and aeronautical radio infrastructure are set out in this chapter. GPA will remain informed when the applicant makes a decision on the use of ADLS.
Meteorological Office	Not stated	Assessment suggests that the highest turbine would be in line of sight from the Holehead radar but below the beam at its lowest elevation. We are likely to have	The turbine height has increased to 250m. The applicant has consulted the

Consultee	Date	Response	Applicant Response
		concerns should the heights of the turbines be increased significantly above 200m.	Met Office, which has confirmed that all turbines will remain below the radar beam.
Meteorological Office	23 March 2023	All turbines in the Design Freeze layout would be at least 34m below the Holehead radar beam and therefore acceptable.	No further action required.
Ministry of Defence (MoD)	7 June 2022	The Proposed Development falls within the Glasgow and Prestwick avoidance area, an area where military low flying is limited, however, the addition of turbines in this location has the potential to introduce a physical obstruction to low flying aircraft that may operate in the area. Therefore, in the interests of air safety, the MOD would request that the development be fitted with MOD accredited aviation safety lighting in accordance with the requirements of the Air Navigation Order 2016.	The turbines will be subject to aviation obstruction lighting in accordance with UK guidance for aerodrome obstacles.. The applicant will inform MOD Safeguarding with the progression of the Proposed Development.

13.4 Statutory and Planning Context

13.4.1 Relevant legislation has been reviewed and taken into account as part of this aviation and radar assessment. Of particular relevance are:

- The Air Navigation Order (ANO) 2016 (UK 2016);
- The Town and Country Planning (Safeguarded Aerodromes, Technical Sites and Military Explosive Storage Areas) (Scotland) Direction 2016 (Scottish Ministers 2016); and
- Commission Regulation (EU) No. 139/2014 (as retained and amended in UK domestic law under the European Union (Withdrawal) Act 2018) (UK, 2021a).

13.5 Existing Environment

13.5.1 The Proposed Development site lies 11 km north of Glasgow Airport and is wholly contained within the controlled airspace of the Glasgow Control Zone. The Proposed Development has the potential for effects on Glasgow Airport's PSRs, obstacle limitation surfaces and instrument flight procedures (IFPs).

13.5.2 The Proposed Development site is within the operational range and line of sight of the following radars used by NATS En Route (NERL):

- Lowther Hill PSR;
- Cumbernauld PSR;
- Glasgow Airport NASR-10 PSR;
- Glasgow Airport Terma PSR; and
- Brownsfield secondary surveillance radar (SSR).

- 13.5.3 The Proposed Development site is 52 km north of Glasgow Prestwick Airport (GPA). The scoping response from GPA rules out any effects on the airport's IFPs, but requests that potential effects on PSR and air-to-ground radio communications are assessed.
- 13.5.4 The Proposed Development site is within the 20 km radius statutory consultation zone of the Meteorological Office radar at Holehead.
- 13.5.5 The Proposed Development site is located within the Glasgow-Prestwick Avoidance Area in the UK Military Low Flying System. This area is classified by the MoD as "*an area with no military low flying concerns*".
- 13.5.6 Due to their proximity to Glasgow Airport the proposed turbines would be subject to aviation obstruction lighting in accordance with Regulation (EU) No 139/2014 (as retained and amended in UK law) and its associated guidance.

13.6 Predicted Impacts

Construction Phase

- 13.6.1 Wind turbine effects on PSR are generated almost entirely from the rotating turbine blades. During the construction phase, the wind turbine rotors would not be turning and would, therefore, not generate effects on PSR.

Glasgow Airport

Obstacle Limitation Surfaces

- 13.6.2 The closest turbine in the Proposed Development (Turbine (T) 10) lies 12.6 km from the Glasgow Airport Aerodrome Reference Point (ARP). The furthest turbine (T2) lies 14.4 km from the ARP. All turbines in the Proposed Development are therefore, within the horizontal boundaries of the Glasgow Airport Outer Horizontal Surface (OHS), which extends from a radius of 6,000 m from the ARP to a radius of 15,000 m from the ARP.
- 13.6.3 The OHS is a horizontal plane at an elevation 145 m above the elevation of the lowest runway threshold, which is that of runway 23, at 6.34 m Above Ordnance Datum (AOD). The elevation of the Glasgow Airport OHS is, therefore, 151.34 m AOD.
- 13.6.4 The Glasgow Airport OHS is already extensively infringed by the terrain to the north, south and west of the airport, including the terrain throughout and surrounding the Proposed Development site.
- 13.6.5 The UK Certification Specification & Guidance Material for Aerodrome Design (CS-ADR-DSN) for Regulation (EU) No. 139/2014 does not specify that an OHS should be provided around an aerodrome with precision approach runways, as is the case at Glasgow Airport. However, the guidance advises that, where provided, the OHS "*represents the level above which consideration needs to be given to the control of new obstacles in order to facilitate practicable and efficient instrument approach procedures, and together with*

the conical and inner horizontal surfaces to ensure safe visual manoeuvring in the vicinity of an aerodrome” and adds that “the outer horizontal surface is of particular importance for safe operations in areas of high ground or where there are concentrations of obstacles.”¹

- 13.6.6 UK CS-ADR-DSN does not provide any guidance on how new objects that infringe an OHS should be treated. However, there are numerous precedents for constructions that infringe the OHS being accepted by Glasgow Airport, such as:
- two electricity pylon lines crossing the Kilpatrick Hills between Bearsden and Dumbarton;
 - two electricity pylon lines crossing the Kilpatrick Hills northwards from Bearsden;
 - multiple radio masts on high ground south-west of Paisley;
 - four electricity pylon lines crossing high ground south-west of Paisley; and
 - a number of wind turbines to the west and south of Neilston.
- 13.6.7 The Proposed Development would have blade tips ranging in elevation from 466 m (1529 ft) to 544 m (1785 ft) AOD. These would be the highest obstacles infringing the Glasgow Airport OHS. The effect of these new infringements will depend on whether they affect (a) the facilitation of practicable and efficient instrument approach procedures and (b) safe visual manoeuvring in the vicinity of the aerodrome, as set out in UK CS-ADR-DSN. The effects on IFPs are addressed below.
- 13.6.8 Visual manoeuvring in the vicinity of an aerodrome may consist of manoeuvring by aircraft flying under the Visual Flight Rules (VFR) or by aircraft flying under the Instrument Flight Rules (IFR) carrying out a Visual Manoeuvring (Circling) (VM(C)) approach. At Glasgow Airport the obstacle assessment areas for VM(C) approaches consist of circles of radius up to 9.79 km around each runway threshold, joined by tangent lines. Since the Proposed Development is located wholly outside those areas, it would have no impact on VM(C) approaches.
- 13.6.9 Significant volumes of VFR traffic operate to and from Glasgow Airport and Glasgow Heliport. The bulk of this traffic routes via established corridors within the Glasgow Control Zone (CTR). These corridors include a route along the River Clyde to enter/exit the CTR at Ardmore Point or Greenock, and a route known as the Alexandria Lane from Dumbarton to enter/exit the CTR at Alexandria. In addition to normal VFR use, these two corridors are designated for use under ‘Special VFR’, when the weather is below normal VFR minima, but visibility remains at least 3 km. For these purposes the Alexandria Lane is three nautical miles (nm) wide, centred on the River Leven. All of the turbines in the Proposed Development would be a minimum of 500 m outside the boundaries of this lane. It is concluded that VFR traffic using the Alexandria Lane would remain horizontally clear of the Proposed Development and would not be constrained by it.
- 13.6.10 Since the Proposed Development’s infringement of the Glasgow Airport OHS is assessed as not preventing the safe visual manoeuvring of aircraft in the vicinity of the aerodrome but would require mitigation under rules governing the surveying and reporting of obstacles, it is concluded that the significance of OHS infringements is of **Moderate** significance.

¹ UK (2021b), GM1 ADR-DSN.H.410 (a) and (b).

IFPs

13.6.11 Under the terms of CAP 785 Vol.II (CAA, 2022), the Proposed Development must be subject to an IFP safeguarding assessment conducted by Glasgow Airport's Approved Procedure Design Organisation (APDO). Notwithstanding the outcome of that assessment, a preliminary assessment indicates that:

- there would be no impacts on the ATC Surveillance Minimum Altitude Chart;
- there would be no impacts on any of the Standard Terminal Arrival Routes (STARs);
- there would be no impacts on any of the Instrument Approach procedures (IAPs);
- there is a possibility of impacts on the NORBO, FOYLE, LOMON, ROBBO and CLYDE Standard Instrument Departures (SIDs) from runway 05; and
- there is a possibility of impacts on the FOYLE, LOMON and PERTH Standard Instrument Departures (SIDs) from runway 23.

13.6.12 Since non-compliance with the obstacle clearance requirements of an IFP would affect all aircraft using that procedure and would be contrary to international and UK regulation, in the event that Glasgow Airport's IFP assessment finds that any of the IFPs would be affected, this would be an effect of **Major** significance.

Glasgow Prestwick Airport

Air-to-Ground Radio Communications

13.6.13 GPA has four air-to-ground radio transmitter antennae and three receiver antennae located on the roofs of buildings on the airport.

13.6.14 Radio line of sight modelling shows that none of the GPA radio transmitter/receiver antennae would have line of sight to any of the turbines in the Proposed Development. It is concluded that the significance of the effect of the Proposed Development on the GPA air-to-ground radio equipment is **None**.

Military Low Flying

13.6.15 The Proposed Development site is located within the Glasgow-Prestwick Avoidance Area in the UK Military Low Flying System. This area is classified by the MoD as "*an area with no military low flying concerns*".² The site is located wholly within the Class D controlled airspace of the Glasgow CTR where all aircraft, civil or military, must obtain a clearance from Glasgow ATC prior to entry and must comply with all ATC instructions once inside the airspace. UK military rules³ stipulate that:

- aircraft are not considered to be low flying when they are directed by ATC or during departure or arrival at an airfield, helicopter landing site or maritime platform;
- low flying exercises may not be authorised within any area subject to low flying avoidance criteria;
- fixed wing aircraft may not enter low flying Avoidance Areas without the prior approval of Officer Commanding Military Airspace Management Cell (OC MAMC); and

² MoD (2011).

³ MAA (2021) paragraphs 3, 16, 45.

- rotary wing and light propellor-driven aircraft may enter Avoidance Areas, but must remain above 500 ft agl in rural areas and 1000 ft agl in Congested Areas unless they have prior approval from OC MAMC.

13.6.16 It is concluded that military low flying does not take place inside the Glasgow CTR and consequently, the significance of the effect of the Proposed Development on military low flying is **None**.

Operational Phase

Glasgow Airport

PSR

13.6.17 Glasgow Airport operates two PSRs – a legacy NASR-10 and a Terma Scanter, the latter installed in 2019 with the sole purpose of mitigating wind farm effects on the NASR-10. Radar line of sight modelling predicts that both PSRs would be capable of detecting four of the ten turbines. This is likely to lead to false targets being displayed on the NASR-10 display. This is assessed as an effect of **Moderate** significance. It is expected that the radar data processing capabilities of the Terma radar would filter out all returns received from the four visible turbines.

Obstacle Limitation Surfaces

13.6.18 The effects on Glasgow Airport obstacle limitation surfaces in the operational phase would be the same as in the construction phase.

IFPs

13.6.19 The effects on Glasgow Airport IFPs in the operational phase would be the same as in the construction phase.

NERL

13.6.20 The NERL Technical and Operational Assessment (TOPA) of the scoping layout of 19 turbines with blade tips of 200 m agl concluded that:

- 15 of the 19 turbines would be detectable by the Lowther Hill PSR and would be likely to cause false plots to be generated;
- 13 of the 19 turbines would be detectable by the Cumbernauld PSR and would be likely to cause false plots to be generated; and
- five of the 19 turbines would be detectable by the Glasgow NASR-10 and Terma PSRs and would be likely to cause false plots to be generated.

13.6.21 Further radar line of sight modelling by Aviatica of the proposed layout of ten turbines with blade tips of 250 m agl has determined that:

- all ten turbines would be detectable by the Lowther Hill and Cumbernauld PSRs and would be likely to cause false plots to be generated;
- four of the ten turbines would be detectable by the Glasgow NASR-10 and Terma PSRs and would be likely to cause false plots to be generated; and
- seven of the ten turbines would be within line of sight of the Brownsfield SSR.

- 13.6.22 The airspace over the Proposed Development site is also within the operational coverage of NERL PSRs at Kincardine, Tiree, Perwinnes Hill and Great Dun Fell, none of which would have line of sight to the Proposed Development. In 2022, the Lowther Hill PSR was replaced by an Indra 3D radar which has inherent radar data processing capability to filter out returns from wind turbines. The Glasgow Terma radar was installed specifically to filter out wind turbine returns and has been fulfilling that task for both Glasgow Airport and NERL since 2019. It is concluded that the effects of the Proposed Development on PSRs used by NERL is of **Moderate** significance.
- 13.6.23 As regards the Brownsfield SSR, the visible turbines would be between 11.4 km and 13.2 km from the radar. The CAA advises that wind turbine effects on SSR are “*typically only a consideration when the turbines are located very close to the SSR i.e. less than 10 km.*”⁴ Additionally, wind turbine effects on SSR are generated by the turbine towers rather than the rotating turbine blades. Only one of the ten turbines is assessed as having line of sight from the Brownsfield SSR to the turbine tower. It is concluded that the effect of the Proposed Development on the Brownsfield SSR is of **Negligible** significance.

Glasgow Prestwick Airport

PSR

- 13.6.24 GPA operates a legacy EN-4000 PSR and a Terma Scanter PSR, the latter installed in 2018 specifically to mitigate impacts of wind turbines on the EN-4000 radar.
- 13.6.25 Radar line of sight modelling shows that neither of the GPA PSRs would have line of sight to any of the turbines in the Proposed Development. It is concluded that the significance of the effect of the Proposed Development on the GPA PSRs is **None**.

Air-to-Ground Radio Communications

- 13.6.26 The effects on GPA's air-to-ground communications equipment in the operational phase would be the same as in the construction phase.

Meteorological Office

- 13.6.27 The Meteorological Office rainfall radar at Holehead lies between 17.7 km and 19.4 km east of the Proposed Development. The Met Office safeguards its rainfall radars to a radius of 20 km.
- 13.6.28 The beam width of the Holehead radar in elevation is one degree. The radar antenna is set to a tilt of +0.5° in elevation, meaning that the base of the radar beam is horizontal, i.e., at 0° elevation. Wind turbines with blade tips that remain below the radar beam are deemed acceptable by the Met Office.
- 13.6.29 Without taking account of the effects of earth curvature, all of the proposed turbines would have blade tips that are at negative elevation angles from the radar. It is concluded that the effect of the Proposed Development on the Met Office Holehead radar is of **Negligible** significance. The Met Office has confirmed that the Proposed Development is acceptable to them.

⁴ CAA (2016) paragraph 2.10.

Military Low Flying

- 13.6.30 The effects on military low flying in the operational phase would be the same as in the construction phase.

Decommissioning Phase

- 13.6.31 During the decommissioning phase, the wind turbine rotors would not be turning. Consequently, there would be no effects on PSRs.

Glasgow Airport

Obstacle Limitation Surfaces

- 13.6.32 The effects on Glasgow Airport obstacle limitation surfaces in the decommissioning phase would be the same as in the construction and operational phases.

IFPs

- 13.6.33 The effects on Glasgow Airport IFPs in the decommissioning phase would be the same as in the construction and operational phases.

Glasgow Prestwick Airport

Air-to-Ground Radio Communications

- 13.6.34 The effects on GPA's air-to-ground communications equipment in the decommissioning phase would be the same as in the construction and operational phases.

Military Low Flying

- 13.6.35 The effects on military low flying in the decommissioning phase would be the same as in the construction and operational phases.

13.7 Mitigation

Glasgow Airport

- 13.7.1 The Applicant is in discussions with Glasgow Airport to agree appropriate means of technical mitigation of the Proposed Development's effects on their PSRs. This would be secured via a planning condition requiring a Radar Mitigation Scheme.
- 13.7.2 Mitigation of the effects of the Proposed Development infringing the Glasgow Airport OHS would be achieved by:
- notification of the details of the Proposed Development, prior to construction, to the CAA as required by Article 225A of the ANO, in order to ensure that it is marked on aeronautical charts and listed in the UK AIP;
 - listing of the location and height of the Proposed Development in the Aerodrome Obstacles section of the Glasgow Airport entry in the UK AIP; and
 - installation of a CAA-approved lighting scheme on the Proposed Development.
- 13.7.3 In the event that any effects on Glasgow Airport IFPs are identified, these would be mitigated by re-design of the relevant procedures to restore the required minimum

obstacle clearance. The re-designed procedures would then be submitted to the CAA for approval. IFP mitigation would be secured by a planning condition requiring an IFP Scheme.

NERL

- 13.7.4 The Applicant is in discussions with NERL to agree appropriate means of technical mitigation of the Proposed Development's effects on their PSRs. This would be secured via a planning condition requiring a Radar Mitigation Scheme.

Glasgow Prestwick Airport

- 13.7.5 There would be no effects on GPA requiring mitigation.

Meteorological Office

- 13.7.6 There would be no effects on the Met Office Holehead radar requiring mitigation.

Military Low Flying

- 13.7.7 There would be no effects on military low flying requiring mitigation.

Aviation Lighting

- 13.7.8 Under international civil aviation regulations, all obstacles at or exceeding 150 m agl are required to have aviation warning lighting to mitigate effects on low flying civilian aircraft. This is based on the international civil aviation standard that the minimum height for aircraft flight, other than during take-off and landing, is 150 m agl.

- 13.7.9 Since all of the turbines in the Proposed Development infringe the Glasgow Airport OHS and Glasgow Airport is a certificated aerodrome regulated under Commission Regulation (EU) No.139/2014 as retained and amended in UK law, the requirements for aviation lighting on the Proposed Development are as specified in UK CS-ADR-DSN. This specifies that:

- a fixed obstacle that extends above a horizontal surface should be marked and if the aerodrome is used at night, lighted, except that such marking and lighting may be omitted when the obstacle is shielded by another fixed obstacle; or for a circuit extensively obstructed by immovable objects or terrain, procedures have been established to ensure safe vertical clearance below prescribed flight paths; or a safety assessment shows the obstacle is not of operational significance;⁵
- other objects inside the obstacle limitation surfaces should be marked and/or lighted if a safety assessment indicates that the object could constitute a hazard to aircraft;⁶
- in the case of an extensive object or of a group of closely spaced objects to be lighted that are penetrating a horizontal obstacle limitation surface (OLS), the top lights should be so arranged as to at least indicate the points or edges of the object highest in relation to OLS or above the ground, and so as to indicate the general definition and the extent of the objects;⁷

⁵ UK (2021b), CS ADR-DSN.Q.840(f).

⁶ UK (2021b), GM1 ADR-DSN.Q.840(b).

⁷ UK (2021b), CS ADR-DSN.Q.846(g).

- when lighting is deemed necessary in the case of a wind farm (i.e. a group of two or more wind turbines), the wind farm should be regarded as an extensive object and lights should be installed:
 - (i) to identify the perimeter of the wind farm;
 - (ii) respecting the maximum spacing, in accordance with CS ADR-DSN.Q.846(i), between the lights along the perimeter, or if after a safety assessment, it is determined that a greater spacing can be used;
 - (iii) so that, where flashing lights are used, they flash simultaneously throughout the wind farm; and
 - (iv) so that, within a wind farm, any wind turbines of significantly higher elevation are also identified wherever they are located.⁸

13.7.10 In accordance with the guidance in UK CS-ADR-DSN, a reduced lighting scheme has been designed that would identify the perimeter of the Proposed Development and the highest turbine within it. This will be submitted to Glasgow Airport for approval.

13.8 Summary of Residual Effects

13.8.1 Following implementation of mitigation, the residual effects of the Proposed Development on aviation will be as set out in **Table 13.3**.

⁸ UK (2021b), CS ADR-DSN.Q.851(c).

Table 13.3: Summary of Residual Effects

Description of Effect	Significance of Potential Effect		Mitigation Measures	Significance of Residual Effect	
	Significance	Beneficial/Adverse		Significance	Beneficial/Adverse
<i>Construction</i>					
Infringement of Glasgow Airport Outer Horizontal Surface	Moderate	Adverse	Prior notification of development; listing of obstacles in UK AIP; lighting	Negligible	Adverse
Increase required in minimum altitudes of Glasgow Airport Instrument Flight Procedures	Major	Adverse	Amend IFP charts	Minor	Adverse
Hazard to low flying aircraft at night	Moderate	Adverse	Install lighting on turbines	Negligible	Adverse
<i>Operation</i>					
Degraded performance of Glasgow Airport NASR-10 radar	Moderate	Adverse	Radar mitigation scheme	Minor	Adverse
Degraded performance of NERL PSRs	Moderate	Adverse	Radar mitigation scheme	Minor	Adverse
Infringement of Glasgow Airport Outer Horizontal Surface	Moderate	Adverse	Prior notification of development; listing of obstacles in UK AIP; lighting	Negligible	Adverse
Increase required in minimum altitudes of Glasgow Airport Instrument Flight Procedures	Major	Adverse	Amend IFP charts	Minor	Adverse
Hazard to low flying aircraft at night	Moderate	Adverse	Install lighting on turbines	Negligible	Adverse
<i>Decommissioning</i>					
Infringement of Glasgow Airport Outer Horizontal Surface	Moderate	Adverse	Prior notification of development; listing of obstacles in UK AIP; lighting	Negligible	Adverse

Description of Effect	Significance of Potential Effect		Mitigation Measures	Significance of Residual Effect	
	Significance	Beneficial/Adverse		Significance	Beneficial/Adverse
Increase required in minimum altitudes of Glasgow Airport Instrument Flight Procedures	Major	Adverse	Amend IFP charts	Minor	Adverse
Hazard to low flying aircraft at night	Moderate	Adverse	Install lighting on turbines	Negligible	Adverse

13.9 References

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