PAGERPOWER
Urban & Renewables

Aviation Impact Assessment

SSE Renewables Developments (UK) Ltd

Achany Extension Wind Farm

June 2021





PAGERPOWER
Urban & Renewables

ADMINISTRATION PAGE

Job Reference:	9667C
Prepared for:	SSE Renewables Developments (UK) Ltd
Author:	Michael Sutton
Telephone:	01787 319001
Email:	michael@pagerpower.com

First Reviewer:	Danny Scrivener (9667A); Kai Frolic (9667C)
Second Reviewer:	Mike Watson
Telephone:	01787 319001
Email:	danny@pagerpower.com; kai@pagerpower.com; mike@pagerpower.com

Issue	Date	Detail of Changes
1	February 2020	Initial issue (9667A)
2	March 2020	Expanded aviation lighting section
3	April 2021	Assessment of updated layout and turbine details (9667C)
4	April 2021	Further consideration of current and future baseline as well as administrative revisions
5	May 2021	Minor amendments
6	June 2021	Minor amendments

Pager Power Limited, Stour Valley Business Centre, Brundon Lane, Sudbury CO10 7GB

T: +44 (0)1787 319001 E: info@pagerpower.com W: www.pagerpower.com

KEY FINDINGS

Background

Pager Power has conducted an aviation impact assessment for the proposed Achany Extension Wind Farm, located west of Lairg, Scotland, to determine its impact upon aviation activity. This assessment has considered the impacts of the Proposed Development in isolation as well as in the context of the current and future baseline.

The proposed wind turbines will have a maximum tip height of 149.9m above ground level (agl).

Overall Conclusions and Recommendations

No impacts upon Inverness Airport Primary Surveillance Radar (PSR), navigational aids, aircraft flying Instrument Flight Rules (IFR), and Obstacle Limitation Surfaces (OLS) are predicted.

The MOD has requested aviation lighting on the perimeter turbines due to the proposed development being located within a high priority low flying zone. Although a COMBI lighting solution has been requested, an infrared lighting scheme is deemed appropriate for the Proposed Development. It is recommended that the MOD is engaged to agree a such a solution.

The Proposed Development will be marked on the relevant aviation charts as best practice.

Technical Findings

Inverness Airport PSR

The analysis has shown that all turbines within the development will be hidden from the Inverness Airport PSR and will not be detectable. Cumulative impacts are therefore not possible as the wind farm in isolation will not be detectable by the radar.

Navigation Aids

No navigation aids have been identified and therefore no impacts are possible. Cumulative impacts are therefore not possible as the wind farm in isolation will not be affect any navigation aids.

Military Low Flying Zones

The Proposed Development is located within the Tactical Training Area 14T (TTA 14T), which is a high priority military low flying area where aircraft can fly down to 45.7 metres above ground level.

The MOD has requested that the perimeter turbines be fitted with 25 candela omni-directional red lighting or infrared COMBI lighting with an optimised flash pattern of 60 flashes per minute of 200ms to 500ms duration at the highest practicable point. However, the developer is keen to pursue an aviation lighting scheme without visible lighting due to the impact upon visual amenity. It is also understood that most of the military night low flying is now conducted with the aid of aircrew night vision goggles (NVGs), for which infrared lighting would be suitable.

It is therefore recommended that an infrared lighting scheme is progressed for the Proposed Development, and the MOD is engaged to agree an appropriate solution.

No cumulative impacts are predicted in the context of low flying constraints because the surrounding operational and consented developments are located within the 'blue' low flying zone, which is a low priority military low flying area, and the proposed developments are located at a sufficient distance from the Proposed Development.

Instrument Flight Rules (IFR)

All high-level assessments have shown that the clearance distances between the assessed procedures and the proposed obstacles exceeded all relevant clearance minima. No detailed IFP assessment is recommended at this stage. Overall, no impact upon aircraft flying IFR is expected.

Dornoch Airstrip's Obstacle Limitation Surfaces

The closest aerodrome to the Proposed Development is Dornoch Airstrip, an unlicensed aerodrome which is located approximately 36 km south east of the closest turbine. As there cannot be any OLS infringement at this range, a more detailed assessment is not required.

Consultation with Highlands and Islands Airports Limited (HIAL) has also confirmed that the Proposed Development will not infringe the Inverness and Wick Airport OLS.

Cumulative impacts are also not possible as the Proposed Development in isolation does not infringe an OLS.

LIST OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABOUT PAGER POWER

Pager Power is a dedicated consultancy company based in Suffolk, UK. The company has undertaken projects in 50 countries within Europe, Africa, America, Asia and Australasia.

The company comprises a team of experts to provide technical expertise and guidance on a range of planning issues for large and small developments.

Pager Power was established in 1997. Initially the company focus was on modelling the impact of wind turbines on radar systems. Over the years, the company has expanded into numerous fields including:

- Renewable energy projects.
- Building developments.
- Aviation and telecommunication systems.

Pager Power prides itself on providing comprehensive, understandable and accurate assessments of complex issues in line with national and international standards. This is underpinned by its custom software, longstanding relationships with stakeholders and active role in conferences and research efforts around the world.

Pager Power's assessments withstand legal scrutiny and the company can provide support for a project at any stage.

1 INTRODUCTION

1.1 Overview

Pager Power has conducted an aviation impact assessment for the proposed Achany Extension Wind Farm, located west of Lairg, Scotland, to determine its impact upon aviation activity. This assessment has considered the impacts of the Proposed Development in isolation as well as in the context of the current and future baseline.

The proposed wind turbines will have a maximum tip height of 149.9m above ground level (agl).

The report includes:

- Identification of relevant aviation infrastructure including:
    - Aerodromes (licensed, unlicensed and military);
    - Radar;
    - Radio navigation aids.
- Overview of relevant safeguarding assessment distances;
- Obstacle limitation surfaces assessment;
- Radio line of sight assessment for the relevant infrastructure, including:
    - Radar installations;
    - Radio navigation aids.
- Overall risk and key issues.

The aim is to identify and assess the aviation risks associated with achieving planning permission and construction of the wind development.

2 PROPOSED DEVELOPMENT INFORMATION

2.1 Wind Turbine Details

The turbines details are presented in Table 1 below. The heights are provided in metres above ground level (agl).

Hub Height	Tip Height	Rotor Diameter
81.9 m	149.9 m	136 m

Table 1 *Turbine details*

2.2 Wind Turbine Layout

The turbine coordinates are presented in Table 2 below.

Turbine	Easting	Northing	Turbine	Easting	Northing
1	245163.95	911082.99	11	246722.00	909421.00
2	244595.05	910950.00	12	246915.00	908855.00
3	245617.67	910922.00	13	246390.00	909004.00
4	245979.92	910739.93	14	245810.50	909163.29
5	244768.06	910506.25	15	246333.99	908448.01
6	246023.00	910241.00	16	245756.01	908237.00
7	245495.01	910094.97	17	246564.00	907472.00
8	244871.84	910017.82	18	247025.00	907297.00
9	245597.43	909695.30	19	246838.01	906821.00
10	246198.00	909516.00	20	247467.95	906809.55

Table 2 *Turbine coordinates*

The locations of the wind turbines are shown in Figure 1[1] on the following page.

[1] Copyright © 2021 Google.

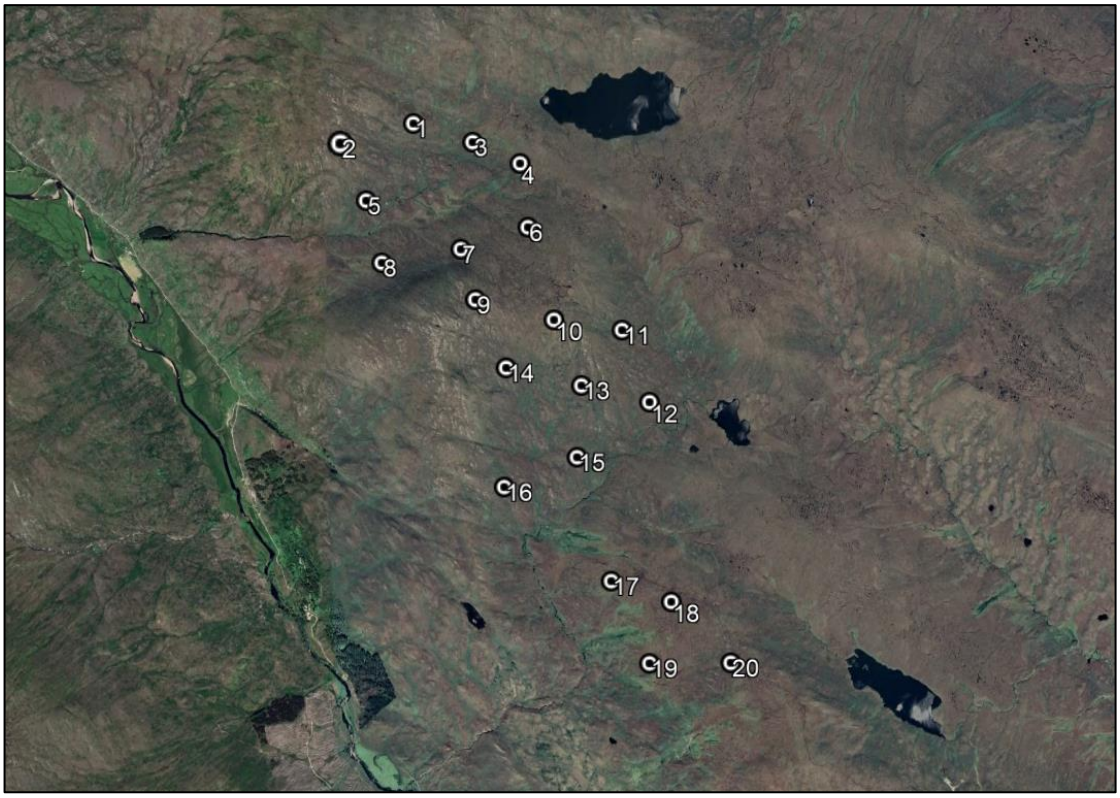


Figure 1 *Wind farm layout*

3 KEY AVIATION RISKS

3.1 Risk Assessment Results

The risk assessment results are presented in Figure 2 below.

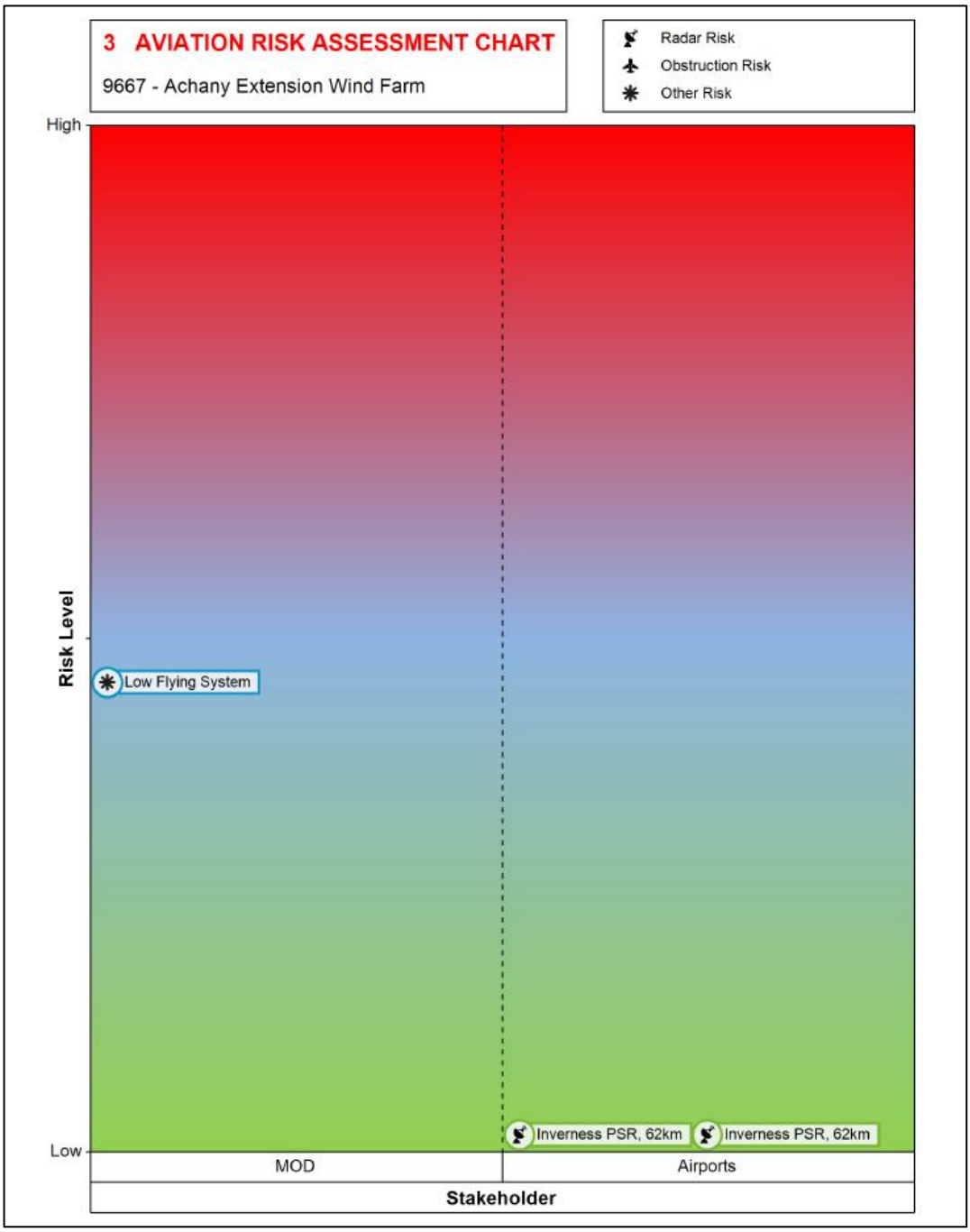


Figure 2 *Aviation Risk Assessment*

3.1.1 Airports and Airport Radar

Aviation Risk	Distance	Risk Level
Inverness Airport PSR	61.7 km	Low

Table 3 *Identified airport risks*

3.1.2 MOD - Ministry of Defence

Aviation Risk	Distance	Risk Level
Low Flying System	-	Medium

Table 4 *Identified MOD risks*

4 RADAR LINE OF SIGHT ANALYSIS

4.1 Methodology

The approach taken within this report is presented in the following section. Information regarding the methodology or the additional line of sight charts can be provided upon request.

Technical Assessment

- Radar line of sight assessment for the Proposed Development;
- Consideration of the distance from the radar;
- Assessment of the predicted impact in the context of the current baseline has been undertaken. The operational Rosehall and Achany Wind Farms are located immediately south-east of the Proposed Development.

Cumulative Assessment

- Assessment of the predicted impact in the context of the future baseline has been undertaken. The consented Braemore Wind Farm is located approximately 5km south-east of the Proposed Development, and the proposed Sallachy and Meall Buidhe Wind Farms are located approximately 9km northwest and 9km south of the Proposed Development, respectively.

The impacts of these developments have been considered due to their proximity to the Proposed Development. In the context of aviation, 5 nautical miles is considered appropriate to assess cumulative impacts due to the deconfliction minima, which is the required separation distance between obstacles receiving Air Traffic Control (ATC) services. This is a conservative approach as aircraft in this area are not predicted to be receiving ATC services.

The location of the operational, consented, and proposed developments are shown in Figure 3[2] on the following page.

[2] Copyright © 2021 Google.

Figure 3 *Current and Future Baseline*

4.2 Inverness Airport PSR

A radar line of sight assessment was completed for the Proposed Development – considering the location of the turbines presented in Section 2.

Figure 4 on the following page shows the line-of-sight chart from the Inverness Airport PSR to turbine T10 (smallest clearance). The box labelled 'certainty' provides the distance (in metres) by which the wind turbine is within line of sight to the assessed radar (rounded to one decimal place). The Proposed Development will be hidden from the radar with a minimum certainty of 670.0m and will not be detectable by the radar.

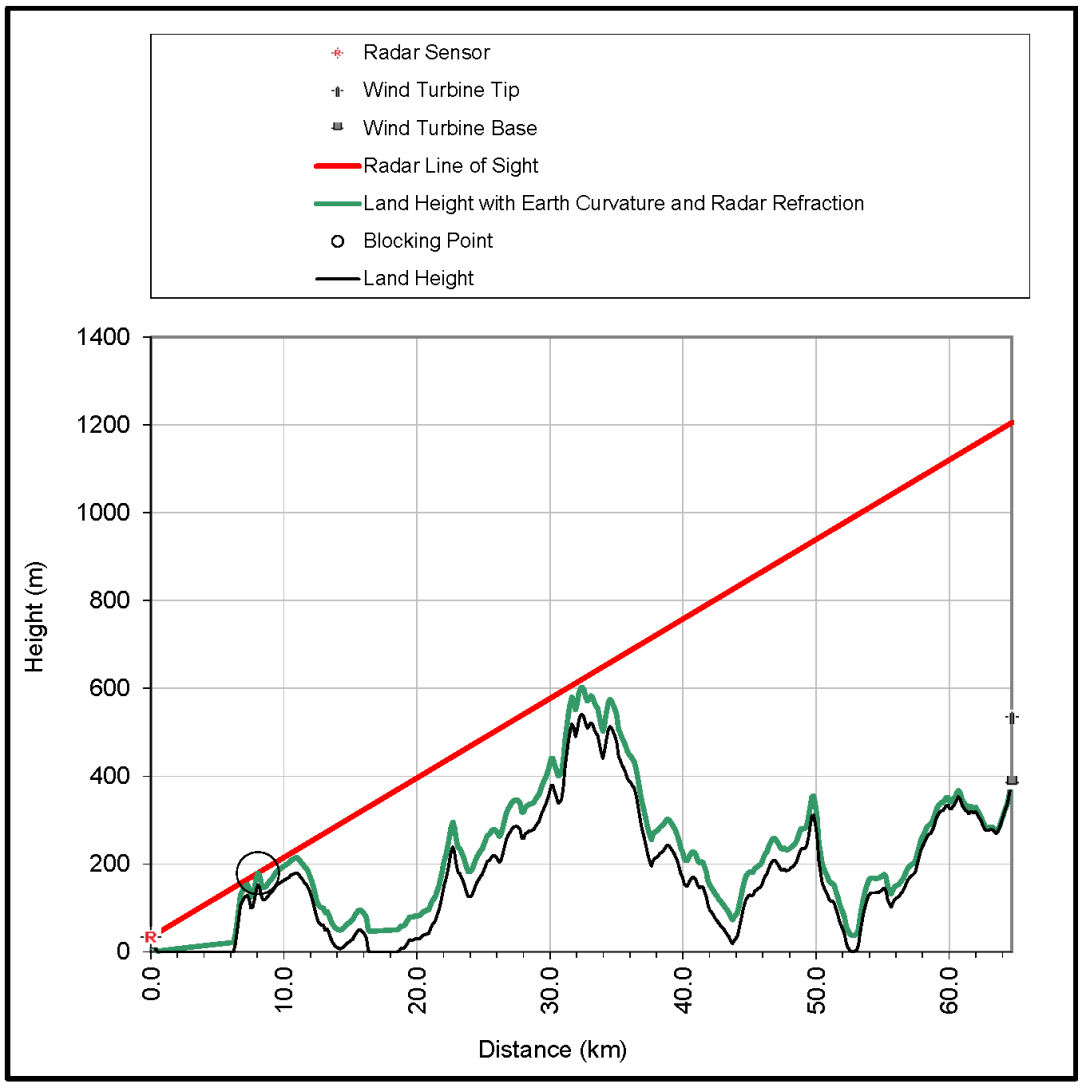
No impacts are therefore expected upon Inverness Airport PSR.

Cumulative impacts are not possible as the Proposed Development in isolation is not predicted to be detectable by the radar.

Radar Line of Sight Calculation

Prepared for Pager Power
Inverness Airport PSR

Achany Extension Wind Farm	
Turbine	10
Result	HIDDEN
Certainty	670.0 metres



Turbine Height (m)	149.9
Hub Height (m)	81.9
Rotor Diameter (m)	136
Turbine Elevation (m)	385.4
Turbine Location	E246196 N909525
Distance to radar (km)	64.7
Blocking Point Location	E273153 N859669
Distance to BP (km)	56.7

Additional Analysis	
Angle (Radar to Tip)	0.225 degrees up
Maximum Tip Height	819.88 metres

Figure 4 *Radar line of sight chart – T10*

4.3 Military Low Flying

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

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

Figure 4 below shows the Proposed Development is located within the 'red' low flying zone, which is a high priority military low flying area where the MOD is likely to raise concerns. Specifically, consultation with the MOD has revealed that the Proposed Development is located within the Tactical Training Area 14T (TTA 14T) where aircraft can fly down to 45.7 metres above ground level.

The MOD has therefore raised concerns with the Proposed Development and requested that the perimeter turbines be fitted with 25 candela omni-directional red lighting or infrared COMBI lighting with an optimised flash pattern of 60 flashes per minute of 200ms to 500ms duration at the highest practicable point.

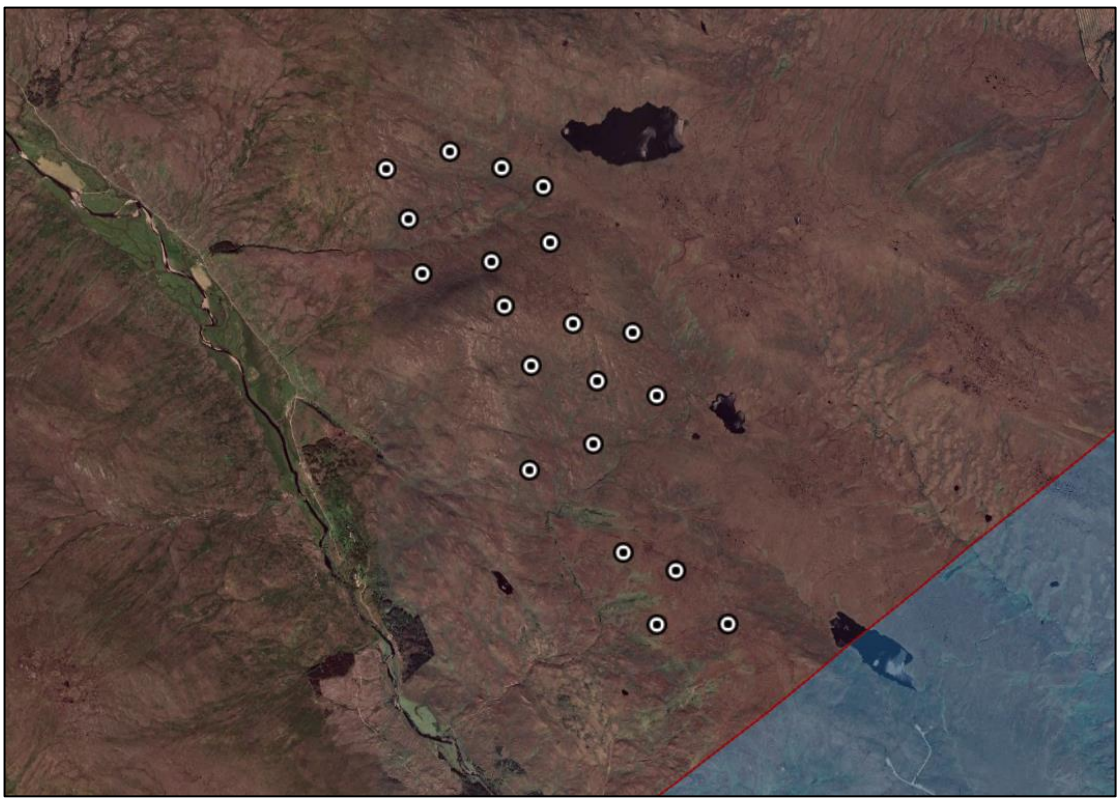


Figure 5 *Military low flying zones*

4.3.1 Consideration of Current Baseline

Rosehall and Achany Wind Farms are located within the 'blue' low flying zone, which is a low priority military low flying area. This means that no wind farms are located within the same 'red' low flying zone as the Proposed Development and so no cumulative impacts are anticipated in the context of low flying constraints.

4.3.2 Consideration of Future Baseline

Braemore Wind Farm is located within the 'blue' low flying zone, which is a low priority military low flying area. This means that it is not located within the same 'red' low flying zone as the Proposed Development and so no cumulative impacts are anticipated in the context of low flying constraints.

Sallachy and Meall Buidhe Wind Farms are located at a sufficient distance from the Proposed Development such that no cumulative impacts are anticipated in the context of low flying constraints.

5 AVIATION LIGHTING

5.1 Requirement for Lighting

Due to the location of the Proposed Development in the Tactical Training Area 14T (TTA 14T), the MOD has requested that the perimeter turbines be fitted with 25 candela omni-directional red lighting or infrared COMBI lighting with an optimised flash pattern of 60 flashes per minute of 200ms to 500ms duration at the highest practicable point.

The developer is however keen to pursue an aviation lighting scheme without visible lighting due to the impact upon visual amenity. It is also understood that most of the military night low flying is now conducted with the aid of aircrew night vision goggles (NVGs), for which infrared lighting would be suitable.

It is therefore recommended that an infrared lighting scheme is progressed for the Proposed Development, and the MOD is engaged to agree an appropriate solution.

5.2 Aviation Lighting Scheme

An aviation lighting scheme for the Proposed Development has been produced and is shown in Figure 6 below. The lighting scheme has been considered in the context of the current and future baseline. The turbines will be lit on the top of the nacelle.

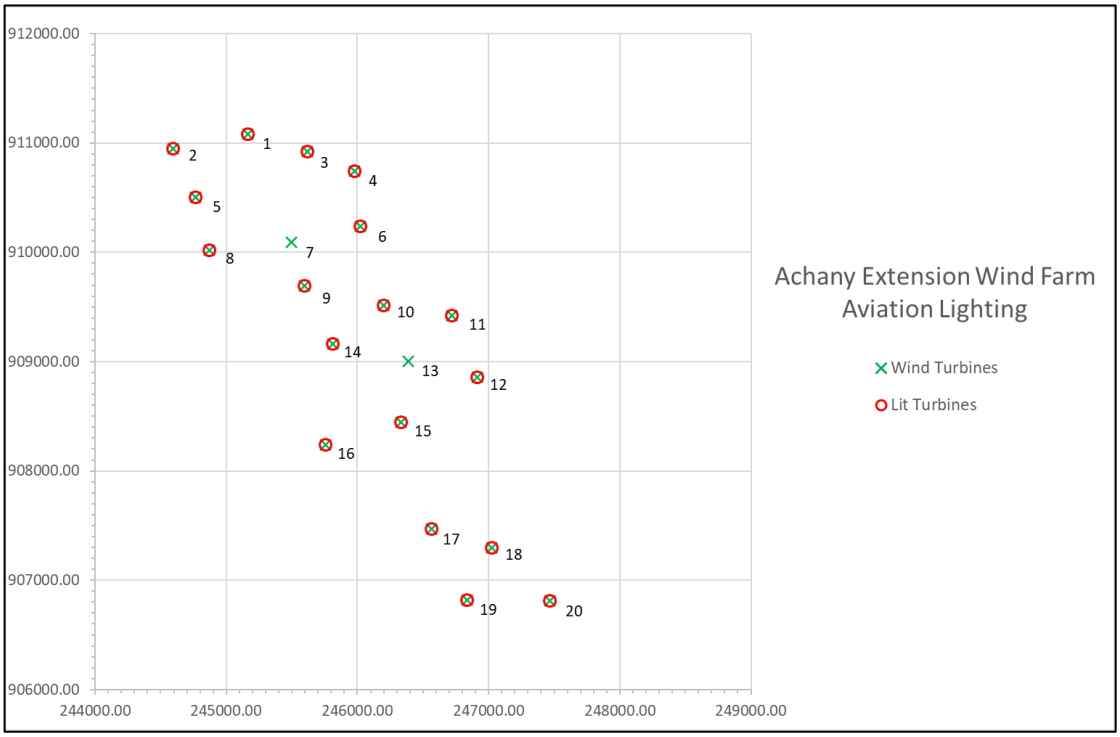


Figure 6 *Aviation lighting scheme*

6 OBSTACLE LIMITATION SURFACE ASSESSMENT

6.1 Overview

Obstacle Limitation Surfaces (OLS) are imaginary planes defined in three dimensions for physical safeguarding purposes (i.e. ensuring that physical structures do not present a safety hazard at an airfield) and are defined around licensed airfields[3].

6.2 Dornoch Airstrip Obstacle Limitation Surfaces

The closest aerodrome to the Proposed Development is Dornoch Airstrip, an unlicensed aerodrome which is located approximately 36km from the closest turbine. The location of the airstrip relative to the Proposed Development is shown in Figure 7[4] below.

As there cannot be any OLS infringement at this range, a more detailed assessment is not required.

Figure 7 *Dornoch Airstrip location*

6.3 Obstacle Limitation Surfaces Conclusions

No impacts upon Dornoch Airstrip Obstacle Limitation Surfaces are possible. Consultation with Highlands and Islands Airports Limited (HIAL) has also confirmed that the Proposed Development will not infringe the Inverness and Wick Airport OLS.

Cumulative impacts are also not possible as the Proposed Development in isolation does not infringe an OLS.

[3] It is industry best practice to safeguard Obstacle Limitation Surfaces of unlicensed aerodromes.
[4] Copyright © 2021 Google.

7 HIGH-LEVEL INSTRUMENT FLIGHT ANALYSIS

7.1 Overview

Aircraft flying Instrument Flight Rules (IFR) have been assessed at a high-level by considering the Maximum Elevation Figure (MEF), Surveillance Minimum Altitude Chart (SMAC) and all published Instrument Flight Procedures (IFP) and their location relative to the Proposed Development. This has been undertaken to determine whether an impact upon Instrument Flight Procedures (IFP) is expected or whether further, more detailed, analysis is required.

7.2 Maximum Elevation Figure

The Maximum Elevation Figure (MEF) shows the maximum altitude of the highest terrain or structure in a particular quadrangle of a standard CAA aeronautical chart. The MEF shown for the quadrangle in which the Proposed Development is located is 3,600 feet. The Proposed Development has a maximum altitude of 1,756 feet which is 1,844 feet below this figure. Aircraft flying in accordance with the published MEF will not be affected by the wind farm.

7.3 Surveillance Minimum Altitude Chart (SMAC)

Surveillance Minimum Altitude Charts (SMAC) are published to show the lowest altitude a pilot will be instructed to fly whilst receiving an Air Traffic Control (ATC) service. The Proposed Development is approximately 15km outside the Inverness SMAC and therefore pilots in this airspace will not be receiving instruction from radar derived ATC services. No impacts upon SMAC's are therefore expected.

7.4 High-level IFP Assessment – Obstacle Clearance Margins

As a general rule Instrument Flight Procedures (IFP) are designed so that there are vertical and horizontal safety margins between the specified trajectory and surrounding terrain and obstacles. These margins vary depending on the phase of flight and whether UK, European or International rules are being considered. Nevertheless, the vertical margins are always 1000 feet or less. This means that if the vertical clearance between an IFP route and the maximum altitude exceeds 1000 feet then the development will not have a significant safety impact on aircraft flying the route. The maximum altitude of T10 is 1,756 feet. This means that aircraft subject to any IFP route or limit which is more than 2,756 feet will have an acceptably low collision risk.

A detailed IFP assessment is not recommended considering the results of this high-level assessment.

7.5 Instrument Flight Analysis Conclusions

All high-level assessments have shown that the clearance distances between the assessed procedures and the Proposed Development exceeded all relevant clearance minima. No detailed IFP assessment is recommended at this stage.

Overall, no impacts upon aircraft flying IFR are expected.

8 OVERALL CONCLUSIONS

8.1 Technical Findings

8.1.1 Inverness Airport PSR

The analysis has shown that all turbines within the development will be hidden from the Inverness Airport PSR and will not be detectable. Cumulative impacts are therefore not possible as the wind farm in isolation will not be detectable by the radar.

8.1.2 Navigation Aids

No navigation aids have been identified and therefore no impacts are possible. Cumulative impacts are therefore not possible as the wind farm in isolation will not be affect any navigation aids.

8.1.3 Military Low Flying Zones

The Proposed Development is located within the Tactical Training Area 14T (TTA 14T), which is a high priority military low flying area where aircraft can fly down to 45.7 metres above ground level.

The MOD has requested that the perimeter turbines be fitted with 25 candela omni-directional red lighting or infrared COMBI lighting with an optimised flash pattern of 60 flashes per minute of 200ms to 500ms duration at the highest practicable point. However, the developer is keen to pursue an aviation lighting scheme without visible lighting due to the impact upon visual amenity. It is also understood that most of the military night low flying is now conducted with the aid of aircrew NVGs, for which infrared lighting would be suitable.

It is therefore recommended that an infrared lighting scheme is progressed for the Proposed Development, and the MOD is engaged to agree an appropriate solution.

No cumulative impacts are predicted in the context of low flying constraints because the surrounding operational and consented developments are located within the 'blue' low flying zone, which is a low priority military low flying area, and the proposed developments are located at a sufficient distance from the Proposed Development.

8.1.4 Instrument Flight Rules (IFR)

All high-level assessments have shown that the clearance distances between the assessed procedures and the proposed obstacles exceeded all relevant clearance minima. No detailed IFP assessment is recommended at this stage. Overall, no impact upon aircraft flying IFR is expected.

8.1.5 Dornoch Airstrip's Obstacle Limitation Surfaces

The closest aerodrome to the Proposed Development is Dornoch Airstrip, an unlicensed aerodrome which is located approximately 36 km south east of the closest turbine. As there cannot be any OLS infringement at this range, a more detailed assessment is not required.

Consultation with HIAL has also confirmed that the Proposed Development will not infringe the Inverness and Wick Airport OLS.

Cumulative impacts are also not possible as the Proposed Development in isolation does not infringe an OLS.

8.2 Overall Conclusions and Recommendations

No impacts upon Inverness Airport Primary Surveillance Radar, navigational aids, aircraft flying Instrument Flight Rules, and Obstacle Limitation Surfaces are predicted.

The MOD has requested aviation lighting on the perimeter turbines due to the proposed development being located within a high priority low flying zone. Although a COMBI lighting solution has been requested, an infrared lighting scheme is deemed appropriate for the Proposed Development. It is recommended that the MOD is engaged to agree a such a solution.

The Proposed Development will be marked on the relevant aviation charts as best practice.

PAGERPOWER

Urban & Renewables

Pager Power Limited
Stour Valley Business Centre
Sudbury
Suffolk
CO10 7GB

Tel: +44 1787 319001 **Email:** info@pagerpower.com **Web:** www.pagerpower.com