13 AVIATION

Executive Summary

The Environmental Impact Assessment Report (EIAR) aviation chapter assesses the potential effects during construction, operation and decommissioning phases of the Proposed Development and the potential cumulative impacts with other projects.

Information on aviation was collected through a detailed desktop review of existing studies and datasets. The desktop review was conducted using comprehensive aviation documentation and charts to identify potential aviation receptors during the construction, operation and decommissioning phases of the Proposed Development. Consultation has been ongoing throughout the EIA process and relevant comments from the 2023 Scoping Opinion and other consultations specific to aviation provided by Edinburgh/Glasgow International/Glasgow Prestwick Airports, Ministry of Defence (MoD) and National Air Traffic Services (NATS) were considered with high-level responses provided within this chapter.

The aviation Study Area was defined to ensure that all relevant aviation receptors were assessed. The aviation receptors considered were as follows:

- Civil airport Instrument Flight Procedures (IFPs) (including navigation aids NAVAIDs);
- Military aerodrome IFPs (including NAVAIDs);
- Civil Air Traffic Control (ATC) radar;
- Military ATC radar;
- Military Air Defence radar;
- Low flying (military and civilian Emergency Helicopter Support Units (EHSUs));
- Local minor aerodromes;
- Local airspace restrictions (Prohibited/Restricted/Danger Areas and Military Practice Exercise Areas (PEXAs); and
- Meteorological (Met) Office radars.

An aviation lighting assessment was also carried out by Wind Farm Low Flying Aviation Consultants (WFLFAC) in order to ascertain the exact aviation lighting requirements for the Proposed Development. The assessment proposed the visible and infra-red aviation lights to be installed on the Proposed Development's wind turbine generators (WTGs). The lighting proposal in the WFLFAC report has since been accepted and approved for installation by the Civil Aviation Authority (CAA).

The desktop review, coupled with consultation responses from the relevant aviation stakeholders, determined that only the following aviation receptors would potentially be affected by the Proposed Development:

- Potential impact on military and civilian Emergency Helicopter Support Units (EHSU) low flying operations; and
- Potential impact on the NATS Lowther Hill Air Traffic Control (ATC) radar.

In terms of military low flying and EHSU helicopter operations, pilots are ultimately responsible for seeing and avoiding obstructions. Wind turbines can be difficult to see from the air, particularly in poor meteorological conditions, leading to a potential increase in obstacle collision risk. To alleviate this risk, MoD has requested that, in the interests of air safety, the WTGs are fitted with MoD accredited aviation

safety lighting and in accordance with the CAA Air Navigation Order 2016 and that details of the Proposed Development are included on aviation charts. These arrangements form part of the embedded mitigation measures identified in the EIAR, and once implemented, will ensure that the overall effect on military low flying and EHSU operations will be negligible and not significant in EIA terms.

Consultation has been carried out with NATS in order to identify how adverse impact on the Lowther Hill ATC radar can be alleviated. A preliminary agreement has been reached such that the ATC radar objection could be withdrawn subject to a suspensive planning condition. The Applicant is currently in discussions with NATS regarding installation of a wind farm mitigation solution and it is expected that an agreement will be in place prior to the Application's consent decision.

In terms of cumulative effects, the impact on any aviation receptor is generally treated as a standalone impact. The predicted effects from the Proposed Development on aviation receptors are considered to be localised to within the footprint of the Site. Consequently, the Proposed Development is not considered to present any cumulative effect on aviation receptors in the region.

Overall, the effects of the Proposed Development have been minimised, as risk control measures will be put in place prior to the construction and operation phases of the wind farm. Once all mitigation measures have been implemented, there will be **no residual significant effects**.

13.1 Introduction

13.1.1 This chapter considers the likely significant effects on aviation associated with the construction, operation and decommissioning of the Proposed Development. The potential effects of WTGs on aviation are widely publicised, but the primary concern is one of safety. Despite innumerable subtleties in the actual effects, there are three dominant scenarios that lead to potential impacts:

- Physical obstruction: Wind turbines can present a physical obstruction to aircraft;
- Impacts on aviation Primary Surveillance Radar systems and the provision of radar-based Air Traffic Services (ATS): Wind Turbines can create unwanted radar clutter which appears on radar displays and can affect the provision of ATS to pilots. Radar clutter (or false radar returns) can make it difficult for air traffic controllers to differentiate between aircraft and those radar returns resulting from the detection of WTGs. Furthermore, the appearance of multiple false targets in close proximity can generate false aircraft tracks and seduce those returns from 'real' aircraft away from their true positions. It should be noted that impacts on radar systems are only possible if the wind turbine blades are moving, therefore this impact is generally only applicable to the operation phase, or at the time of blade tip installation; and
- Communication, Navigation and Surveillance (CNS) equipment: A wide range of systems, together with air-ground communications facilities, can be adversely affected by development of infrastructure projects; specifically, when located within the physical safeguarding zones of CNS equipment.

13.1.2 The specific objectives of the chapter are to:

- describe the aviation baseline;
- describe the assessment methodology and significance criteria used in completing the impact assessment;
- describe the potential effects, including direct, indirect, and cumulative effects;
- describe the mitigation measures proposed to address likely significant effects; and
- assess the residual effects remaining following the implementation of mitigation (noting that effects of aviation lighting are dealt with in **Chapter 5: Landscape and Visual, EIAR Volume 1**).

13.1.3 The assessment has been carried out by Wing Commander Mike Coleman Royal Air Force (RAF) (Ret'd), Director, Coleman Aviation Limited. Mike retired from the RAF in 2012 after 27 years' service. His last appointment was as RAF lead for safeguarding against the impact of wind farms on Ministry of Defence (MoD) operations. Prior to converting to Air Traffic Control (ATC), he completed operational tours as a fast-jet navigator compiling nearly 1000 flying hours on the Tornado GR1. Since leaving the RAF, he has worked for over 10 years resolving wind farm-related aviation issues for developers; including provision of aviation specialist input into EIAR's.

13.1.4 This chapter is supported by **Figure 13.1 (EIAR Volume 2**) and Technical Appendices (TAs) (**EIAR Volume 4**) listed in **Table 13.1,** which are referenced throughout the chapter.

Table 13-1: Supporting Figures and Technical Appendices

Document Location	Document Description
Figure 13.1 Aviation Study Area and Locations of Potential Aviation Receptors	Aviation chart depicting airspace structure and locations of relevant aviation receptors (i.e. airports and radar sites).
TA 13.1: Aviation Lighting Report for Glentarken Wind Farm	Aviation lighting assessment outlining the minimum lighting requirements (visible and infra-red) that would be acceptable to the Civil Aviation Authority (CAA) and MoD.
TA 13.2: MoD response to Drummond Wind Farm Scoping Report	MoD scoping response outlining potential impact of the Proposed Development on military aviation operations.
TA 13.3: National Air Traffic Services (NATS) Technical and Operational Assessment (TOPA) of Drummond Wind Farm	NATS scoping response outlining potential impact of the Proposed Development on NATS ATC radar operations, navigation aids (NAVAIDs) and radio communication infrastructure.
TA 13.4: CAA response to Aviation Lighting Report for Glentarken Wind Farm	CAA assessment of TA 13.1 and position on reduced aviation lighting scheme.
TA 13.5: MoD response to Aviation Lighting Report for Glentarken Wind Farm	MoD assessment of TA 13.1 and position on reduced aviation lighting scheme.
TA 13.6: Aviation Assessment Methodology (Volume 4).	Outlines methodology utilised in assessing the impact of the Proposed Development on key aviation receptors.

13.2 Assessment Methodology and Significance criteria

Scope of Assessment

13.2.1 The assessment of aviation impacts of the Proposed Development has been undertaken following a desk-based review of literature and available data sources to support this EIAR and considers the following main potential impacts upon aviation receptors associated with construction, operation and decommissioning of the Proposed Development:

- Civil airport Instrument Flight Procedures (IFPs) (including NAVAIDS);
- Military aerodrome IFPs (including NAVAIDS);
- Civil ATC radar;
- Military ATC radar;
- Military Air Defence (AD) radar;
- Low flying operations (military and civilian Emergency Helicopter Support Units (EHSUs));
- Local minor aerodromes;
- Local airspace restrictions (Prohibited/Restricted/Danger Areas and Military Practice Exercise Areas (PEXAs); and
- Meteorological (Met) Office radars.

13.2.2 The assessment is based on the Proposed Development as described in **Chapter 2: Development Description (EIAR Volume 1).** In respect of aviation, the key factor of the Proposed Development is that

that there will be up to 12 WTGs with a maximum tip height of up to 180 metres (m) above ground level (agl).

13.2.3 The scope of the assessment has been informed by consultation responses summarised in **Table 13-2** and the following key legislation, planning policy and guidance documents:

Legislation and Policy:

13.2.4 The assessment has been carried out in accordance with the principles contained within the following:

- Civil Aviation Publication (CAP) 393 Regulations made under powers in the Civil Aviation Act 1982 and the Air Navigation Order 2016, Version 6, 12 February 2021 (CAP393).

13.2.5 CAP393 regulations stipulate that any en-route structure extending 150 m or greater must be fitted with medium intensity steady red, visible aviation lighting at the highest practical point. Consequently, the Applicant commissioned an aviation lighting assessment from Wind Farm Low Flying Aviation Consultants (WFLFAC) which can be found at **TA 13.1 (EIAR Volume 4)**.

13.2.6 CAA policy on WTGs is set out in CAP 764 - Policy and Guidance on Wind Turbines, Version 6, February 2016. This contains the CAA's position on the impacts of WTGs on radar, radio NAVAIDs, physical obstacle hazards to aircraft and turbulence; describes a range of mitigations that may be applied; and outlines the process of assessing the aviation impacts of wind energy developments in the planning system.

13.2.7 The assessment is also carried out in accordance with the principles contained within the following policy documents:

- CAP 168 Licensing of Aerodromes, Version 12, 14 January 2022;
- CAP 670 ATS Safety Requirements, Version 3, 7 June 2019;
- CAP 774 UK Flight Information Services, Version 4, 15 December 2021;
- CAP 738 Safeguarding of Aerodromes, Version 3, 29 October 2020;
- CAP 793 Safe Operating Practices at Unlicensed Aerodromes, Edition 1, July 2010;
- CAP 493 Manual of Air Traffic Services Part 1, Edition 11, 27 October 2023; and
- CAP 660 Parachuting, Version 5, March 2020.

Guidance

13.2.8 This assessment has also been carried out in accordance with the principles contained within the following guidance documents:

- CAA 1:500,000 Visual Flight Rules (VFR) Aviation Charts;
- Military Aeronautical Information Publication (Mil AIP); and
- United Kingdom (UK) Integrated Aeronautical Information Package (IAIP).

Consultation

13.2.9 **Table 13-2** below summarises the consultation undertaken throughout the EIAR process, including Scoping and further pre-application consultation, relevant to aviation.

Table 13-2: Consultation with Aviation Stakeholders

Organisation and Type of Consultation	Response	How Response has been Considered
Aberdeen Airport – Scoping Response	The proposal is located outwith our consultation zone. As such we have no comment to make and need not be consulted further.	The Proposed Development will have no impact on aviation operations at Aberdeen Airport; consequently, this impact has been scoped out of the EIAR.
Edinburgh Airport – Scoping Response	The location of the Proposed Development falls out with the Aerodrome safeguarding zone for Edinburgh Airport therefore we have no objection/comment.	The Proposed Development will have no impact on aviation operations at Edinburgh Airport; consequently, this impact has been scoped out of the EIAR.
Glasgow International Airport – Scoping Response	The Proposed Development is out with the obstacle limitation surfaces and radar consultation zone for Glasgow Airport. It is within the radar and instrument flight procedures safeguarding areas, however in this location we would only require to assess development over 300 m agl. No further consultation with Glasgow Airport is required.	The Proposed Development will have no impact on aviation operations at Glasgow International Airport; consequently, this impact has been scoped out of the EIAR.
Glasgow Prestwick Airport – Scoping Response	The Proposed Development lies out with Glasgow Prestwick Airport's safeguarding area, and as such we have no comment or objection.	The Proposed Development will have no impact on aviation operations at Glasgow Prestwick Airport; consequently, this impact has been scoped out of the EIAR.
Highlands and Islands Airports Limited (HIAL) – Scoping Response	Our preliminary assessment shows that, at the given position and height, the Proposed Development would not infringe the safeguarding criteria and operation of any HIAL airports. HIAL has no objections to the proposal.	The Proposed Development will have no impact on HIAL airport operations; consequently, this impact has been scoped out of the EIAR.
Ministry of Defence – Scoping Response	The principal safeguarding concerns of MoD with respect to the Proposed Development relates to their potential to create a physical obstruction to air traffic movements. To address this impact, and given the location and scale of the development, MoD requires conditions to be added to any consent issued requiring that the development is fitted with	The Applicant accepts that MoD accredited aviation lighting will be required and has commissioned an aviation lighting report from WFLFAC which can be found at **TA 13.1**; the MoD scoping response can be found at **TA 13.2**. The Applicant has since consulted with

Organisation and Type of Consultation	Response	How Response has been Considered
	aviation safety lighting and that sufficient data is submitted to ensure that structures can be accurately charted to allow deconfliction.	CAA and MoD on the aviation lighting scheme identified at **TA 13.1.** CAA has since approved the reduced lighting scheme (**TA 13.4**) and MoD has also since approved the reduced lighting scheme (**TA 13.5**).
National Air Traffic Services (NATS)	The Proposed Development conflicts with NATS safeguarding criteria for the Lowther Hill ATC radar. It has been determined that the terrain screening available will not adequately attenuate the signal for turbines T6, T7, T8, T10, T11, T12, and therefore these turbines are likely to cause false primary plots to be generated. A reduction in the RADAR's probability of detection, for real aircraft, is anticipated. Accordingly, NATS objects to the proposal. The reasons for NATS's objection are outlined in TOPA SG34499 (**TA 13.3**) which also confirms that there would be no impact on NATS NAVAIDs or radio communication infrastructure.	The Applicant has engaged with NATS regarding changes to the wind turbine layout since submission of the scoping report. NATS have confirmed that the revised layout would continue to adversely impact the Lowther Hill ATC radar. The Applicant has subsequently engaged with NATS regarding mitigation and a potential solution has been identified. Further details are provided in **Section 13.4**; the NATS TOPA can be found at **TA 13.3**.

13.2.10 Full details of all consultation undertaken is provided in **TA 1.2: Consultation Register (Volume 4**).

Potential Effects Scoped Out

13.2.11 On the basis of the desk-based study, professional judgement, experience from other relevant projects and policy guidance or standards, and feedback received from consultees, the following topic areas have been scoped out of detailed assessment:

- Civil Airport IFPs (including NAVAIDS): The Proposed Development is not within the safeguarding zone of any civilian airports; consequently, there will be no impact on civilian airport patterns and procedures. NATS also confirmed in their scoping response (**Table 13-2** and **TA 13.3, EIAR Volume 4)** that there would be no impact on their NAVAIDs or radio communication systems;
- Military Aerodrome IFPs (including NAVAIDS): The Proposed Development is not within the safeguarding zone of any military aerodromes and potential impact on this receptor is not mentioned in MoD's scoping response (**Table 13-2** and **TA 13.2, EIAR Volume 4**); consequently, there will be no impact on military aerodrome patterns and procedures;
- Military ATC radar: The Proposed Development is not within radar coverage of any military ATC radar systems and potential impact on this receptor is not mentioned in MoD's scoping response (**Table 13-2** and **TA 13.2, EIAR Volume 4**); consequently, there will be no impact on military ATC radar systems;

- Military AD radar: The Proposed Development is not within radar coverage of any military AD radar systems and potential impact on this receptor is not mentioned in MoD's scoping response (**Table 13-2** and **TA 13.2, EIAR Volume 4**); consequently, there will be no impact on military AD radar systems;
- Local minor aerodromes: There are no local minor aerodromes in the vicinity of the Proposed Development;
- Local Airspace Restrictions (Prohibited/Restricted/Danger Areas and Military PEXAs): The Proposed Development is situated outside the boundaries of any active Prohibited/Restricted/Danger Areas and Military PEXAs; consequently, there will be no impact on MoD operations within restricted airspace;
- Met Office radar: The nearest Met Office radars to the Proposed Development are located at Holehead, 25 nautical miles (nm) (46 kilometres (km)) to the south and Munduff Hill, 31 nm (57 km) to the southeast. The Proposed Development is therefore outside the 20 km safeguarding area for radars of this nature.

Method of Baseline Characterisation

Extent of the Study Area

13.2.12 To assess the impact on aviation, a Study Area has been devised that takes into account the immediate vicinity of the Proposed Development, the consultation criteria for aviation assets as described in CAP 764 - Policy and Guidelines on Wind Turbines and the range of potentially affected radar systems; both ATC and AD radar systems. A pictorial representation of the Site and location of potential aviation receptors is depicted on an aviation chart and shown at **Figure 13.1 (Volume 2)**.

Desk Study

13.2.13 The desk-based review was conducted using comprehensive aviation documentation and charts to identify potential aviation receptors during the construction, operation and decommissioning phases of the Proposed Development. The set of data sources used is shown in **Table 13-3**.

Table 13-3: Data Sources

Data	Source	Details
CAA 1:500,000 VFR Aviation Chart	CAA (2024)	Designed to assist in the navigation of aircraft. Enables pilots to determine their position, safe altitude and route to a destination, highlighting NAVAIDS along the way, alternative landing areas in case of an in-flight emergency, and other useful information such as radio frequencies and airspace boundaries.
CAP 393 - Regulations made under powers in the Civil Aviation Act 1982 and the Air Navigation Order 2016	CAA (Version 6, 12 February 2021)	Contains the Air Navigation Order (ANO) 2016 and Regulations made under the order; and defines the Rules of the Air regarding civil aviation in the UK.
CAP 764 - CAA Policy and Guidelines on Wind Turbines	CAA (Version 6, February 2016)	Provides CAA policy and guidance on a range of issues associated with WTGs and their effect on aviation that need to be considered by aviation stakeholders, wind energy developers and local planning authorities when assessing the viability of wind turbine developments.

Data	Source	Details
UK IAIP	CAA (2024)	Provides comprehensive information on UK civilian aerodromes and aviation procedures within UK airspace.
UK Mil AIP	MoD (2024)	Provides comprehensive information on UK military aerodromes and guidance to military aircrew on in-flight navigation procedures.
NATS Self-Assessment Maps	NATS (2024)	Designed for applicants to ascertain whether their Proposed Development is anticipated to have an impact upon NATS infrastructure and operations.

Field Survey

13.2.14 In order to ascertain the exact aviation lighting requirements for the Proposed Development, the Applicant commissioned an aviation lighting assessment from WFLFAC. The assessment proposed the visible and infra-red aviation lights to be installed on the Proposed Development's WTGs. The WFLFAC report, which can be found at **TA 13.1**, has since been accepted and approved by the CAA. The CAA approval letter can be found at **TA 13.4 (EIAR Volume 4)**.

13.2.15 No other site-specific surveys have been undertaken to inform this assessment. This is because the baseline characterisation developed through existing data sources, coupled with ongoing consultation with relevant stakeholders is considered sufficient to inform the aviation chapter.

Method of Assessment

13.2.16 The full assessment methodology, including criteria for assessing sensitivity of receptors, magnitude of change and cumulative effects, as well as overall significance criteria and approach to mitigation, is detailed in **TA 13.6: Aviation Assessment Methodology (Volume 4).**

Cumulative Effects

13.2.17 In terms of cumulative impact, any potential impact on an aviation receptor is generally treated as a standalone effect. Whilst other wind turbine developments may be located in close proximity, the effect on each receptor is considered on a case-by-case basis and any significant effect is sufficient to trigger an objection from the relevant aviation stakeholder. Although mitigation may have been agreed for other developments, it would still be necessary for negotiations and discussions with aviation stakeholders to be carried out under separate arrangement. As such, no specific cumulative effects on aviation stakeholders/receptors are expected.

Limitations and Assumptions

13.2.18 The data used in this chapter are the most up to date publicly available information which can be obtained from the applicable data sources as cited (T**able 13.4 TA 13.6, EIAR Volume 4**). Information has also been provided through consultation as detailed in Table 13-4. It is considered that the data employed in the assessment are robust and sufficient for the purposes of the impact assessment presented.

13.3 Baseline Conditions

Current Baseline

13.3.1 This section should be read in conjunction with **Figure 13.1 (EIAR Volume 2)**. The Proposed Development baseline pertinent to aviation is that there will be up to 12 WTGs with a maximum turbine tip height of

up to 180 m agl. There are a number of civilian and military aviation interests in the vicinity of the Proposed Development which can be described as follows:

Airspace

13.3.2 The Proposed Development is situated in an area of Class G uncontrolled airspace which is established from the surface up to 5,500 ft above mean sea level. Above 5,500 ft the airspace in Class E controlled airspace which forms part of the Moray Control Area, and which extends up to Flight Level (FL) 195 (19,500 feet (ft)). Above FL195, the airspace is Class C controlled airspace which extends from FL 195 to FL 245 (24,500 ft) and forms Temporary Reserved Area 008B which exists to aid and provide flexibility to military training and operations. Class C controlled airspace then continues above FL 245 (24,500 ft) and contains upper air routes mainly utilised by aircraft routeing between Europe and North America. In Class C, E and G airspace, the following ATS rules apply:

- **Class C airspace** – all aircraft operating within Class C controlled airspace (i.e. above FL195) must be in receipt of an ATS from NATS En-Route PLC or a separate authorised military service provider;
- **Class E airspace** - airspace in which VFR flight without ATC clearance is permitted, although the VFR aircraft must carry and operate a transponder to operate without ATC clearance. Controllers will separate aircraft at the request of the pilot but to limits decided by the controller, or if information has been received which indicates that an aircraft is lost or experiencing radio failure; and
- **Class G airspace** - any aircraft can operate in this area of uncontrolled airspace without mandatory requirement to be in communication with, or receive a radar service from, an ATC unit. Pilots of aircraft operating under VFR in Class G airspace are ultimately responsible for seeing and avoiding other aircraft and obstructions.

Civil airport IFPs (including NAVAIDS)

13.3.3 The nearest major civil airports to the Proposed Development are Edinburgh, Glasgow International and Glasgow Prestwick airports all of which confirmed in their scoping responses that the proposed WTGs will not be outside their relevant IFP safeguarding zones; and that the Proposed Development is not anticipated to impact on the airports' patterns and procedures. NATS also confirmed in their scoping response (**Table 13-2** and **TA 13.3, EIAR Volume 4**) that none of their en-route NAVAIDS or radio communication systems would be affected by the Proposed Development.

Military aerodrome IFPs (including NAVAIDS)

13.3.4 No military aerodrome IFPs (including NAVAIDS) will be affected by the Proposed Development; as confirmed in the MoD consultation response (**Table 13-2** and **TA 13.2, EIAR Volume 4**).

Civil ATC Radars

13.3.5 The Proposed Development is within the operating range of a number of civil ATC radars including Edinburgh, Glasgow International and Glasgow Prestwick airports' ATC radars; however, in their scoping responses all three airport operators confirmed that their radar operations would not be affected by the Proposed Development (**Table 13-2**). NATS however carried out an assessment of the Proposed Development on receipt of the Scoping Report and determined that the Lowther Hill ATC radar would be adversely affected by 6 of the proposed WTGs and that these turbines would cause false primary plots on ATC radar displays. NATS assessment is contained in **TA 13.3**.

Military ATC Radars

13.3.6 No military ATC radars will be affected by the Proposed Development; as confirmed by the MoD scoping response (**Table 13-2** and **TA 13.2, EIAR Volume 4**).

Military AD Radars

13.3.7 No military AD radars will be affected by the Proposed Development; as confirmed by the MoD scoping response (**Table 13-2** and **TA 13.2, EIAR Volume 4**).

Low Flying (Military and Civilian EHSUs)

13.3.8 The Proposed Development is located in Low Flying Area (LFA) 14, a strategically important LFA within the UK Low Flying System. Military aircraft can fly down to a minimum of 250 ft agl and, helicopters normally operate down to 100 ft agl but due to the nature of their task, and for specific training purposes, are occasionally permitted to fly lower. However, the airspace in the vicinity of the Proposed Development is considered by MoD to be of low priority in terms of the UKLFS.

13.3.9 When conducting operational missions, UK Search and Rescue helicopters and other emergency helicopter operators, such as Air Ambulance and Police Air Support units, are not constrained by the normal rules of the air, which allows them flexibility to manoeuvre, as required, for the particular mission being carried out.

13.3.10 There is a statutory CAA requirement to provide visible aviation warning lights for structures of a height of 150 m agl or more; MoD however request that all turbines are fitted with MOD-accredited infra-red lighting which is not visible to the naked eye but is visible to aircrew using night vision equipment. The turbines will be erected with a mixture of visible and infra-red lighting installed that will remain operational throughout the duration of any consent.

13.3.11 As outlined in **Table 13-2**, a detailed Lighting Plan (LP) has been agreed with CAA and forms the basis of the lighting scheme to be installed. The WFLFAC aviation lighting report is at **TA 13.1** and the CAA approval letter is at **TA 13.4 (EIAR Volume 4)**.

Local minor aerodromes

13.3.12 No local minor/unlicensed aerodromes are located within CAA recommended consultation distances for airfields of this nature.

Local airspace restrictions (Prohibited/Restricted/Danger Areas and Military PEXAs)

13.3.13 There are no local airspace restrictions in the vicinity of the Proposed Development.

Met Office Radars

13.3.14 The closest Met Office radar system is located at Holehead, 25nm (46 km) to the south of the Proposed Development; which is outside the 20 km safeguarding area for radars of this nature.

Future Baseline

13.3.15 An assessment of the future baseline conditions has been carried out assuming that the Proposed Development does not come forward. There are no anticipated future changes to the airspace and aviation environment in the vicinity of the Proposed Development that affect this assessment of the impact on aviation receptors.

Sensitive Receptors

13.3.16 A summary of identified sensitive/important aviation receptors is provided within **Table 13-4.**

Table 13-4: Summary of Identified Sensitive/Important Aviation Receptors

Receptor	Sensitivity
Military and civilian EHSUs low flying operations	High
NATS Lowther Hill ATC radar	High

13.4 Assessment of Likely Effects

Embedded Mitigation

13.4.1 As part of the design process, a number of embedded mitigation measures and management plans have been proposed to reduce the potential for impacts on aviation receptors, as summarised in **Table 13-5**. As these measures are considered standard industry good practice for this type of development, they are therefore considered inherently part of the design of the Proposed Development.

Table 13-5: Embedded Mitigation Measures Specific to Aviation

Embedded Mitigation Measures	Justification/How Mitigation Will Be Secured
Approval and implementation of a Lighting Plan (LP), which will set out specific requirements in terms of aviation lighting to be installed on the WTGs, as required under CAA (2016) CAP 393, Regulations made under powers in the Civil Aviation Act 1982 and the Air Navigation Order 2016.	An LP has been prepared (**TA 13.2, EIAR Volume 4**) and approved by CAA (**TA 13.4**) which considers requirements for aviation lighting as specified in Article 223 of the UK ANO, 2016 and changes to International Civil Aviation Organisation Annex 14 Volume 2, Chapter 6, paragraph 6.2.4 promulgated in November 2016. Implementation of the LP will be a condition of any planning consent. These measures will ensure that the potential for risk of aircraft collision with the Proposed Development's infrastructure is minimised.
All structures of more than 91.4 m in height will be charted on aeronautical charts and reported to the Defence Geographic Centre, which maintains the UK's database of tall structures (Digital Vertical Obstruction File) at least ten weeks prior to construction.	An LP has been prepared (**TA 13.2, EIAR Volume 4**) and approved by CAA (**TA 13.4**). Implementation of the LP will be a condition of any planning consent. These measures will ensure that the potential for risk of aircraft collision with the Proposed Development's infrastructure is minimised.
Any temporary obstacles associated with wind farms which are of more than 91.4 m in height are to be alerted to aircrews by means of the Notice to Aviation (NOTAM) system.	Consultation with the CAA will be required to ensure that temporary obstacles of more than 91.4 m are identified to aircrews by NOTAM. Notification of temporary obstacles will be a condition of any planning consent. Measures will be adopted to ensure that the potential for risk of aircraft collision with the Proposed Development's infrastructure is minimised.
CAA will be informed of the locations, heights and lighting status of the WTGs including estimated and actual dates of	Consultation with the CAA will be required. Inclusion of locations, heights and lighting status of the WTGs on aviation charts and in the UK an IAIP will be a condition of any planning

Embedded Mitigation Measures	Justification/How Mitigation Will Be Secured
construction and the maximum heights of any construction equipment to be used, prior to the start of construction.	consent. Measures will be adopted to ensure that the potential for risk of aircraft collision with the Proposed Development's infrastructure is minimised.

Potential Construction Effects

Potential impact on military low flying and civilian EHSU operations

13.4.2 The installation and presence of WTGs pose physical obstructions to aviation operations carried out in the vicinity of wind farms. Wind turbines can be difficult to see from the air, particularly in poor meteorological conditions, leading to a potential increase in obstacle collision risk. Furthermore, during the construction phase, the presence and movement of installation vehicles (e.g. cranes) may also present a potential obstacle collision risk to aircraft operations. As explained in **TA 13.6 (EIAR Volume 4)**, the sensitivity of aviation receptors is considered to be high, and the magnitude of baseline aviation activities and equipment (without applied mitigation) is considered to be high.

Sensitivity of the receptor

13.4.3 Pilots are obliged to plan their flying activities in advance and to be familiar with any en-route obstacles they may encounter; however, during flight, weather conditions or operational requirements may necessitate route adjustments. In Visual Meteorological Conditions (VMC) (i.e. good weather conditions), pilots are ultimately responsible for seeing and avoiding obstructions such as WTGs and will be aware of their presence through the notification procedures set out in **Table 13-5**.

13.4.4 The Proposed Development is located within LFA 14. Aircraft completing low flying training in this area would be considered to be operating in VMC. This means that aircraft will be operating in weather conditions in which pilots would have sufficient visibility to maintain visual separation from terrain, obstacles and other aircraft. The Proposed Development's WTGs would be additional obstacles that low flying aircraft would have to avoid.

13.4.5 The Applicant is committed to lighting and charting the turbines and that, in the interests of air safety, the Proposed Development will be fitted with civilian, and military, accredited aviation safety lighting in accordance with the UK ANO, 2016 and further embedded mitigation measures, as outlined in **Table 13-5**, will be implemented to ensure that any potential impacts of the Proposed Development are alleviated. Irrespective of any embedded mitigation measures the sensitivity of the receptor remains **high**.

Magnitude of impact

13.4.6 The presence of construction infrastructure, more than 91.4 m in height, will be alerted to pilots under the NOTAM system (**Table 13-5**). The NOTAM will provide details of potential hazards along a flight route, or at a location, that could affect the safety of flight. The cranes will also have appropriate aviation lighting installed.

13.4.7 In terms of WTGs creating physical obstacles, aircraft operating at low levels are required to set a Minimum Safe Altitude (MSA); this is the lowest altitude set in areas to ensure safe separation between aircraft and known obstacles. The MSA for aircraft operating in Instrument Meteorological Conditions (i.e. poor weather conditions), enables aircraft to maintain a minimum of 1,000 ft (305 m) clearance between aircraft and known obstacles.

13.4.8 As detailed in **Table 13-5**, potential impacts to low flying aircraft operating in the vicinity of the Proposed Development will be managed through the agreement of a LP with key aviation stakeholders, and notification of the locations, heights and lighting status of the WTGs to aviation stakeholders for inclusion in appropriate aviation documentation and charts. This will enable aviation operators to set an appropriate MSA over the Proposed Development. Implementation of the embedded mitigation measures (**Table 13-5**) enables the magnitude of impact to be assessed as negligible.

Significance of the effect

13.4.9 The impact is predicted to be of local spatial extent, short to medium term duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor directly. The sensitivity of low flying activities to change is considered to be high and, following implementation of embedded mitigation measures (**Table 13-5**) the magnitude of the impact is assessed as negligible. Therefore, any potential effects resulting from the Proposed Development are determined as negligible and **not significant**.

Potential Operational Effects

Potential impact on NATS Lowther Hill ATC Radar

13.4.10 WTGs have been shown to have detrimental effects on the performance of ATC radar systems and have the potential to affect the provision of radar-based ATS.

Sensitivity of the receptor

13.4.11 NATS air traffic controllers are responsible for maintaining typically 5 nm lateral separation between aircraft. Where line of sight to an ATC radar exists, WTGs may appear as genuine aircraft targets and could mask real aircraft responses. Radar clutter (or false radar returns) can confuse air traffic controllers making it difficult to differentiate between aircraft and those radar returns resulting from the detection of WTGs. Furthermore, the appearance of multiple false targets in close proximity can generate false aircraft tracks and seduce those returns from real aircraft away from the true aircraft position.

13.4.12 This effect could hamper the ATC operators' ability to distinguish actual aircraft returns from those created by the WTGs and degrade the safety and efficiency of the ATS being provided.

Magnitude of impact

13.4.13 NATS uses long-range radar systems to support their provision of navigational services to aircraft operating between the UK and mainland Europe and to those overflying UK airspace. Surveillance data from the NATS Lowther Hill ATC radar is also used by other air traffic service providers such as civilian airports and MoD.

13.4.14 The effects of WTGs on ATC radar systems include the desensitisation of radar in the vicinity of the turbines, shadowing and the creation of unwanted returns which air traffic controllers must treat as aircraft returns. NATS have confirmed (**Table 13-5** and **TA 13.3, EIAR Volume 4**) that the Proposed Development would create false primary plots to be generated on the Lowther Hill ATC radar which would create a reduction in the radar's probability of detection for real aircraft and that this effect on the radar would be unacceptable. In order to ensure aircraft safety, it is important for NATS to maintain solid surveillance coverage in the vicinity of the Proposed Development.

Significance of the effect

13.4.15 The sensitivity of the effect on the NATS Lowther Hill ATC radar activities to change is considered to be high and, in the absence of additional mitigation measures, the magnitude of the impact is assessed as high. Therefore, any potential effect of the Proposed Development on the NATS Lowther Hill ATC Radar is assessed as major and **significant**. It is concluded that additional mitigation is required beyond the embedded mitigation described in **Table 13-5**.

Potential Decommissioning Effects

13.4.16 No effects on aviation are expected during the decommissioning phase further to those effects identified in relation to the construction phase.

Potential Cumulative Construction Effects

13.4.17 As outlined in **TA 13.6 (EIAR Volume 4)**, no specific cumulative effects on aviation stakeholders/receptors are expected.

Potential Cumulative Operational Effects

13.4.18 As outlined in **TA 13.6 (EIAR Volume 4)**, no specific cumulative effects on aviation stakeholders/receptors are expected.

13.5 Additional Mitigation

Mitigation During Construction

Potential impact on military low flying and civilian EHSU operations

13.5.1 The effects of the Proposed Development have been minimised, as industry standard risk control measures will be put in place prior to the construction phase of the WTGs. These mitigation measures will further serve to reduce the impact of the Proposed Development and ensure the project conforms to regular requirements and industry good practice. Consequently, no additional mitigation is required as there are **no significant effects** as a result of the construction of the Proposed Development.

Mitigation During Operation

Potential impact on NATS Lowther Hill ATC Radar

13.5.2 NATS has proven processes and techniques to mitigate the adverse impact of WTGs on their ATC radars. The Applicant has commenced discussions with NATS about potential mitigation solutions and it is likely that the proposed solution will be Multi-Radar Tracker (MRT) blanking, which is a technical mitigation solution routinely offered by NATS to remove wind turbine returns from the ATC radar display. The Applicant intends to continue negotiations with NATS with the aim of delivering a suitable radar mitigation solution prior to the operation phase of the Proposed Development.

13.5.3 Once a mitigation solution is implemented, it is concluded that effects would be negligible and **not significant**. Mitigation can therefore be achieved by an appropriate suspensive planning condition. Since it is generally the operation of turbines that may cause the significant adverse effects (see para.13.1.1 above), such a condition need not make commencement of the development suspensive. A requirement that no turbine was operated (other than agreed testing) pending approval by the planning authority, after consultation with NATS, of a radar mitigation scheme would be sufficient to secure this mitigation.

13.6 Assessment of Residual Effects

Residual Construction Effects

Potential impact on military low flying and civilian EHSU operations

13.6.1 Once embedded mitigation measures (Table 13-5) have been implemented, no residual significant effects are expected.

Residual Operational Effects

Potential impact on NATS Lowther Hill ATC Radar

13.6.2 Once additional mitigation measures (Paragraph 13.5.2) have been implemented, no residual significant effects are expected.

Residual Decommissioning Effects

13.6.3 **No residual effects** on aviation are expected during the decommissioning phase further to those effects identified in relation to the construction phase.

Residual Cumulative Effects

13.6.4 As outlined in **TA 13.6 (EIAR Volume 4)**, no specific cumulative effects on aviation stakeholders/receptors are expected.

13.7 Monitoring

13.7.1 The assessment of effects on aviation as a result of the construction and operation phases of the Proposed Development are predicted to be **not significant** in EIA terms. Based on the predicted impacts, it is concluded that no further surveys or specific monitoring are required.

13.8 Summary

13.8.1 Information on aviation was collected through a detailed desktop review of existing studies and datasets. The desktop review was conducted using comprehensive aviation documentation and charts to identify potential aviation receptors during the construction, operation and decommissioning phases of the Proposed Development. Consultation has been ongoing throughout the EIA process; with MoD and NATS.

13.8.2 The aviation Study Area was defined to ensure that all relevant aviation receptors were assessed, and an aviation lighting assessment was carried out in order to ascertain the exact aviation lighting requirements for the Proposed Development. A reduced lighting scheme has since been accepted and approved for installation by the CAA.

13.8.3 The desktop review, coupled with consultation responses from the relevant aviation stakeholders, determined that the following aviation receptors would potentially be affected by the Proposed Development:

- Military and civilian EHSU low flying operations; and
- NATS Lowther Hill ATC radar.

13.8.4 In order to alleviate these risks, MoD has requested that the WTGs are fitted with MoD accredited aviation safety lighting and in accordance with the CAA, Air Navigation Order 2016 and that details of the Proposed Development are included on aviation charts. These arrangements form part of the embedded mitigation measures identified in the EIAR and once implemented, will ensure that the overall effect on military low flying and EHSU operations will be negligible and **not significant** in EIA terms.

13.8.5 For the Lowther Hill ATC radar, a preliminary agreement has been reached with NATS regarding installation of a wind farm mitigation solution. It is expected that an agreement will be in place prior to the application's consent decision. Once mitigation has been implemented, the overall effect on the NATS Lowther Hill ATC radar will be negligible and **not significant** in EIA terms. The Proposed Development is not considered to present any cumulative effect on aviation receptors in the region.

13.8.6 Overall, the effects of the Proposed Development have been minimised and risk control measures will be put in place prior to the construction and operation phases of the wind farm. Once all mitigation measures have been implemented**, there will be no residual significant effects**. A summary of potential significant effects is provided in **Table 13-6**.

Table 13-6: Summary of Potential Significant Effects

Likely Significant Effect	Mitigation Proposed	Means of Implementation	Outcome/ Residual Effect
Construction			
Potential impact on military low flying and civilian EHSU operations	Embedded mitigation as outlined in **Table 13-5** (Implementation of LP; site details included on aeronautical charts; temporary obstacles more than 91.4 m alerted to aircrews by NOTAM).	Secured through suspensive planning conditions.	**not significant**
Operation			
Potential impact on NATS Lowther Hill ATC Radar	Additional mitigation to be agreed with NATS (MRT blanking)	Secured through suspensive planning condition.	**not significant**