

**CLOICH FOREST WIND FARM**  
**EIA Report – Volume 1 – EIA Report Text**

**Chapter 14**  
**Aviation and Radar**



## **14 AVIATION AND RADAR**

### **14.1 INTRODUCTION**

1. This Chapter of the Environmental Impact Assessment (EIA Report) identifies and assesses the potential effects that the proposed Cloich Forest Wind Farm ('the Development') may have on the aviation and radar stakeholders in the area.
2. This Chapter of the EIA Report is supported by the following Technical Appendices provided in Volume 3 Technical Appendices:
  - Technical Appendix A14.1: Cloich Wind Farm, Eskdalemuir, Desktop Budget Calculations.
3. This Chapter of the EIA Report is supported by the following Figures provided in Volume 2a Figures excluding LVIA:
  - Figure 14.1: VFR 250k Chart Extract; and
  - Figure 14.2: VFR 500k Chart Extract.
4. This Chapter aligns closely to the following elements as far as possible:
  - Overview;
  - Legislation, Policy and Guidance;
  - Scoping Responses and Consultation
  - Baseline Conditions;
  - Assessment of Potential Effects;
  - Mitigation;
  - Residual Effects;
  - Statement of Significance; and
  - Summary.
5. The Aviation & Radar assessment within this Chapter was undertaken by Cdr John Taylor RN (Ret) of Wind Power Aviation Consultants Ltd (WPAC). John Taylor has over 35 years' experience as an Air Traffic Controller, Fighter Controller and Aviation Regulator and was head of Air Traffic Control for the Royal Navy. His responsibilities included responding to wind farm consultations onshore and offshore. Since 2008 his company has provided expert advice on the interaction between wind turbines and aviation including assessing over 3,000 wind turbine proposals and giving evidence at over 20 Public Inquiries and Appeals in England and Scotland. He has also advised a number of Local Authorities on this issue. His team includes experts on radar propagation and modelling and low flying operations.
6. This Chapter also includes input from specialists from Xi Engineering Consultants Ltd in relation to Eskdalemuir Seismic Array.

## **14.2 LEGISLATION, POLICY AND GUIDANCE**

7. 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);
  - CAP 168 Licensing of Aerodromes, Version 11 March 2019 (CAA 2019);
  - CAP 670 ATS Safety Requirements Version 3 June 2019 (CAA 2019);
  - CAP 774 UK Flight Information Services, Ed 3 May 2017 (CAA 2017);
  - CAP 738 Safeguarding of Aerodromes Version 2 Dec 2006 (CAA 2006);
  - CAP 793 Safe Operating Practices at Unlicensed Aerodromes Ed 1 July 2010 (CAA 2010);
  - CAP 493 Manual of Air Traffic Services Part 1 Ed 7.0 2017 (CAA 2017);
  - CAP393 The Air Navigation Order 2016 and Regulations (CAA 2016);
  - CAP 660 Parachuting Ed 5 March 2020 (CAA 2020);
  - Military Aviation Authority Regulatory Article 2330 (Low Flying) (MOD MAA 2019);
  - UK Aeronautical Information Publications (AIP) (NATS 2020);
  - CAA 1:250,000 and 1:500,000 VFR Charts (NATS 2019,2020); and
  - CAA Policy Statement: Lighting of En-Route Obstacles and Onshore Wind Turbines 01 April 2010 (CAA 2010).

## **14.3 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA**

### **14.3.1 Overview and Study Area**

8. The assessment of effects of the 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.
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 kilometres (km);
  - Non-radar licensed aerodrome with a runway of more than 1,100 metres (m) – 17 km;
  - Non-radar licensed aerodrome with a runway of less than 1,100 metres – 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.
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 the study area being modified as required based on specific airspace and operational considerations.

### **14.3.2 Ministry of Defence (MoD)**

11. It is also necessary to take into account the aviation and air defence activities of the Ministry of Defence (MOD) as safeguarded by the Defence Infrastructure Organisation (DIO). The types of issues that are addressed in this Chapter include:
  - Ministry of Defence Airfields, both radar and non-radar equipped;
  - Ministry of Defence Air Defence Radars;
  - Ministry of Defence (now UK Met Office) Meteorological Radars; and
  - Military Low Flying.

### **14.3.3 National Air Traffic Services Ltd (NERL) Facilities**

12. It is necessary to take into account the possible effects of wind turbines upon the National Air Traffic Services En Route Ltd (NERL) communications, navigation and surveillance systems – a network of primary and secondary radars and navigation facilities around the United Kingdom.
13. 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.

### **14.3.4 Desk Study**

14. The radar calculation results shown in this Chapter have been produced using specialist propagation prediction software (RView Version 5). Developed over a number of years, it has been designed and refined specifically for the task. RView uses a comprehensive systems database which incorporates the safeguarding criteria for a wide range of radar and radio navigation systems. RView models terrain using the Ordnance Survey (OS) Terrain 50 digital terrain model, which has a post spacing of 50 m and has a root mean square (RMS) error of 4 m. The results are verified using the Shuttle Radar Topography Mission (SRTM) dataset, a separate smoothed digital terrain model with data spacing of 3 arc seconds. By using two separate and independently generated digital terrain models, anomalies are identified and consistent results assured. RView models the refractive effects of the atmosphere on radio waves and the First Fresnel Zone. A feature of RView is that as well as performing calculations in the manner believed to be most appropriate it also allows comparison with results from simpler models. For example, RView can perform calculations using the true Earth Radius at the midpoint between the radar and the wind turbine or the simplified 4/3 Earth Radius model. If needed, RView is also capable of modelling a range of atmospheric refractive conditions. RView models the trajectory of radar signals at different elevations, enabling modelling of both volume surveillance and pencil beam radars as well as the effects of angular sterilisation as applied, for example, in Met Office radars.

### **14.3.5 Site Visit**

15. Site surveys were not required for the evaluation of aviation impacts at Cloich Forest and have not been undertaken for this assessment.

### **14.3.6 Methodology for the Assessment of Potential Effects**

16. Assessment of potential effects has been undertaken by identifying whether impacts are anticipated upon aviation and radar infrastructure, and therefore whether aviation stakeholders are anticipated to object to the Development.
17. The assessment does not determine significant or non-significant effects, but whether there is an effect or no effect.

### 14.3.7 Scoping Responses and Consultations

18. Consultation for this EIA Report topic was undertaken with the organisations shown in Table 14.1.

**Table 14.1 Consultation Responses**

Consultee	Type and Date	Summary of Consultation Response	Response to Consultee
MOD DIO	Scoping Response (DIO13930) 31/10/2019	The MOD expressed concerns regarding two issues: firstly, the effect on the RAF Spadeadam ATC Radar and secondly the Eskdalemuir Seismic Array. They also requested infra-red OR 25cd red lights.	Noted further consultation required.
	Tip Height Increase Consultation (DIO13930) 06/02/2020	The MOD expressed concerns regarding two issues: firstly, the effect on the RAF Spadeadam ATC Radar and secondly the Eskdalemuir Seismic Array. They also requested infra-red OR 25cd red lights.	WPAC wrote to DIO to challenge the ATC radar objection based on the location. This resulted in the additional response below which removes the Spadeadam ATC concern.
MOD DIO	Further Consultation (DIO13930) 20/10/2020	The MOD has concerns in relation to the Eskdalemuir Seismological Recording Station. Military Low Flying Training – “ <i>The development site occupies Tactical Training Area 20T (TTA 20T) therefore in the interests of air safety, the MOD would request that the development be fitted with MOD accredited aviation safety lighting. The perimeter turbines and any additional masts are to be fitted with MOD accredited 25 candela omnidirectional red lighting or infrared lighting with an optimised flash pattern of 60 flashes per minute of 200ms to 500ms duration at the highest practicable point.</i> ”	Xi Engineering has undertaken an assessment (Appendix A14.1) in relation to the Eskdalemuir Seismological Recording Station.

Consultee	Type and Date	Summary of Consultation Response	Response to Consultee
Edinburgh Airport	Scoping Response 04/11/2019	No Objection to the Development.	Noted.
	Tip Height Increase Consultation 29/01/20	Increase in tip height does not change previous response. No Objection to the Development.	Noted.
Highlands and Islands Airport Limited	Scoping Response 24/10/2019	No Objection to the Development.	Noted.
	Tip Height Increase Consultation 30/01/20	Increase in tip height does not change previous response. No Objection to the Development.	Noted.
Glasgow Prestwick Airport	Scoping Response 01/11/2019	No Objection to the Development.	Noted.
	Tip Height Increase Consultation 07/02/20	Increase in tip height does not change previous response. No Objection to the Development.	Noted.
NATS Safeguarding	Scoping Response	No Objection to the Development.	Noted.
	Email response dated 21/01/20 (Ref SG10504)	Increase in tip height does not change previous response. No Objection to the Development.	Noted.

## 14.4 BASELINE CONDITIONS

### 14.4.1 Aviation & Radar

19. The location of the Development in an aviation context is shown in Figures 14.1 and 14.2.
20. The Development is located 25 km to the south-east of Edinburgh Airport and under the Edinburgh Control Area (CTA), Class D regulated airspace which in this area has a base level of 3,500 feet (ft) above mean sea level (amsl) and extends upwards to 6,000 ft.
21. Above and beyond this area is the Scottish Terminal Area (TMA) which is controlled by NATS En Route Ltd (NERL) from the Scottish ATC Centre at Prestwick. In military terms, the Development is remote from any military airfields, the closest being the ex-RAF Leuchars, now an army base over 75 km to the north-east of the Development. The closest military ATC facility is the RAF Spadeadam Electronic Warfare Training Facility; the control centre is located over 63 km to the south-east of the Development. The danger areas associated with the Spadeadam facility are shown in Figure 14.2 delineated by a purple hashed boundary line and designated D510 and D510A. The northernmost point of the danger areas is 55 km to the south of the Development.

#### 14.4.2 Eskdalemuir Seismic Array

22. The Eskdalemuir Seismic Array is located approximately 42 km south of the Development; therefore, the Development falls within the 50 km consultation zone.
23. The Development represents a re-design of the consented Cloich Forest Wind Farm ('the Consented Scheme'), which was granted S36 consent and deemed planning permission following a Public Local Inquiry (PLI), on 8 July 2016 (Planning and Environmental Appeals Division (DPEA) Reference: WIN-140-1).
24. The Consented Scheme, consisting of 18 turbines, is allocated a seismic budget of 0.0064902 nm by the Ministry of Defence – this budget remains valid at the time of writing this Chapter of the EIA Report.

### 14.5 ASSESSMENT OF POTENTIAL EFFECTS

#### 14.5.1 Licensed Aerodromes

25. The only licensed aerodrome within standard consultation distance is Edinburgh Airport at 25 km. The Development is beyond the distance where physical safeguarding needs to be considered. Radar modelling has been undertaken to determine if any of the turbines will be in view of the main primary surveillance radar (PSR) at the Edinburgh Airport with the results shown in Table 14.2 below.

**Table 14.2 Radar Line of Sight (RLOS) Results Edinburgh Airport PSR**

Turbine	RLOS (metres AGL)
1	517.3
2	554.8
3	566.9
4	583.1
5	576.5
6	464.9
7	555
8	471.2
9	560.4
10	460.9
11	466
12	432.4

26. These results confirm that every turbine is very well screened by terrain, confirming the Edinburgh Airport assessment that there will be no effect on facilities or operations at the airport.
27. It is noted that both Glasgow Prestwick Airport (GPA) and Highlands and Islands Airports Ltd (HIAL) were consulted and responded with no objection therefore no assessment is required in this Chapter. In relation to HIAL their closest radar equipped airport is at Inverness and their closest non-radar equipped licensed aerodrome is at Dundee, located over 80 km to the north, both airports are clearly well beyond any possible requirement for consultation or assessment, and are therefore not assessed in this Chapter. The lack of any effect on any of these facilities is confirmed in the consultation responses listed in Table 14.1.

### 14.5.2 Unlicensed Aerodromes

28. There are no unlicensed aerodromes within or close to consultation distance. The closest shown on aviation charts is Kirknewton, over 18 km to the north of the Development, therefore, consultation is not required.
29. An online search for private airfields has also been conducted and none identified within consultation distance. Not all private strips are listed in publications or marked on charts.

### 14.5.3 Ministry of Defence

30. As reported previously, there are no MOD airfields in the region, however, there is an ATC facility at RAF Spadeadam. Radar modelling has been undertaken against the two main radars located at Deadwater Fell and Berryhill. In the case of Berryhill, there is no radar line of sight below 500 m across the Development. The results for the Deadwater Fell radar are shown in Table 14.3.

**Table 14.3 RAF Spadeadam Deadwater Fell radar**

Turbine	RLOS (metres AGL)
1	124.6
2	54.5
3	115.1
4	112
5	89.1
6	63.4
7	126.3
8	36.1
9	85.5
10	39.8
11	72.1
12	47.3

31. The results show that all of the turbines are in radar line of sight of the Spadeadam Deadwater Fell radar and will create an area of clutter on the radar displays at the unit; however, discussions with the MOD have enabled them to conclude that they have no objection due to the fact that the turbines are in airspace sufficiently separated from the Spadeadam Area of Interest.

### 14.5.4 Air Defence Radar

32. The closest air defence radar is located at Brizlee Wood, near Alnwick, Northumberland. Radar modelling shows that radar line of sight is in excess of 500 m AGL and the proposed development will therefore have no effect on air defence radar systems. This is confirmed by the MOD response listed previously.

### 14.5.5 Military Low Flying

33. The MOD response in Table 14.1 is factually incorrect. The Development is not within Tactical Training Area 20 where aircraft can be authorised to fly as low as 100 ft, but within LFA16, where aircraft are generally limited to 250 ft. However, the lighting requirement as laid out in the MOD response is still a sensible and proportionate flight safety measure and applies irrespective of the type and designation of the specific low



flying area. As stated in Table 14.1 the MOD are not objecting to the Development on aviation grounds.

#### 14.5.6 Met Office Radars

34. 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. The factors they will consider include the following:
- Proximity to airports;
  - River catchment response times; and
  - Population density.
35. In this case the closest Met Office radar is at Holehead over 70 km to the north-west of the Development and therefore well beyond 20 km. There is no requirement for consultation to be undertaken with the Met Office.

#### 14.5.7 NATS En Route Ltd (NERL)

36. The two NERL long range radars with the lowest coverage in this area are at Great Dun Fell and Lowther Hill. Radar modelling has been undertaken against both radars with the results shown in Tables 14.4 and 14.5 respectively below.

**Table 14.4 Great Dun Fell Radar**

Turbine	RLOS (metres AGL)
1	546.9
2	566.3
3	531.3
4	485.8
5	434.5
6	479.4
7	540.2
8	402.1
9	457.8
10	369.8
11	461.8
12	425.2

37. The results in Table 14.4 show that the turbines will all be well screened by terrain from the Great Dun Fell radar.

**Table 14.5 Lowther Hill Radar**

Turbine	RLOS (metres AGL)
1	335.8
2	405.8
3	398
4	426.5

Turbine	RLOS (metres AGL)
5	442.5
6	270.5
7	391.4
8	278.8
9	388.6
10	249.5
11	261
12	171.5

38. The results in Table 14.5 show that all the turbines will be screened by terrain from the Lowther Hill radar. Both sets of results show that there will be no effect on the NERL surveillance systems and this is confirmed by the NATS consultation response stating that *"NATS (En Route) Public Limited Company ("NERL") has no safeguarding objection to the proposal."*

#### 14.5.8 Eskdalemuir Seismic Array

39. The Development Site lies within the Eskdalemuir Consultation Zone and is subject to MoD approval for seismic budget. The MoD has allocated the Consented Scheme, and therefore the Development, a seismic budget of 0.0064902nm. Whilst the size of the candidate turbine has increased since the allocation of this budget, Technical Appendix 14.1 shows that by either using a turbine with very low seismic vibration levels or by adopting a before and after measurement process, it is possible to build out the Development within the current seismic budget allocated by the MoD. The Development is situated approximately 42 km from the Array, and as such has a minimal seismic signature. Ongoing work being performed by Xi Engineering Consultants on behalf of the wind industry and the Scottish Government also has the capability to increase the available budget for the entire Eskdalemuir consultation Zone and potentially assist the Development.

#### 14.6 MITIGATION AND RESIDUAL EFFECTS

40. There are no radars or other ATC systems that will require any mitigation in relation to the Development. The only mitigation required is to satisfy the MOD requirement to ensure the wind farm is visible to pilots of low flying aircraft.
41. The MOD response states that either *"MOD accredited 25 candela omnidirectional red lighting or infrared lighting with an optimised flash pattern of 60 flashes per minute of 200ms to 500ms duration at the highest practicable point."*
42. Cloich Windfarm Partnership LLP (the Applicant) will elect to install infra-red lighting as it is invisible to the naked eye and will therefore, have no landscape or visual effects.
43. There is no requirement for CAA standard visible aviation obstruction lighting as the turbine tip height will be less than 150 metres above ground level.

#### 14.7 CUMULATIVE EFFECT ASSESSMENT

44. Given no effects are identified, there are no cumulative effects to take into account.

## **14.8 SUMMARY**

45. An assessment has been made of the potential for significant effects of the Development on the aviation resource. This assessment did not identify potential significant effects on any receptors during the construction, operation and decommissioning of the Development.
46. The Development has been shown to not exceed allocated budget with regard to Eskdalemuir Seismic Array.

## **14.9 GLOSSARY**

AGL	Above Ground Level
ATC	Air Traffic Control
AMSL	Above Mean Sea Level
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
CTA	Control Area
DIO	Defence Infrastructure Organisation
HIAL	Highlands and Islands Airports Ltd
LFA	Low Flying Area
MOD	Ministry of Defence
NATS	National Air Traffic Service
NERL	NATS En Route Ltd
OPERA	Operational Programme on the Exchange of Radar data
RAF	Royal Air Force
RLOS	Radar Line of Sight
TMA	Terminal Area
TTA	Tactical Training Area (for low flying)
VFR	Visual Flight Rules
WPAC	Wind Power Aviation Consultants