Fred. Olsen Renewables

Chapter 13

Aviation and Existing Infrastructure

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Glossary

Term	Definition
Environmental Impact Assessment	Environmental Impact Assessment (EIA) is a means of drawing together, in a systematic way, an assessment of the likely significant environmental effects arising from a Proposed Development
Environmental Impact Assessment Report	A document reporting the findings of the EIA and produced in accordance with the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 Regulation 5
Instrument Flight Procedure (IFP)	A set of heading and altitude instructions for pilots that provide defined vertical separations from the terrain and obstacles, and horizontal and/or vertical separation from other procedures, to enable aircraft to safely arrive at and depart from airports under the Instrument Flight Rules
Proposed Development	The Proposed Windy Standard I Repower Wind Farm
Proposed Development Area	The area shown delineated by the red line boundary shown on Figure 1.2.
Primary Surveillance Radar (PSR)	A device which transmits pulses of electromagnetic energy into a volume of airspace and detects reflections of that energy from objects such as aircraft and rainfall
Secondary Surveillance Radar (SSR)	A device which transmits pulses of electromagnetic energy which trigger a coded response from any aircraft equipped with a transponder

List of Abbreviations

List and describe your abbreviations here.

Abbreviation	Description
ACP	Airspace Change Proposal
ADLS	Aircraft Detection Lighting System
agl	above ground level
AIP	Aeronautical Information Publication
amsl	above mean sea level
ANO	Air Navigation Order
ANSP	Air Navigation Service Provider
APD	Approved Procedure Designer
ATC	Air traffic control
ATCSMAC	ATC Surveillance Minimum Altitude Chart
ATS	Air traffic service
CAA	Civil Aviation Authority
EC	Electronic conspicuity
EIA	Environmental impact assessment
ft	feet
GPA	Glasgow Prestwick Airport
IAP	Instrument Approach Procedure
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
ILS	Instrument Landing System
km	Kilometres
LDP	Local Development Plan
LFA	Low Flying Area
LPA	Local Planning Authority
MoD	Ministry of Defence
MSA	Minimum Sector Altitude
NATS	(formerly) National Air Traffic Services
NDB	Non-Directional Beacon
NERL	NATS En Route plc
nm	Nautical miles
NVIS	Night Vision Imaging Systems
PSR	Primary surveillance radar
RAF	Royal Air Force
SID	Standard Instrument Departure
SPP	Scottish Planning Policy
SSR	Secondary surveillance radar
STAR	Standard Arrival Route
TMA	Terminal Control Area
TOPA	Technical and Operational Assessment
TTA	Tactical Training Area
UHF	Ultra High Frequency
VHF	Very High Frequency

13.1 AVIATION

Statement of Competence

13.1.1 This section of the chapter has been compiled by Gladhouse Planning Ltd, trading as Aviatica. Aviatica is a specialist aviation consultancy with more than 25 years' experience of assessing the impacts of wind energy developments on aviation. This has included the preparation of more than one hundred Environmental Impact Assessment (EIA) chapters for projects across the UK and assessment of more than fifty wind farm developments in the south of Scotland.

Introduction

13.1.2 This section considers the likely significant effects on aviation and defence associated with the construction, operation and decommissioning of the Proposed Development. It has been compiled by Malcolm Spaven, Director of Gladhouse Planning Ltd.

Legislation, Policy and Guidance

Legislation

13.1.3 Relevant legislation and guidance documents have been reviewed and taken into account as part of this aviation assessment. This includes the Air Navigation Order 2016 (as amended in September 2021) and aviation Statutory Instruments enacted under the European Union (Withdrawal) Act 2018.

13.1.4 The assessment has also taken account of the provisions of the Ministry of Defence (Eskdalemuir Seismic Recording Station) Technical Site Direction 2005.

Planning Policy

13.1.5 Scottish Planning Policy (SPP) (2014) advises that wind energy proposals should take account of impacts on aviation and defence interests and seismological recording.[1]

13.1.6 The Scottish Government Onshore Wind Policy Statement (December 2017)[2] advised of the government's intention to pursue a more strategic approach to the mitigation of effects of wind farms on civil and military radar. In the Consultative Draft Refresh of that Policy Statement in 2021[3], the Scottish Government stated the expectation that, due to the now established nature of onshore wind in Scottish landscapes and the importance of onshore wind's contribution to Scotland's net zero commitments, the onus for developing and funding mitigation for the effects of wind farms on radar will transition from the renewables sector to the aviation sector. It is expected that this transition of responsibility will be established by 2030. Collaboration towards this is already underway between the renewables and aviation sectors through the Aviation 2030 Vision Taskforce.

13.1.7 The Dumfries and Galloway Council Local Development Plan 2 (LDP2)[4], Policy IN2, advises that wind energy proposals will be assessed against the extent to which the proposal addresses any impacts arising from location within an area subject to potential aviation and defence constraints, including the Eskdalemuir Safeguard Area.

Guidance

13.1.8 The Dumfries and Galloway Council Supplementary Guidance on Wind Energy Development[5] advises that the main aviation and defence constraints in the region are the NATS radar safeguarding zone; a 13 km radar management zone around the MoD range at West Freugh; the Civil Aviation Authority (CAA) consultation zone around Carlisle Airport; areas that may be subject to low flying military aircraft; and the Eskdalemuir seismic monitoring station. The document states that effects on aviation and defence require detailed consultation with the relevant stakeholders.

13.1.9 The assessment in this chapter of potential effects on aviation and defence has also been informed by the following aviation guidance and sources of information:

- CAA Policy and Guidelines on Wind Turbines (CAP 764);[6]
- CAA, Air Traffic Services Safety Requirements (CAP 670);[7]
- CAA, Air traffic control surveillance minimum altitude chart (CAP 777);[8]
- CAA Policy Statement: Lighting of Onshore Wind Turbine Generators in the United Kingdom with a maximum blade tip height at or in excess of 150 m Above Ground Level;[9]
- International Civil Aviation Organisation (ICAO), Annex 14 to the Chicago Convention, Vol.1;[10]
- UK Aeronautical Information Publication (AIP);[11] and
- UK Military AIP.[12]

Method of Assessment

Study Area

13.1.10 Study areas with the following radii were used in determining the aviation and defence baseline:

- 120 km for air traffic control and air defence primary surveillance radars;
- 60 km for airport Instrument Flight Procedures (IFPs);
- 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;
- 10 km for unlicensed aerodromes, airstrips and gliding sites; and

[1] A revised version of the Scottish Planning Policy was published in 2020 but has since been removed following a legal challenge in the Court of Session in August 2021.

[2] Scottish Government (2017). Onshore Wind Policy Statement

[3] Scottish Government (2021). Scottish Onshore Wind Policy Statement Refresh 2021: Consultative Draft

[4] Dumfries and Galloway Council (2019). Local Development Plan 2

[5] Dumfries and Galloway Council (2020). Local Development Plan 2: Supplementary Guidance on Wind Energy Development - Development Management Considerations.

[6] Civil Aviation Authority (2016). Safety Regulation Group, CAP 764: CAA Policy and Guidelines on Wind Turbines. [Online] Available at: https://publicapps.caa.co.uk/docs/33/CAP764 Issue6 FINAL Feb.pdf [Accessed March 2022]

[7] Civil Aviation Authority (2019). CAP 670: Air Traffic Services Safety Requirements, Third Issue, Amendment 1/2019. Online. Available at https://publicapps.caa.co.uk/docs/33/CAP670%20Issue3%20Am%201%202019(p).pdf [Accessed March 2022]

[8] CAA (2018). Air traffic control surveillance minimum altitude chart. CAP 777. Online. Available at https://publicapps.caa.co.uk/docs/33/CAP777%20SEP18.pdf [Accessed March 2022]

[9] CAA, Safety & Airspace Regulation Group (2017). Policy Statement: Lighting of Onshore Wind Turbine Generators in the United Kingdom with a maximum blade tip height at or in excess of 150m Above Ground Level. Online. Available at https://publicapps.caa.co.uk/docs/33/DAP01062017_LightingWindTurbinesOnshoreAbove150mAGL.pdf

[10] International Civil Aviation Organisation (2018). Annex 14 to the Chicago Convention: Aerodromes, Vol.1: Aerodrome Design and Operations. Eighth Edition.

[11] NATS (2022). eAIS Package United Kingdom. Online. Available at https://nats.aero/ais [Accessed March 2022]

[12] No 1 Aeronautical Information Documents Unit (2022). UK Military AIP. Online. Available at https://www.aidu.mod.uk/aip/ [Accessed March 2022]

- 50 km for the Eskdalemuir seismic array.

Desk Study

13.1.11 The description of baseline conditions for aviation and defence has been completed using the following methods:

- Assessment of the turbine visibility to all potentially affected air traffic control and air defence radars;
- Desk studies to identify all potentially affected airfields, airstrips and other aviation activity sites in the vicinity of the Proposed Development Area, referencing the UK AIP, the UK Military AIP, aeronautical charts and published pilots' guides;
- Measurement of the distance of the Proposed Development Area from the Eskdalemuir seismic array; and
- Consultation with identified aviation consultees.

13.1.12 The potential impacts of the Proposed Development on aviation and defence have been assessed by considering whether any of the turbines would be within line of sight of, and in an area of operational significance to, any aeronautical or defence radar equipment; whether any of the turbines would breach the obstacle limitation surfaces around civil or military airfields, or pose an obstacle hazard to aircraft in the vicinity of airfields or conducting military low flying; and whether the turbines would be within the safeguarding zones for aeronautical radio navigation or communication equipment or the Eskdalemuir seismic array.

Assessment of Likely Effect Significance

13.1.13 The significance of an impact on the use of air traffic control or air defence radar has been determined by assessing any technical effects on the radar in the context of the classification of the airspace in which the radar provides a service; the nature and density of air traffic in the airspace; the routes flown by aircraft in the vicinity of the Proposed Development Area; the types of service requested by, and provided to, aircraft using services provided from the affected radar; and the capacity of normal operational air traffic management measures to address the effects on the radar.

13.1.14 Potential obstacle hazard impacts of the turbines have been determined by assessing the proximity of the Proposed Development to airfields, airstrips and aerodromes, including whether any obstacle limitation surfaces at Government, certificated or licensed aerodromes would be infringed; and whether the turbines, in combination with the terrain and other vertical obstructions in the area, would impose constraints on military low flying.

13.1.15 The significance of potential effects on aviation and radar receptors is based on industry regulations for safe obstacle avoidance and the ability to maintain radar separation from radar clutter. The criteria used in determining significance are set out in Table 13.1. Major and moderate effects are considered significant in relation to the EIA Regulations.

Table 13.1: Significance criteria

Significance of Effect	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.
Nil	No measurable change from baseline conditions

Consultation

Table 13.2: Aviation consultations

Consultee and Date	Scoping/Other Consultation	Issue Raised	Response/Action Taken
Glasgow Airport (4 October 2021)	Scoping	Proposal is within the safeguarding area for instrument flight procedures (IFPs) and this will require further assessment.	Effects on Glasgow Airport IFPs are addressed in this chapter. Submission made to Glasgow Airport 11 November 2021 with finding of no impact on IFPs. Response awaited.
NATS (En Route) plc (7 October 2021)	Scoping	NERL objects to the proposal. Terrain screening available will not adequately attenuate the signal, and therefore this development is likely to cause false primary plots to be generated on the Lowther Hill radar. A reduction in the radar's probability of detection, for real aircraft, is also anticipated.	Effects on NERL radars are addressed in this chapter.
Glasgow Prestwick Airport (GPA) (11 October 2021)	Scoping	It is likely that GPA would object to the development until such time as the following matters are appropriately addressed: 1. use of an Aircraft Detection Lighting System (ADLS) dependent upon Electronic Conspicuity (EC) Equipment 2. Mitigation of effects on PSR 3. Effects on IFPs 4. Potential effects on GPA Runway 30 Instrument Landing	The Applicant is in discussions with GPA on the scope of the assessment, the nature and scale of any impacts and the requirements for mitigation. Effects on GPA are addressed in this chapter.

Consultee and Date	Scoping/Other Consultation	Issue Raised	Response/Action Taken
		System (ILS) and VHF/UHF Radio Navigation Equipment(s). 5. Potential effects on low level coverage of Lowther Hill Secondary Surveillance Radar (SSR) feed used by GPA.	
Ministry of Defence (10 November 2021)	Scoping	The proposed will occupy Tactical Training Area 20T (TTA 20T) in which military fixed wing aircraft can engage in operational low flying training down to 45.7 m above terrain features. 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 Civil Aviation Authority, Air Navigation Order 2016.	Effects on military low flying are addressed in this chapter.

Baseline

13.1.16 The Proposed Development Area is located in uncontrolled airspace from ground level to 5,500 feet above mean sea level (amsl). Above that level is the Class D controlled airspace of the Scottish Terminal Control Area (TMA), within which air traffic services are provided by the NATS En Route (NERL) Prestwick Centre. Radars used to provide these services include Lowther Hill (South Lanarkshire).

13.1.17 The following primary surveillance radars (PSRs) are located within a radius of 120 km of the Proposed Development Area:

- Glasgow Prestwick Airport EN-4000;
- Glasgow Prestwick Airport Terma Scanter;
- Glasgow Airport NASR-10;
- Glasgow Airport Terma Scanter;
- Cumbernauld;
- Kincardine;
- Edinburgh Airport NASR-10;
- Edinburgh Airport Terma Scanter;
- NATS Lowther Hill;
- RAF Spadeadam Deadwater Fell;
- RAF Spadeadam Berry Hill; and
- QinetiQ West Freugh.

13.1.18 Wind turbines within line of sight and operational range of a primary surveillance radar may cause false targets to be displayed on the radar, which may have an adverse effect on the provision of air traffic services by controllers.

13.1.19 The Proposed Development is located 32 km southeast of Glasgow Prestwick Airport (GPA) and is therefore within the 30 nautical mile (nm) (55.6 km) radius zone where impacts on Instrument Flight Procedures may require consideration.

13.1.20 The Proposed Development Area is located within Low Flying Area (LFA) 16, where military aircraft are permitted to fly as low as 250 ft above ground level. It is also within Low Flying Area 20(T), the Borders Tactical Training Area (TTA), where fixed wing aircraft may be authorised to fly as low as 100 feet above ground level during daylight hours. The TTA as a whole is designated by the MoD as a “high priority military low flying area likely to raise considerable and significant concerns”. However, the Proposed Development Area is wholly located within a part of the TTA designated by the MoD as a “Low priority military low flying area less likely to raise concerns”.[13]

13.1.21 There are no Meteorological Office radars within range and line of sight of turbines up to 200 m tip height on the Proposed Development Area. There are also no airfields, airstrips, gliding or other aviation sites within 20 km of the Proposed Development Area.

13.1.22 The Proposed Development is approximately 65 km from the Eskdalemuir seismic array and is therefore beyond the 50 km consultation zone specified in the Ministry of Defence (Eskdalemuir Seismic Recording Station) Technical Site Direction 2005.

13.1.23 Wind turbines with blade tip heights of 150 m or more are subject to the obstruction lighting provisions of Article 222 of the Air Navigation Order and the CAA Policy Statement on Lighting of Onshore Wind Turbine Generators in excess of 150 m Above Ground Level.

13.2 ASSESSMENT OF POTENTIAL EFFECTS

Primary surveillance radars

13.2.1 The PSRs at Glasgow Airport, Kincardine, Edinburgh Airport, RAF Spadeadam and QinetiQ West Freugh have no line of sight to the Proposed Development due to intervening terrain. Consequently, the Proposed Development will have no effects on those radars.

13.2.2 Assessment of the line of sight from the NERL PSR at Lowther Hill indicates that it is likely to be capable of detecting all turbines in the Proposed Development, resulting in false plots on the radar. However, the Lowther Hill PSR is an Indra 3D radar with inherent wind farm mitigation. Further, NERL already applies mitigation to the Proposed Development Area in order to mitigate the effects of the existing Windy Standard I and II wind farms on the Lowther Hill radar. As a result, the impact of the Proposed Development on the Lowther Hill PSR is assessed as negligible.

13.2.3 The newly installed Indra 3D PSR at Lowther Hill uses electronically-scanned elevation beams to differentiate targets in elevation as well as in azimuth. Targets detected in the lower elevation beams are less likely to be aircraft and can then be removed from the display.

13.2.4 Modelling indicates that the Lowther Hill PSR already has line of sight to 32 turbines in the operational Windy Standard I and II wind farms which currently occupy the Proposed Development Area. The effect of the Proposed Development on the Lowther Hill PSR will therefore consist of the difference between the existing impact from the

[13] Defence Infrastructure Organisation (2011). Low flying consultation zones. DE090071. Version Number 007.

Windy Standard I and II wind farms and the impact of the eight turbines of the Proposed Development. The Windy Standard I wind farm will be decommissioned prior to the construction of the Proposed Development. However it is assumed that the period between decommissioning of Windy Standard I and construction of the Proposed Development is short and that the mitigation put in place by NERL over Windy Standard I will remain in place during this period.

13.2.5 NERL has indicated that it will object to the Proposed Development on grounds of unacceptable impact on the Lowther Hill radar. However, it is not clear whether the NERL assessment has taken into account the effect of the existing Windy Standard I and II wind farms. The map at Figure 2 of the NERL Technical and Operational Assessment (TOPA) depicting other wind farms in the vicinity of the Proposed Development does not show either of those wind farms.

13.2.6 Notwithstanding the question of whether the marginal impact on the Lowther Hill PSR of the Proposed Development is sufficiently greater than that of the existing Windy Standard I and II wind farms to require implementation of technical mitigation, there is evidence that NERL has already implemented technical mitigation in the Lowther Hill radar's coverage of the Proposed Development Area. The consents for Windy Standard I and II contained no planning conditions requiring mitigation of impacts on NERL radars. However, Figure 3 of the NERL TOPA for the Proposed Development shows a "Radar map approximating the maximum extent of the existing Windy Standard Mitigation". This mitigation covers all turbines in the Proposed Development with the exception of Turbine 1.

13.2.7 The Applicant is in discussions with NERL on whether the Proposed Development generates any additional effects on the Lowther Hill radar over and above those already generated by the Windy Standard I turbines, all of which will be removed prior to the construction of the Proposed Development; and on the extent to which the inherent mitigation capacity of the newly-installed Indra 3D radar at Lowther Hill and the blanking mitigation already applied to the Lowther Hill radar will mitigate the effects of the Proposed Development.

13.2.8 Assessment of the line of sight from the NERL PSR at Cumbernauld indicates that it is likely to be capable of detecting five of the eight turbines in the Proposed Development, resulting in false plots on the radar. The principal function of the Cumbernauld radar is to provide in-fill coverage of the airspace over the Clyde wind farm to mitigate its effects on the Lowther Hill PSR. Potential effects of the Proposed Development on the Cumbernauld radar were included in the NERL TOPA. However, the TOPA did not refer to any technical effects on the Cumbernauld radar and NERL has not objected on grounds of effects on that radar. It is concluded that the effects of the Proposed Development on the Cumbernauld PSR are negligible.

13.2.9 Assessment of the line of sight from the EN-4000 PSR at GPA indicates that it is likely to be capable of detecting all turbines in the Proposed Development, resulting in false plots on the radar. However, modelling indicates that the GPA EN-4000 PSR already has line of sight to four of the turbines in the operational Windy Standard I Wind Farm which currently occupies the Proposed Development Area. The effect of the Proposed Development on the GPA EN-4000 PSR will therefore consist of the difference between the existing impact from the Windy Standard I Wind Farm and the impact of the eight turbines of the Proposed Development.

13.2.10 In 2018 GPA installed a Terma Scanter 4002 PSR on the airport. This system was procured using funds received from wind farm developers, with the purpose of mitigating the effects of wind farms on the pre-existing EN-4000 PSR at the airport. The Terma radar will have line of sight to all turbines in the Proposed Development. The Terma Scanter is an X-band radar with high range and azimuth resolution, allowing it to differentiate returns received from individual wind turbines from returns received from aircraft passing over the wind farm, and to display only the genuine aircraft returns. The GPA Terma radar has been approved by the CAA to be the sole source of primary radar data for provision of air traffic services by the airport and is successfully mitigating the effects of all wind farms within its line of sight. The GPA Terma radar is expected to replace the EN-4000 as the sole PSR providing air traffic radar services at GPA during 2022.

13.2.11 In view of the successful operation of the Terma Scanter at GPA, the effects of the Proposed Development on GPA PSRs are assessed as negligible.

Instrument Flight Procedures

13.2.12 As a result of discussions between the Applicant and GPA, the potential for the Proposed Development to affect GPA's IFPs is the subject of an assessment being carried out by GPA's Approved Procedure Designer (APD). If this assessment concludes that any of the airport's IFPs require alteration, this will necessitate an Airspace Change Proposal (ACP) to the CAA. The process for carrying this out will be secured by planning condition. In the event that the IFP assessment concludes that changes are required, the effect will be of moderate significance.

13.2.13 Glasgow Airport advised in its scoping response that the Proposed Development is within the safeguarding area for the airport's IFPs and that this will require further assessment. On completion of this further assessment, Glasgow Airport has advised that there will be no impact on their IFPs; that the site is also outwith their radar consultation area; and that the airport will not be objecting when consulted on the full planning application.

GPA Instrument Landing System

13.2.14 GPA has advised that it may be necessary to assess potential effects on the airport's Instrument Landing System (ILS) equipment. International standards for ILS are set out in ICAO Annex 10. These specify[14] that the coverage of the localiser signal (which provides lateral guidance to the aircraft) shall extend:

- to 25 nm range from the transmitter, +/-10° either side of the final approach track;
- to 17 nm range between 10 and 35° either side of the final approach track; and
- to 10 nm range at greater than 35° either side of the final approach track, if coverage is provided.

13.2.15 The closest turbine in the Proposed Development will be T1, 18.9 nm from the localiser aerial for runway 30. The whole of the Proposed Development is therefore in the area where the designated operational coverage of the ILS localiser extends to 10° either side of the final approach track. Turbines 1 and 2 of the Proposed Development are calculated to be just inside the +/-10° arc. All other turbines are calculated to be outside the arc.

13.2.16 The coverage area for the glide path (which provides vertical guidance to the aircraft) is required to extend to 10 nm from the antenna.[15] The closest turbine in the Proposed Development (T1) will be 17.5 nm from the GPA runway 30 ILS glide path aerial and therefore well beyond its designated operational coverage area.

13.2.17 CAA guidance on wind farms (CAP 764) advises that technical safeguarding criteria for ILS are contained in CAP 670. Section GEN01 of that document provides guidance on technical safeguarding of aeronautical radio equipment against wind turbines. It states: "ATS Providers and ANSPs should also ensure that any area of particularly intense aircraft activity, e.g. an approach to a runway, is also considered by the LPA as requiring safeguarding. This will normally be outside the 'standard' 20 km range and may extend to 34 km for ILS approaches."[16] The closest turbine in the Proposed Development is 35 km from the GPA runway 30 localiser aerial.

13.2.18 Section GEN02 of CAP 670 provides further detail of example frame sizes for "a technical area to be safeguarded against the possibility that buildings or other structures erected within the safeguarded area cause interference to the signal radiated by that station". For ILS, these frame sizes do not extend beyond 1500 metres from the localiser aerial.[17]

[14] ICAO (2006). Annex 10 to the Convention on International Civil Aviation: Aeronautical Telecommunications, Volume I: Radio Navigation Aids, Sixth Edition, paragraph 3.1.3.3.1.

[15] ICAO (2006). Annex 10 to the Convention on International Civil Aviation: Aeronautical Telecommunications, Volume I: Radio Navigation Aids, Sixth Edition, paragraph 3.1.5.3.1.

[16] CAA (2019). CAP 670: Air Traffic Services Safety Requirements, Third Issue, Amendment 1/2019, GEN01.5.

[17] CAA (2019). CAP 670: Air Traffic Services Safety Requirements, Third Issue, Amendment 1/2019, GEN02.8 to 02.14.

13.2.19 The Proposed Development is located beyond the areas where the CAA advises ILS equipment may need to be safeguarded against wind turbines. No examples have been found of wind turbines causing any adverse effects on the performance of ILS equipment. It is concluded that the Proposed Development will have nil effect on GPA ILS equipment.

GPA radio communications equipment

13.2.20 GPA has advised that it may be necessary to assess potential effects on the airport's VHF/UHF radio communications equipment.

13.2.21 International guidance for safeguarding of civil aviation communications facilities are set out in ICAO EUR Doc 015. This advises that the area around VHF transmitter and receiver facilities within which construction of buildings should be restricted consists of a cone with a radius of 2000 metres, with its base extending at an elevation angle of 1° from ground level at the facility. The closest turbine in the Proposed Development will be

13.2.22 The main operator of aeronautical radio communications transmitter/receiver sites in the UK is NERL. Their radio transmitter receiver sites have significantly larger areas of Designated Operational Coverage than those serving airports since they are required to communicate with en route traffic which may be at significant range offshore. NERL applies a safeguarding consultation zone of 10km radius around these sites for wind farm developments.

13.2.23 CAA guidance CAP 670[18] advises that wind farm developments of up to ten turbines at distances in excess of 17.2 km from an aeronautical radio communications transmitter/receiver site are regarded as acceptable.

13.2.24 The shortest distance between any of the turbines in the Proposed Development and the GPA radio transmitter/receiver antennae is 32.4 km. It is concluded that the Proposed Development will have a negligible effect on GPA aeronautical radio communications equipment.

Military low flying

13.2.25 The Proposed Development Area is located within a part of Low Flying Area 20(T), the Borders TTA, which is designated by the MoD as a "Low priority military low flying area less likely to raise concerns". This area was designated by the MoD in the mid-2000s in recognition of the fact that aircraft engaged in operational low flying (OLF) training do not seek to fly over high terrain, but rather seek to route through valleys.

13.2.26 Since the Proposed Development is in an area of existing wind turbines and with terrain up to 2290 feet amsl, low flying military aircraft will already be avoiding the area horizontally. Consequently the effect of the Proposed Development on military low flying is assessed as negligible.

13.2.27 Any effects on military low flying are partially mitigated by Article 225A of the Air Navigation Order (ANO), which requires that the details of any planned construction with a height of 100 metres or more above ground level (agl) are notified to the CAA at least eight weeks prior to the commencement of the planned works. Similar pre-notification requirements for the MoD will be secured by planning condition. These provisions ensure that all turbines and other structures associated with the Proposed Development are depicted on civil and military aeronautical charts and listed in official obstacle databases, enabling aircrew to locate them and avoid them horizontally and/or vertically.

13.2.28 All turbines in the Proposed Development will exceed 150 metres above ground level and will therefore be classed as en route obstacles under the terms of the ANO Article 222. This requires obstruction lighting to be installed on the nacelles of the turbines. A reduced lighting scheme, in which selected turbines are fitted with lighting, will be submitted to the CAA for approval. The lighting scheme will mitigate any effects on civil and military low flying at night.

[18] CAA (2019). CAP 670: Air Traffic Services Safety Requirements, Third Issue, Amendment 1/2019, Appendix A to GEN 02: Methodology for the Prediction of Wind Turbine Interference Impact on Aeronautical Radio Station Infrastructure.

Cumulative Effects

Primary surveillance radars

13.2.29 Cumulative effects on NERL PSRs are assessed by NERL when compiling their Technical and Operational Assessments of individual wind farm developments. The Proposed Development is located in an area with numerous existing and consented wind farms that are within line of sight of NERL radars. All of these, including the existing Windy Standard I, Windy Standard II and Afton wind farms, are already mitigated by NERL by means of blanking of the Lowther Hill radar's coverage. Therefore, the cumulative impact of the Proposed Development on NERL PSRs is assessed as negligible.

13.2.30 As regards the cumulative effects of the Proposed Development on the GPA PSRs, the proposed mitigation agreement using the GPA Terma Scanter radar includes a technical feasibility assessment to confirm that the Terma radar can meet required performance standards, taking into account all other wind farm developments within its line of sight. This will ensure that the cumulative effects of the Proposed Development on the GPA Terma radar will be acceptable.

Instrument Flight Procedures

13.2.31 Two proposed wind farms within 5 km of the Proposed Development Area – Euchanhead and Sanquhar II – will have similar tip heights to those of the Proposed Development. These two developments are also closer to the final approach track of runway 30 at GPA than the Proposed Development. If consented, either or both of these developments will require upward revision of the minimum altitudes of some of GPA's IFPs. Because of the close proximity of Euchanhead, Sanquhar II and the Proposed Development, these changes are likely to be required if any one or more of the three developments is consented. It is concluded that the cumulative impact of the Proposed Development on GPA's IFPs will be no greater than the stand-alone impact.

13.2.32 The Proposed Development will have no effect on Glasgow Airport's IFPs. Consequently, the cumulative impact will also be nil.

GPA Instrument Landing System

13.2.33 The Proposed Development is outside the areas advised by the CAA for safeguarding ILS equipment against effects from wind turbines and only two of the turbines in the Proposed Development are inside the designated operational coverage of the GPA runway 30 localiser. The existing wind farms at Hare Hill, Hare Hill Extension and Afton are fully within the designated operational coverage of the localiser but are also beyond the ILS safeguarding areas recommended by the CAA. The consented Pencloe, Enoch Hill, Overhill, South Kyle and North Kyle wind farms are within the designated operational coverage of the localiser and also within the maximum 34 km range ILS safeguarding area recommended by the CAA. GPA has not raised the issue of potential effects on the ILS in relation to any of those eight projects (nor the subsequent applications for increased tip height at Pencloe, Enoch Hill and Overhill). It is concluded that cumulative effects on the GPA ILS are not considered to be significant by GPA and are therefore assessed as negligible.

GPA radio communications equipment

13.2.34 While there are numerous operational, consented and in-planning wind farms in the area between the Proposed Development and Glasgow Prestwick Airport, none are within the 17.2 km distance advised by CAP 670 as the area within which unacceptable impacts on radio co0mmunications equipment may occur. It is concluded that the cumulative effects of the Proposed Development on GPA radio communications equipment are negligible.

GPA secondary surveillance radar

13.2.35 In its scoping response, GPA stated: "*GPA has concerns that the cumulative impact and proliferation of windfarms in the vicinity of this proposed development may have an impact on the low level coverage that GPA currently enjoys from the SSR data feed it receives from the NATS Lowther Hill SSR*."

13.2.36 The CAA advises that "wind turbine effects on SSR can be caused due to the physical blanking and diffracting effects of the turbine towers depending on the size of the turbines and the wind farm. These effects are only a consideration when the turbines are located very close to the SSR, i.e. less than 10 km."[19]

13.2.37 The closest turbine in the Proposed Development will be 28.6 km from the Lowther Hill SSR. Since this is well in excess of the distance at which the CAA advises that wind farms can have adverse effects on SSR, it is concluded that no such effects will occur. It should also be noted that NERL, the operator of the Lowther Hill SSR, has not raised concerns about the impact of the Proposed Development on that facility. NERL applies a safeguarding consultation zone of 27.78 km (15 nm) around its SSR facilities. The Proposed Development is located beyond that zone.

13.2.38 Additionally, since the Proposed Development will replace all of the existing Windy Standard I turbines, it is appropriate to assess whether the turbine towers of that existing wind farm have the theoretical possibility of causing blanking and diffraction and therefore affecting the low level coverage of the Lowther Hill SSR; and if so, whether any such effects generated by the Proposed Development could be of a greater scale than those that might be caused by the existing turbines.

13.2.39 Radar line of sight assessment shows that the Lowther Hill SSR has line of sight to hub height (35 m agl) or lower at 27 of the 36 turbines of Windy Standard I. When the Proposed Development is constructed, these turbines will be removed, and replaced with eight turbines, all of which are within line of sight of the Lowther Hill SSR at hub height and below. The 27 SSR-visible turbines of Windy Standard I are concentrated into an azimuth sector of approximately 3°. The eight SSR-visible turbines of the Proposed Development occupy an azimuth sector of approximately 5°.

13.2.40 It is concluded that, notwithstanding the fact that CAA advice and NERL policy does not support the contention that wind turbines at ranges greater than 28 km from an SSR can affect the radar's low level coverage, in this particular case the Proposed Development does not create a clearly greater physical barrier to the SSR signals than the turbines that it will replace. The cumulative effects are therefore assessed as negligible.

Military low flying

13.2.41 In addition to the Proposed Development there are thirteen existing, consented or proposed wind farms in this part of LFA 20(T) which is designated by the MoD as a "Low priority military low flying area less likely to raise concerns" – Afton, Benbrack, Benbrack Variation, Euchanhead, Lorg, Pencloe, Pencloe Variation, Sanquhar II, Whiteside Hill, Windy Rig, Windy Standard I, Windy Standard II and Windy Standard III. Since the designation of that zone within LFA 20(T) in 2004, none of these developments has received an objection from the MoD in relation to effects on low flying. It is concluded that the MoD does not consider the cumulative effects of multiple wind farm developments within this zone as having a significant effect on military low flying. Consequently the cumulative impact of the Proposed Development on military low flying is assessed as negligible.

Conclusions

- The NERL Lowther Hill PSR will have line of sight to all turbines in the Proposed Development. However blanking has already been applied to the Lowther Hill radar over the Proposed Development Area to mitigate the effects of the Windy Standard I and Windy Standard II wind farms. The effects of the Proposed Development on the Lowther Hill PSR are therefore assessed as negligible.
- The GPA Terma PSR will have line of sight to all turbines in the Proposed Development. In view of the Terma radar's ability to filter out returns from wind turbines while continuing to display wanted aircraft targets, the effects of the Proposed Development on this radar are assessed as negligible.
- Effects on GPA Instrument Flight Procedures are the subject of an assessment by GPA's Approved Procedure Designer. In the event that the IFP assessment concludes that changes are required, the effect will be of moderate significance.
- There will be no effects on Glasgow Airport IFPs.
- There will be no effects on the GPA Instrument Landing System.
- The effect of the Proposed Development on GPA radio communications equipment will be negligible.
- The effect of the Proposed Development on military low flying is assessed as negligible.
- The cumulative effects on NERL PSRs are assessed as negligible.
- The cumulative effects on the GPA Terma radar are assessed as negligible.
- The cumulative effects on GPA IFPs will be of moderate significance.
- The cumulative effects on the GPA Instrument Landing System are assessed as negligible.
- The cumulative effects on GPA radio communications equipment are assessed as negligible.
- The cumulative effects on GPA's use of SSR data from Lowther Hill SSR are assessed as negligible.
- The cumulative effect of the Proposed Development on military low flying is assessed as negligible.

Mitigation and Residual Effects

- Existing mitigation in the form of blanking of the Lowther Hill PSR will continue to be applied. The residual effect on the Lowther Hill PSR will be negligible.
- The GPA Terma radar has inherent wind farm mitigation capabilities. The residual effect on the GPA PSR will be negligible.
- Any effects on GPA IFPs will be mitigated by submission of an Airspace Change proposal (ACP) to the CAA. The residual effect on GPA IFPs will be negligible.

13.3 EXISTING INFRASTRUCTURE

Telecommunications

13.3.1 Fixed microwave links are direct line-of-sight communication links between transmitting and receiving dishes placed on masts generally locate on hilltops that vary in length from a few kilometres to over 70 km. They are used for the transmission of information to broadcasting masts for TV and radio and for the mobile telephone networks.

13.3.2 A desk-based study of potential telecommunication links was undertaken using information already held by the Applicant and through a search using an online tool[20].

[19] CAA (2019). CAP 670: Air Traffic Services Safety Requirements, Third Issue, Amendment 1/2019, Part C, Section 3: Appendix A to SUR 13: Guidance on Wind Farm Mitigation Techniques, paragraph SUR13A.75. See also CAA (2016). CAP 764: CAA Policy and Guidelines on Wind Turbines, paragraph 2.10. Online. Available at: https://publicapps.caa.co.uk/docs/33/CAP764 Issue6 FINAL Feb.pdf

[20] Line Search Before You Dig (n.d.) [Online] Available at:: https://www.linesearchbeforeudig.co.uk/ [Accessed March 2022]

Consultation

13.3.3 Telecommunications and broadcasting network operators were consulted during the scoping exercise and British Telecom (BT) and Joint Radio Company (JRC) provided a consultation response. Point to point microwave radio links were investigated by JRC who confirmed in their Scoping Opinion (Technical Appendix 1.2) that there would be no potential problems with interference.

13.3.4 BT stated that the proposed site layout at Scoping stage as shown, Figure 4.6 of the EIAR will cause interference to BT's current and presently planned radio network as turbine two fails BT's 100 m required infringement zone but all other turbine locations pass.

13.3.5 The existence of the radio link present at the location of Turbine 2 was known to Fred. Olsen Renewables Limited (the Applicant) at an early stage of the repower design process as it provides a communication link for the Windy Standard Control Room. The full wireless link is transmitted from Cumnock to a receiving dish within the Windy Standard Complex.

13.3.6 The applicant has advised that they no longer wish to keep this link active and would take the link offline at the point of decommissioning. A fibre link would be installed for communication purposes at the time of constructing the Proposed Development.

Existing Network Plans

13.3.7 An online search tool was used to investigate the location of the Proposed Development against utility asset owners of underground and overhead pipes and existing cable routes in the electricity, gas, high pressure fuel, water and fibre optic networks.

13.3.8 Scottish Power (SP) Energy Network identified underground extra high voltage (EHV) 33 kV lines present at the proposed locations of turbines one and seven, which are current infrastructure components of the existing Windy Standard I Wind Farm connecting the existing turbines to the onsite substation. Maps of where the SP Energy Network assets are located can be found in Technical Appendix 13.1.

13.3.9 Where there are utility assets within the Proposed Development Area, these are proposed to be re-used insofar as possible for the repowering of Windy Standard I or safely removed during the decommissioning of the existing wind farm. This is described further in Chapter 5 Project Description.