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Urban & Renewables

Radar Risk Assessment

Asland Walks Energy Park Wind Turbine

Renewables First Ltd

December 2022

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ADMINISTRATION PAGE

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Issue	Date	Detail of Changes
1	13th June 2022	Initial issue
2	1st November 2022	Second issue – High-level assessment of missed approach paths
3	7th December 2022	Third issue – minor updates

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KEY FINDINGS

Background

Pager Power has conducted an aviation risk assessment for a proposed wind development located approximately two kilometres south of Bretherton in Lancashire, to determine its impact upon aviation activity. The proposed development comprises one wind turbine with a maximum tip height of 200m above ground level (agl).

Overall Results

RAF Warton Primary Surveillance Radar (PSR)

The Ministry of Defence (MOD) has been consulted on the proposed development. While they have stated that, at this stage, they might not object to the proposed development they have confirmed that the proposed development will be detected by the PSR at RAF Warton and stated that it will likely have an impact upon MOD flying operations.

The analysis showed that the proposed turbine will be almost fully visible to the RAF Warton PSR and it is likely that the MOD will raise an objection. Furthermore, the turbine is expected to be installed in close proximity (circa 9.4 km southeast) to the radar. Therefore, the impact of the proposed development upon MOD infrastructure is high. Technical mitigation is likely to be a requirement, options are presented in Section 5 on page 18. Local in-fill is likely to be the most comprehensive strategy for mitigation.

The Instrument Flight Procedure (IFP) high-level assessment has shown that, whilst the proposed development is within 5 nautical miles from several approaches procedures (horizontal clearance), the vertical clearance between the assessed procedure and the proposed turbine exceed the relevant clearance minima. Therefore, RAF Warton Aerodrome IFPs are unlikely to be significantly affected by the proposed development. It is possible that a detailed IFP assessment will be requested.

Military Low Flying

The proposed development is located within a green zone, where there are no military low flying concerns, and the MOD is unlikely to raise concerns.

RAF Warton Obstacle Limitation Surface (OLS)

The analysis showed that the proposed development is within RAF Warton's Outer Horizontal Surface (OHS), and it is expected to infringe the OHS by 51.9m. An infringement of the OHS will not automatically result in an objection and in this specific case some mitigating circumstances have been identified. The turbine is located away from the runway's extended centreline and at least 5 nautical miles horizontally clear of the published Instrument Flight Procedures. The OHS breach could therefore be safely accommodated subject to lighting of the turbine and marking its location on the relevant aviation charts, engagement with the MOD to understand their position is recommended to progress this option further. The results of this report should be discussed with the MOD.

Blackpool Airport

Blackpool Airport has been consulted and confirmed the following: Blackpool Airport has no PSR and the proposed development will potentially result in changes to safety altitudes.

The Instrument Flight Procedure (IFP) high-level assessment has shown that, while the proposed development is within 5 nautical miles from one of the approach procedures (horizontal clearance), the vertical clearance between the assessed procedure and the proposed turbine exceed the relevant clearance minima. Therefore, Blackpool Airport IFPs are unlikely to be affected by the proposed development. It is possible that a detailed IFP assessment will be requested.

The missed approach path (MAP) high-level assessment has shown that the proposed development is located at a significant distance from the two MAPs (6.7 and 9.4NM horizontal distance). Furthermore, for the closest MAP (MAP 10) aircraft will turn away from the proposed development. Therefore, aircraft using the MAPs at Blackpool Airport are unlikely to be affected by the proposed development.

NATS NERL - NATS En Route

NATS has been consulted and prepared a (Technical and Operational Assessment) TOPA assessment. The proposed development has been examined by technical and operational safeguarding teams. The assessment concluded that while a technical impact is anticipated, it has been deemed to be operationally acceptable.

Aviation Lighting

There is a statutory requirement to fit structures having a height of 150 metres or more with medium intensity (2000 Candela) aviation warning lights. This statutory requirement is set out within article 222 of The Air Navigation Order 2016 and Regulations – CAP 393. In addition, there is a CAA Policy Statement entitled "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". Section 4.4 sets out the lighting requirements in more detail.

Overall Conclusion

The analysis carried out by Pager Power shows that an impact upon the MOD infrastructure is predicted and will likely require mitigation for both the PSR and RAF Warton OLS. Impacts upon the Blackpool IFP infrastructure are not predicted; however, the airport might require a IFP assessment to be carried out.

It is recommended that further consultation is undertaken with the MOD and Blackpool Airport to further understand their position.

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ABOUT PAGER POWER

Pager Power is a dedicated consultancy company based in Suffolk, UK. The company has undertaken projects in 54 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 risk assessment for a proposed wind development located approximately two kilometres south of Bretherton in Lancashire, to determine its impact upon aviation activity. The proposed development comprises one wind turbine with a maximum tip height of 200m 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;
- 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 Proposed Development Location

The location of the proposed development is shown in Figure 1 below.

Figure 1 – Proposed development location

2.2 Coordinate Data

The proposed turbine coordinates are shown in Table 1 below.

Easting	Northing	Heights
346096	419341	Tip height is 200 metres above ground level. Hub height 131m above ground level.

Table 1 – Proposed turbine coordinates

3 KEY AVIATION RISKS

3.1 Risk Assessment Results

Figure 2 below presents the aviation risk assessment chart[1].

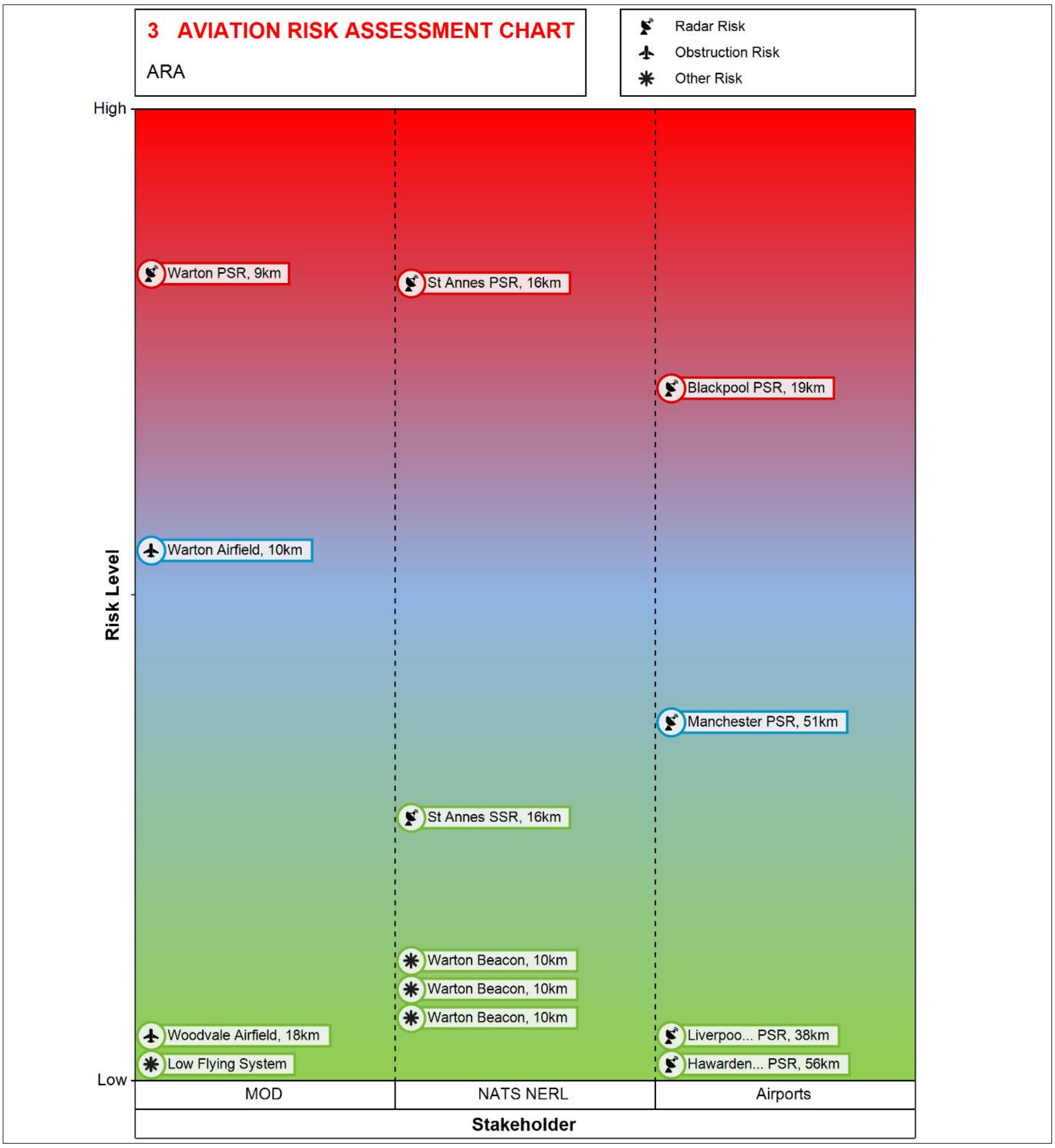


Figure 2 – *Risk Assessment for the proposed development*

[1] The chart shows an impact on Blackpool PSR. Blackpool Airport has confirmed that they do not have a PSR.

3.2 MOD - Ministry of Defence

Aviation Risk	Distance	Risk Level
Warton PSR	9.4 km	High
Warton Airfield	9.7 km	Medium
Woodvale Airfield	18.5 km	Low
Low Flying System	/	Low

Table 2 – Identified MOD risks

3.3 Airports

Aviation Risk	Distance	Risk Level
Manchester PSR (NATS)	50.8 km	Medium
Blackpool OLS	18.8 km	Low
Liverpool John Lennon PSR	37.6 km	Low
Hawarden/ Chester PSR	55.8 km	Low

Table 3 – Identified airport risks

3.4 NATS NERL - NATS En Route

Aviation Risk	Distance	Risk Level
St Annes PSR	16.0 km	High
St Annes SSR	16.0 km	Low
Warton Beacon	9.5 km	Low
Warton Beacon	9.5 km	Low
Warton Beacon	9.6 km	Low

Table 4 – Identified NATS NERL - NATS En Route risks

3.5 Civil Airfields

Aviation Risk	Distance	Risk Level
None	/	/

Table 5 – Identified civil airfield risks

3.6 Met Office

Met Office Risk	Distance	Risk Level
None	/	/

Table 6 – Identified Met Office risks

3.7 Risks Requiring Assessment

Further assessment has been undertaken with regard to:

- Warton PSR;
- Warton Airfield OLS;
- Military Low Flying System;
- Blackpool OLS;
- Manchester PSR;
- St Annes PSR;
- Aviation Lighting.

4 RISK ASSESSMENT DISCUSSION

4.1 MOD - Ministry of Defence

4.1.1 Primary Surveillance Radar

4.1.1.1 MOD Consultation

The MOD has been consulted on the proposed development. While they have stated that, at this stage, they might not object to the proposed development they have stated that the proposed development will be detected by the PSR radar at RAF Warton however, the technical impacts may be operationally accommodatable. Pre-application responses from the MOD are typically based on little to no bespoke assessment, they are designed mostly to flag potential constraints based on geographic location. A more detailed response is typically only available after submission of an application. Whether the operational impact of the development is deemed to be acceptable or unacceptable will be dependent on a variety of constraints including, but not limited to, the proliferation of other actual and potential turbine developments in the vicinity at that time.

4.1.1.2 Assessment of Risks

The location of the proposed development relative to the RAF Warton is shown in Figure 3 below.

Figure 3 – Location of the proposed development relative to nearby RAF Warton

The approach taken for the radar line of sight assessment is presented below:

- Radar line of sight assessment for the proposed wind development assessed at its maximum height (200m agl);
- Consideration of the distance from the radar.

A radar line of sight assessment was completed for the proposed development – considering the location of the turbine presented in Section 2.2. A radar detectability analysis was also undertaken for the proposed turbine to assess the likelihood of false returns from the wind turbine appearing on the radar display. Table 7 below presents the radar detection classifications as well as a comment on the likelihood of an objection being raised by the MOD.

Radar Detection	Comment
Highly Unlikely	Turbine hidden behind terrain. MOD is not likely to raise an objection to these turbines.
Unlikely	Turbine within line-of-sight but not likely to cause false returns. Impacts not predicted but the MOD may raise an objection to these turbines.
Possible	Turbine within line-of-sight and may cause false returns. MOD is likely to raise an objection to these turbines.
Likely	False returns predicted to appear on the radar display. MOD will raise an objection to these turbines.
Highly Likely	

Table 7 – *Radar detection and objection likelihood*

The analysis showed that the proposed turbine will be almost fully visible to the RAF Warton PSR (see Figure 5 on page 17) and therefore the turbine will have a technical impact upon the radar. Furthermore, the turbine is expected to be installed in close proximity (circa 9.4 km southeast) to the radar. Therefore, the impact of the proposed development upon MOD infrastructure is high when considered in isolation.

4.1.1.3 Cumulative Assessment

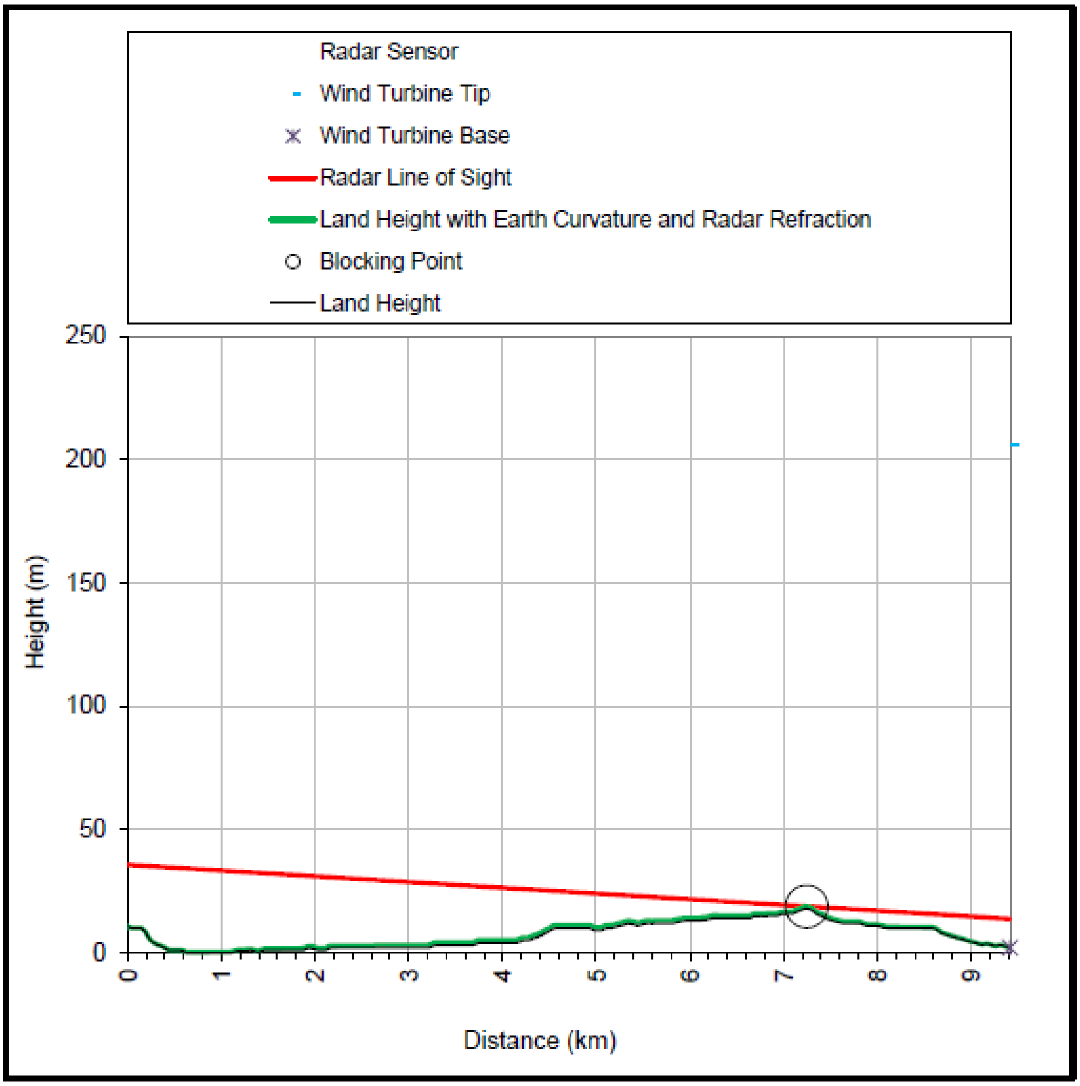
The proposed development is located near the existing Mawdesley Moss wind farm (Figure 4 on the following page). The existing wind farm is located circa 4.6km southeast of the proposed development and comprises three wind turbines. It can be beneficial to discuss with the MOD what, if any, mitigation strategies were applied for this existing development.

Figure 4 – Location of the proposed development relative to Mawdesley Moss wind farm

Radar Line of Sight Calculation

Warton PSR

ARA Warton PSR	
Turbine	T1
Result	VISIBLE
Certainty	192.3 metres



Turbine Height (m)	204
Hub Height (m)	135
Rotor Diameter (m)	138
Turbine Elevation (m)	2.1
Turbine Location	E346096 N419341
Distance to radar (km)	9.4
Blocking Point Location	E344949 N421183
Distance to BP (km)	2.2

Additional Analysis	
Angle (Radar to Tip)	1.005 degrees up
Maximum Tip Height	11.72 metres

Figure 5 – RAF Warton PSR line of sight with WT1

4.1.2 RAF Warton Instrument Flight Procedures (High-Level Overview)

4.1.2.1 Description of Instrument Flight Procedures

Instrument flight procedures are published documents that consist of defined three dimensional routes for aircraft arriving and departing airports. In reality, aircraft do not necessarily fly these routes exactly due to limitations on the performance of aeronautical instruments, pilots and variations in wind and pressure conditions.

This means that an area around and beneath these three-dimensional routes must be kept clear of obstacles to ensure that there is no significant collision risk to aircraft flying these procedures as shown in Figure 6 below.

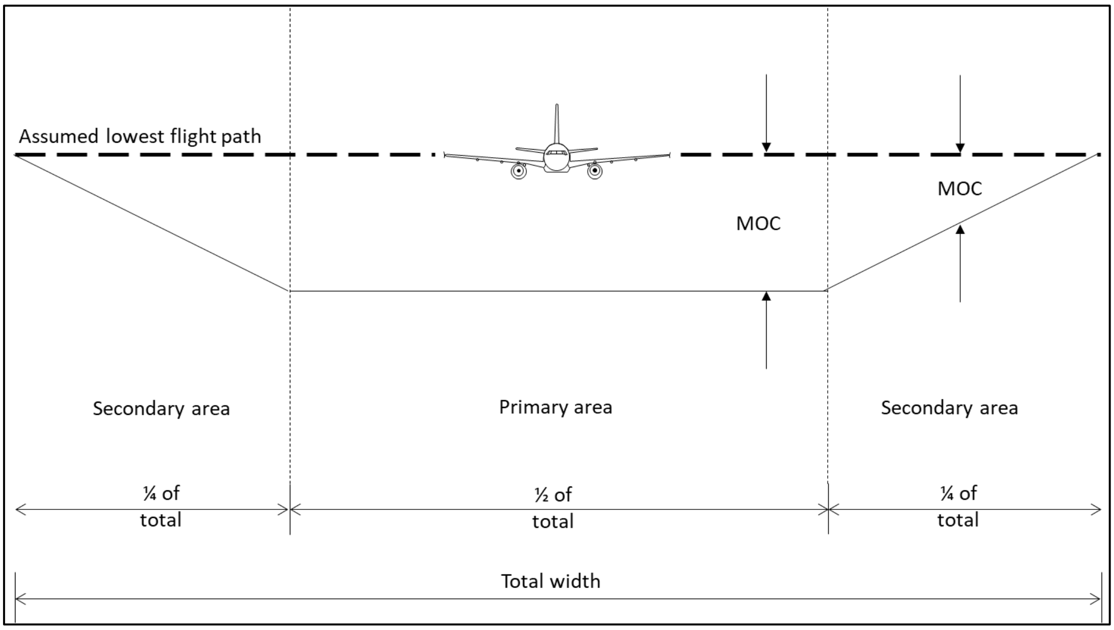


Figure 6 – Instrument Flight Procedure Minimum Obstacle Clearances

4.1.2.2 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 aeronautical chart. The MEF shown for the quadrangle in which the development is located is 2,500 feet. The proposed wind development has a maximum altitude of 676 feet which is 1,824 feet below this figure. The MEF will not change as a result of the wind farm.

4.1.2.3 Relevant Instrument Flight Procedures at RAF Warton

There are several charts within the AIP for RAF Warton with IFP procedures that come close to the proposed development. These are shown in Table 9 on the following page along with an initial commentary on potential impacts.

Chart – Description	Initial commentary on potential impacts
NDB to ILS/DME Rwy 25	The horizontal distance between the closest approach and the proposed turbine is 4.7 nautical miles (NM). In the worst-case scenario the vertical clearance between NDB to ILS/DME Rwy 25 and the proposed turbine is circa 1,884 feet. It is likely that these procedures will be unaffected.
TAC to ILS/DME Rwy 25	The horizontal distance between the closest approach and the proposed turbine is 3.8 NM. In the worst-case scenario the vertical clearance between TAC to ILS/DME Rwy 25 and the proposed turbine is circa 1,884 feet. It is likely that these procedures will be unaffected.
HI-TAC to ILS/DME Rwy 25	The horizontal distance between the closest approach and the proposed turbine is 4.0 NM. In the worst-case scenario the vertical clearance between HI-TAC to ILS/DME Rwy 25 and the proposed turbine is circa 1,884 feet. It is likely that these procedures will be unaffected.
NDB/DME Rwy 07	The horizontal distance between the closest approach and the proposed turbine is 3.8 NM. In the worst-case scenario the vertical clearance between NDB/DME Rwy 07 and the proposed turbine is circa 1,331 feet. It is likely that these procedures will be unaffected.
NDB Rwy 07	The horizontal distance between the closest approach and the proposed turbine is 4.0 NM. In the worst-case scenario the vertical clearance between NDB Rwy 07 and the proposed turbine is circa 1,054 feet. It is likely that these procedures will be unaffected.
TAC Rwy 07	The horizontal distance between the closest approach and the proposed turbine is 2.7 NM. In the worst-case scenario the vertical clearance between TAC Rwy 07and the proposed turbine is circa 1,884[2] feet. It is likely that these procedures will be unaffected.
TAC Rwy 25	The horizontal distance between the closest approach and the proposed turbine is 4.0 NM. In the worst-case scenario the vertical clearance between TAC Rwy 25 and the proposed turbine is circa 1,884 feet. It is likely that these procedures will be unaffected.

[2] No height has been provided for the missed approach. The worst-case scenario height of 2560 feet used for HI-TAC Rwy 25 has been used.

Chart – Description	Initial commentary on potential impacts
HI-TAC Rwy 07	The horizontal distance between the closest approach and the proposed turbine is 2.7 NM. In the worst-case scenario the vertical clearance between HI-TAC Rwy 07 and the proposed turbine is circa 1,884[3] feet. It is likely that these procedures will be unaffected.
HI-TAC Rwy 25	The horizontal distance between the closest approach and the proposed turbine is 4.0 NM. In the worst-case scenario the vertical clearance between HI-TAC Rwy 25 and the proposed turbine is circa 1,884 feet. It is likely that these procedures will be unaffected.

Table 8 – Initial commentary – IFPs at RAF Warton

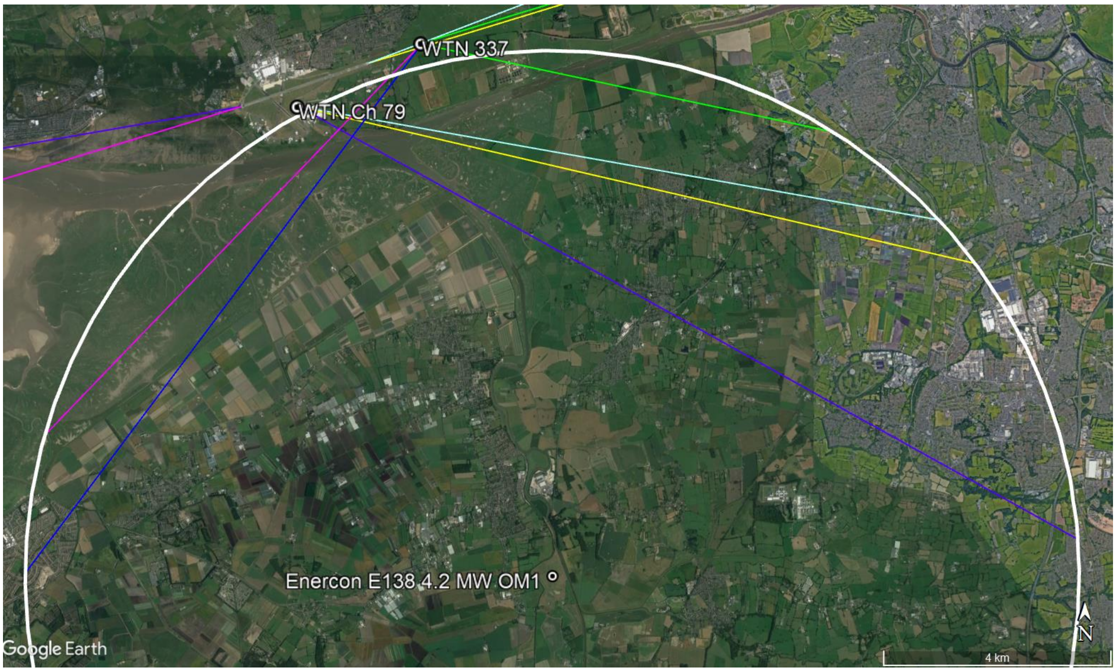


Figure 7 – Location of the proposed development relative to the instrument approach charts

4.1.2.4 Surveillance Minimum Altitude Chart

Surveillance Minimum Altitude Charts (SMAC) are published to show the lowest altitude a pilot will be instructed to fly whilst receiving radar-based Air Traffic Control (ATC) service. The proposed development has been plotted on Figure 8 below. The proposed development lies on the border between the 2,300 feet or 3,500 area. Even in the worst case-scenario the clearance

[3] No height has been provided for the missed approach. The worst-case scenario height of 2560 feet used for HI-TAC Rwy 25 has been used.

for both will be larger than 1,000 feet. However, if it falls within the 2,300 feet area it will be the tallest object within that airspace.

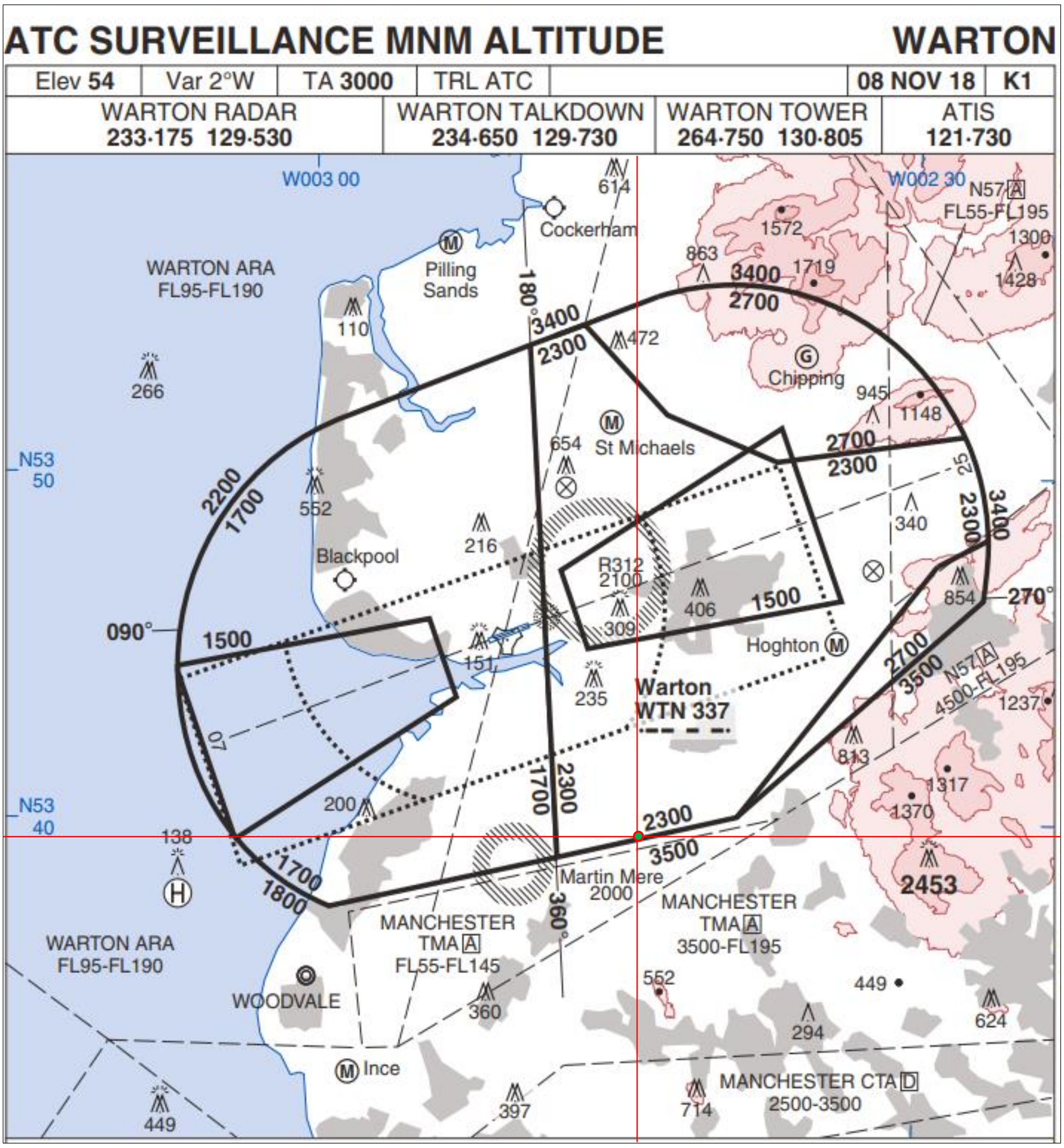


Figure 8 – ATC Surveillance MNM Altitude RAF Warton Aerodrome

4.1.2.5 Instrument Flight Procedure Conclusions

The Instrument Flight Procedure (IFP) high-level assessments has shown that several approach procedures are within the 5NM buffer considered by Pager Power (horizontal clearance). However, only two are within 3NM from the proposed development: TAC Rwy 07 and HI-TAC Rwy 07.

The vertical clearance between the assessed procedures and the proposed turbine exceeds the relevant clearance minima (1,000 feet) for all procedures considered. Therefore, RAF Warton

IFPs are unlikely to be affected by the proposed development. However, it is possible that a detailed IFP assessment will be requested.

4.1.3 Obstacle Limitation Surfaces Assessment

4.1.3.1 Overview

The OLS for RAF Warton have been modelled with respect to the proposed development. Obstacle Limitation Surfaces 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. The dimensions and geometry of the surfaces are constructed based on detailed rules defined in the Regulatory Article (RA) 3512 for military aerodromes. Obstacle Limitation Surfaces are established for the purpose of physical safeguarding i.e. minimising the risk of a collision between an aircraft and a tall object on the ground. The physical parameters of the surfaces are dependent on factors including the runway type, the runway dimensions and the procedures carried out at the aerodrome.

4.1.3.2 Obstacle Limitation Surfaces

The Obstacle Limitation Surfaces for RAF Warton and the location of the proposed turbine are presented in Figure 9 on the following page along with the development location. Pager Power analysis showed that the development is within RAF Warton's Outer Horizontal Surface (OHS) which has a height of 145m above the lowest threshold. The overall elevation of RAF Warton's OHS is 154.144m amsl. The proposed turbine has an elevation of 206m amsl and therefore it is expected to infringe the OHS by 51.9m.

Therefore, the proposed development is expected to have a moderate impact upon RAF Warton OLS. However, OLS breaches can be operationally acceptable in some circumstances, and examples of OHS infringement exist in the UK. Examples of aerodromes with infringed surfaces include Manchester (multiple infringements of the OHS by buildings), Birmingham (multiple infringements of the OHS by buildings) and Heathrow (infringement of the Inner Horizontal Surface (IHS) by the control tower. Furthermore, mitigating factors should be taken into consideration, such as:

- In this specific case the proposed turbine is located away from the runway centreline;
- The proposed development is unlikely to have a significant effect upon the RAF Warton IFPs (see Section 4.1.2 on page 18);
- It is expected that the lighting will be a requirement for the proposed development. Lighting can also be a mitigation solution for a surface breach.

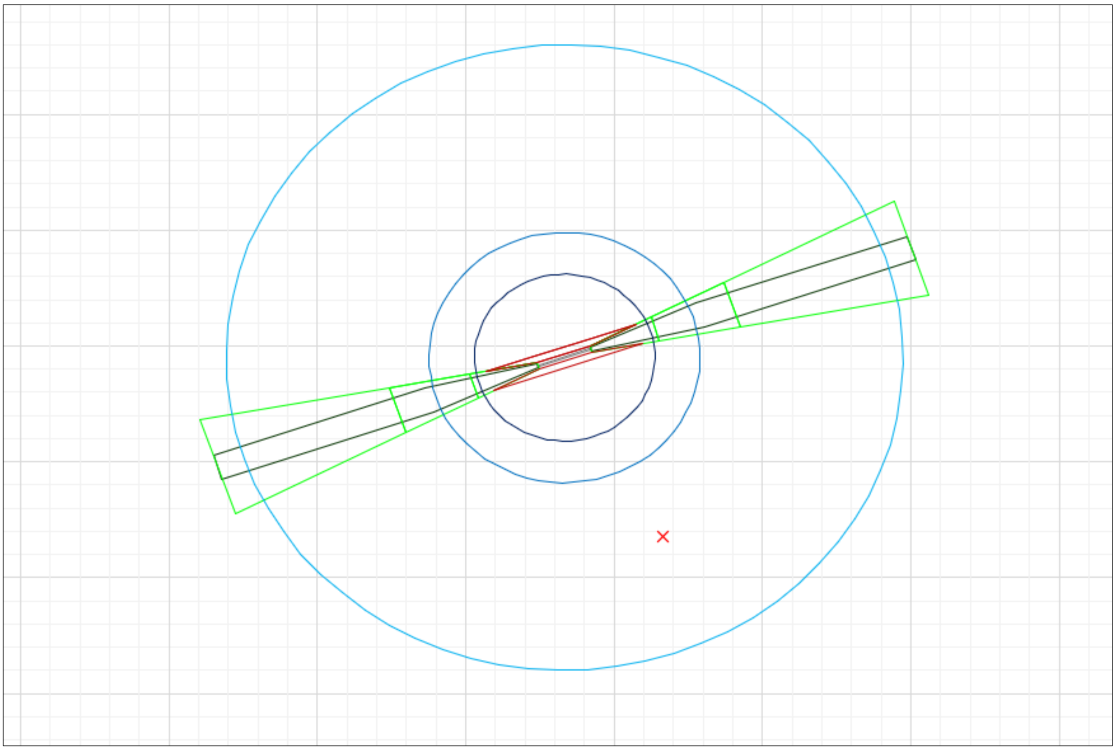


Figure 9 – RAF Warton OLS and location of the proposed development

4.1.4 Military Low Flying

4.1.4.1 MOD Consultation

The MOD has been consulted and has stated that "A turbine development of the height and at the location you propose may have an impact on low flying operations [...] Regardless of whether we object to your proposal, it is probable the MOD will request the turbine be fitted with MOD accredited visible or infrared aviation safety lighting".

4.1.4.1 Assessment of Risks

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.

The location of the wind turbine relative to the military low flying zones is shown in Figure 10 below. The figure shows that the wind turbines are located within the 'green' zone, where there are no military low flights concerns, and the MOD is not likely to raise an objection.

Figure 10 – Military low flying zones

4.1.5 MOD Obstruction Lighting Guidance[4] – Extracts

1. *… The proliferation of wind turbines across the UK has caused the MOD concern with regard to military night flying training … Whilst acknowledging that there is no statutory requirements, MOD considers that there is an absolute requirements for the lighting … to enhance the probability of the obstruction being acquired visually by the crew.*
2. *MOD will request some form of lighting in all but exceptional circumstances …*
3. *…*
4. *MOD's standard aviation obstacle lighting standards are … 2000cd steady red lights (for obstacles >45m and (150m) … the proliferation of wind turbines, lighting pollution is an issue and so MOD has addressed this public concern for onshore developments by revising the aerodrome standard to suit the en-route requirement.*

[4] Dated 2014

a. ***Infra-Red (IR) Lighting***. *MOD is cognisant that the majority of military night low flying is now conducted with the aid of aircrew night vision goggles (NVGs) … the specification required is detailed Appendix 1 to this Annex. When requesting lighting on turbines, MOD will specify IR lighting as an option* ***wherever possible*** *in the interests of public amenity.*

b. ***Visible Lighting***. *There are circumstances where IR lighting is incompatible with the military operations … in such cases visible lighting will be requested …*

(1) MOD will request either 25cd or 200cd flashing red lighting (depending on the circumstances). This is a deviation from ICAO stds but flashing permits visual acquisition at a greater range (in excess of 5nm in the case of 25cd) and compensates for the reduction in intensity. 25cd will be requested wherever circumstances permit, but in some locations a brighter 200cd (still low intensity) light will be needed. These areas will be close to elementary/basic flying training schools.

(2) Occasionally, these lights will also be required to mark the corners/cardinals of large wind farm sites where circumstances might reduce the pilot's ability to quickly identify the full size of the site if marked with less intense lights. The specification recommended for visible lighting is detailed in Appendix 1 to this Annex.

c. ***Combi Lighting***. *In some locations it may be appropriate to combine IR and 25cd elements. The combination increases the probability of early detection. Combi lighting is appropriate in low flying choke points or on the cardinal turbines of large wind farms where circumstances might reduce the pilot's ability to quickly identify the full size of the site if marked with less intense lights ..*

Lighting Layouts

8. For sites of more than 2 turbines it may not be necessary to light all turbines. Indeed, on the larger sites it may only be necessary to light the perimeter turbines or, for tightly packed sites with smaller turbines, every other perimeter turbine. Combi lights will be requested to define the 'ends' of turbine lines or the cardinal/corner turbines on the largest sites. Full details of lighting layout requirements are at Appendix 3.

Appendix 1

IR Light Specification Requirements

1. Onshore Lighting Specification

	25cd Red	200cd Red	25cd or 200cd/IR Combi	IR
				7-8nm pickup range
IR wavelength			As per IR specification	**750-900nm** ideally concentrated 800- 850nm for optimum detection.
Intensity	Equal or better than 25cd.	Equal or better than 200cd.	As per visible and IR specifications.	**600mW/sr min at peak flash** **1200W/sr max** Typically a 300mW/sr steady burn LED IR light will generate 600mW/sr at peak flash.
Horizontal Pattern	**360° unrestricted**			
Vertical Pattern	25cd minimum intensity between +15 deg and level (0 deg).	200cd minimum intensity between +15 deg and level (0 deg).	As per visible and IR specifications.	600 mW/sr Min flash intensity between +30 deg and -15 deg elevation. Up to 50% reduction between +25 to +30 deg and -10 to -15 deg is acceptable.
Overspill	Upwards overspill is acceptable. Downwards overspill is to be minimised such that the red light intensity is no more than 10% of the intensity at 0 deg.			Vertical overspill is acceptable.
Flash Pattern	60 flashes per min at 100-500ms duration (ideally 250ms).			
Synchronisation	All lights to be visually synchronised across a windfarm site.			

4.2 Airports

4.2.1 Blackpool Airport

4.2.1.1 Blackpool Consultation

Blackpool Airport has confirmed the following:

- Blackpool Airport has no Primary Surveillance Radar;
- The proposed development will probably result in changes to safety altitudes.

4.2.2 Blackpool Instrument Flight Procedures (High-Level Overview)

4.2.2.1 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 aeronautical chart. The MEF shown for the quadrangle in which the development is located is 2,500 feet. The proposed wind development has a maximum altitude of 676 feet which is 1,824 feet below this figure. Aircraft flying in accordance with the published MEF will not be affected by the wind farm.

4.2.2.2 Relevant Instrument Flight Procedures at Blackpool Airport

There is one chart within the AIP for Blackpool Airport with IFP procedures that come close to the proposed development. These are shown in Table 9 below along with an initial commentary on potential impacts.

Chart	Description	Initial commentary on potential impacts
AD 2.EGNH-8-5	Instrument approach chart NDB(L)/DME RWY 28 - ICAO	The horizontal distance between the closest approach and the proposed turbine is 3.5 nautical miles (NM). The vertical clearance between RIOBLU and the proposed turbine is circa 2,800 feet. It is likely that the impact upon these procedures will be low.

Table 9 – Initial commentary – IFPs at Blackpool Airport

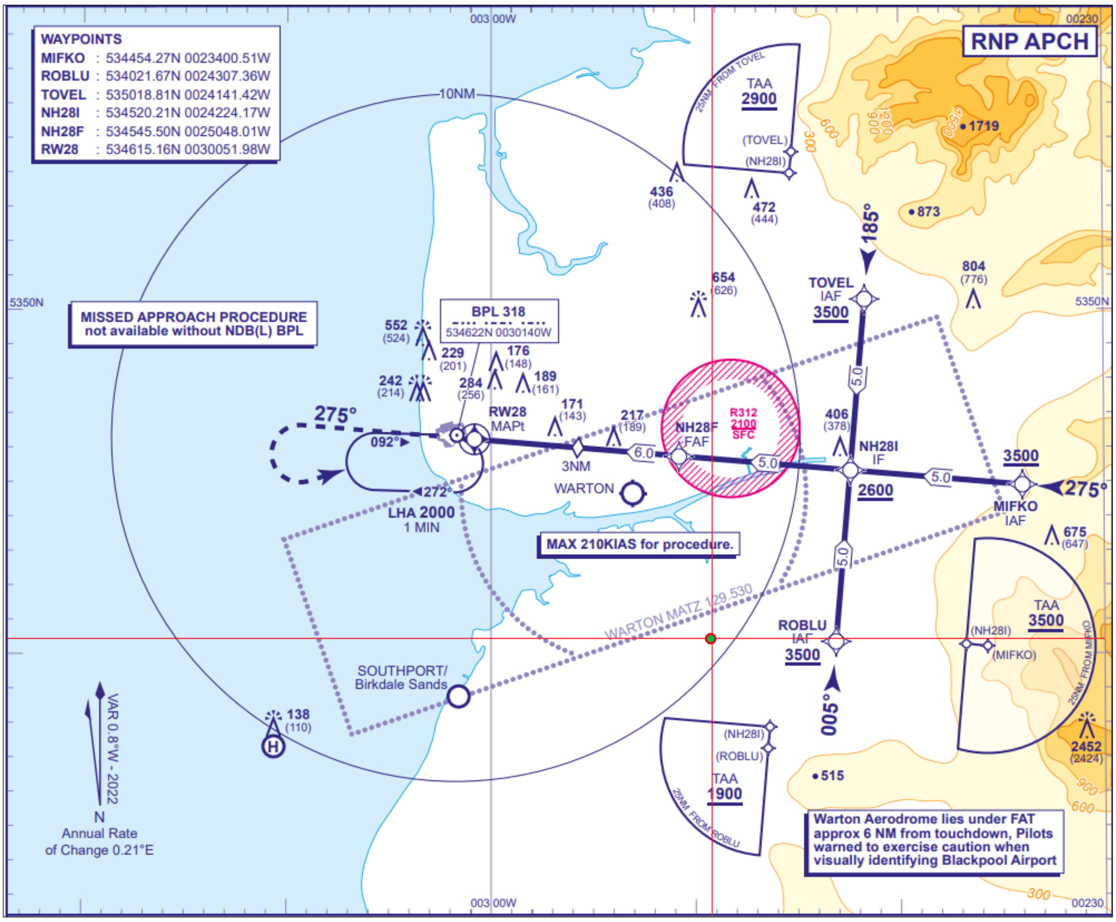


Figure 11 – Location of the proposed development relative to the instrument approach chart NDB(L)/DME RWY 28 – ICAO

4.2.2.1 Relevant Missed Approach Paths (MAP) at Blackpool Airport

There are several charts within the AIP for Blackpool Airport with missed approach path procedures. Two paths[5] have been identified that require further consideration (one per each approach path). These are discussed in Table 9 below along with an initial commentary on potential impacts and shown in Figure 12 on the following page.

Chart	Description	Initial commentary on potential impacts
AD 2.EGNH-8-1 AD 2.EGNH-8-2	BLACKPOOL NDB(L)/DME RWY 10 BLACKPOOL NDB(L) RWY 10	The horizontal distance between the MAP and the proposed turbine is circa 6.7NM at its closest point. The vertical clearance between MAP closest point to the proposed turbine and the proposed turbine is circa 1,324 feet. Furthermore, a pilot will turn away from the proposed development. Therefore, the proposed development is not predicted to affect this procedure.
AD 2.EGNH-8-3 AD 2.EGNH-8-3 AD 2.EGNH-8-5 AD 2.EGNH-8-6	BLACKPOOL ILS/DME RWY 28 BLACKPOOL LOC/DME RWY 28 BLACKPOOL RNP RWY 28 BLACKPOOL NDB(L)/DME RWY 28	The horizontal distance between the MAP and the proposed turbine is circa 9.4NM at its closest point. Therefore, the proposed development is not predicted to affect this procedure.

Table 10 – Initial commentary – IFPs at Blackpool Airport

[55] While there are six charts many share the same missed approach path.

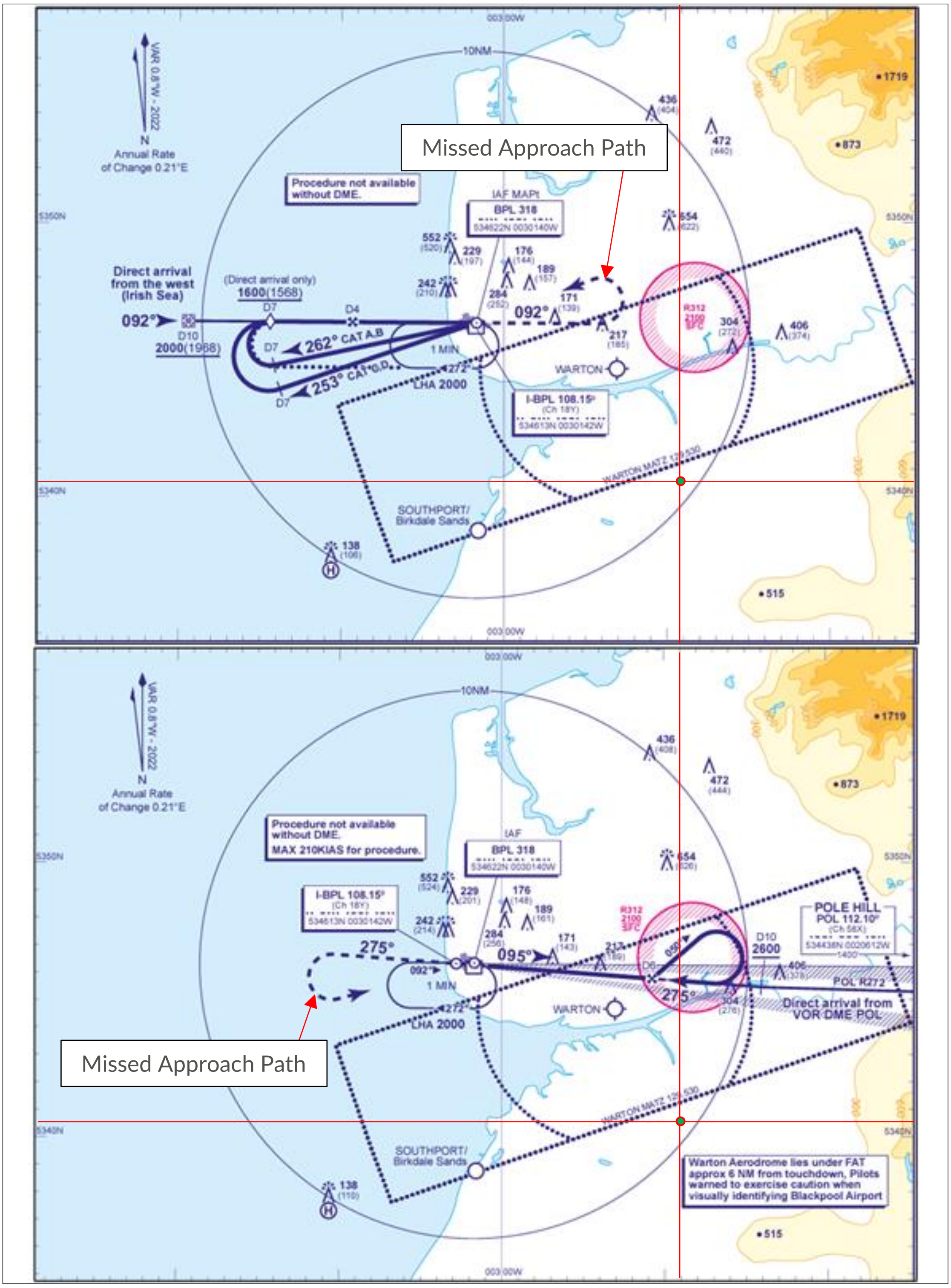


Figure 12 – Location of the proposed development relative to the missed approach paths 10/28 (top – BLACKPOOL NDB(L)/DME RWY 10 & bottom – BLACKPOOL ILS/DME RWY 28)

4.2.2.2 Surveillance Minimum Altitude Chart

Surveillance Minimum Altitude Charts (SMAC) are published to show the lowest altitude a pilot will be instructed to fly whilst receiving radar-based Air Traffic Control (ATC) service.

However, due to the lack of radar coverage in the area, Blackpool Airport does not have a SMAC. The review of the instrument approach charts has shown that the minimum safety altitude in the southeast section is 1700 feet. This, is more than 1000 feet than the proposed development.

4.2.2.3 Instrument Flight Procedure Conclusions

The Instrument Flight Procedure (IFP) high-level assessments has shown that while the proposed development is within 5 nautical miles from one of the approach procedures (horizontal clearance) the vertical clearance between the assessed procedure and the proposed turbine exceed the relevant clearance minima. Therefore, Blackpool Airport IFPs are unlikely to be affected by the proposed development. however, it is possible that a detailed IFP assessment will be requested.

4.2.3 Obstacle Limitation Surfaces Assessment

4.2.3.1 Overview

The OLS for Blackpool Airport has been modelled with respect to the proposed development. The dimensions and geometry of the surfaces are constructed based on detailed rules defined in the UK Civil Aviation Authority's Civil Aviation Publication 168 for civil aerodromes.

4.2.3.1 Obstacle Limitation Surfaces

The OLS for Blackpool Airport and the location of the proposed turbine are presented in Figure 9 on the following page along with the development location. Pager Power analysis showed that the development is outside Blackpool OLS.

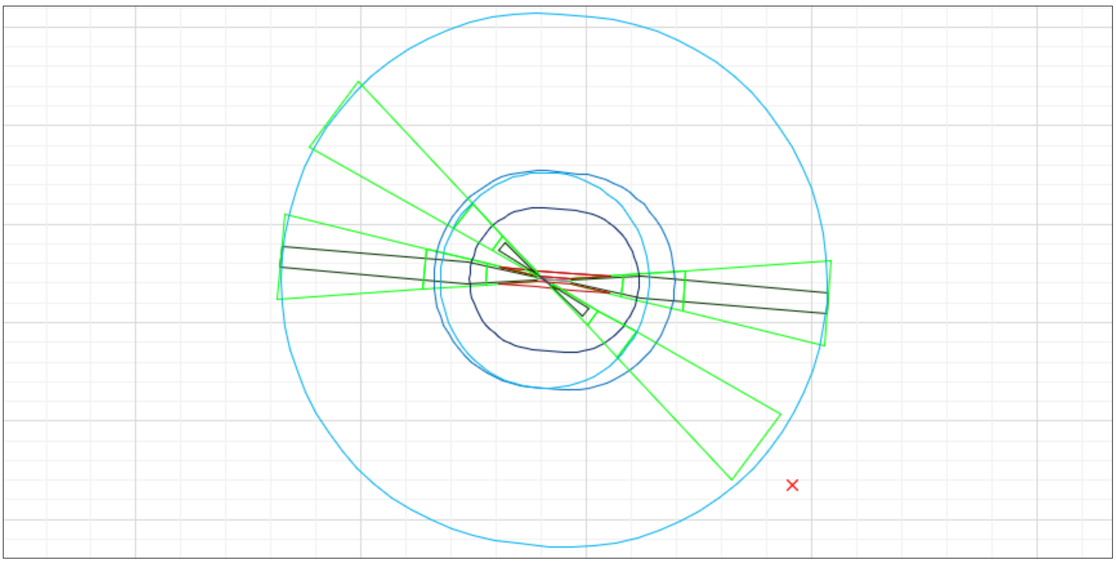


Figure 13 – Blackpool OLS and location of the proposed development

4.3 NATS NERL - NATS En Route

4.3.1.1 NATS Consultation

NATS has been consulted and prepared a (Technical and Operational Assessment) TOPA assessment. The proposed development has been examined by technical and operational safeguarding teams. The assessment concluded that while a technical impact is anticipated, it has been deemed to be operationally acceptable.

4.4 Aviation Lighting

As well as the MOD's aviation lighting requirement (see Section 4.1.2), there is a statutory requirement to fit structures having a height of 150 metres or more with medium intensity (2000 Candela) aviation warning lights. This statutory requirement is set out within article 222 of The Air Navigation Order 2016 and Regulations – CAP 393.

In addition, there is a CAA Policy Statement entitled "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". The policy sets out the following lighting requirements for onshore wind turbines that are 150 metres or more in height:

- Fitting of at least one, preferably two, 2000 Candela lights on top of the wind turbine nacelle. Note - where two lights are fitted only one need be lit;
- Fitting of three 32 Candela lights halfway up the wind turbine tower;
- The lights should switch on automatically when it is dark;
- Intensity of the 2000 Candela nacelle light may be reduced when there is good visibility.

4.4.1 CAA Guidance

CAP 168 clearly states the following, all of which are relevant extracts for the proposed development.

4.74 All objects which extend to a height of 150 m or more above ground elevation are regarded as obstacles and shall be lit in accordance with ANO Article 219.

4.76 Objects which are deemed by the CAA to be en route obstacles should be marked and/or lit.

4.79 When lighting is deemed necessary, medium intensity obstacle lights should be used. In the case of a wind farm, i.e. group of two or more wind turbines, it should be regarded as an extensive object and the lights should be installed: 1. to identify the perimeter of the wind farm; 2. respecting the maximum spacing between the lights along the perimeter, unless a dedicated assessment shows that a greater spacing can be used; 3. so that, where flashing lights are used, they flash simultaneously; and 4. so that, within a wind farm, any wind turbines of significantly higher elevation are also identified wherever they are located.

4.80 The obstacle lights should be installed on the nacelle in such a manner as to provide an unobstructed view for aircraft approaching from any direction.

Based on the extracts above, each turbine nacelle should be fitted with medium intensity red steady lights – because each turbine extends to 150 metres or more, making each one an en-route obstacle. The ANO referred to in point 4.74 requires intermediate lighting at an interval of no more than 52 metres, this is also referred to in CAP 764 (discussed below).

4.4.2 CAP 764 Policy and Guidelines on Wind Turbines[6]

Extracts from Chapter 3 are presented below.

3.9. Onshore Obstacle Lighting Requirement ICAO regulations (Annex 14 Chapter 6) and article 219 of the ANO 2009 require that structures away from the immediate vicinity of an aerodrome, which have a height of 150 m (492 ft) or more AGL are:

1. Fitted with medium intensity steady red lights positioned as close as possible to the top of the obstacle, and also equally spaced at intermediate levels, so far as practicable, between the top lights and ground level with an interval not exceeding 52 m;

2. Illuminated at night, visible in all directions and any lighting failure is rectified as soon as is reasonably practicable;

3. Painted appropriately: the rotor blades, nacelle and upper 2/3 of the supporting mast of wind turbines that are deemed to be an aviation obstruction should be painted white, unless otherwise indicated by an aeronautical study.

3.10. In addition, the CAA will provide advice and recommendations regarding any extra lighting requirements for aviation obstruction purposes where, owing to the nature or location of the structure, it presents a significant hazard to air navigation. However, in general terms, structures less than 150 m (492 ft) high, which are outside the immediate vicinity of an aerodrome, are not routinely lit; unless the 'by virtue of its nature or location' argument is maintained. UK AIP ENR 1.1 para 5.4 'Air Navigation Obstacles' refers.

The requirements set out above are in agreement with the guidance in CAP 168 and the ANO.

4.4.3 CAA 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 – Extracts

2. The UK statutory requirements for the lighting of en–route obstacles (i.e. those away from the vicinity of a licensed aerodrome) are set out in Article 222 of the UK Air Navigation Order (ANO) 2016. This article requires medium intensity (2000 candela) steady red aviation warning lights to be mounted as close as possible to the top of all structures at or above 150 meters above ground level (AGL). In terms of requirement for lighting wind turbines generators in accordance with the ANO, the CAA considers the top of a wind turbine generator to be the maximum blade tip height. In terms of positioning of aviation obstruction lighting on wind turbine generators with a maximum height of 150m AGL or above onshore, the CAA interprets 'as close as possible to the top of the obstacle' as the fitting of lights on the top of the supporting structure (the nacelle) rather than the blade tips.

[6] Civil Aviation Authority, 2016, *Policy and Guidelines on Wind Turbines*, Version 6

4. Under Article 222 (5), the CAA may direct that an en-route obstacle must be fitted with and must display such additional lights in such positions and at such times as it may specify. In addition, under Article 222 (6) a permission may be granted for the purposes of this article for a particular case or class of cases or generally. Accordingly, the following policy shall apply to all UK land based wind turbine generators which have a maximum blade tip height at or above 150m AGL:

a. The person in charge of the wind turbine generator must ensure that it is fitted with a medium intensity (2000 candela) red light positioned as close as practicable to the top of the fixed structure. A second light serving as an alternative should be provided in case of failure of the operating light.

b. The lights required by paragraph (a) must be so fitted to show when displayed in all directions without interruption.

c. Additionally, at least three (to provide 360 degree coverage) low-intensity Type B lights (32 candela) lights should be provided at an intermediate level of half the nacelle height.

d. Subject to sub-paragraphs (e) and (f), the person in charge of a wind turbine generator must ensure that any light required to be fitted by this article is displayed.

e. Lights should be operated by an acceptable control device (e.g., photocell, timer, etc.) adjusted so the lights will be turned on whenever illuminance reaching a vertical surface falls below 500 LUX. The control device should turn the lights off when the illuminance rises to a level of 500 LUX or more.

f. In the event of the failure of any light which is required by this policy statement to be displayed, the person in charge of a wind turbine generator must repair or replace the light as soon as practicable. For any outage that is expected to be or is greater than 12 hours, the operator shall request a NOTAM to be issued by informing the NOTAM section ...

g. If the horizontal meteorological visibility in all directions from every wind turbine generator in a group is more than 5 km, the intensity for the light positioned as close as practicable to the top of the fixed structure required to be fitted to any generator in the windfarm and displayed may be reduced to not less than 10% of the minimum peak intensity specified for a light of this type.

Point 'g' suggests that a dimming of aviation lights under suitable visibility conditions is a possibility. There are technologies for implementation of such a solution, set out later in this section.

4.5 Lighting Options and Specification

Aviation lighting will change the wind development's visual impact at night. Strategies for reducing the impact of aviation lighting have been explored. These include:

- Use of infra-red lighting.
- Radar-controlled lighting.
- Not lighting every turbine.
- Reducing light intensity during good visibility.
- Designing lights to minimize downward "spill".

These are discussed in turn below.

4.5.1 Infra-red lighting

Infra-red light is not visible to the naked eye. It is visible via equipment such as night-vision goggles, which are used by military pilots conducting training flights in the area.

Fitting the turbines with infra-red lights would ensure little to no visual impact, and this solution may satisfy MOD lighting requirements. It will not satisfy lighting requirements for civil aircraft, which require visible lights.

This solution is unlikely to be viable for the proposed development.

4.5.2 Radar-controlled lighting

This is a lighting system whereby a local primary radar can be used to switch aviation lights on when an aircraft is in the vicinity of the wind farm. Implementation of radar-controlled lighting would significantly reduce the illumination time because the turbines would only be lit when an aircraft is within their vicinity.

There are commercially available systems that are likely to be suitable for the proposed development. It appears likely that a radar-controlled lighting scheme would be feasible for the proposed development. This is due to its relatively remote location in airspace with low activity.

Typically, such arrangements would be implemented using a planning condition that requires a radar-controlled lighting scheme to be submitted and implemented. Suppliers of such systems include:

- **Terma** – The Terma solution utilises[7] an X Band SCANTER radar to detect aircraft approaching the windfarm, illuminating the turbines when required. Terma states that its solution is certified for deployment in the USA, Germany and Denmark[8]. The system is installed and operational at a wind farm in Brandenburg[9] for six 200 metre turbines.
- **Vestas InteliLight** – The Vestas InteliLight solution utilises[10] a radar with an instrumented range of up to 36 kilometres. Approaching aircraft distance, speed and heading are analysed to facilitate an automatic assessment of whether to switch the aviation lights on.
- **PARASOL** – The PARASOL solution utilises[11] broadcast signal from DVB-T2, comparing the original signal and the received signal to determine whether a plane is in the area.

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[7] Information taken from Terma website, accessed September 2019.
[8] It is Pager Power's understanding that Terma is the closest supplier to getting approval in the UK.
[9] Rasmussen, K, *First Wind Farm Obstruction Light Control project from Terma approved and operational*, International Cooperation on Airport Surveillance (last accessed September 2019 http://www.icas-group.org/wp/first-wind-farm-obstruction-light-control-project-from-terma-approved-and-operational/)
[10] Information taken from Vestas website, accessed September 2019.
[11] Information taken from a press release via the Fraunhofer website, accessed September 2019.

The system is reported to have received accreditation from German Air Traffic Control (DFS).

- **DeTect** – DeTect has developed[12] the HARRIER Aircraft Detection Lighitng System, which provides 360 degree radar surveillance to activate aviation lighting when required. The DeTect system claims to meet or exceed all regulatory requirements of the Federal Aviation Administration in the USA.

4.5.3 Reducing light intensity during good visibility

Paragraph 4g of the CAA Policy Statement means the wind farm could be fitted with a visibility sensor that reduces the intensity of the nacelle lights significantly when the visibility meets the specified criteria.

Effectively this allows the Medium Intensity Lights (2000 Candela) to be reduced to Low Intensity Lights (200 Candela) during good visibility.

There are commercially available systems that are likely to be suitable for the proposed development. This is a relatively low-cost mitigation solution that is already allowed within the existing CAA policy.

Suppliers of such solutions include Technostrobe.

4.5.4 Designing lights to minimize downward "spill"

Nacelle aviation warning lights are designed to be visible to aircraft flying level with the nacelle and above.

There is no requirement for intense light to be radiated downwards.

It is therefore possible to limit downward light radiation significantly whilst ensuring the lighting scheme is compliant with CAA requirements.

This form of mitigation can either be achieved by selecting lights with a particular optical characteristic or by fitting shields that prevent light from the lamps being seen below a certain angle from the horizontal.

4.5.5 Conclusions – Aviation Lighting

Aviation lighting will be required for the proposed turbines due to their height. The UK CAA rules for lighting suggest that medium intensity steady red lights will be required on each turbine nacelle, and that intermediate turbines will be required at a spacing of no more than 52 metres on the turbine towers.

It is recommended that the turbine is lit with medium intensity red lighting on the nacelle and one intermediate light approximately halfway down the tower. If this recommendation is progressed it should be communicated to the MOD and the CAA for comment.

[12] Information taken from DeTect website, accessed September 2019.

5 RADAR MITIGATION

5.1 Requirement

The proposed development is likely to have significant impacts on the military PSR at RAF Warton Aerodrome safeguarded by the MOD. The MOD is likely toobject to the proposed development technical mitigation might be required.

5.2 Acceptability

In some cases, wind developments can be unacceptable even if technical radar mitigation is put in place. It is useful to consider whether the radar impact is likely to be acceptable if technical mitigation is established in this case.

The following points have been considered:

- The radar impact of the proposed development is similar to that of neighbouring developments (Mawdesley Moss);

5.3 Mitigation Options

Radar mitigation can broadly be considered within two categories:

1. Technical mitigation, whereby physical or software changes are made that reduce, remove or otherwise address the issues caused by interaction of the radar signals with the wind turbines;
2. Operational mitigation, whereby the technical impact is accommodated, often subject to promulgation of information and marking on the relevant maps.

This section presents the most commonly progressed technical mitigation options for PSR impacts from wind turbines.

Progressing any technical mitigation solution must be done in coordination with the radar operator / safeguarding team, in this case the MOD.

5.3.1 Radar Blanking

This is a software-based solution whereby an area is defined around a source of radar clutter (in this case a single turbine), and radar returns within this are not displayed on an operator's screen.

This has the benefit of removing the radar clutter from the screen, with the drawback that it leaves a 'hole' in the radar coverage, such that genuine targets (aircraft) overflying the blanked area would not be displayed.

The reduction in coverage is minimised by keeping the blanked area as small as possible, which in this case is possible because it is a single wind turbine as opposed to a development comprising multiple turbines spanning a wider area.

Radar blanking is most suitable in areas of airspace that are of low operational sensitivity.

In this case, the turbine is located away from the runway's extended centreline and laterally clear of the published IFPs. A small radar blank could potentially be operationally accommodated.

The cost of implementing single-cell blanking for one turbine is typically of the order of £50,000.

5.3.2 Radar In-Fill

This is a hardware and software-based solution whereby coverage from an alternative radar is fed into the display system of the affected radar. The affected radar is blanked, as described above, and coverage from the alternative radar feed is imported to fill the gap.

For this solution to be feasible, a radar feed from an alternative source needs to be available which:

- Provides coverage down to the required altitude;
- Is itself not affected by the wind turbine;
- Can be technically and commercially integrated with the exiting radar system / organisation.

The solution can be further subdivided into:

- Conventional radar in-fill – whereby a 'normal' radar is used for provision of the in-fill coverage. This can be from:
  - An existing radar installation – provided it meets the requirements set out above;
  - A newly acquired radar installation specifically for the purpose of providing in-fill.
- Local radar in-fill – whereby a bespoke radar sensor designed specifically for this mitigation solution is deployed at or near the wind development site.

The most favourable approach to radar infill is generally:

- Use of an existing radar is preferred, because it is the most cost and time effective. It requires there to be an existing radar installation that meets the criteria, which may not be the case here.
- If a new radar is required, local in-fill is generally a better option than purchasing a new conventional radar because:
  - Local in-fill has capabilities designed specifically for this purpose.
  - Local in-fill is generally cheaper than conventional radar.

Implementation of a local radar in-fill is likely to be the most technically comprehensive solution because it mitigates the impact with the fewest drawbacks.

The most advanced providers of local in-fill for UK developments appear to be Terma and Thales. Other providers may be available.

The cost of a radar in-fill solution is highly variable. Local in-fill radar costs are likely to be in the region of £1-2 million. Purchasing a new conventional radar can be in the region of £5-£10 million. Service and maintenance costs can vary but are generally less of a barrier than the initial outlay.

Use of an existing radar does not involve purchasing new infrastructure but would likely have setup and leasing costs for the radar feed, the latter is estimated to be around £20,000 per year but this could vary significantly.

5.3.3 Non-Automatic Initiation Zone (NAIZ)

This is a software-based solution whereby a zone is defined around a clutter source. Any returns that originate within this zone are suppressed from the radar display. Where an aircraft track is present that overflies the zone, it continues to be displayed.

This results in a more sophisticated version of a blank, whereby the turbine will not cause clutter by itself but coverage is not entirely compromised at the turbine location. Drawbacks can include track-seduction if aircraft are tracked in close proximity to the NAIZ.

NAIZ mitigation requires a radar system that can accommodate this solution. The radar capability and availability of NAIZ 'slots' should be discussed with the MOD.

This solution has a good track record for long-range air defence radar. It is less common for onshore wind developments impacting ATC radar.

The costs associated with this solution are highly variable. An indicative cost is in the region of £75,000 but this could vary significantly.

5.3.4 Layout Changes

Reduction in turbine size or relocation to a less 'visible' position would reduce the level of impact. In this case, the potential for a significant change in predicted visibility to the radar is unlikely to be achievable.

The costs associated with down-sizing the development are typically associated with reduced generation and logistical factors.

5.3.5 Radar Upgrade

Newer radar are, in general, more tolerant to interference than older ones. Provision of a new radar can therefore ameliorate the level of impact while also improving safety with superior overall performance.

New radar can cost in the region of £5-10 million.

5.3.6 Other Options

Further options do exist but are relatively uncommon for onshore UK wind developments. These include:

- Beam tilt – whereby the radar beam is physically or electronically elevated such that the effect of the turbine is reduced. This results in a potential reduction of coverage and is unlikely in practice.

- Provision of a screen – whereby the turbine's visibility is physically obstructed from the radar's view.
- Software solutions that mask or suppress the level of visible radar clutter.

The above have not been discussed in detail because they are unlikely to be feasible in practice.

Below a brief discussion on some possible mitigating strategies:

- Blanking a single turbine is technically possible but may not be operationally acceptable given the proximity to the airport;
- Local in-fill might be the most appropriate from a technical perspective but may not be cost-efficient for a single turbine;
- Reducing the turbine height below the OHS can reduce the overall impact of the proposed development.

A discussion with the MOD should aim to identify what mitigation has been applied for the Mawdesley Moss, if any, with a view to understanding whether these can be extended or applied to this development.

6 EXAMPLES OF WIND FARMS AND RADAR COEXISTING

6.1 Developments that Coexist with PSR

6.1.1 Dublin International Airport – Ireland

Dublin Airport is located on the northern side of the city. There are 5 small scale wind turbines located at Father Collins Park, which is Irelands first wind powered public park, located in the heart of the North Fringe, close to the new communities of Clongriffen and Belmayne, between the Hole in the Wall Road and the Mayne River in Donaghmede. The turbines are EW15 50kW machines, each having a maximum blade tip height of 32.5m above ground level. The site is located approximately 7km from the airport and is located within the Dublin CTA.

6.1.2 Amsterdam (Schiphol) Airport – The Netherlands

There is a wind farm in the Amsterdam Western Harbour region which lies approximately 10km north of Schiphol Airport. This was built in 2000-2001 and consists of 14 wind turbines, each having a maximum blade tip height of 89m above ground level. The wind turbines are operational and exist within controlled airspace. They are also located beneath the final approach path for Runway 19L. It is noted that the radar at Schiphol Airport has Line of Sight to at least three other operational wind developments, these being Haarlem, Velsen and Flevoland. Haarlem is located approximately 15km to the northwest of Schiphol Airport and has four wind turbines with a maximum blade tip height of 53m above ground level. These are located within controlled airspace. Velsen is located approximately 20km to the northwest of Shiphol Airport and consists of five wind turbines with each having a maximum blade tip height of 45m above ground level. These are located outside of controlled airspace. Flevoland is located approximately 25km east northeast of Schiphol Airport and consists of ten wind turbines, each having a maximum blade tip height of 102m above ground level. These are located outside of controlled airspace.

6.1.3 East Midlands Airport – United Kingdom

There are two wind turbines located approximately 1.15km southwest of the PSR at East Midlands Airport (EMA). The wind turbines are operational and exist within the EMA controlled airspace. The turbines are Wind Technik Nord 250kW machines, each having a maximum blade tip height of 45m above ground level.

7 OVERALL CONCLUSION

7.1 Overall Results

7.1.1 RAF Warton Primary Surveillance Radar (PSR)

The Ministry of Defence (MOD) has been consulted on the proposed development. While they have stated that, at this stage, they might not object to the proposed development they have confirmed that the proposed development will be detected by the PSR at RAF Warton and stated that it will likely have an impact upon MOD flying operations.

The analysis showed that the proposed turbine will be almost fully visible to the RAF Warton PSR and it is likely that the MOD will raise an objection. Furthermore, the turbine is expected to be installed in close proximity (circa 9.4 km southeast) to the radar. Therefore, the impact of the proposed development upon MOD infrastructure is high. Technical mitigation is likely to be a requirement, options are presented in Section 5 on page 18. Local in-fill is likely to be the most comprehensive strategy for mitigation.

The Instrument Flight Procedure (IFP) high-level assessment has shown that, whilst the proposed development is within 5 nautical miles from several approaches procedures (horizontal clearance), the vertical clearance between the assessed procedure and the proposed turbine exceed the relevant clearance minima. Therefore, RAF Warton Aerodrome IFPs are unlikely to be significantly affected by the proposed development. It is possible that a detailed IFP assessment will be requested.

7.1.2 Military Low Flying

The proposed development is located within a green zone, where there are no military low flights concerns, and the MOD is unlikely to raise concerns.

7.1.3 RAF Warton Obstacle Limitation Surface (OLS)

The analysis showed that the proposed development is within RAF Warton's Outer Horizontal Surface (OHS), and it is expected to infringe the OHS by 51.9m. An infringement of the OHS will not automatically result in an objection and in this specific case some mitigating circumstances have been identified. The turbine is located away from the runway's extended centreline and at least 5 nautical miles horizontally clear of the published Instrument Flight Procedures. The OHS breach could therefore be safely accommodated subject to lighting of the turbine and marking its location on the relevant aviation charts, engagement with the MOD to understand their position is recommended to progress this option further. The results of this report should be discussed with the MOD.

7.1.4 Blackpool Airport

Blackpool Airport has been consulted and confirmed the following:

- Blackpool Airport has no PSR;

- The proposed development will probably result in changes to safety altitudes.

The Instrument Flight Procedure (IFP) high-level assessment has shown that, while the proposed development is within 5 nautical miles from one of the approaches procedures (horizontal clearance), the vertical clearance between the assessed procedure and the proposed turbine exceed the relevant clearance minima. Therefore, Blackpool Airport IFPs are unlikely to be affected by the proposed development. It is possible that a detailed IFP assessment will be requested.

The missed approach path (MAP) high-level assessment has shown that the proposed development is located at a significant distance from the two MAPs (6.7 and 9.4NM horizontal distance). Furthermore, for the closest MAP (MAP 10) aircraft will turn away from the proposed development. Therefore, aircraft using the MAPs at Blackpool Airport are unlikely to be affected by the proposed development.

7.1.5 Aviation Lighting

There is a statutory requirement to fit structures having a height of 150 metres or more with medium intensity (2000 Candela) aviation warning lights. This statutory requirement is set out within article 222 of The Air Navigation Order 2016 and Regulations – CAP 393. In addition, there is a CAA Policy Statement entitled "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". Section 4.2 sets out the lighting requirements in more detail.

7.1.6 NATS NERL - NATS En Route

NATS has been consulted and prepared a (Technical and Operational Assessment) TOPA assessment. The proposed development has been examined by technical and operational safeguarding teams. The assessment concluded that while a technical impact is anticipated, it has been deemed to be operationally acceptable.

7.2 Overall Conclusion

The analysis carried out by Pager Power shows that an impact upon the MOD infrastructure is predicted and will likely require mitigation for both the PSR and RAF Warton OLS. Impacts upon the Blackpool IFP infrastructure are not predicted; however, the airport might require a IFP assessment to be carried out.

It is recommended that further consultation is undertaken with the MOD and Blackpool Airport to further understand their position.

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